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Thanks

Thanks to Julian Smart for wxWindows and his help. Thanks also to Brent Benson for libscheme, and to Hans Boehm for the conservative garbage collector and his help.

The geometry-management classes were originally developed by Richard Cobbe.

This manual was typeset using \LaTeX, \SLATeX, and \texttt{tex2page}. Some typesetting macros were originally taken from Julian Smart’s Reference Manual for wxWindows 1.60: a portable C++ GUI toolkit.

This manual was typeset on June 18, 2006.
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1. Introduction

This manual describes the MrEd GUI toolbox for programmers developing MrEd applications. It assumes familiarity with MzScheme as described in *PLT MzScheme: Language Manual*, the `class.ss` library of MzLib (which defines the class and interface system), and basic GUI concepts (such as windows and events).

What is MrEd?

MrEd is a Scheme implementation based on MzScheme (see *PLT MzScheme: Language Manual*). MrEd embeds MzScheme and extends it with a graphical user interface (GUI) toolbox. GUI applications written with MrEd run without modification under Windows, Mac OS X, and Unix/X.

MrEd is not a graphical environment for developing Scheme programs. DrScheme, documented in *PLT DrScheme: Development Environment Manual*, is the development environment for producing MzScheme- and MrEd-based applications.\(^1\)

Toolbox Organization

For documentation purposes, the MrEd toolbox is organized into three parts:

- **The windowing toolbox**, for implementing form-filling GUI programs (such as a database query window) using buttons, menus, text fields, and events. The windowing toolbox is described in §2.

- **The drawing toolbox**, for drawing pictures or implementing dynamic GUI programs (such as a video game) using drawing canvases, pens, and brushes. The drawing toolbox is described in §5.

- **The editor toolbox**, for developing traditional text editors, editors that mix text and graphics, or free-form layout editors (such as a word processor, HTML editor, or icon-based file browser). The editor toolbox is described in §8.

These three parts roughly represent layers of increasing sophistication. Simple GUI programs access only the windowing toolbox directly, more complex programs use both the windowing and drawing toolboxes, and large-scale applications rely on all three toolboxes.\(^2\)

All three parts are immediately available when MrEd is started, as well as the base class system from MzLib. The `mred.ss` library module of the `mred` collection provides all of the class, interface, and procedure names defined in this manual. When MrEd starts up, it imports the `mred.ss` module and MzLib’s `class.ss` module into the initial namespace (so no knowledge about modules is required to understand this manual).

The module `#%mred-kernel` is built into the MrEd executable, and intended for use only by `mred.ss`. Attempting to require `mred.ss` in a plain MzScheme executable will result in a run-time error, because `#%mred-kernel` will not be available.

---

\(^1\)DrScheme is itself a MrEd-based application that is developed using DrScheme.

\(^2\)This three-layer view of the toolbox breaks down under close scrutiny, because the windowing, drawing, and editor toolboxes are actually interdependent and intertwined. Nevertheless, the layered separation is a good approximation.
To create a namespace in which the mred.ss module will be used, call the make-namespace-with-mred procedure. That procedure attaches the mred.ss instance of the current namespace to the created namespace. Otherwise, different namespaces create different instances of the mred.ss module, which in turn generate distinct classes.
Part I

Windowing Toolbox
2. **Windowing Toolbox Overview**

MrEd’s windowing toolbox provides the basic building blocks of GUI programs, including frames (top-level windows), modal dialogs, menus, buttons, check boxes, text fields, and radio buttons. The toolbox provides these building blocks via built-in classes, such as the `frame` class:

```scheme
;; Make a frame by instantiating the frame% class
(define frame (instantiate frame% ("Example")))

;; Show the frame by calling its show method
(send frame show #t)
```

The built-in classes provide various mechanisms for handling GUI events. For example, when instantiating the `button` class, the programmer supplies an event callback procedure to be invoked when the user clicks the button. The following example program creates a frame with a text message and a button; when the user clicks the button, the message changes:

```scheme
;; Make a frame by instantiating the frame% class
(define frame (instantiate frame% ("Example")))

;; Make a static text message in the frame
(define msg (instantiate message% ("No events so far...") frame))

;; Make a button in the frame (using keyword-based arguments)
(instantiate button% () (label "Click Me") (parent frame)
   ;; Callback procedure for a button click
   (callback (lambda (button event)
               (send msg set-label "Button click"))))

;; Show the frame by calling its show method
(send frame show #t)
```

Programmers never implement the GUI event loop directly. Instead, the system automatically pulls each event from an internal queue and dispatches the event to an appropriate window. The dispatch invokes the window’s callback procedure or calls one of the window’s methods. In the above program, the system automatically invokes the button’s callback procedure whenever the user clicks Click Me.

If a window receives multiple kinds of events, the events are dispatched to methods of the window’s class instead of to a callback procedure. For example, a drawing canvas receives update events, mouse events, keyboard events, and sizing events; to handle them, a programmer must derive a new class from the built-in `canvas` class and override the event-handling methods. The following expression extends the frame created above with a canvas that handles mouse and keyboard events:

```scheme
;; Derive a new canvas (a generic drawing window) class to handle events
```

---

1. To run the example, type it into DrScheme’s top window and click the Run button. (The current language in DrScheme should be MrEd Debug.) Alternatively, save the program to a file using your favorite text editor, and then load it into MrEd via the Load File menu item.
2. Windowing Toolbox Overview  

2.1 Core Windowing Classes

The fundamental graphical element in MrEd's windowing toolbox is an area. The following classes implement the different types of areas in the windowing toolbox:

- **Containers** — areas that can contain other areas:
  - `frame%` — a frame is a top-level window that the user can move and resize.
  - `dialog%` — a dialog is a modal top-level window; when a dialog is shown, other top-level windows are disabled until the dialog is dismissed.
  - `panel%` — a panel is a subcontainer within a container. The toolbox provides three subclasses of `panel%`: `vertical-panel%`, `horizontal-panel%`, and `tab-panel%`.

```scheme
(define my-canvas%)
(class canvas% ; The base class is canvas%
    ;; Declare overrides:
    (override on-event on-char)
    ;; Define overriding method to handle mouse events
    (define on-event (lambda (event) (send msg set-label "Canvas mouse")))
    ;; Define overriding method to handle keyboard events
    (define on-char (lambda (event) (send msg set-label "Canvas keyboard")))
    ;; Call the superclass initialization (and pass on all init args)
    (super-instantiate ()))

    ;; Make a canvas that handles events in the frame
    (instantiate my-canvas% (frame))

(It may be necessary to enlarge the frame to see the new canvas.) Moving the cursor over the canvas calls the canvas's `on-event` method with an object representing a motion event. Clicking on the canvas calls `on-event`. While the canvas has the keyboard focus, typing on the keyboard invokes the canvas's `on-char` method.

The system dispatches GUI events sequentially; that is, after invoking an event-handling callback or method, the system waits until the handler returns before dispatching the next event. To illustrate the sequential nature of events, we extend the frame again, adding a Pause button:

```scheme
(instantiate button% ("Pause" frame (lambda (button event) (sleep 5))))
```

After the user clicks Pause, the entire frame becomes unresponsive for five seconds; the system cannot dispatch more events until the call to `sleep` returns. For more information about event dispatching, see §2.4 Eventspaces.

In addition to dispatching events, the GUI classes also handle the graphical layout of windows. Our example frame demonstrates a simple layout; the frame's elements are lined up top-to-bottom. In general, a programmer specifies the layout of a window by assigning each GUI element to a parent `container`. A vertical container, such as a frame, arranges its children in a column, and a horizontal container arranges its children in a row. A container can be a child of another container; for example, to place two buttons side-by-side in our frame, we create a horizontal panel for the new buttons:

```scheme
(define panel (instantiate horizontal-panel% (frame)))
(instantiate button% ("Left" panel (lambda (button event) (send msg set-label "Left button click"))))
(instantiate button% ("Right" panel (lambda (button event) (send msg set-label "Right button click"))))
```

For more information about window layout and containers, see §2.2 Geometry Management.
- pane% — a pane is a lightweight panel. It has no graphical representation or event-handling capabilities. The pane% class has three subclasses: vertical-pane%, horizontal-pane%, and grow-box-spacer-pane%.

- Containees — areas that must be contained within other areas:
  - panel% — a panel is a containee as well as a container.
  - pane% — a pane is a containee as well as a container.
  - canvas% — a canvas is a subwindow for drawing on the screen.
  - editor-canvas% — an editor canvas is a subwindow for displaying a text editor or pasteboard editor. The editor-canvas% class is documented with the editor classes in §8 Editor Toolbox.

- Controls — containees that the user can manipulate:
  - message% — a message is a static text field or bitmap with no user interaction.
  - button% — a button is a clickable control.
  - check-box% — a check box is a clickable control; the user clicks the control to set or remove its check mark.
  - radio-box% — a radio box is a collection of mutually exclusive radio buttons; when the user clicks a radio button, it is selected and the radio box’s previously selected radio button is deselected.
  - choice% — a choice item is a pop-up menu of text choices; the user selects one item in the control.
  - list-box% — a list box is a scrollable lists of text choices; the user selects one or more items in the list (depending on the style of the list box).
  - text-field% — a text field is a box for simple text entry.
  - combo-field% — a combo field combines a text field with a pop-up menu of choices.
  - slider% — a slider is a draggable control that selects an integer value within a fixed range.
  - gauge% — a gauge is an output-only control (the user cannot change the value) for reporting an integer value within a fixed range.

As suggested by the above listing, certain areas, called containers, manage certain other areas, called containees. Some areas, such as panels, are both containers and containees.

Most areas are windows, but some are non-windows. A window, such as a panel, has a graphical representation,\(^2\) receives keyboard and mouse events, and can be disabled or hidden. In contrast, a non-window, such as a pane, is useful only for geometry management; a non-window does not receive mouse events, and it cannot be disabled or hidden.

Every area is an instance of the area<%> interface. Each container is also an instance of the area-container<%> interface, whereas each containee is an instance of subarea<%>. Windows are instances of window<%>. The area-container<%>, subarea<%>, and window<%> interfaces are subinterfaces of area<%>. Figure 2.1 shows more of the type hierarchy under area<%>.

Figure 2.2 extends the previous figure to show the complete type hierarchy under area<%>.\(^3\) To avoid intersecting lines, the hierarchy is drawn for a cylindrical surface; lines from subarea<%> and subwindow<%> wrap from the left edge of the diagram to the right edge.

Menu bars, menus, and menu items are graphical elements, but not areas (i.e., they do not have all of the properties that are common to areas, such as an adjustable graphical size). Instead, the menu classes form a separate container–containee hierarchy:

- Menu Item Containers
  - menu-bar% — a menu bar is a top-level collection of menus that are associated with a frame.

\(^2\)For a non-tab panel, the graphical representation is merely an optional border.

\(^3\)Some of the types in Figure 2.2 are represented by interfaces, and some types are represented by classes. In principle, every area type should be represented by an interface, but whenever the windowing toolbox provides a concrete implementation, the corresponding interface is omitted from the toolbox.
2. Windowing Toolbox Overview

2.1. Core Windowing Classes

Figure 2.1: Core area type hierarchy

Figure 2.2: Complete area type hierarchy (drawn on a cylinder with wraparound lines)
2.2 Geometry Management

MrEd’s geometry management makes it easy to design windows that look right on all platforms, despite different graphical representations of GUI elements. Geometry management is based on containers; each container arranges its children based on simple constraints, such as the current size of a frame and the natural size of a button.

The built-in container classes include horizontal panels (and panes), which align their children in a row, and vertical panels (and panes), which align their children in a column. By nesting horizontal and vertical containers, a programmer can achieve most any layout. For example, we can construct a dialog with the following shape:

```
| Your name: |------------------------- | |------------------------- |
|-----------|------------------------- | |------------------------- |
|           | ( Cancel ) ( OK )       |
```

with the following program:

```
;; Create a dialog
```
(define dialog ( instantiate dialog% ("Example")))

;; Add a text field to the dialog (with a dummy callback procedure)
(instantiate text-field% ("Your name" dialog void))
;; Note: MzScheme’s void procedure accepts any number of arguments

;; Add a horizontal panel to the dialog, with centering for buttons
(define panel ( instantiate horizontal-panel% (dialog) (alignment ’(center center)) ))

;; Add Cancel and Ok buttons to the horizontal panel
(instantiate button% ("Cancel" panel void))
(instantiate button% ("Ok" panel void))

;; Show the dialog
(send dialog show #t)

Each container arranges its children using the natural size of each child, which usually depends on instantiation parameters of the child, such as the label on a button or the number of choices in a radio box. In the above example, the dialog stretches horizontally to match the minimum width of the text field, and it stretches vertically to match the total height of the field and the buttons. The dialog then stretches the horizontal panel to fill the bottom half of the dialog. Finally, the horizontal panel uses the sum of the buttons’ minimum widths to center them horizontally.

As the example demonstrates, a stretchable container grows to fill its environment, and it distributes extra space among its stretchable children. By default, panels are stretchable in both directions, whereas buttons are not stretchable in either direction. The programmer can change whether an individual GUI element is stretchable.

The following subsections describe the container system in detail, first discussing the attributes of a containee in §2.2.1 Containees, and then describing the attributes of a container in §2.2.2 Containers. In addition to the built-in vertical and horizontal containers, programmers can define new types of containers as discussed in the final subsection, §2.2.3 Defining New Types of Containers.

### 2.2.1 Containees

Each containee, or child, has the following properties:

- a graphical minimum width and a graphical minimum height;
- a requested minimum width and a requested minimum height;
- horizontal and vertical stretchability (on or off); and
- horizontal and vertical margins.

A container arranges its children based on these four properties of each containee. A containee’s parent container is specified when the containee is created, and the parent cannot be changed. However, a containee can be hidden or deleted within its parent, as described in §2.2.2 Containers.

The graphical minimum size of a particular containee, as reported by get-graphical-min-size, depends on the platform, the label of the containee (for a control), and style attributes specified when creating the containee. For example, a button’s minimum graphical size ensures that the entire text of the label is visible. The graphical minimum size of a control (such as a button) cannot be changed; it is fixed at creation time. A panel or pane depends on the total minimum size of its children and the way that they are arranged.

---

4 A control’s minimum size is not recalculated when its label is changed.
To select a size for a containee, its parent container considers the containee’s *requested minimum size* rather than its graphical minimum size (assuming the requested minimum is larger than the graphical minimum). Unlike the graphical minimum, the requested minimum size of a containee can be changed by a programmer at any time using the `min-width` and `min-height` methods.

Unless a containee is stretchable (in a particular direction), it always shrinks to its minimum size (in the corresponding direction). Otherwise, containees are stretched to fill all available space in a container. Each containee begins with a default stretchability. For example, buttons are not initially stretchable, whereas a one-line text field is initially stretchable in the horizontal direction. A programmer can change the stretchability of a containee at any time using the `stretchable-width` and `stretchable-height` methods.

A margin is whitespace surrounding a containee. Each containee’s margin is independent of its minimum size, but from the container’s point of view, a margin effectively increases the minimum size of the containee. For example, if a button has a vertical margin of 2, then the container must allocate enough room to leave two pixels of whitespace above and below the button, in addition to the space that is allocated for the button’s minimum height. A programmer can adjust a containee’s margin with `horiz-margin` and `vert-margin`. The default margin is 2 for a control, and 0 for any other type of containee.

In practice, the requested minimum size and margin of a control are rarely changed, although they are often changed for a canvas. Stretchability is commonly adjusted for any type of containee, depending on the visual effect desired by the programmer.

### 2.2.2 Containers

A container has the following properties:

- a list of (non-deleted) children containees;
- a requested minimum width and a requested minimum height;
- a spacing used between the children;
- a border margin used around the total set of children;
- horizontal and vertical stretchability (on or off); and
- an alignment setting for positioning leftover whitespace.

These properties are factored into the container’s calculation of its own size and the arrangement of its children. For a container that is also a containee (e.g., a panel), the container’s requested minimum size and stretchability are the same as for its containee aspect.

A containee’s parent container is specified when the containee is created, and the parent cannot be changed. However, a containee window can be *hidden* or *deleted* within its parent container:

- A hidden child is invisible to the user, but space is still allocated for each hidden child within a container. To hide or show a child, call the child’s `show` method.
- A deleted child is hidden *and* ignored by container as it arranges its other children, so no space is reserved in the container for a deleted child. To make a child deleted or non-deleted, call the container’s `delete-child` or `add-child` method (which calls the child’s `show` method).

---

3 A non-window containee cannot be make hidden or deleted.
When a child is created, it is initially shown and non-deleted. A deleted child is subject to garbage collection when no external reference to the child exists. A list of non-deleted children (hidden or not) is available from a container through its `get-children` method.

The order of the children in a container’s non-deleted list is significant. For example, a vertical panel puts the first child in its list at the top of the panel, and so on. When a new child is created, it is put at the end of its container’s list of children. The order of a container’s list can be changed dynamically via the `change-children` method. (The `change-children` method can also be used to activate or deactivate children.)

The (graphical) minimum size of a container, as reported by `get-graphical-min-size`, is calculated by combining the minimum sizes of its children (summing them or taking the maximum, as appropriate to the layout strategy of the container) along with the spacing and border margins of the container. A larger minimum may be specified by the programmer using `min-width` and `min-height` methods; when the computed minimum for a container is larger than the programmer-specified minimum, then the programmer-specified minimum is ignored.

A container’s spacing determines the amount of whitespace left between adjacent children in the container, in addition to any whitespace required by the children’s margins. A container’s border margin determines the amount of whitespace to add around the collection of children; it effectively decreases the area within the container where children can be placed. A programmer can adjust a container’s border and spacing dynamically via the `border` and `spacing` methods. The default border and spacing are 0 for all container types.

Because a panel or pane is a containee as well as a container, it has a containee margin in addition to its border margin. For a panel, these margins are not redundant because the panel can have a graphical border; the border is drawn inside the panel’s containee margin, but outside the panel’s border margin.

For a top-level-window container, such as a frame or dialog, the container’s stretchability determines whether the user can resize the window to something larger than its minimum size. Thus, the user cannot resize a frame that is not stretchable. For other types of containers (i.e., panels and panes), the container’s stretchability is its stretchability as a containee in some other container. All types of containers are initially stretchable in both directions, but a programmer can change the stretchability of an area at any time via the `stretchable-width` and `stretchable-height` methods.

The alignment specification for a container determines how it positions its children when the container has leftover space. (A container can only have leftover space in a particular direction when none of its children are stretchable in that direction.) For example, when the container’s horizontal alignment is ‘left’, the children are left-aligned in the container and leftover whitespace is accumulated to the right. When the container’s horizontal alignment is ‘center’, each child is horizontally centered in the container. A container’s alignment is changed with the `set-alignment` method.

### 2.2.3 Defining New Types of Containers

Although nested horizontal and vertical containers can express most layout patterns, a programmer can define a new type of container with an explicit layout procedure. A programmer defines a new type of container by deriving a class from `panel%` or `pane%` and overriding the `container-size` and `place-children` methods. The `container-size` method takes a list of size specifications for each child and returns two values: the minimum width and height of the container. The `place-children` method takes the container’s size and a list of size specifications for each child, and returns a list of sizes and placements (in parallel to the original list).

An input size specification is a list of four values:

- the child’s minimum width;
- the child’s minimum height;

---

6Except instances of `grow-box-spacer-pane%`, which is intended as a lightweight spacer class rather than a useful container class.
• the child’s horizontal stretchability (#t means stretchable, #f means not stretchable); and

• the child’s vertical stretchability.

For **place-children**, an output position and size specification is a list of four values:

• the child’s new horizontal position (relative to the parent);
• the child’s new vertical position;
• the child’s new actual width;
• the child’s new actual height.

The widths and heights for both the input and output include the children’s margins. The returned position for each child is automatically incremented to account for the child’s margin in placing the control.

### 2.3 Mouse and Keyboard Events

Whenever the user moves the mouse, clicks or releases a mouse button, or presses a key on the keyboard, an event is generated for some window. The window that receives the event depends on the current state of the graphic display:

• The receiving window of a mouse event is usually the window under the cursor when the mouse is moved or clicked. If the mouse is over a child window, the child window receives the event rather than its parent.

  When the user clicks in a window, the window “grabs” the mouse, so that all mouse events go to that window until the mouse button is released (regardless of the location of the cursor). As a result, a user can click on a scrollbar thumb and drag it without keeping the cursor strictly inside the scrollbar control. A mouse button-release event is normally generated for each mouse button-down event, but a button-release event might get dropped. For example, a modal dialog might appear and take over the mouse. More generally, any kind of mouse event can get dropped in principle, so avoid algorithms that depend on precise mouse-event sequences. For example, a mouse tracking handler should reset the tracking state when it receives an event other than a dragging event.

• The receiving window of a keyboard event is the window that owns the keyboard focus at the time of the event. Only one window owns the focus at any time, and focus ownership is typically displayed by a window in some manner. For example, a text field control shows focus ownership by displaying a blinking caret.

  Within a top-level window, only certain kinds of subwindows can have the focus, depending on the conventions of the platform. Furthermore, the subwindow that initially owns the focus is platform-specific. A user can move the focus in various ways, usually by clicking the target window. A program can use the `focus` method to move the focus to a subwindow or to set the initial focus.

  Under X, a `wheel-up` or `wheel-down` event may be sent to a window other than the one with the keyboard focus, because X generates wheel events based on the location of the mouse pointer.

A key-press event may correspond to either an actual key press or an auto-key repeat. Multiple key-press events without intervening key-release events normally indicate an auto-key. Like any input event, however, key-release events sometimes get dropped (e.g., due to the appearance of a modal dialog).

Controls, such as buttons and list boxes, handle keyboard and mouse events automatically, eventually invoking the callback procedure that was provided when the control was created. A canvas propagates mouse and keyboard events to its `on-event` and `on-char` methods, respectively.
A mouse and keyboard event is delivered in a special way to its window. Each ancestor of the receiving window gets a chance to intercept the event through the `on-subwindow-event` and `on-subwindow-char` methods. See the method descriptions for more information.

The default `on-subwindow-char` method for a top-level window intercepts keyboard events to detect menu-shortcut events and focus-navigation events. See `on-subwindow-char` in `frame%` and `on-subwindow-char` in `dialog%` for details. Certain OS-specific key combinations are captured at a low level, and cannot be overridden. For example, under Windows and X, pressing and releasing Alt always moves the keyboard focus to the menu bar. Similarly, Alt-Tab switches to a different application under Windows.\(^7\)

### 2.4 Event Dispatching and Eventspaces

A graphical user interface is an inherently multi-threaded system: one thread is the program managing windows on the screen, and the other thread is the user moving the mouse and typing at the keyboard. GUI programs typically use an event queue to translate this multi-threaded system into a sequential one, at least from the programmer’s point of view. Each user action is handled one at a time, ignoring further user actions until the previous one is completely handled. The conversion from a multi-threaded process to a single-threaded one greatly simplifies the implementation of GUI programs.

Despite the programming convenience provided by a purely sequential event queue, certain situations require a less rigid dialog with the user:

- **Nested event handling**: In the process of handling an event, it may be necessary to obtain further information from the user. Usually, such information is obtained via a modal dialog: in whatever fashion the input is obtained, more user events must be received and handled before the original event is completely handled. To allow the further processing of events, the handler for the original event must explicitly yield to the system. Yielding causes events to be handled in a nested manner, rather than in a purely sequential manner.

- **Asynchronous event handling**: An application may consist of windows that represent independent dialogs with the user. For example, a drawing program might support multiple drawing windows, and a particularly time-consuming task in one window (e.g., a special filter effect on an image) should not prevent the user from working in a different window. Such an application needs sequential event handling for each individual window, but asynchronous (potentially parallel) event handling across windows. In other words, the application needs a separate event queue for each window, and a separate event-handling thread for each event queue.

In MrEd, an eventspace is a context for processing GUI events. Each eventspace maintains its own queue of events, and events in a single eventspace are dispatched sequentially by a designated handler thread. An event-handling procedure running in this handler thread can yield to the system by calling `yield`, in which case other event-handling procedures may be called in a nested (but single-threaded) manner within the same handler thread. Events from different eventspaces are dispatched asynchronously by separate handler threads.

When a frame or dialog is created without a parent, it is associated with the current eventspace as described in §2.4.3 Creating and Setting the Eventspace. Events for a top-level window and its descendants are always dispatched in the window’s eventspace. Every dialog is modal; a dialog’s `show` method implicitly calls `yield` to handle events while the dialog is shown. (See also §2.4.2 Eventspaces and Threads for information about threads and modal dialogs.) Furthermore, when a modal dialog is shown, the system disables all other top-level windows in the dialog’s eventspace,\(^8\) but windows in other eventspaces are unaffected by the modal dialog.

---

7 Alt-Space invokes the system menu under Windows, but this shortcut is implemented by `on-system-menu-char`, which is called by `on-subwindow-char` in `frame%` and `on-subwindow-char` in `dialog%`.  
8 Disabling a window prevents mouse and keyboard events from reaching the window, but other kinds of events, such as update events, are still delivered.
2.4. Event Dispatching and Eventspaces

2.4.1 Event Types and Priorities

In addition to events corresponding to user and windowing actions, such as button clicks, key presses, and updates, the system dispatches two kinds of internal events: **timer events** and **explicitly queued events**.

Timer events are created by instances of `timer%`. When a timer is started and then expires, the timer queues an event to call the timer’s `notify` method. Like a top-level window, each timer is associated with a particular eventspace (the **current eventspace** as described in §2.4.3 Creating and Setting the Eventspace) when it is created, and the timer queues the event in its eventspace.

Explicitly queued events are created with `queue-callback`, which accepts a callback procedure to handle the event. The event is enqueued in the current eventspace at the time of the call to `queue-callback`, with either a high or low priority as specified by the (optional) second argument to `queue-callback`.

An eventspace’s event queue is actually a priority queue with events sorted according to their kind, from highest-priority (dispatched first) to lowest-priority (dispatched last):

- The highest-priority events are high-priority events installed with `queue-callback`.
- Timer events have the second-highest priority.
- Graphical events, such as mouse clicks or window updates, have the second-lowest priority.
- The lowest-priority events are low-priority events installed with `queue-callback`.

Although a programmer has no direct control over the order in which events are dispatched, a programmer can control the timing of dispatches by setting the event dispatch handler via the `event-dispatch-handler` parameter. This parameter and other eventspace procedures are described in more detail in §4.2 Eventspaces.

2.4.2 Eventspaces and Threads

When a new eventspace is created, a corresponding **handler thread** is created for the eventspace. When the system dispatches an event for an eventspace, it always does so in the eventspace’s handler thread. A handler procedure can create new threads that run indefinitely, but as long as the handler thread is running a handler procedure, no new events can be dispatched for the corresponding eventspace.

When a handler thread shows a dialog, the dialog’s `show` method implicitly calls `yield` for as long as the dialog is shown. When a non-handler thread shows a dialog, the non-handler thread simply blocks until the dialog is dismissed. Calling `yield` with no arguments from a non-handler thread has no effect. Calling `yield` with a semaphore from a non-handler thread is equivalent to calling MzScheme’s `semaphore-wait`.

2.4.3 Creating and Setting the Eventspace

Whenever a frame, dialog, or timer is created, it is associated with the eventspace specified by the `current-eventspace` parameter (see parameters, §7.9 in *PLT MzScheme: Language Manual*). When the `current-eventspace` procedure is called with no arguments, it returns the current eventspace value. When `current-eventspace` is called with an eventspace value, it changes the current eventspace to the provided one.

The `make-eventspace` procedure creates a new eventspace. The following example creates a new eventspace and a new frame in the eventspace (the `parameterize` syntactic form temporarily sets a parameter value):

```scheme
(let ([new-es (make-eventspace)])
  (parameterize ([current-eventspace new-es])
    (instantiate frame% "Example")))
```
2. Windowing Toolbox Overview

When an eventspace is created, it is placed under the management of the current custodian (see parameters, §7.9 in PLT McScheme: Language Manual). When a custodian shuts down an eventspace, all frames and dialogs associated with the eventspace are destroyed (without calling can-close? or on-close in top-level-window%), all timers in the eventspace are stopped, and all enqueued callbacks are removed. Attempting to create a new window, timer, or explicitly queued event in a shut-down eventspace raises the exn:misc exception.

An eventspace is a waitable object, so it can be used with object-wait-multiple, §7.7 in PLT McScheme: Language Manual. An eventspace is in a blocking state when a frame is visible, a timer is active, a callback is queued, or a menu-bar% is created with a 'root parent. (Note that the blocking state of an eventspace is unrelated to whether an event is ready for dispatching.)

2.4. Event Dispatching and Eventspaces

2.4.4 Exceptions and Continuation Jumps

Whenever the system dispatches an event, the call to the handler procedure is wrapped so that full continuation jumps are not allowed to escape from the dispatch, and escape continuation jumps are blocked at the dispatch site. The following block procedure illustrates how the system blocks escape continuation jumps:

```
(define (block f)
  ;; calls f and returns void if f tries to escape
  (let ([done? #f])
    (let/ec k
      (dynamic-wind
       void
       (lambda () (begin0 (f) (set! done? #t)))
       (lambda () (unless done? (k (void))))))))
```

Calls to the event dispatch handler are also protected with block.

This blocking of continuation jumps complicates the interaction between with-handlers and yield (or the default event dispatch handler). For example, in evaluating the expression

```
(with-handlers ([[(lambda (x) #t)
                    (lambda (x) (error "error during yield"))]])
 (yield))
```

the "error during yield" handler is never called, even if a callback procedure invoked by yield raises an exception. The with-handlers expression installs an exception handler that tries to jump back to the context of the with-handlers expression before invoking a handler procedure; this jump is blocked by the dispatch within yield, so "error during yield" is never printed. Exceptions during yield are “handled” in the sense that control jumps out of the event handler, but yield may dispatch another event rather than escaping or returning.

The following expression demonstrates a more useful way to handle exceptions within yield:

```
(let/ec k
  (parameterize ([current-exception-handler
    (lambda (x)
      (error "error during yield")
      (k))])
     (yield))
```

This expression installs an exception handler that prints an error message before trying to escape. Like the continuation escape associated with with-handlers, the escape to k never succeeds. Nevertheless, if an exception is raised by an event handler during the call to yield, an error message is printed before control returns to the event dispatcher within yield.
3. Windowing Class Reference

3.1 Class Listing
3.2. area

An area object is either a window or a windowless container for managing the position and size of other areas. An area can be a container, a containee, or both. The only areas without a parent are top-level windows.

All area classes accept the following named instantiation arguments:

- **min-width** — default is 0; passed to min-width
- **min-height** — default is 0; passed to min-height
- **stretchable-width** — default is class-specific; passed to stretchable-width
- **stretchable-height** — default is class-specific; passed to stretchable-height

**get-graphical-min-size**

Returns the area’s graphical minimum size as two values: the minimum width and the minimum height (in pixels).

See §2.2 Geometry Management for more information. Note that the return value does not depend on the area’s min-width and min-height settings.

- (send an-area get-graphical-min-size) ⇒ two exact integers in [0, 10000]
get-parent

Returns the area’s parent. A top-level window may have no parent (in which case \#f is returned), or it may have another top-level window as its parent.

- (send an-area get-parent) ⇒ area-container\% object or \#f

get-top-level-window

Returns the area’s closest frame or dialog ancestor. For a frame or dialog area, the frame or dialog itself is returned.

- (send an-area get-top-level-window) ⇒ frame\% or dialog\% object

min-height

Gets or sets the area’s minimum height for geometry management.

The minimum height is ignored when it is smaller than the area’s minimum graphical height, or when it is smaller than the height reported by container-size if the area is a container. See §2.2 Geometry Management for more information.

An area’s initial minimum height is its graphical minimum height. See also get-graphical-min-size.

- (send an-area min-height) ⇒ exact integer in [0, 10000]
  Returns the current minimum height (in pixels).

- (send an-area min-height h) ⇒ void
  h : exact integer in [0, 10000]
  Sets the minimum height (in pixels); if h is smaller than the internal hard minimum, an exn:fail:contract exception is raised.

min-width

Gets or sets the area’s minimum width (in pixels) for geometry management.

The minimum width is ignored when it is smaller than the area’s minimum graphical width, or when it is smaller than the width reported by container-size if the area is a container. See §2.2 Geometry Management for more information.

An area’s initial minimum width is its graphical minimum width. See also get-graphical-min-size.

- (send an-area min-width) ⇒ exact integer in [0, 10000]
  Returns the current minimum width (in pixels).

- (send an-area min-width w) ⇒ void
  w : exact integer in [0, 10000]
  Sets the minimum width (in pixels); if w is smaller than the internal hard minimum, an exn:fail:contract exception is raised.
3.3 area-container

Extends: area

An area-container is a container area.

All area-container classes accept the following named instantiation arguments:

- border — default is 0; passed to border
- spacing — default is 0; passed to spacing
- alignment — default is class-specific, such as ’(center top) for vertical-panel; the list elements are passed to set-alignment

add-child

Add the given subwindow to the set of non-deleted children. See also change-children.

- (send an-area-container add-child child) ⇒ void
  child: subwindow object
after-new-child

This method is called after a new containee area is created with this area as its container. The new child is provided as an argument to the method.

- (send an-area-container after-new-child child) ⇒ void
  child: subarea object

  Does nothing.

begin-container-sequence

Suspends geometry management in the container’s top-level window until end-container-sequence is called. The begin-container-sequence and end-container-sequence methods are used to bracket a set of container modifications so that the resulting geometry is computed only once. A container sequence also delays hide and show actions by change-children until the sequence is complete. Sequence begin and end commands may be nested arbitrarily deep.

- (send an-area-container begin-container-sequence) ⇒ void

border

Gets or sets the border margin for the container in pixels. This margin is used as an inset into the panel’s client area before the locations and sizes of the subareas are computed.

- (send an-area-container border) ⇒ exact integer in [0, 1000]
  Returns the current border margin.

- (send an-area-container border margin) ⇒ void
  margin: exact integer in [0, 1000]

  Sets the border margin.

change-children

Takes a filter procedure and changes the container’s list of non-deleted children. The filter procedure takes a list of children areas and returns a new list of children areas. The new list must consist of children that were created as subareas of this area (i.e., change-children cannot be used to change the parent of a subarea).

After the set of non-deleted children is changed, the container computes the sets of newly deleted and newly non-deleted children. Newly deleted windows are hidden. Newly non-deleted windows are shown.

Since non-window areas cannot be hidden, non-window areas cannot be deleted. If the filter procedure removes non-window subareas, an exception is raised and the set of non-deleted children is not changed.

- (send an-area-container change-children filter) ⇒ void
  filter: procedure of one argument, a list of subarea objects, that returns a list of subarea objects

container-flow-modified

Call this method when the result changes for an overridden flow-defining method, such as place-children. The call notifies the geometry manager that the placement of the container’s children needs to be recomputed.
The **reflow-container** method only recomputes child positions when the geometry manager thinks that the placement has changed since the last computation.

- (send an-area-container container-flow-modified) ⇒ void

**container-size**

Called to determine the minimum size of a container. See §2.2 Geometry Management for more information.

- (send an-area-container container-size info) ⇒ two exact integers in [0, 10000]
  info: list of list containing two exact integers in [0, 10000] and two booleans

**delete-child**

Removes the given subwindow from the list of non-deleted children. See also change-children.

- (send an-area-container delete-child child) ⇒ void
  child: subwindow object

**end-container-sequence**

See begin-container-sequence.

- (send an-area-container end-container-sequence) ⇒ void

**get-alignment**

Returns the container’s current alignment specification. See set-alignment for more information.

- (send an-area-container get-alignment) ⇒ two symbols

**get-children**

Returns a list of the container’s non-deleted children. (The non-deleted children are the ones currently managed by the container; deleted children are generally hidden.) The order of the children in the list is significant. For example, in a vertical panel, the first child in the list is placed at the top of the panel.

- (send an-area-container get-children) ⇒ list of subarea objects

**place-children**

Called to place the children of a container. See §2.2 Geometry Management for more information.

- (send an-area-container place-children info width height) ⇒ list of list containing four exact integers in [0, 10000]
  info: list of list containing two exact integers in [0, 10000] and two booleans
  width: exact integer in [0, 10000]
  height: exact integer in [0, 10000]
reflow-container

When a container window is not shown, changes to the container’s set of children do not necessarily trigger the immediate re-computation of the container’s size and its children’s sizes and positions. Instead, the recalculation is delayed until the container is shown, which avoids redundant computations between a series of changes. The reflow-container method forces the immediate recalculation of the container’s and its children’s sizes and locations.

Immediately after calling the reflow-container method, get-size, get-client-size, get-width, get-height, get-x, and get-y report the manager-applied sizes and locations for the container and its children, even when the container is hidden. A container implementation can call functions such as get-size at any time to obtain the current state of a window (because the functions do not trigger geometry management).

See also container-flow-modified.

- (send an-area-container reflow-container) ⇒ void

set-alignment

Sets the alignment specification for a container, which determines how it positions its children when the container has leftover space (when a child was not stretchable in a particular dimension).

When the container’s horizontal alignment is ‘left’, the children are left-aligned in the container and whitespace is inserted to the right. When the container’s horizontal alignment is ‘center’, each child is horizontally centered in the container. When the container’s horizontal alignment is ‘right’, leftover whitespace is inserted to the left.

Similarly, a container’s vertical alignment can be ‘top’, ‘center’, or ‘bottom’.

- (send an-area-container set-alignment horiz-align vert-align) ⇒ void
  horiz-align: symbol in ‘(left center right)
  vert-align: symbol in ‘(top center bottom)

spacing

Gets or sets the spacing, in pixels, used between subareas in the container. For example, a vertical panel inserts this spacing between each pair of vertically aligned subareas (with no extra space at the top or bottom).

- (send an-area-container spacing) ⇒ exact integer in [0, 1000]
  Returns the current spacing.

- (send an-area-container spacing spacing) ⇒ void
  spacing: exact integer in [0, 1000]
  Sets the spacing.

3.4 area-container-window

Extends: window

Extends: area-container
3.5 button%

Implements: control<%>

Whenever a button is clicked by the user, the button's callback procedure is invoked. A callback procedure is provided as an initialization argument when each button is created.

- (new button% (label _) (parent _) [(callback _)] [(style _)] [(font _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ button% object
  label: string (up to 200 characters) or bitmap% object
  parent: frame%, dialog%, panel%, or pane% object
  callback = (lambda (b e) (void)) : procedure of two arguments: a button% object and a control-event% object
  style = null : list of symbols in '(border deleted)
  font = normal-control-font : font% object
  enabled = #t : boolean
  vert-margin = 2 : exact integer in [0, 1000]
  horiz-margin = 2 : exact integer in [0, 1000]
  min-width = 0 : exact integer in [0, 10000]
  min-height = 0 : exact integer in [0, 10000]
  stretchable-width = #f : boolean
  stretchable-height = #f : boolean

Creates a button with a string or bitmap label. If label is a bitmap, then the bitmap must be valid (see ok? in bitmap%) and not installed in a bitmap-dc% object; otherwise, an exn:fail:contract exception is raised. If the bitmap has a mask (see get-loaded-mask in bitmap%) that is the same size as the bitmap, then the mask is used for the label; furthermore, in contrast to the limitations of draw-bitmap in dc<%>, non-monochrome label masks work consistently on all platforms.

If an ampersand (“&”) occurs in label (when label is a string), it is specially parsed; under Windows and X, the character following an ampersand is underlined in the displayed control to indicate a keyboard mnemonic. (Under Mac OS X, mnemonic underlines are not shown.) The underlined mnemonic character must be a letter or a digit. The user can effectively click the button by typing the mnemonic when the control’s top-level-window contains the keyboard focus. The user must also hold down the Meta or Alt key if the keyboard focus is currently in a control that handles normal alphanumeric input. The ampersand itself is removed from label before it is displayed for the control; a double-ampersand in label is converted to a single ampersand (with no mnemonic underlining). Under Mac OS X, a parenthesized mnemonic character is removed (along with any surrounding space) before the label is displayed, since a parenthesized mnemonic is often used for non-Roman languages. Finally, any text after a tab character is removed on all platforms. Mnemonic keyboard events are handled by on-traverse-char (but not under Mac OS X).

The callback procedure is called (with the event type 'button) whenever the user clicks the button.

If style includes 'border, the button is drawn with a special border that indicates to the user that it is the default action button (see on-traverse-char). If style includes 'deleted, then the button is created as hidden, and it does not affect its parent's geometry; the button can be made active later by calling parent's add-child method.

The font argument determines the font for the control. For information about the enabled argument, see window<%>. For information about the horiz-margin and vert-margin arguments, see subarea<%>. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area<%>.
set-label

Sets a window’s label. The window’s natural minimum size might be different after the label is changed, but the window’s minimum size is not recomputed.

See get-label for more information.

- (send a-button set-label label) ⇒ void
  label: bitmap% object

  Sets the bitmap label for a bitmap button. Since label is a bitmap, the bitmap must be valid (see ok? in bitmap%) and not installed in a bitmap-dc% object; otherwise, an exn:fail:contract exception is raised. If the bitmap has a mask (see get-loaded-mask in bitmap%) that is the same size as the bitmap, then the mask is used for the label; furthermore, in contrast to the limitations of draw-bitmap in dc<%>, non-monochrome label masks work consistently on all platforms. The bitmap label is installed only if the control was originally created with a bitmap label.

- (send a-button set-label l) ⇒ void
  l: string (up to 200 characters)

  If the window was not created with a label, or if the window was created with a non-string label, l is ignored.

3.6 canvas%

Extends: subwindow%

A canvas is a subwindow onto which graphics and text can be drawn. Canvases also receive mouse and keyboard events.

To draw onto a canvas, get its device context (see get-dc).

The canvas<%> interface is implemented by two classes:

- canvas% — a canvas for arbitrary drawing and event handling
- editor-canvas% — a canvas for displaying editor<%> objects

get-canvas-background

Returns the color currently used to “erase” the canvas content before on-paint is called. See also set-canvas-background.

The result is #f if the canvas was created with the ’transparent style, otherwise it is always a color% object.

- (send a-canvas get-canvas-background) ⇒ color% object or #f

get-dc

Gets the canvas’s device context. See dc<%> for more information about drawing.

- (send a-canvas get-dc) ⇒ dc<%> object
min-client-height

Gets or sets the canvas’s minimum height for geometry management, based on the client size rather than the full size. The client height is obtained or changed via `min-height in area<%>`, adding or subtracting border and scrollbar sizes as appropriate.

The minimum height is ignored when it is smaller than the canvas’s `minimum graphical height`. See §2.2 Geometry Management for more information.

- `(send a-canvas min-client-height) ⇒ exact integer in [0, 10000]`
  Returns the current minimum client height (in pixels).

- `(send a-canvas min-client-height h) ⇒ void
  h: exact integer in [0, 10000]`
  Sets the minimum client height (in pixels).

min-client-width

Gets or sets the canvas’s minimum width for geometry management, based on the canvas’s client size rather than its full size. The client width is obtained or changed via `min-width in area<%>`, adding or subtracting border and scrollbar sizes as appropriate.

The minimum width is ignored when it is smaller than the canvas’s `minimum graphical width`. See §2.2 Geometry Management for more information.

- `(send a-canvas min-client-width) ⇒ exact integer in [0, 10000]`
  Returns the current minimum client width (in pixels).

- `(send a-canvas min-client-width w) ⇒ void
  w: exact integer in [0, 10000]`
  Sets the minimum client width (in pixels).

on-char

Called when the canvas receives a keyboard event. See also “Mouse and Keyboard Events” (section 2.3, page 12).

- `(send a-canvas on-char ch) ⇒ void
  ch: key-event% object`
  Does nothing.

on-event

Called when the canvas receives a mouse event. See also “Mouse and Keyboard Events” (section 2.3, page 12), noting in particular that certain mouse events can get dropped.

- `(send a-canvas on-event event) ⇒ void
  event: mouse-event% object`
  Does nothing.
on-paint

Called when the canvas is exposed or resized so that the image in the canvas can be repainted.

When on-paint is called in response to a system expose event and only a portion of the canvas is newly exposed, any drawing operations performed by on-paint are clipped to the newly-exposed region; however, the clipping region as reported by get-clipping-region does not change.

- (send a-canvas on-paint) ⇒ void

  Does nothing.

on-scroll

Called when the user changes one of the canvas’s manual scrollbars. A scroll-event% argument provides information about the scroll action.

This method is not called when automatic scrollbars are changed; the on-paint method is called instead.

- (send a-canvas on-scroll event) ⇒ void
  event: scroll-event% object

on-tab-in

Called when the keyboard focus enters the canvas via keyboard navigation events. The on-focus method is also called, as usual for a focus change. When the keyboard focus leaves a canvas due to a navigation event, only on-focus is called.

See also accept-tab-focus in canvas% and on-traverse-char in top-level-window%.

- (send a-canvas on-tab-in) ⇒ void

  Does nothing.

set-canvas-background

Sets the color used to “erase” the canvas content before on-paint is called. (This color is typically associated with the canvas at a low level, so that it is used even when a complete refresh of the canvas is delayed by other activity.)

If the canvas was created with the ’transparent style, an exn:fail:contract exception is raised.

- (send a-canvas set-canvas-background color) ⇒ void
  color: color% object

  Sets the canvas’s background.

set-resize-corner

Under Mac OS X, enables or disables space for a resize tab at the canvas’s lower-right corner when only one scrollbar is visible. This method has no effect under Windows or X, and it has no effect when both or no scrollbars are visible. The resize corner is disabled by default, but it can be enabled when a canvas is created with the ’resize-corner style.
3.7. canvas%

A canvas% object is a general-purpose window for drawing and handling events.

- (new canvas% (parent _) [(style _)] [(label _)] [(paint-callback _)] [(gl-config _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ canvas% object

  parent: frame%, dialog%, panel%, or pane% object
  style = null: list of symbols in ‘(border control-border combo vscroll hscroll resize-corner gl deleted no-autoclear transparent)
  paint-callback = void: procedure of two arguments: a canvas% object and a dc% object
  label = #f: string (up to 200 characters) or #f
  gl-config = #f: gl-config% object or #f
  enabled = #t: boolean
  vert-margin = 0: exact integer in [0, 1000]
  horiz-margin = 0: exact integer in [0, 1000]
  min-width = 0: exact integer in [0, 10000]
  min-height = 0: exact integer in [0, 10000]
  stretchable-width = #t: boolean
  stretchable-height = #t: boolean

The style argument indicates one or more of the following styles:
- ‘border — gives the canvas a thin border
- ‘control-border — gives the canvas a border that is like a text-field% control
- ‘combo — gives the canvas a combo button that is like a combo-field% control; this style is intended for use with ‘control-border and not with ‘hscroll or ‘vscroll
- ‘hscroll — enables horizontal scrolling (initially visible but inactive)
- ‘vscroll — enables vertical scrolling (initially visible but inactive)
- ‘resize-corner — leaves room for a resize control at the canvas’s bottom right when only one scroll-bar is visible
- ‘gl — obsolete (every canvas is an OpenGL context where supported)
- ‘deleted — creates the canvas as initially hidden and without affecting parent’s geometry; the canvas can be made active later by calling parent’s add-child method
- ‘no-autoclear — prevents automatic erasing of the canvases before calls to on-paint
- ‘transparent — the canvas is automatically “erased” before an update using it’s parent window’s background; the result is undefined if this flag is combined with ‘no-autoclear

The ‘hscroll and ‘vscroll styles create a canvas with an initially inactive scrollbar. The scrollbars are activated with either init-manual-scrollbars or init-auto-scrollbars, and they can be hidden.
and re-shown with `show-scrollbars`.

The `paint-callback` argument is called by the default `on-paint` method, using the canvas and the DC returned by `get-dc` as the argument.

The `label` argument names the canvas for `get-label`, but it is not displayed with the canvas.

The `gl-config` argument determines properties of an OpenGL context for this canvas, as obtained through the canvas’s drawing context. See also `get-dc` and `get-gl-context` in `dc<%>`.

For information about the `enabled` argument, see `window<%>`. For information about the `horiz-margin` and `vert-margin` arguments, see `subarea<%>`. For information about the `min-width`, `min-height`, `stretchable-width`, and `stretchable-height` arguments, see `area<%>`.

### accept-tab-focus

Gets or sets whether tab-focus is enabled for the canvas. When tab-focus is enabled, the canvas can receive the keyboard focus when the user navigates among a frame or dialog’s controls with the Tab and arrow keys. By default, tab-focus is disabled.

When tab-focus is enabled for a canvas, Tab, arrow, and Enter keyboard events are consumed by a frame’s default `on-traverse-char` method. (In addition, a dialog’s default method consumes Escape key events.) Otherwise, `on-traverse-char` allows the keyboard events to be propagated to the canvas.

- `(send a-canvas accept-tab-focus) ⇒ boolean`
  Returns `#t` if tab-focus is enabled for the canvas, `#f` otherwise.

- `(send a-canvas accept-tab-focus on?) ⇒ void
  on?: boolean`
  Enables or disables tab-focus for the canvas.

### get-scroll-page

Get the current page step size of a manual scrollbar. The result is 0 if the scrollbar is not active or it is automatic.

See also `init-manual-scrollbars`.

- `(send a-canvas get-scroll-page which) ⇒ exact integer in [1, 10000]
  which: symbol in ’(horizontal vertical)`
  The `which` argument is either ’horizontal or ’vertical, indicating whether to get the page step size of the horizontal or vertical scrollbar, respectively.

### get-scroll-pos

Gets the current value of a manual scrollbar. The result is always 0 if the scrollbar is not active or it is automatic.

See also `init-manual-scrollbars`.

- `(send a-canvas get-scroll-pos which) ⇒ exact integer in [0, 10000]
  which: symbol in ’(horizontal vertical)`
  The `which` argument is either ’horizontal or ’vertical, indicating that the value of the horizontal or vertical scrollbar should be returned, respectively.
get-scroll-range

Gets the current maximum value of a manual scrollbar. The result is always 0 if the scrollbar is not active or it is automatic.

See also init-manual-scrollbars.

- (send a-canvas get-scroll-range which) ⇒ exact integer in [0, 10000]
  which: symbol in ’(horizontal vertical)

  The which argument is either ’horizontal or ’vertical, indicating whether to get the maximum value of the horizontal or vertical scrollbar, respectively.

get-view-start

Get the location at which the visible portion of the canvas starts, based on the current values of the horizontal and vertical scrollbars if they are initialized as automatic (see init-auto-scrollbars). Combined with get-client-size, an application can efficiently redraw only the visible portion of the canvas. The values are in pixels.

If the scrollbars are disabled or initialized as manual (see init-manual-scrollbars), the result is (values 0 0).

- (send a-canvas get-view-start) ⇒ two exact integers in [0, 10000]

get-virtual-size

Gets the size in device units of the scrollable canvas area (as opposed to the client size, which is the area of the canvas currently visible). This is the same size as the client size (as returned by get-client-size) unless scrollbars are initialized as automatic (see init-auto-scrollbars).

- (send a-canvas get-virtual-size) ⇒ two exact integers in [0, 10000]

init-auto-scrollbars

Enables and initializes automatic scrollbars for the canvas. A horizontal or vertical scrollbar can be activated only in a canvas that was created with the ’hscroll or ’vscroll style flag, respectively.

With automatic scrollbars, the programmer specifies the desired virtual size of the canvas, and the scrollbars are automatically handled to allow the user to scroll around the virtual area. The scrollbars are not automatically hidden if they are unneeded; see show-scrollbars.

See also init-manual-scrollbars for information about manual scrollbars. The horizontal and vertical scrollbars are always either both manual or both automatic, but they are independently enabled. Automatic scrollbars can be re-initialized as manual, and vice-versa.

- (send a-canvas init-auto-scrollbars hORIZ-pixels vert-pixels h-value v-value) ⇒ void
  hORIZ-pixels: exact integer in [1, 10000] or #f
  vert-pixels: exact integer in [1, 10000] or #f
  h-value: real number in [0.0, 1.0]
  v-value: real number in [0.0, 1.0]
Initialize the scrollbars and resets the canvas’s virtual size to the given values. If either \texttt{horiz-pixels} or \texttt{vert-pixels} is \#f, the scrollbar is not enabled in the corresponding direction, and the canvas’s virtual size in that direction is the same as its client size.

The \texttt{h-value} and \texttt{v-value} arguments specify the initial values of the scrollbars as a fraction of the scrollbar’s range. A 0.0 value initializes the scrollbar to its left/top, while a 1.0 value initializes the scrollbar to its right/bottom.

See also \texttt{on-scroll} and \texttt{get-virtual-size}.

\texttt{init-manual-scrollbars}

Enables and initializes manual scrollbars for the canvas. A horizontal or vertical scrollbar can be activated only in a canvas that was created with the ‘hscroll or ‘vscroll style flag, respectively.

With manual scrollbars, the programmer is responsible for managing all details of the scrollbars, and the scrollbar state has no effect on the canvas’s virtual size. Instead, the canvas’s virtual size is the same as its client size.

See also \texttt{init-auto-scrollbars} for information about automatic scrollbars. The horizontal and vertical scrollbars are always either both manual or both automatic, but they are independently enabled. Automatic scrollbars can be re-initialized as manual, and vice-versa.

\begin{verbatim}
- (send a-canvas init-manual-scrollbars h-length v-length h-page v-page h-value v-value) \Rightarrow void
  h-length: exact integer in [0, 10000] or \#f
  v-length: exact integer in [0, 10000] or \#f
  h-page: exact integer in [1, 10000]
  v-page: exact integer in [1, 10000]
  h-value: exact integer in [0, 10000]
  v-value: exact integer in [0, 10000]
\end{verbatim}

The \texttt{h-length} and \texttt{v-length} arguments specify the length of each scrollbar in scroll steps (i.e., the maximum value of each scrollbar). If either is \#f, the scrollbar is disabled in the corresponding direction.

The \texttt{h-page} and \texttt{v-page} arguments set the number of scrollbar steps in a page, i.e., the amount moved when pressing above or below the value indicator in the scrollbar control.

The \texttt{h-value} and \texttt{v-value} arguments specify the initial values of the scrollbars.

If \texttt{h-value} is greater than \texttt{h-length} or \texttt{v-value} is greater than \texttt{v-length}, an \texttt{exn:fail:contract} exception is raised. (The page step may be larger than the total size of a scrollbar.)

See also \texttt{on-scroll} and \texttt{get-virtual-size}.

\texttt{on-paint}

Called when the canvas is exposed or resized so that the image in the canvas can be repainted.

When \texttt{on-paint} is called in response to a system expose event and only a portion of the canvas is newly exposed, any drawing operations performed by \texttt{on-paint} are clipped to the newly-exposed region; however, the clipping region as reported by \texttt{get-clipping-region} does not change.

\begin{verbatim}
- (send a-canvas on-paint) \Rightarrow void
\end{verbatim}

Calls the procedure supplied as the \texttt{paint-callback} argument when the \texttt{canvas} was created.
scroll

Sets the values of automatic scrollbars. (This method has no effect on manual scrollbars.)

- `(send a-canvas scroll h-value v-value) ⇒ void`
  h-value: real number in [0.0, 1.0] or #f
  v-value: real number in [0.0, 1.0] or #f

  If either argument is #f, the scrollbar value is not changed in the corresponding direction.

  The h-value and v-value arguments each specify a fraction of the scrollbar’s movement. A 0.0 value sets the scrollbar to its left/top, while a 1.0 value sets the scrollbar to its right/bottom. A 0.5 value sets the scrollbar to its middle. In general, if the canvas’s virtual size is v, its client size is c, and (> v c), then scrolling to p sets the view start to `(floor (* p (- v c)))`.

  See also `init-auto-scrollbars` and `get-view-start`.

set-scroll-page

Set the current page step size of a manual scrollbar. (This method has no effect on automatic scrollbars.)

See also `init-manual-scrollbars`.

- `(send a-canvas set-scroll-page which value) ⇒ void`
  which: symbol in ’(horizontal vertical)
  value: exact integer in [1, 10000]

  The which argument is either ’horizontal or ’vertical, indicating whether to set the page step size of the horizontal or vertical scrollbar, respectively.

set-scroll-pos

Sets the current value of a manual scrollbar. (This method has no effect on automatic scrollbars.)

The value of the canvas’s scrollbar can be changed by the user scrolling, and such changes do not go through this method; use on-scroll to monitor scrollbar value changes.

See also `init-manual-scrollbars` and `scroll`.

- `(send a-canvas set-scroll-pos which value) ⇒ void`
  which: symbol in ’(horizontal vertical)
  value: exact integer in [0, 10000]

  The which argument is either ’horizontal or ’vertical, indicating whether to set the value of the horizontal or vertical scrollbar set, respectively.

set-scroll-range

Sets the current maximum value of a manual scrollbar. (This method has no effect on automatic scrollbars.)

See also `init-manual-scrollbars`.

- `(send a-canvas set-scroll-range which value) ⇒ void`
  which: symbol in ’(horizontal vertical)
  value: exact integer in [0, 10000]
The \textit{which} argument is either \texttt{'horizontal} or \texttt{'vertical}, indicating whether to set the maximum value of the horizontal or vertical scrollbar, respectively.

\texttt{show-scrollbars}

Shows or hides scrollbar. The horizontal scrollbar can be shown only if the canvas was created with the \texttt{'hscroll} style, and the vertical scrollbar can be shown only if the canvas was created with the \texttt{'vscroll} style. See also \texttt{init-auto-scrollbars} and \texttt{init-manual-scrollbars}.

\begin{verbatim}
- (send a-canvas show-scrollbars show-horiz? show-vert?) ⇒ void
  show-horiz?: boolean
  show-vert?: boolean
  Shows or hides the scrollbars as indicated by show-horiz? and show-vert?. If show-horiz? is true and the canvas was not created with the \texttt{'hscroll} style, an \texttt{exn:fail:contract} exception is raised. Similarly, if show-vert? is true and the canvas was not created with the \texttt{'vscroll} style, an \texttt{exn:fail:contract} exception is raised.
\end{verbatim}

\texttt{swap-gl-buffers}

Calls \texttt{swap-buffers} on the result of \texttt{get-gl-context} for this canvas’s DC as returned by \texttt{get-dc}.

The \texttt{swap-buffers} method acquires a re-entrant lock, so nested calls to \texttt{with-gl-context} on different threads or OpenGL contexts can block or deadlock.

\begin{verbatim}
- (send a-canvas swap-gl-buffers) ⇒ void
\end{verbatim}

\texttt{with-gl-context}

Passes the given thunk to \texttt{call-as-current} of the result of \texttt{get-gl-context} for this canvas’s DC as returned by \texttt{get-dc}.

The \texttt{call-as-current} method acquires a re-entrant lock, so nested calls to \texttt{with-gl-context} on different threads or OpenGL contexts can block or deadlock.

\begin{verbatim}
- (send a-canvas with-gl-context thunk) ⇒ return value of thunk
  thunk: procedure of no arguments
\end{verbatim}

\section*{3.8 \texttt{check-box%}}

\textbf{Implements: control<%>}

A check box is a labeled box which is either checked or unchecked.

Whenever a check box is clicked by the user, the check box’s value is toggled and its callback procedure is invoked. A callback procedure is provided as an initialization argument when each check box is created.

\begin{verbatim}
- (new check-box% (label _) (parent _) [(callback _)] [(style _)] [(value _)] [(font _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _))] ⇒ check-box% object
\end{verbatim}
3.8. check-box

**label**: string (up to 200 characters) or bitmap object
**parent**: frame, dialog, panel, or pane object
**callback** = (lambda (c e) (void)): procedure of two arguments: a check-box object and a control-event object
**style** = null: list of symbols in ’(deleted)
**value** = #f: boolean
**font** = normal-control-font: font object
**enabled** = #t: boolean
**vert-margin** = 2: exact integer in [0, 1000]
**horiz-margin** = 2: exact integer in [0, 1000]
**min-width** = 0: exact integer in [0, 10000]
**min-height** = 0: exact integer in [0, 10000]
**stretchable-width** = #f: boolean
**stretchable-height** = #f: boolean

Creates a check box with a string or bitmap label. If label is a bitmap, then the bitmap must be valid (see ok? in bitmap%) and not installed in a bitmap-dc% object; otherwise, an exn:fail:contract exception is raised. If the bitmap has a mask (see get-loaded-mask in bitmap%) that is the same size as the bitmap, then the mask is used for the label; furthermore, in contrast to the limitations of draw-bitmap in dc<%>, non-monochrome label masks work consistently on all platforms.

If an ampersand (“&)” occurs in label (when label is a string), it is specially parsed; under Windows and X, the character following an ampersand is underlined in the displayed control to indicate a keyboard mnemonic. (Under Mac OS X, mnemonic underlines are not shown.) The underlined mnemonic character must be a letter or a digit. The user can effectively click the check box by typing the mnemonic when the control’s top-level-window contains the keyboard focus. The user must also hold down the Meta or Alt key if the keyboard focus is currently in a control that handles normal alphanumeric input. The ampersand itself is removed from label before it is displayed for the control; a double-ampersand in label is converted to a single ampersand (with no mnemonic underlining). Under Mac OS X, a parenthesized mnemonic character is removed (along with any surrounding space) before the label is displayed, since a parenthesized mnemonic is often used for non-Roman languages. Finally, any text after a tab character is removed on all platforms. Mnemonic keyboard events are handled by on-traverse-char (but not under Mac OS X).

The callback procedure is called (with the event type ’check-box) whenever the user clicks the check box.

If style includes ’deleted, then the check box is created as hidden, and it does not affect its parent’s geometry; the check box can be made active later by calling parent’s add-child method.

If value is true, it is passed to set-value so that the box is initially checked.

The font argument determines the font for the control. For information about the enabled argument, see window<%>. For information about the horiz-margin and vert-margin arguments, see subarea<%>. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area<%>.

get-value

Gets the state of the check box: #t if it is checked, #f otherwise.

- (send a-check-box get-value) ⇒ boolean

set-label

Sets a window’s label. The window’s natural minimum size might be different after the label is changed, but the window’s minimum size is not recomputed.

See get-label for more information.
3. Windowing Class Reference

3.9 checkable-menu-item%

- (send a-check-box set-label label) ⇒ void
  label: bitmap% object
  Since label is a bitmap, the bitmap must be valid (see ok? in bitmap%) and not installed in a bitmap-dc% object; otherwise, an exn:fail:contract exception is raised. If the bitmap has a mask (see get-loaded-mask in bitmap%) that is the same size as the bitmap, then the mask is used for the label; furthermore, in contrast to the limitations of draw-bitmap in dc<%, non-monochrome label masks work consistently on all platforms. The bitmap label is installed only if the control was originally created with a bitmap label.

- (send a-check-box set-label l) ⇒ void
  l: string (up to 200 characters)
  If the window was not created with a label, or if the window was created with a non-string label, l is ignored.

set-value

Sets the check box’s state. (The control’s callback procedure is not invoked.)

The check box’s state can be changed by the user clicking the control, and such changes do not go through this method; use the control callback procedure (provided as an initialization argument) to monitor state changes.

- (send a-check-box set-value state) ⇒ void
  state: boolean
  If state is #f, the box is unchecked, otherwise it is checked.

3.9 checkable-menu-item%

Implements: selectable-menu-item<%>

A checkable-menu-item% is a string-labelled menu item that maintains a check mark. Its parent must be a menu% or popup-menu%. When the user selects the menu item, the item’s check mark is toggled and its callback procedure is called.

- (new checkable-menu-item% (label _) (parent _) (callback _) [(shortcut _)] [(help-string _)] [(demand-callback _)] [(checked _)]) ⇒ checkable-menu-item% object
  label: string (up to 200 characters)
  parent: menu% or popup-menu% object
  callback: procedure of two arguments: a menu-item% object and a control-event% object
  shortcut = #f: character or #f
  help-string = #f: string (up to 200 characters) or #f
  demand-callback = void: procedure of one argument: a checkable-menu-item% object
  checked = #f: boolean

Creates a new menu item in parent. The item is initially shown, appended to the end of its parent, and unchecked. The callback procedure is called (with the event type ‘menu) when the menu item is selected (either via a menu bar, popup-menu in window<%, or popup-menu in editor-admin%). See set-label for information about mnemonic ampersands (“&”) in label.

If shortcut is not #f, the item has a shortcut. See get-shortcut for more information.

If help-string is not #f, the item has a help string. See get-help-string for more information.

The demand-callback procedure is called by the default on-demand method with the object itself.
By default, the menu item is initially unchecked. If checked is true, then check is called so that the menu item is initially checked.

check

Checks or unchecks the menu item.

A menu item’s check state can be changed by the user selecting the item, and such changes do not go through this method; use the menu item callback procedure (provided as an initialization argument) to monitor check state changes.

- (send a-checkable-menu-item check check?) ⇒ void
  check?: boolean

is-checked?

Returns #t if the item is checked, #f otherwise.

- (send a-checkable-menu-item is-checked?) ⇒ boolean

3.10 choice%

Implements: list-control<%>

A choice item allows the user to select one string item from a pop-up list of items. Unlike a list box, only the currently selection is visible until the user pops-up the menu of choices.

Whenever the selection of a choice item is changed by the user, the choice item’s callback procedure is invoked. A callback procedure is provided as an initialization argument when each choice item is created.

See also list-box%.

- (new choice% (label _) (choices _) (parent _) [(callback _)] [(style _)] [(selection _)] [(font _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ choice% object
  label: string (up to 200 characters) or #f
  choices: list of strings (up to 200 characters each)
  parent: frame%, dialog%, panel%, or pane% object
  callback = (lambda (c e) (void)): procedure of two arguments: a choice% object and a control-event% object
  style = null: list of symbols in ’(vertical-label horizontal-label deleted)
  selection = 0: exact non-negative integer
  font = normal-control-font: font% object
  enabled = #t: boolean
  vert-margin = 2: exact integer in [0, 1000]
  horiz-margin = 2: exact integer in [0, 1000]
  min-width = 0: exact integer in [0, 10000]
  min-height = 0: exact integer in [0, 10000]
  stretchable-width = #f: boolean
  stretchable-height = #f: boolean

  Creates a choice item. If label is a string, it is used as the label for the choice item.
If an ampersand ("\&") occurs in `label`, it is specially parsed; under Windows and X, the character following an ampersand is underlined in the displayed control to indicate a keyboard mnemonic. (Under Mac OS X, mnemonic underlines are not shown.) The underlined mnemonic character must be a letter or a digit. The user can move the keyboard focus to the choice item by typing the mnemonic when the control’s top-level-window contains the keyboard focus. The user must also hold down the Meta or Alt key if the keyboard focus is currently in a control that handles normal alphanumeric input. The ampersand itself is removed from `label` before it is displayed for the control; a double-ampersand in `label` is converted to a single ampersand (with no mnemonic underlining). Under Mac OS X, a parenthesized mnemonic character is removed (along with any surrounding space) before the label is displayed, since a parenthesized mnemonic is often used for non-Roman languages. Finally, any text after a tab character is removed on all platforms. Mnemonic keyboard events are handled by `on-traverse-char` (but not under Mac OS X).

The `choices` list specifies the initial list of user-selectable items for the control. The initial set of choices determines the control’s minimum graphical width (see §2.2 Geometry Management for more information).

The `callback` procedure is called (with the event type ‘choice’) when the user selects a choice item (or re-selects the currently selected item).

If `style` includes ‘vertical-label’, then the choice item is created with a label above the control; if `style` does not include ‘vertical-label’ (and optionally includes ‘horizontal-label’), then the label is created to the left of the choice item. If `style` includes ‘deleted’, then the choice item is created as hidden, and it does not affect its parent’s geometry; the choice item can be made active later by calling `parent`’s `add-child` method.

By default, the first choice (if any) is initially selected. If `selection` is positive, it is passed to `set-selection` to set the initial choice selection. Although `selection` normally must be less than the length of `choices`, it can be 0 when `choices` is empty.

The `font` argument determines the font for the control. For information about the `enabled` argument, see `window<%>`. For information about the `horiz-margin` and `vert-margin` arguments, see `subarea<%>`. For information about the `min-width`, `min-height`, `stretchable-width`, and `stretchable-height` arguments, see `area<%>.

### 3.11 `clipboard<%>`

A single `clipboard<%>` object, `the-clipboard`, manages the content of the system-wide clipboard for cut and paste.

Under X, a second `clipboard<%>` object, `the-x-selection-clipboard`, manages the content of the system-wide X selection. If the ‘[MrEd:selectionAsClipboard] preference preference (see “Preferences” (section 12, page 365)) is set to a non-zero true value, however, then `the-clipboard` is always the same as `the-x-selection-clipboard`, and the system-wide X clipboard is not used.

Under Windows and Mac OS X, `the-x-selection-clipboard` is always the same as `the-clipboard`

Data can be entered into a clipboard in one of two ways: by setting the current clipboard string or byte string, or by installing a `clipboard-client<%>` object. When a client is installed, requests for clipboard data are directed to the client.

Generic data is always retrieved from the clipboard as a byte string. When retrieving clipboard data, a data type string specifies the format of the data string. The availability of different clipboard formats is determined by the current clipboard owner.
get-clipboard-bitmap

Gets the current clipboard contents as a bitmap (Windows, Mac OS X), returning \#f if the clipboard does not contain a bitmap.

See get-clipboard-data for information on eventspaces and the current clipboard client.

- (send a-clipboard get-clipboard-bitmap time) ⇒ bitmap% object or \#f
  time: exact integer

  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

get-clipboard-data

Gets the current clipboard contents in a specific format, returning \#f if the clipboard does not contain data in the requested format.

If the clipboard client is associated to an eventspace that is not the current one, the data is retrieved through a callback event in the client’s eventspace. If no result is available within one second, the request is abandoned and \#f is returned.

- (send a-clipboard get-clipboard-data format time) ⇒ byte string or \#f
  format: string
  time: exact integer

  The format string is typically four capital letters. (Under Mac OS X, only four characters for format are ever used.) For example, "TEXT" is the name of the UTF-8-encoded string format. New format names can be used to communicate application- and platform-specific data formats.

  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

get-clipboard-string

Gets the current clipboard contents as simple text, returning \#f if the clipboard does not contain any text.

See get-clipboard-data for information on eventspaces and the current clipboard client.

- (send a-clipboard get-clipboard-string time) ⇒ string or \#f
  time: exact integer

  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

set-clipboard-bitmap

Changes the current clipboard contents to a bitmap (Windows, Mac OS X) and releases the current clipboard client (if any).

- (send a-clipboard set-clipboard-bitmap new-bitmap time) ⇒ void
  new-bitmap: bitmap% object
  time: exact integer

  Sets the clipboard contents to new-bitmap. See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.
3. Windowing Class Reference

3.12. clipboard-client%

set-clipboard-client

Changes the clipboard-owning client.

- (send a-clipboard set-clipboard-client new-owner time) ⇒ void
  
  new-owner: clipboard-client% object
  time: exact integer

  Sets the client to new-owner and associates new-owner with the current eventspace (as determined by current-eventspace). The eventspace association is removed when the client is no longer the current one.

  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

set-clipboard-string

Changes the current clipboard contents to a text string and releases the current clipboard client (if any).

- (send a-clipboard set-clipboard-string new-text time) ⇒ void
  
  new-text: string
  time: exact integer

  Sets the clipboard contents to new-text. See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

3.12. clipboard-client%

A clipboard-client% object allows a program to take over the clipboard and service requests for clipboard data. See clipboard<> for more information.

A clipboard-client% object is associated to an eventspace when it becomes the current client; see set-clipboard-client for more information.

- (new clipboard-client% ) ⇒ clipboard-client% object

  Creates a clipboard client that supports no data formats.

add-type

Adds a new data format name to the list supported by the clipboard client.

- (send a-clipboard-client add-type format) ⇒ void
  
  format: string

  The format string is typically four capital letters. (Under Mac OS X, only four characters for format are ever used.) For example, "TEXT" is the name of the UTF-8-encoded string format. New format names can be used to communicate application- and platform-specific data formats.

get-data

Called when a process requests clipboard data while this client is the current one for the clipboard. The requested format is passed to the method, and the result should be a byte string matching the requested format, or #f if the
request cannot be fulfilled.

Only data format names in the client’s list will be passed to this method; see add-type.

When this method is called by the clipboard, the current eventspace is the same as the client’s eventspace. If, at the point of the clipboard request, the current eventspace is not the client’s eventspace, then current thread is guaranteed to be the handler thread of the client’s eventspace.

- (send a-clipboard-client get-data format) ⇒ byte string or #f
  
  The format string is typically four capital letters. (Under Mac OS X, only four characters for format are ever used.) For example, "TEXT" is the name of the UTF-8-encoded string format. New format names can be used to communicate application- and platform-specific data formats.

get-types

Returns a list of names that are the data formats supported by the clipboard client.

- (send a-clipboard-client get-types) ⇒ list of strings

on-replaced

Called when a clipboard client is dismissed as the clipboard owner (because the clipboard has be taken by another client or by an external application).

- (send a-clipboard-client on-replaced) ⇒ void

3.13 combo-field%

Superclass: text-field%

A combo-field% object is a text-field% object that also resembles a choice% object, because it has a small popup button to the right of the text field. By default, clicking the button pops up a menu, and selecting a menu item copies the item into the text field.

- (new combo-field% (label _) (choices _) (parent _) [(callback _) [(init-value _)] [(style _)] [(font _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ combo-field% object

  label: string (up to 200 characters) or #f
  choices: list of strings (up to 200 characters each)
  parent: frame%, dialog%, panel%, or pane% object
  callback = (lambda (cf e) (void)): procedure of two arguments: a combo-field% object and a control-event% object
  init-value = "": string
  style = null: list of symbols in ’(vertical-label horizontal-label deleted)
  font = normal-control-font: font% object
  enabled = #t: boolean
  vert-margin = 2: exact integer in [0, 1000]
  horiz-margin = 2: exact integer in [0, 1000]
  min-width = 0: exact integer in [0, 10000]
If \texttt{label} is not \texttt{#f}, it is used as the combo label. Otherwise, the combo does not display its label.

If an ampersand ("&") occurs in \texttt{label}, it is specially parsed; under Windows and X, the character following an ampersand is underlined in the displayed control to indicate a keyboard mnemonic. (Under Mac OS X, mnemonic underlines are not shown.) The underlined mnemonic character must be a letter or a digit. The user can move the keyboard focus to the combo by typing the mnemonic when the control’s top-level-window contains the keyboard focus. The user must also hold down the Meta or Alt key if the keyboard focus is currently in a control that handles normal alphanumeric input. The ampersand itself is removed from \texttt{label} before it is displayed for the control; a double-ampersand in \texttt{label} is converted to a single ampersand (with no mnemonic underlining). Under Mac OS X, a parenthesized mnemonic character is removed (along with any surrounding space) before the label is displayed, since a parenthesized mnemonic is often used for non-Roman languages. Finally, any text after a tab character is removed on all platforms. Mnemonic keyboard events are handled by \texttt{on-traverse-char} (but not under Mac OS X).

The \texttt{choices} list specifies the initial list of items for the combo’s popup menu. The \texttt{append} method adds a new item to the menu with a callback to install the appended item into the combo’s text field. The \texttt{get-menu} method returns the combo’s menu to allow arbitrary other operations. This menu might not be used at all if \texttt{on-popup} is overridden.

The \texttt{callback} procedure is called when the user changes the text in the combo or presses the Enter key (and Enter is not handled by the combo’s frame or dialog; see \texttt{on-traverse-char} in \texttt{top-level-window}). If the user presses Enter, the type of event passed to the callback is ’text-field-enter, otherwise it is ’text-field.

If \texttt{init-value} is not "", the minimum width of the text item is made wide enough to show \texttt{init-value}. Otherwise, a built-in default width is selected.

If \texttt{style} includes ’vertical-label, then the combo is created with a label above the control; if \texttt{style} does not include ’vertical-label (and optionally includes ’horizontal-label), then the label is created to the left of the combo. If \texttt{style} includes ’deleted, then the combo is created as hidden, and it does not affect its parent’s geometry; the combo can be made active later by calling \texttt{parent’s add-child} method.

The \texttt{font} argument determines the font for the control. For information about the \texttt{enabled} argument, see \texttt{window}. For information about the \texttt{horiz-margin} and \texttt{vert-margin} arguments, see \texttt{subarea}. For information about the \texttt{min-width}, \texttt{min-height}, \texttt{stretchable-width}, and \texttt{stretchable-height} arguments, see \texttt{area}.

\textbf{append}

Adds a new item to the combo’s popup menu. The given label is used for the item’s name, and the item’s callback installs the label into the combo’s text field.

\begin{verbatim}
- (send a-combo-field append l) ⇒ void
  l : string (up to 200 characters)
\end{verbatim}

\textbf{get-menu}

Returns the \texttt{popup-menu\%} that is used by the default \texttt{on-popup} method. This menu is initialized with the \texttt{labels} argument when the \texttt{combo-field\%} is created, and the \texttt{append} method adds a new item to the menu.

\begin{verbatim}
- (send a-combo-field get-menu) ⇒ popup-menu\% object
\end{verbatim}
on-popup

Called when the user clicks the combo’s popup button.

- (send a-combo-field on-popup event) ⇒ void
  
  event : control-event% object

  Gets a menu from get-menu, sets its minimum width to match the combo control’s width, and then pops up the menu.

3.14 control%

Extends: subwindow%

The control% interface is implemented by the built-in control window classes:

- message%
- button%
- check-box%
- slider%
- gauge%
- text-field%
- radio-box%
- choice%
- list-box%

command

Calls the control’s callback function, passing on the given control-event% object.

- (send a-control command event) ⇒ void
  
  event : control-event% object

get-font

Returns the font used for the control, which is optionally supplied when a control is created.

- (send a-control get-font) ⇒ font% object

3.15 control-event%

Superclass: event%

A control-event% object contains information about a control event. An instance of control-event% is always provided to a control or menu item callback procedure.

- (new control-event% (event-type .) [(time-stamp .)]) ⇒ control-event% object
  
  event-type : symbol in '(button check-box choice list-box list-box-dclick text-field text-field-enter slider radio-box menu-popdown menu-popdown-none tab-panel)
  
  time-stamp = 0: exact integer
The `event-type` argument is one of the following:
- `button` — for `button` clicks
- `check-box` — for `check-box` toggles
- `choice` — for `choice` item selections
- `list-box` — for `list-box` selections and deselections
- `list-box-dclick` — for `list-box` double-clicks
- `text-field` — for `text-field` changes
- `text-field-enter` — for single-line `text-field` Enter event
- `menu` — for `selectable-menu-item` callbacks
- `slider` — for `slider` changes
- `radio-box` — for `radio-box` selection changes
- `menu-popdown` — for `popup-menu` callbacks (item selected)
- `menu-popdown-none` — for `popup-menu` callbacks (no item selected)
- `tab-panel` — for `tab-panel` tab changes

This value is extracted out of a `control-event` object with the `get-event-type` method.

See the corresponding `get-` and `set-` methods for information about `time-stamp`.

**get-event-type**

Returns the type of the control event. See `control-event` for information about each event type symbol.

- `(send a-control-event get-event-type) ⇒ symbol in ' (button check-box choice list-box list-box-dclick text-field text-field-enter menu slider radio-box)`

**set-event-type**

Sets the type of the event. See `control-event` for information about each event type symbol.

- `(send a-control-event set-event-type type) ⇒ void
  type: symbol in ' (button check-box choice list-box list-box-dclick text-field text-field-enter menu slider radio-box)`

### 3.16. `cursor%`

A cursor is a small icon that indicates the location of the mouse pointer. The bitmap image typically indicates the current mode or meaning of a mouse click at its current location.

A cursor is assigned to each window (or the window may use its parent’s cursor; see `set-cursor` for more information), and the pointer image is changed to match the window’s cursor when the pointer is moved over the window. Each cursor object may be assigned to many windows.

- `(make-object cursor% image mask hot-spot-x hot-spot-y) ⇒ cursor% object
  image: bitmap% object
  mask: bitmap% object
  hot-spot-x = 0: exact integer in [0, 15]
  hot-spot-y = 0: exact integer in [0, 15]`

Creates a cursor using an image bitmap and a mask bitmap. Both bitmaps must have depth 1 and size 16 by 16 pixels.

The `hot-spot-x` and `hot-spot-y` arguments determine the focus point of the cursor within the cursor image, relative to its top-left corner.
If the cursor is created successfully, \texttt{ok?} returns \texttt{#t}, otherwise the cursor object cannot be assigned to a window.

- \texttt{(make-object cursor\% id) ⇝ cursor\% object}
  
  \texttt{id: symbol in ’(arrow bullseye cross hand ibeam watch blank size-n/s size-e/w size-ne/sw size-nw/se)}

  Creates a cursor using a stock cursor, specified as one of the following:
  
  - ’arrow — the default cursor
  - ’bullseye — concentric circles
  - ’cross — a crosshair
  - ’hand — an open hand
  - ’ibeam — a vertical line, indicating that clicks control a text-selection caret
  - ’watch — a watch or hourglass, indicating that the user must wait for a computation to complete
  - ’arrow+watch — the default cursor with a watch or hourglass, indicating that some computation is in progress, but the cursor can still be used
  - ’blank — invisible
  - ’size-e/w — arrows left and right
  - ’size-n/s — arrows up and down
  - ’size-ne/sw — arrows up-right and down-left
  - ’size-nw/se — arrows up-left and down-right

  \texttt{ok?}

  Returns \texttt{#t} if the cursor is can be assigned to a window, \texttt{#f} otherwise.

- \texttt{(send a-cursor ok?) ⇝ boolean}

### 3.17 dialog\%

Implements: \texttt{top-level-window<%>}

A dialog is a top-level window that is \textit{modal}: while the dialog is shown, all other top-level windows in the dialog’s eventspace are disabled.

- \texttt{(new dialog\% (label _ ) [(parent _ )] [(width _ )] [(height _ )] [(x _ )] [(y _ )] [(style _ )] [(enabled _ )] [(border _ )] [(spacing _ )] [(alignment _ )] [(min-width _ )] [(min-height _ )] [(stretchable-width _ )] [(stretchable-height _ )]) ⇝ dialog\% object}

  \texttt{label: string (up to 200 characters)}

  \texttt{parent = #f: frame\% or dialog\% object or #f}

  \texttt{width = #f: exact integer in [0, 10000] or #f}

  \texttt{height = #f: exact integer in [0, 10000] or #f}

  \texttt{x = #f: exact integer in [0, 10000] or #f}

  \texttt{y = #f: exact integer in [0, 10000] or #f}

  \texttt{style = null: list of symbols in ’(no-caption resize-border no-sheet)}

  \texttt{enabled = #t: boolean}

  \texttt{border = 0: exact integer in [0, 1000]}

  \texttt{spacing = 0: exact integer in [0, 1000]}

  \texttt{alignment = ’(center top): two-element list: ’left,’ center, or ’right and ’top,’ center, or ’bottom}

  \texttt{min-width = 0: exact integer in [0, 10000]}

  \texttt{min-height = 0: exact integer in [0, 10000]}

  \texttt{stretchable-width = #t: boolean}

  \texttt{stretchable-height = #t: boolean}
The label string is used as the dialog’s title in its title bar. If the dialog’s label is changed (see set-label), the title bar is updated.

The parent argument can be #f or an existing frame. Under Windows, if parent is an existing frame, the new dialog is always on top of its parent. Under Windows and X, a dialog is iconized when its parent is iconized. If parent is #f, then the eventspace for the new dialog is the current eventspace, as determined by current-eventspace. Otherwise, parent’s eventspace is the new dialog’s eventspace.

If the width or height argument is not #f, it specifies an initial size for the dialog (in pixels) assuming that it is larger than the minimum size, otherwise the minimum size is used. Under Windows and Mac OS X (and with some X window managers) dialogs are not resizeable.

If the x or y argument is not #f, it specifies an initial location for the dialog. Otherwise, if no location is set before the dialog is shown, it is centered (with respect parent if not #f, the screen otherwise).

The style flags adjust the appearance of the dialog on some platforms:
- ‘no-caption — omits the title bar for the dialog (Windows)
- ‘resize-border — adds a resizeable border around the window (Windows) or grow box in the bottom right corner (Mac OS X)
- ‘no-sheet — uses a movable window for the dialog, even if a parent window is provided (Mac OS X)

Even if the dialog is not shown, a few notification events may be queued for the dialog on creation. Consequently, the new dialog’s resources (e.g., memory) cannot be reclaimed until some events are handled, or the dialog’s eventspace is shut down.

For information about the enabled argument, see window%. For information about the border, spacing, and alignment arguments, see area-container%. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area%.

on-subwindow-char

Called when this window or a child window receives a keyboard event. The on-subwindow-char method of the receiver’s top-level window is called first (see get-top-level-window); if the return value is #f, then the on-subwindow-char method is called for the next child in the path to the receiver, and so on. Finally, if the receiver’s on-subwindow-char method returns #f, the event is passed on to the receiver’s normal key-handling mechanism.

BEWARE: The default on-subwindow-char in frame% and on-subwindow-char in dialog% methods consume certain keyboard events (e.g., arrow keys, Enter) used for navigating within the window. Because the top-level window gets the first chance to handle the keyboard event, some events never reach the “receiver” child unless the default frame or dialog method is overridden.

- (send a-dialog on-subwindow-char receiver event) ⇒ boolean
  receiver: window% object
  event: key-event% object

Returns the result of
  (or (send this on-system-menu-char event)
  (send this on-traverse-char event))

show

Shows or hides a window.

The visibility of a window can be changed by the user clicking the window’s close box, for example, and such changes do not go through this method; use on-superwindow-show or on-close to monitor visibility changes.
- (send a-dialog show show?) ⇒ void
  show?: boolean

  If show? is #f, the window is hidden. Otherwise, the window is shown.

  If the window is already shown, it is moved front of other top-level windows. If the window is iconized (frames
  only), it is deiconized.

  If show? is true, the dialog is shown and all frames (and other dialogs) in the eventspace become disabled until
  the dialog is closed. If show? is false, the dialog is hidden and other frames and dialogs are re-enabled (unless
  a different, pre-existing dialog is still shown).

  If show? is true, the method does not immediately return. Instead, it loops with yield until the dialog is found
  to be hidden between calls to yield. An internal semaphore is used with yield to avoid a busy-wait, and to
  ensure that the show method returns as soon as possible after the dialog is hidden.

3.18  event%

An event% object contains information about a control, keyboard, mouse, or scroll event. See also
control-event%, key-event%, mouse-event%, and scroll-event%.

- (new event% [(time-stamp .)]) ⇒ event% object
  time-stamp = 0: exact integer

  See the corresponding get- and set- methods for information about time-stamp.

get-time-stamp

Returns the time, in milliseconds, when the event occurred. This time is compatible with times reported by
MzScheme’s current-milliseconds procedure.

- (send an-event get-time-stamp) ⇒ exact integer

set-time-stamp

Set the time, in milliseconds, when the event occurred. See also MzScheme’s current-milliseconds.

If the supplied value is outside the platform-specific range of time values, an exn:fail:contract exception is
raised.

- (send an-event set-time-stamp time) ⇒ void
  time: exact integer

3.19  frame%

Implements: top-level-window<%>

A frame is a top-level container window. It has a title bar (which displays the frame’s label), an optional menu bar,
and an optional status line.

Under Windows, both Multiple Document Interface (MDI) and Single Document Interface (SDI) frames are supported.
- (new frame% (label _) [(parent _)] [(width _)] [(height _)] [(x _)] [(y _)] [(style _)][(enabled _)] [(border _)] [(spacing _)] [(alignment _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ frame% object

  label: string (up to 200 characters)
  parent = #f: frame% object or #f
  width = #f: exact integer in [0, 10000] or #f
  height = #f: exact integer in [0, 10000] or #f
  x = #f: exact integer in [-10000, 10000] or #f
  y = #f: exact integer in [-10000, 10000] or #f
  style = null: list of symbols in ’(no-resize-border no-caption no-system-menu
    mdi-parent mdi-child toolbar-button hide-menu-bar float
    metal)
  enabled = #t: boolean
  border = 0: exact integer in [0, 1000]
  spacing = 0: exact integer in [0, 1000]
  alignment = ’(center top): two-element list: ’left,’center,or ’right and ’top,’center,or ’bottom
  min-width = 0: exact integer in [0, 10000]
  min-height = 0: exact integer in [0, 10000]
  stretchable-width = #t: boolean
  stretchable-height = #t: boolean

The label string is displayed in the frame’s title bar. If the frame’s label is changed (see set-label ), the title bar is updated.

The parent argument can be #f or an existing frame. Under Windows, if parent is an existing frame, the new frame is always on top of its parent. Also, the parent frame may be an MDI parent frame from a new MDI child frame. Under Windows and X (for many window managers), a frame is iconized when its parent is iconized.

If parent is #f, then the eventspace for the new frame is the current eventspace, as determined by current-eventspace. Otherwise, parent’s eventspace is the new frame’s eventspace.

If the width or height argument is not #f, it specifies an initial size for the frame (in pixels) assuming that it is larger than the minimum size, otherwise the minimum size is used.

If the x or y argument is not #f, it specifies an initial location for the frame. Otherwise, a location is selected automatically (tiling frames and dialogs as they are created).

The style flags adjust the appearance of the frame on some platforms:

- ’no-resize-border — omits the resizable border around the window (Windows, X MWM) or grow box in the bottom right corner (Mac OS X)
- ’no-caption — omits the title bar for the frame (Windows, X MWM)
  (X Gnome, X KDE: the frame decoration is omitted completely when ’no-resize-border and’nocaption are combined.)
- ’no-system-menu — omits the system menu (Windows)
- ’mdi-child — creates the frame as a MDI (multiple document interface) child frame, mutually exclusive with ’mdi-parent (Windows)
- ’mdi-parent — creates the frame as a MDI (multiple document interface) parent frame, mutually exclusive with ’mdi-child (Windows)
- ’toolbar-button — includes a toolbar button on the frame’s title bar (Mac OS X); a click on the toolbar button triggers a call to on-toolbar-button-click
- ’hide-menu-bar — hides the menu bar and dock when the frame is active (Mac OS X)
- ’float — causes the frame to stay in front of all other non-floating windows (Windows and Mac OS X always, X when combined with ’no-caption); under Mac OS X, a floating frame shares the focus with an active non-floating frame; when this style is combined with ’no-caption, then showing the frame does not cause the keyboard focus to shift to the window, and under X, clicking the frame does not move the focus

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- ‘metal’ — draws the frame with a brushed-metal background (Mac OS X); this style is ignored when ‘no-caption’ is specified

If the ‘mdi-child’ style is specified, the parent must be a frame with the ‘mdi-parent’ style, otherwise an exn:fail:contract exception is raised.

Even if the frame is not shown, a few notification events may be queued for the frame on creation. Consequently, the new frame’s resources (e.g., memory) cannot be reclaimed until some events are handled, or the frame’s eventspace is shut down.

For information about the enabled argument, see window<%>. For information about the border, spacing, and alignment arguments, see area-container<%>. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area<%>.

create-status-line

- (send a-frame create-status-line) ⇒ void

Creates a status line at the bottom of the frame. The width of the status line is the whole width of the frame (adjusted automatically when resizing), and the height and text size are platform-specific.

See also set-status-text.

get-menu-bar

Returns the frame’s menu bar, or #f if none has been created for the frame.

- (send a-frame get-menu-bar) ⇒ menu-bar% object or #f

has-status-line?

Returns #t if the frame’s status line has been created, #f otherwise. See also create-status-line.

- (send a-frame has-status-line?) ⇒ boolean

iconize

Iconizes or deiconizes the frame. Deiconizing brings the frame to the front. Iconization has no effect under Mac OS X.

A frame’s iconization can be changed by the user, and such changes do not go through this method. A program cannot detect when a frame has been iconized except by polling is-iconized?.

- (send a-frame iconize iconize?) ⇒ void
  iconize?: boolean

is-iconized?

Returns #t if the frame is iconized, #f otherwise.

- (send a-frame is-iconized?) ⇒ boolean
maximize

Maximizes or restores the frame under Windows and Mac OS X; the frame’s show state is not affected. Under Windows, an iconized frame cannot be maximized or restored.

A window’s maximization can be changed by the user, and such changes do not go through this method; use on-size to monitor size changes.

- (send a-frame maximize maximize?) ⇒ void
  maximize?: boolean
  If maximize? is #f, the window is restored, otherwise it is maximized.

modified

Gets or sets the frame’s modification state as reflected to the user. Under Mac OS X, the modification state is reflected as a dot in the frame’s close button. Under Windows and X, the modification state is reflected by an asterisk at the end of the frame’s displayed title.

- (send a-frame modified) ⇒ boolean
  Returns the current displayed modification state.

- (send a-frame modified modified?) ⇒ void
  modified?: boolean
  Sets the displayed modification state.

on-mdi-activate

Called under Windows when a MDI-child frame becomes the active frame within its parent (in which case the argument is #t), or when the child frame ceases to be the active frame (in which case the argument is #f).

MDI activation is different from keyboard-focus activation. If the parent frame is the frontmost top-level frame, so that the MDI child gets or loses the keyboard focus, then a separate on-activate notification is sent to the MDI-child frame.

- (send a-frame on-mdi-activate active?) ⇒ void
  active?: boolean

on-menu-char

If the frame has a menu bar with keyboard shortcuts, on-menu-char attempts to match the given event to a menu item. If a match is found, #t is returned, otherwise #f is returned.

When the match corresponds to a complete shortcut combination, the menu item’s callback is called (before on-menu-char returns). A match may also correspond to a shortcut prefix (under X, when when prefix style is ‘ctl-m; see set-x-shortcut-prefix), in which case the prefix key event is consumed and #t is returned, but the menu item’s callback is not called until the shortcut is completed (if it is completed).

If the event does not correspond to a complete shortcut combination, the event may be handled anyway if it corresponds to a mnemonic in the menu bar (i.e., an underlined letter in a menu’s title, which is installed by including an ampersand in the menu’s label). If a mnemonic match is found, the keyboard focus is moved to the menu bar (selecting the menu with the mnemonic), and #t is returned.
- (send a-frame on-menu-char event) ⇒ boolean
  event: key-event% object

on-subwindow-char

Called when this window or a child window receives a keyboard event. The on-subwindow-char method of the receiver’s top-level window is called first (see get-top-level-window); if the return value is #f, then the on-subwindow-char method is called for the next child in the path to the receiver, and so on. Finally, if the receiver’s on-subwindow-char method returns #f, the event is passed on to the receiver’s normal key-handling mechanism.

BEWARE: The default on-subwindow-char in frame% and on-subwindow-char in dialog% methods consume certain keyboard events (e.g., arrow keys, Enter) used for navigating within the window. Because the top-level window gets the first chance to handle the keyboard event, some events never reach the “receiver” child unless the default frame or dialog method is overridden.

- (send a-frame on-subwindow-char receiver event) ⇒ boolean
  receiver: window<> object
  event: key-event% object

Returns the result of

  (or (send this on-menu-char event)
    (send this on-system-menu-char event)
    (send this on-traverse-char event))

on-toolbar-button-click

Under Mac OS X, called when the user clicks the toolbar button on a frame created with the ’toolbar-button style.

- (send a-frame on-toolbar-button-click) ⇒ void

set-icon

Sets the large or small icon bitmap for this frame. Future changes to the bitmap do not affect the frame’s icon.

The icon is used in a platform-specific way:

- Windows — the small icon is used for the frame’s icon (in the top-left) and in the task bar, and the large icon is used for the Atl-Tab task switcher.
- Mac OS X — both icons are ignored.
- X — many window managers use the small icon in the same way as Windows, and others use the small icon when iconifying the frame; the large icon is ignored.

The bitmap for either icon can be any size, but most platforms scale the small bitmap to 16 by 16 pixels and the large bitmap to 32 by 32 pixels.

If a mask bitmap is not provided, then the entire (rectangular) bitmap is used as an icon.
If a mask bitmap is provided, the mask must be monochrome. In the mask bitmap, use black pixels to indicate the icon’s region and use white pixels outside the icon’s region. In the icon bitmap, use black pixels for the region outside the icon.

- (send a-frame set-icon icon mask which) ⇒ void
  icon: bitmap% object
  mask = #f: bitmap% object
  which = ‘both: symbol in ’ (small large both)

set-status-text
Sets the frame’s status line text and redraws the status line. See also create-status-line.

- (send a-frame set-status-text text) ⇒ void
  text: string

3.20 gauge%

Implements: control<%>

A gauge is a horizontal or vertical bar for displaying the output value of a bounded integer quantity. Each gauge has an adjustable range, and the gauge’s current value is always between 0 and its range, inclusive. Use set-value to set the value of the gauge.

- (new gauge% (label _) (range _) (parent _) [(style _)] [(font _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ gauge% object
  label: string (up to 200 characters) or #f
  range: exact integer in [1, 10000]
  parent: frame%, dialog%, panel%, or pane% object
  style=’(horizontal): list of symbols in ’ (horizontal vertical vertical-label horizontal-label deleted)
  font = normal-control-font: font% object
  enabled = #t: boolean
  vert-margin = 2: exact integer in [0, 1000]
  horiz-margin = 2: exact integer in [0, 1000]
  min-width = 0: exact integer in [0, 10000]
  min-height = 0: exact integer in [0, 10000]
  stretchable-width = #t for ‘horizontal style, #f for ‘vertical: boolean
  stretchable-height = #t for ‘vertical style, #f for ‘horizontal: boolean

If label is a string, it is used as the gauge label; otherwise the gauge does not display a label.

If an ampersand (“&”) occurs in label, it is specially parsed; under Windows and X, the character following an ampersand is underlined in the displayed control to indicate a keyboard mnemonic. (Under Mac OS X, mnemonic underlines are not shown.) The mnemonic is meaningless for a gauge (as far as on-traverse-char is concerned), but it is supported for consistency with other control types. A programmer may assign a meaning to the mnemonic, e.g., by overriding on-traverse-char.

The range argument is an integer specifying the maximum value of the gauge (inclusive). The minimum gauge value is always 0.

The style list must include either ‘horizontal, specifying a horizontal gauge, or ‘vertical, specifying a vertical gauge. If style includes ‘vertical-label, then the gauge is created with a label above the
control; if style does not include 'vertical-label' (and optionally includes 'horizontal-label'), then the label is created to the left of the gauge. If style includes 'deleted', then the gauge is created as hidden, and it does not affect its parent’s geometry; the gauge can be made active later by calling parent’s add-child method.

The font argument determines the font for the control. For information about the enabled argument, see window%. For information about the horiz-margin and vert-margin arguments, see subarea%. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area%.

class gauge

get-range

Returns the range (maximum value) of the gauge.

- (send a-gauge get-range) ⇒ exact integer in [1, 10000]

class gauge

get-value

Returns the gauge’s current value.

- (send a-gauge get-value) ⇒ exact integer in [0, 10000]

class gauge

set-range

Sets the range (maximum value) of the gauge.

- (send a-gauge set-range range) ⇒ void
  range: exact integer in [1, 10000]

class gauge

set-value

Sets the gauge’s current value. If the specified value is larger than the gauge’s range, an exn:fail:contract exception is raised.

- (send a-gauge set-value pos) ⇒ void
  pos: exact integer in [0, 10000]

3.21  group-box-panel%

Superclass: vertical-panel%

A group-box panel arranges its subwindows in a single column, but also draws an optional label at the top of the panel and a border around the panel content.

Unlike most panel classes, a group-box panel’s horizontal and vertical margins default to 2.

- (new group-box-panel% (label _) (parent _) [(style _)] [(font _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(border _)] [(spacing _)] [(alignment _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]
3.22. grow-box-spacer-pane%

Superclass: pane%

A grow-box-spacer-pane% object is intended for use as a lightweight spacer in the bottom-right corner of a frame, rather than as a container. Under Mac OS X, a grow-box-spacer-pane% has the same width and height as the grow box that is inset into the bottom-right corner of a frame. Under Windows and X, a grow-box-spacer-pane% has zero width and height. Unlike all other container types, a grow-box-spacer-pane% is unstretchable by default.

- (new grow-box-spacer-pane% (parent .) [[(vert-margin .)] [[(horiz-margin .)] [[(border .)] [[(spacing .)] [[(alignment .)] [[(min-width .)] [[(min-height .)] [[(stretchable-width .)] [[(stretchable-height .)]]) ⇒ grow-box-spacer-pane% object

parent: frame%, dialog%, panel%, or pane% object
vert-margin = 0: exact integer in [0, 1000]
horiz-margin = 0: exact integer in [0, 1000]
border = 0: exact integer in [0, 1000]
spacing = 0: exact integer in [0, 1000]
alignment = ’(center center): two-element list: ’left,’ center,or ’right and ’top,’ center,or ’bottom
min-width = 0: exact integer in [0, 10000]
min-height = 0: exact integer in [0, 10000]
stretchable-width = #t: boolean
stretchable-height = #t: boolean

For information about the horiz-margin and vert-margin arguments, see subarea<%>. For information about the border, spacing, and alignment arguments, see area-container<%>. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area<%>.
3.23 horizontal-pane

Superclass: pane

A horizontal pane arranges its subwindows in a single row. See also pane.

- (new horizontal-pane% (parent _) [(vert-margin _)] [(horiz-margin _)] [(border _)] [(spacing _)] [(alignment _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ horizontal-pane% object

  parent: frame%, dialog%, panel%, or pane% object
  vert-margin = 0: exact integer in [0, 1000]
  horiz-margin = 0: exact integer in [0, 1000]
  border = 0: exact integer in [0, 1000]
  spacing = 0: exact integer in [0, 1000]
  alignment = ‘(left center): two-element list: ‘left,’ center, or ‘right and ‘top,’ center, or ‘bottom
  min-width = 0: exact integer in [0, 10000]
  min-height = 0: exact integer in [0, 10000]
  stretchable-width = #t: boolean
  stretchable-height = #t: boolean

For information about the horiz-margin and vert-margin arguments, see subarea%. For information about the border, spacing, and alignment arguments, see area-container%. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area%.

3.24 horizontal-panel

Superclass: panel

A horizontal panel arranges its subwindows in a single row. See also panel.

- (new horizontal-panel% (parent _) [(style _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(border _)] [(spacing _)] [(alignment _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ horizontal-panel% object

  parent: frame%, dialog%, panel%, or pane% object
  style = null: list of symbols in ’(border deleted)
  enabled = #t: boolean
  vert-margin = 0: exact integer in [0, 1000]
  horiz-margin = 0: exact integer in [0, 1000]
  border = 0: exact integer in [0, 1000]
  spacing = 0: exact integer in [0, 1000]
  alignment = ‘(left center): two-element list: ‘left,’ center, or ‘right and ‘top,’ center, or ‘bottom
  min-width = 0: exact integer in [0, 10000]
  min-height = 0: exact integer in [0, 10000]
  stretchable-width = #t: boolean
  stretchable-height = #t: boolean

If the ’border style is specified, the window is created with a thin border (only in this case, the client size of the panel may be less than its total size). If style includes ’deleted, then the panel is created as hidden, and it does not affect its parent’s geometry; the panel can be made active later by calling parent’s add-child method.

For information about the enabled argument, see window%. For information about the horiz-margin and vert-margin arguments, see subarea%. For information about the border, spacing,
and alignment arguments, see area-container. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area.

### 3.25 key-event%

Superclass: event%

A key-event object contains information about a key press or release event. Key events are primarily processed by on-subwindow-char in window and on-char in canvas.

For a key-press event, a virtual key code is provided by get-key-code. For a key-release event, get-key-code reports ‘release, and a virtual key code is provided by get-key-release-code.

See also “Mouse and Keyboard Events” (section 2.3, page 12).

- (new key-event [(key-code)]) [(shift-down)] [(control-down)] [(meta-down)] [(alt-down)] [(x)] [(y)] [(time-stamp)] ⇒ key-event object

  key-code = #\null: character or symbol
  shift-down = #f: boolean
  control-down = #f: boolean
  meta-down = #f: boolean
  alt-down = #f: boolean
  x = 0: exact integer
  y = 0: exact integer
  time-stamp = 0: exact integer

  See the corresponding get- and set- methods for information about key-code, shift-down, control-down, meta-down, alt-down, x, y, and time-stamp.

  The release key code, as returned by get-key-release-code, is initialized to ’press.

get-alt-down

Returns #t if the Option (Mac OS X) key was down for the event. When the Alt key is pressed in Windows, it is reported as a Meta press (see get-meta-down).

- (send a-key-event get-alt-down) ⇒ boolean

get-control-down

Returns #t if the Control key was down for the event.

Under Mac OS X, if a control-key press is combined with a mouse button click, the event is reported as a right-button click and get-control-down for the event reports #f.

- (send a-key-event get-control-down) ⇒ boolean

get-key-code

gets the virtual key code for the key event. The virtual key code is either a character or a special key symbol, one of the following:
• 'start
• 'cancel
• 'clear
• 'shift
• 'control
• 'menu
• 'pause
• 'capital
• 'prior
• 'next
• 'end
• 'home
• 'left
• 'up
• 'right
• 'down
• 'escape
• 'select
• 'print
• 'execute
• 'snapshot
• 'insert
• 'help
• 'numpad0
• 'numpad1
• 'numpad2
• 'numpad3
• 'numpad4
• 'numpad5
• 'numpad6
• 'numpad7
• 'numpad8
• 'numpad9
• 'numpad-enter
• 'multiply
• 'add
• 'separator
• 'subtract
• 'decimal
• 'divide
• 'f1
• 'f2
• 'f3
• 'f4
• 'f5
• 'f6
• 'f7
• 'f8
• 'f9
• 'f10
• 'f11
• 'f12
• 'f13
• 'f14
3. Windowing Class Reference

- 'f15
- 'f16
- 'f17
- 'f18
- 'f19
- 'f20
- 'f21
- 'f22
- 'f23
- 'f24
- 'numlock
- 'scroll
- 'wheel-up — mouse wheel up one notch
- 'wheel-down — mouse wheel down one notch
- 'release — indicates a key-release event
- 'press — indicates a key-press event; usually only from get-key-release-code

The special key symbols attempt to capture useful keys that have no standard ASCII representation. A few keys have standard representations that are not obvious:

- '#space — the space bar
- '#return — the Enter or Return key (on all platforms), but not necessarily the Enter key near the numpad (which is reported as 'numpad-enter if the platform distinguishes the two Enter keys)
- '#tab — the tab key
- '#backspace — the backspace key
- '#rubout — the delete key

If a suitable special key symbol or ASCII representation is not available, '#null (the null character) is reported.

Under X, a ‘wheel-up or ‘wheel-down event may be sent to a window other than the one with the keyboard focus, because X generates wheel events based on the location of the mouse pointer.

- (send a-key-event get-key-code) ⇒ character or symbol

get-key-release-code

Gets the virtual key code for a key-release event; the result is ‘press for a key-press event. See get-key-code for the list of virtual key codes.

- (send a-key-event get-key-release-code) ⇒ character or symbol

get-meta-down

Returns #t if the Meta (X), Alt (Windows), or Command (Mac OS X) key was down for the event.

- (send a-key-event get-meta-down) ⇒ boolean
get-shift-down

Returns #t if the Shift key was down for the event.

- (send a-key-event get-shift-down) ⇒ boolean

get-x

Returns the x-position of the mouse at the time of the event, in the target’s window’s (client-area) coordinate system.

- (send a-key-event get-x) ⇒ exact integer

get-y

Returns the y-position of the mouse at the time of the event in the target’s window’s (client-area) coordinate system.

- (send a-key-event get-y) ⇒ exact integer

set-alt-down

Sets whether the Option (Mac OS X) key was down for the event. When the Alt key is pressed in Windows, it is reported as a Meta press (see set-meta-down).

- (send a-key-event set-alt-down down?) ⇒ void
  down?: boolean

set-control-down

Sets whether the Control key was down for the event.

Under Mac OS X, if a control-key press is combined with a mouse button click, the event is reported as a right-button click and get-control-down for the event reports #f.

- (send a-key-event set-control-down down?) ⇒ void
  down?: boolean

set-key-code

Sets the virtual key code for the event, either a character or one of the special symbols listed with get-key-code.

- (send a-key-event set-key-code code) ⇒ void
  code: character or symbol

set-key-release-code

Sets the virtual key code for a release event, either a character or one of the special symbols listed with get-key-code. See also get-key-release-code.

- (send a-key-event set-key-release-code code) ⇒ void
  code: character or symbol
set-meta-down

Sets whether the Meta (X), Alt (Windows), or Command (Mac OS X) key was down for the event.

- (send a-key-event set-meta-down down?) ⇒ void
down?: boolean

set-shift-down

Sets whether the Shift key was down for the event.

- (send a-key-event set-shift-down down?) ⇒ void
down?: boolean

set-x

Sets the x-position of the mouse at the time of the event in the target’s window’s (client-area) coordinate system.

- (send a-key-event set-x pos) ⇒ void
pos: exact integer

set-y

Sets the y-position of the mouse at the time of the event in the target’s window’s (client-area) coordinate system.

- (send a-key-event set-y pos) ⇒ void
pos: exact integer

3.26 labelled-menu-item

Extends: menu-item

A labelled-menu-item object is a menu-item with a string label (i.e., any menu item other than a separator). More specifically, it is an instance of either menu-item (a plain menu item), checkable-menu-item (a checkable menu item), or menu (a submenu).

enable

Enables or disables the menu item. If the item is a submenu (or menu in a menu bar), the entire menu is disabled, but each submenu item’s is-enabled? method returns #f only if the item is specifically disabled (in addition to the submenu).

- (send a-labelled-menu-item enable enabled?) ⇒ void
enabled?: boolean

get-help-string

Returns the help string for the menu item, or #f if the item has no help string.
When an item has a help-string, the string may be used to display help information to the user.

- (send a-labelled-menu-item get-help-string) ⇒ string (up to 200 characters) or #f

get-label
Returns the item’s label.
See also set-label and get-plain-label.

- (send a-labelled-menu-item get-label) ⇒ string (up to 200 characters)

get-plain-label
Like get-label, except that ampersands in the label are removed as described in set-label.

- (send a-labelled-menu-item get-plain-label) ⇒ string (up to 200 characters)

is-enabled?
Returns #t if the menu item is enabled, #f otherwise.
See also enable.

- (send a-labelled-menu-item is-enabled?) ⇒ boolean

on-demand
Normally called when the user clicks on the menu bar containing the item (before the user sees any menu items), just before the popup menu containing the item is popped up, or just before inspecting the menu bar containing the item for a shortcut key binding.

A on-demand in menu-item-container method can be overridden in such a way that the container does not call the on-demand method of its items.

- (send a-labelled-menu-item on-demand) ⇒ void

Calls the demand-callback procedure that was provided when the object was created.

set-help-string
Sets the help string for the menu item. Use #f to remove the help string for an item.

- (send a-labelled-menu-item set-help-string help) ⇒ void

help: string (up to 200 characters) or #f

set-label
Sets the menu item’s label. If the item has a shortcut, the shortcut is not affected.
If the label contains an ampersand ("&") and the window is a control, the label is parsed specially; under Windows
and X, the character following an ampersand is underlined in the displayed menu to indicate a keyboard mnemonic.
Pressing the Alt key with an underlined character from a menu’s name in the menu bar causes the menu to be selected
(via on-menu-char). When a menu has the focus, the mnemonic characters are used for navigation without Alt. A
double-ampersand in the label is replaced by a literal (non-navigation) ampersand. Under Mac OS X, ampersands in
the label are parsed in the same way as for X and Windows, but no mnemonic underline is displayed.

An ampersand is always preserved in the label returned by get-label, but never preserved in the label returned by
get-plain-label.

For historical reasons, if a label contains a tab character, then the tab and all remaining characters are hidden in the
displayed menu.

- (send a-labelled-menu-item set-label label) ⇒ void
  label: string (up to 200 characters)

3.27 list-box%

Implements: list-control<%>

A list box allows the user to select one or more string items from a scrolling list. A list box is either a single-selection
control (if an item is selected, the previous selection is removed) or a multiple-selection control (clicking an item
toggles the item on or off independently of other selections).

Whenever the user changes the selection in a list box, the list box’s callback procedure is called. A callback procedure
is provided as an initialization argument when each list box is created.

List box items are indexed from 0.

See also choice%.

- (new list-box% (label _) (choices _) (parent _) [(callback _)] [(style _)] [(selection _)] [(font _)] [(label-font _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ list-box% object
  label: string (up to 200 characters) or #f
  choices: list of strings (up to 200 characters each)
  parent: frame%, dialog%, panel%, or pane% object
  callback = (lambda (lb e) (void)) procedure of two arguments: a list-box% object and a control-event%
  style=’(single): list of symbols in ’(single multiple extended vertical-label
    horizontal-label deleted)
  selection = #f: exact non-negative integer or #f
  font = view-control-font: font% object
  label-font = normal-control-font: font% object
  enabled = #t: boolean
  vert-margin = 2: exact integer in [0, 1000]
  horiz-margin = 2: exact integer in [0, 1000]
  min-width = 0: exact integer in [0, 10000]
  min-height = 0: exact integer in [0, 10000]
  stretchable-width = #t: boolean
  stretchable-height = #t: boolean

If label is not #f, it is used as the list box label. Otherwise, the list box will not display its label.
If an ampersand ("&") occurs in \textit{label}, it is specially parsed; under Windows and X, the character following an ampersand is underlined in the displayed control to indicate a keyboard mnemonic. (Under Mac OS X, mnemonic underlines are not shown.) The underlined mnemonic character must be a letter or a digit. The user can move the keyboard focus to the list box by typing the mnemonic when the control's top-level-window contains the keyboard focus. The user must also hold down the Meta or Alt key if the keyboard focus is currently in a control that handles normal alphanumerical input. The ampersand itself is removed from \textit{label} before it is displayed for the control; a double-ampersand in \textit{label} is converted to a single ampersand (with no mnemonic underlining). Under Mac OS X, a parenthesized mnemonic character is removed (along with any surrounding space) before the label is displayed, since a parenthesized mnemonic is often used for non-Roman languages. Finally, any text after a tab character is removed on all platforms. Mnemonic keyboard events are handled by \texttt{on-traverse-char} (but not under Mac OS X).

The \texttt{choices} list specifies the initial list of items to appear in the list box.

The \texttt{callback} procedure is called when the user changes the list box selection, by either selecting, re-selecting, deselecting, or double-clicking an item. The type of the event provided to the callback is \texttt{'list-box-dclick} when the user double-clicks on an item, or \texttt{'list-box} otherwise.

The \texttt{style} specification must include exactly one of the following:

- \texttt{'single} — Creates a single-selection list.
- \texttt{'multiple} — Creates a multiple-selection list where a single click deselects other items and selects a new item. Use this style for a list when single-selection is common, but multiple selections are allowed.
- \texttt{'extended} — Creates a multiple-selection list where a single click extends or contracts the selection by toggling the clicked item. Use this style for a list when multiple selections are the rule rather than the exception.

The \texttt{'multiple} and \texttt{'extended} styles determine a platform-independent interpretation of unmodified mouse clicks, but dragging, shift-clicking, control-clicking, etc. have platform-standard interpretations. Whatever the platform-specific interface, the user can always select disjoint sets of items or deselect items (and leave no items selected). On some platforms, the user can deselect the (sole) selected item in a \texttt{'single} list box.

If \texttt{style} includes \texttt{'vertical-label}, then the list box is created with a label above the control; if \texttt{style} does not include \texttt{'vertical-label} (and optionally includes \texttt{'horizontal-label}), then the label is created to the left of the list box. If \texttt{style} includes \texttt{'deleted}, then the list box is created as hidden, and it does not affect its parent's geometry; the list box can be made active later by calling \texttt{parent}'s \texttt{add-child} method.

If \texttt{selection} is an integer, it is passed to \texttt{set-selection} to set the initial selection. The \texttt{selection} must be less than the length of \texttt{choices}.

The \texttt{font} argument determines the font for the control content, and \texttt{label-font} determines the font for the control label. For information about the \texttt{enabled} argument, see \texttt{window<%). For information about the \texttt{horiz-margin} and \texttt{vert-margin} arguments, see \texttt{subarea<%. For information about the \texttt{min-width}, \texttt{min-height}, \texttt{stretchable-width}, and \texttt{stretchable-height} arguments, see \texttt{area<%.}

\textbf{append}

Adds a new item to the list of user-selectable items. The current selection is unchanged (unless the list control is an empty choice control, in which case the new item is selected).

\begin{verbatim}
- (send a-list-box append item data) ⇒ void
  item : string
  data : value
\end{verbatim}

Adds a new item to the list box with an associated "data" object. The \texttt{data} object is not displayed in the list box; it is provided merely as a convenience for use with \texttt{get-data}, possibly allowing a programmer to avoid managing a separate item-to-data mapping in addition to the list box control.
- (send a-list-box append item) ⇒ void
  item: string

**delete**

Deletes a choice from the list box. Selected items that are not deleted remain selected, and no other items are selected.

- (send a-list-box delete n) ⇒ void
  n: exact non-negative integer

  Deletes the item indexed by n. List box items are indexed from 0. If n is equal to or larger than the number of items in the control, an `exn:fail:contract` exception is raised.

**get-data**

Returns the data value associated with a list box item, or `#f` if there is no associated data. See also `append` and `set-data`.

- (send a-list-box get-data n) ⇒ value
  n: exact non-negative integer

  Returns the data for the item indexed by n. List box items are indexed from 0. If n is equal to or larger than the number of choices, an `exn:fail:contract` exception is raised.

**get-first-visible-item**

Reports the index of the item currently scrolled to the top of the list box. List box items are indexed from 0.

- (send a-list-box get-first-visible-item) ⇒ exact non-negative integer

**get-label-font**

Returns the font used for the control’s label, which is optionally supplied when a list box is created.

- (send a-list-box get-label-font) ⇒ font% object

**get-selections**

Returns a list of indices for all currently selected items. List box items are indexed from 0. For single-selection lists, the result is always either `null` or a list containing one number.

- (send a-list-box get-selections) ⇒ list of exact integers

**is-selected?**

Returns `#t` if the item matching the specifies index is selected, `#f` otherwise.

A list box’s selection can be changed by the user clicking the control, and such changes do not go through this method; use the control callback procedure (provided as an initialization argument) to monitor selection changes.
- (send a-list-box is-selected? n) ⇒ boolean
  n: exact non-negative integer

  Returns #t if the item index by n is selected. List box items are indexed from 0. If n is equal to or larger than
  the number of choices, an exn:fail:contract exception is raised.

number-of-visible-items

Returns the maximum number of items in the list box that are visible to the user with the control’s current size
(rounder down if the exact answer is fractional, but returning at least 1).

- (send a-list-box number-of-visible-items) ⇒ exact positive integer

select

Selects or deselects an item. For selection in a single-selection list box, if a different choice is currently selected,
it is automatically deselected. For selection in a multiple-selection list box, other selections are preserved, unlike
set-selection.

A list box’s selection can be changed by the user clicking the control, and such changes do not go through this method;
use the control callback procedure (provided as an initialization argument) to monitor selection changes.

The control’s callback procedure is not invoked.

- (send a-list-box select n select?) ⇒ void
  n: exact non-negative integer
  select? = #t: boolean

  If select? is #f, the item indexed by n is deselected; otherwise it is selected. List box items are indexed
  from 0. If n is equal to or larger than the number of choices, an exn:fail:contract exception is raised.

set

Clears the list box and installs a new list of items.

- (send a-list-box set choices) ⇒ void
  choices: list of strings (up to 200 characters each)

set-data

Sets the associated data for a list box choice item. See also append.

- (send a-list-box set-data n data) ⇒ void
  n: exact non-negative integer
  data: value

  Sets the associated data for item indexed by n. List box items are indexed from 0. If n is equal to or larger than
  the number of choices, an exn:fail:contract exception is raised.

set-first-visible-item

Scrolls the list box so that the specified item is at the top of the list box display.
A list box’s scroll position can be changed by the user clicking the control, and such changes do not go through this method. A program cannot detect when the scroll position changes except by polling `get-first-visible-item`.

- `(send a-list-box set-first-visible-item n) ⇒ void
  n: exact non-negative integer

  Shows the item indexed by \( n \) at the list box’s top. List box items are indexed from 0. If \( n \) is equal to or larger than the number of choices, an `exn:fail:contract` exception is raised.

`set-string`

Changes an item in the list box.

- `(send a-list-box set-string n label) ⇒ void
  n: exact non-negative integer
  label: string (up to 200 characters)

  Sets the item indexed by \( n \). List box items are indexed from 0. If \( n \) is equal to or larger than the number of choices, an `exn:fail:contract` exception is raised.

### 3.28 list-control%

Extends: `control`%

A list control gives the user a list of string items to choose from. There are two built-in classes that implement `list-control`%:

- `choice`% — presents the list in a popup menu (so the user can choose only one item at a time)
- `list-box`% — presents the list in a scrolling box, allowing the use to choose one item (if the style includes `'single`) or any number of items

In either case, the set of user-selectable items can be changed dynamically.

`append`

Adds a new item to the list of user-selectable items. The current selection is unchanged (unless the list control is an empty choice control, in which case the new item is selected).

- `(send a-list-control append item) ⇒ void
  item: string`

`clear`

Removes all user-selectable items from the control.

- `(send a-list-control clear) ⇒ void`
find-string

Finds a user-selectable item matching the given string. If no matching choice is found, #f is returned, otherwise the index of the matching choice is returned (items are indexed from 0).

- (send a-list-control find-string s) ⇒ exact non-negative integer or #f
  s: string

get-number

Returns the number of user-selectable items in the control (which is also one more than the greatest index in the list control).

- (send a-list-control get-number) ⇒ exact non-negative integer

get-selection

Returns the index of the currently selected item (items are indexed from 0). If the choice item currently contains no choices or no selections, #f is returned. If multiple selections are allowed and multiple items are selected, the index of the first selection is returned.

- (send a-list-control get-selection) ⇒ exact non-negative integer or #f

get-string

Returns the item for the given index (items are indexed from 0). If the provided index is larger than the greatest index in the list control, an exn:fail:contract exception is raised.

- (send a-list-control get-string n) ⇒ immutable string (up to 200 characters)
  n: exact non-negative integer

get-string-selection

Returns the currently selected item. If the control currently contains no choices, #f is returned. If multiple selections are allowed and multiple items are selected, the first selection is returned.

- (send a-list-control get-string-selection) ⇒ immutable string (up to 200 characters) or #f

set-selection

Selects the item specified by the given index (items are indexed from 0). If the given index larger than the greatest index in the list control, an exn:fail:contract exception is raised.

In a list box control, all other items are deselected, even if multiple selections are allowed in the control. See also select-in-list-box%.

The control’s callback procedure is not invoked when this method is called.

The list control’s selection can be changed by the user clicking the control, and such changes do not go through this method; use the control callback procedure (provided as an initialization argument) to monitor selection changes.
3. Windowing Class Reference

3.29 menu%

- (send a-list-control set-selection n) ⇒ void
  $n$: exact non-negative integer

set-string-selection

Selects the item matching that matches the given string. If no match is found in the list control, an \texttt{exn:fail:contract} exception is raised.

In a list box control, all other items are deselected, even if multiple selections are allowed in the control. See also \texttt{select-in-list-box%}.

The control’s callback procedure is \texttt{not} invoked when this method is called.

The list control’s selection can be changed by the user clicking the control, and such changes do not go through this method; use the control callback procedure (provided as an initialization argument) to monitor selection changes.

- (send a-list-control set-string-selection s) ⇒ void
  $s$: string

3.29 menu%

Implements: \texttt{labelled-menu-item<%}>

Implements: \texttt{menu-item-container<%}>

A menu% object is a submenu within a menu% or popup-menu%, or as a top-level menu in a menu-bar%.

- (new menu% (label _) (parent _) [(help-string _)] [(demand-callback _)]) ⇒ menu% object
  \texttt{label}: string (up to 200 characters)
  \texttt{parent}: menu%, popup-menu%, or menu-bar% object
  \texttt{help-string} = \texttt{#f}: string (up to 200 characters) or \texttt{#f}
  \texttt{demand-callback} = \texttt{void}: procedure of one argument: a menu% object

Creates a new menu with the given label.

If \texttt{label} contains an ampersand (“&”), it is handled specially; under Windows, the character following an ampersand is underlined in the displayed menu title to indicate a keyboard mnemonic. Pressing and releasing the Alt key switches to menu-selection mode in the menu bar where mnemonic characters are used for navigation. An Alt combination might select a specific menu via \texttt{on-menu-char}. A double-ampersand in \texttt{label} is replaced by a literal (non-navigation) ampersand. Under X and Mac OS X, ampersands in the label are parsed in the same way as for Windows, but no mnemonic underline is displayed.

If \texttt{help-string} is not \texttt{#f}, the menu has a help string. See \texttt{get-help-string} for more information.

The \texttt{demand-callback} procedure is called by the default \texttt{on-demand} method with the object itself.

If the menu has the label “Help” in a menu bar, it is treated specially on some platforms. Under Mac OS X, the items of a “Help” menu are folded into the standard help menu. In addition, under Mac OS X, if the name of the first item in the “Help” menu starts with “About”, then the menu item is duplicated as the first item under the Apple menu.
### 3.30 menu-bar%

Implements: menu-item-container%

A menu-bar% object is created for a particular frame% object. A frame can have at most one menu bar; an exn:fail:contract exception is raised when a new menu bar is created for a frame that already has a menu bar.

- (new menu-bar% (parent _) [(demand-callback _)]) ⇒ menu-bar% object
  
  parent: frame% object or 'root
  
  demand-callback = void: procedure of one argument: a menu-bar% object

Creates a menu bar in the specified frame. The menu bar is initially empty. If 'root is supplied as parent, the menu bar becomes active only when no other frames are shown. A 'root parent is allowed only when current-eventspace-has-menu-root? returns #t, and only if no such menu bar has been created before, otherwise an exn:fail:contract exception is raised.

The demand-callback procedure is called by the default on-demand method with the object itself.

**enable**

Enables or disables the menu bar (i.e., all of its menus). Each menu’s is-enabled? method returns #f only if the menu is specifically disabled (in addition to the menu bar).

- (send a-menu-bar enable enable?) ⇒ void
  
  enable?: boolean

**get-frame**

Returns the menu bar’s frame.

- (send a-menu-bar get-frame) ⇒ frame% object

**is-enabled?**

Returns #t if the menu bar is enabled, #f otherwise.

- (send a-menu-bar is-enabled?) ⇒ boolean

### 3.31 menu-item%

A menu-item% object is an element within a menu%, popup-menu%, or menu-bar%. Operations that affect the parent — such as renaming the item, deleting the item, or adding a check beside the item — are accomplished via the menu-item% object.

A menu item is either a separator-menu-item% object (merely a separator), of a labelled-menu-item% object; the latter is more specifically an instance of either menu-item% (a plain menu item), checkable-menu-item% (a checkable menu item), or menu% (a submenu).

**delete**

Removes the item from its parent. If the menu item is already deleted, delete has no effect.
See also `restore`.

- `(send a-menu-item delete) ⇒ void`

`get-parent`

Returns the menu, popup menu, or menu bar containing the item. The parent for a menu item is specified when the menu item is created, and it cannot be changed.

- `(send a-menu-item get-parent) ⇒ menu%, popup-menu%, or menu-bar% object`

`is-deleted?`

Returns `#t` if the menu item is deleted from its parent, `#f` otherwise.

- `(send a-menu-item is-deleted?) ⇒ boolean`

`restore`

Adds a deleted item back into its parent. The item is always restored to the end of the parent, regardless of its original position. If the item is not currently deleted, `restore` has no effect.

- `(send a-menu-item restore) ⇒ void`

### 3.32 menu-item%

Implements: `selectable-menu-item%`

A `menu-item%` is a plain string-labelled menu item. Its parent must be a `menu%` or `popup-menu%`. When the user selects the menu item, its callback procedure is called.

- `(new menu-item% (label . ) (parent . ) (callback . ) [(shortcut . )] [(help-string . )] [(demand-callback . )]) ⇒ menu-item% object`

  `label`: string (up to 200 characters)
  `parent`: menu% or popup-menu% object
  `callback`: procedure of two arguments: a menu-item% object and a control-event% object
  `shortcut` = `#f`: character or `#f`
  `help-string` = `#f`: string (up to 200 characters) or `#f`
  `demand-callback` = `void`: procedure of one argument: a menu-item% object

Creates a new menu item in `parent`. The item is initially shown, appended to the end of its parent. The `callback` procedure is called (with the event type `'menu`) when the user selects the menu item (either via a menu bar, popup-menu in window<%>, or popup-menu in editor-admin%).

See `set-label` for information about mnemonic ampersands (“&”) in `label`.

If `shortcut` is not `#f`, the item has a shortcut. See `get-shortcut` for more information.

If `help-string` is not `#f`, the item has a help string. See `get-help-string` for more information.

The `demand-callback` procedure is called by the default `on-demand` method with the object itself.
3.33 menu-item-container

A menu-item-container object is a menu, popup-menu, or menu-bar.

get-items

Returns a list of the items in the menu, popup menu, or menu bar. The order of the items in the returned list corresponds to the order as the user sees them in the menu or menu bar.

- (send a-menu-item-container get-items) ⇒ list of menu-item objects

on-demand

Called when the user clicks on the container as a menu bar (before the user sees any menu items), just before the container as a popup menu is popped up, or just before inspecting the menu bar containing the item for a shortcut key binding.

If the container is not a menu bar or a popup menu, this method is normally called via the on-demand method of the container’s owning menu bar or popup menu, because the default implementation of the method chains to the on-demand method of its items. However, the method can be overridden in a container such that it does not call the on-demand method of its items.

- (send a-menu-item-container on-demand) ⇒ void
  Calls the demand-callback procedure that was provided when the object was created, then calls the on-demand method of the contained items.

3.34 message

Implements: control

A message control is a static line of text or a static bitmap. The text or bitmap corresponds to the message’s label (see set-label).

- (new message% (label _) (parent _) [(style _)] [(font _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)] ⇒ message% object
  label: string (up to 200 characters), bitmap% object, ’app’, ’caution’, or ’stop
  parent: frame%, dialog%, panel%, or pane% object
  style = null: list of symbols in ’ (deleted)
  font = normal-control-font: font% object
  enabled = #t: boolean
  vert-margin = 2: exact integer in [0, 1000]
  horiz-margin = 2: exact integer in [0, 1000]
  min-width = 0: exact integer in [0, 10000]
  min-height = 0: exact integer in [0, 10000]
  stretchable-width = #f: boolean
  stretchable-height = #f: boolean

Creates a string or bitmap message initially showing message. If message is a bitmap, then the bitmap must be valid (see ok? in bitmap%) and not installed in a bitmap-dc% object; otherwise, an
3. Windowing Class Reference

3.35. mouse-event%

Superclass: event%

A mouse-event% object encapsulates a mouse event. Mouse events are primarily processed by on-subwindow-event in window% and on-event in canvas%.

See also “Mouse and Keyboard Events” (section 2.3, page 12).

- (new mouse-event% (event-type _) [(left-down _)] [(middle-down _)] [(right-down _)] [(x _)] [(y _)] [(shift-down _)] [(control-down _)] [(meta-down _)] [(alt-down _)] [(time-stamp _)] ) ⇒ mouse-event% object

  event-type: symbol in ‘(enter leave left-down left-up middle-down middle-up right-down right-up motion)
left-down = #f: boolean
middle-down = #f: boolean
right-down = #f: boolean
x = 0: exact integer
y = 0: exact integer
shift-down = #f: boolean
control-down = #f: boolean
meta-down = #f: boolean
alt-down = #f: boolean
time-stamp = 0: exact integer

Creates a mouse event for a particular type of event. The event types are:
- ‘enter — mouse pointer entered the window
- ‘leave — mouse pointer left the window
- ‘left-down — left mouse button pressed
- ‘left-up — left mouse button released
- ‘middle-down — middle mouse button pressed
- ‘middle-up — middle mouse button released
- ‘right-down — right mouse button pressed (Mac OS X: click with control key pressed)
- ‘right-up — right mouse button released (Mac OS X: release with control key pressed)
- ‘motion — mouse moved, with or without button(s) pressed

See the corresponding get- and set- methods for information about left-down, middle-down, right-down, x, y, shift-down, control-down, meta-down, alt-down, and time-stamp.

button-changed?

Returns #t if this was a mouse button press or release event, #f otherwise. See also button-up? and button-down?.

- (send a-mouse-event button-changed? button) ⇒ boolean
  
  button = ’any: symbol in ’(left middle right any)

  If button is not ’any, then #t is only returned if it is a release event for a specific button.

button-down?

Returns #t if the event is for a button press, #f otherwise.

- (send a-mouse-event button-down? button) ⇒ boolean
  
  button = ’any: symbol in ’(left middle right any)

  If button is not ’any, then #t is only returned if it is a press event for a specific button.

button-up?

Returns #t if the event is for a button release, #f otherwise. (As noted in “Mouse and Keyboard Events” (section 2.3, page 12), button release events are sometimes dropped.)

- (send a-mouse-event button-up? button) ⇒ boolean
  
  button = ’any: symbol in ’(left middle right any)

  If button is not ’any, then #t is only returned if it is a release event for a specific button.
dragging?

Returns #t if this was a dragging event (motion while a button is pressed), #f otherwise.

- (send a-mouse-event dragging?) ⇒ boolean

entering?

Returns #t if this event is for the mouse entering a window, #f otherwise.

When the mouse button is up, an enter/leave event notifies a window that it will start/stop receiving mouse events. When the mouse button is down, however, the window receiving the mouse-down event receives all mouse events until the button is released; enter/leave events are not sent to other windows, and are not reliably delivered to the click-handling window (since the window can detect movement out of its region via get-x and get-y). See also “Mouse and Keyboard Events” (section 2.3, page 12).

- (send a-mouse-event entering?) ⇒ boolean

get-alt-down

Returns #t if the Option (Mac OS X) key was down for the event. When the Alt key is pressed in Windows, it is reported as a Meta press (see get-meta-down).

- (send a-mouse-event get-alt-down) ⇒ boolean

get-control-down

Returns #t if the Control key was down for the event.

Under Mac OS X, if a control-key press is combined with a mouse button click, the event is reported as a right-button click and get-control-down for the event reports #f.

- (send a-mouse-event get-control-down) ⇒ boolean

get-event-type

Returns the type of the event; see mouse-event% for information about each event type. See also set-event-type.

- (send a-mouse-event get-event-type) ⇒ symbol in \(\text{`enter leave left-down left-up middle-down middle-up right-down right-up motion`}\)

get-left-down

Returns #t if the left mouse button was down (but not pressed) during the event.

- (send a-mouse-event get-left-down) ⇒ boolean
get-meta-down

Returns \#t if the Meta (X), Alt (Windows), or Command (Mac OS X) key was down for the event.

- (send a-mouse-event get-meta-down) \Rightarrow boolean

get-middle-down

Returns \#t if the middle mouse button was down (but not pressed) for the event. Under Mac OS X, a middle-button click is impossible.

- (send a-mouse-event get-middle-down) \Rightarrow boolean

get-right-down

Returns \#t if the right mouse button was down (but not pressed) for the event. Under Mac OS X, a control-click combination is treated as a right-button click.

- (send a-mouse-event get-right-down) \Rightarrow boolean

get-shift-down

Returns \#t if the Shift key was down for the event.

- (send a-mouse-event get-shift-down) \Rightarrow boolean

get-x

Returns the x-position of the mouse at the time of the event, in the target’s window’s (client-area) coordinate system.

- (send a-mouse-event get-x) \Rightarrow exact integer

get-y

Returns the y-position of the mouse at the time of the event in the target’s window’s (client-area) coordinate system.

- (send a-mouse-event get-y) \Rightarrow exact integer

leaving?

Returns \#t if this event is for the mouse leaving a window, \#f otherwise.

See entering? for information about enter and leave events while the mouse button is clicked.

- (send a-mouse-event leaving?) \Rightarrow boolean
moving?

Returns #t if this was a moving event (whether a button is pressed is not), #f otherwise.

- (send a-mouse-event moving?) ⇒ boolean

set-alt-down

Sets whether the Option (Mac OS X) key was down for the event. When the Alt key is pressed in Windows, it is reported as a Meta press (see set-meta-down).

- (send a-mouse-event set-alt-down down?) ⇒ void
down?: boolean

set-control-down

Sets whether the Control key was down for the event.

Under Mac OS X, if a control-key press is combined with a mouse button click, the event is reported as a right-button click and get-control-down for the event reports #f.

- (send a-mouse-event set-control-down down?) ⇒ void
down?: boolean

set-event-type

Sets the type of the event; see mouse-event% for information about each event type. See also get-event-type.

- (send a-mouse-event set-event-type event-type) ⇒ void
  event-type: symbol in 'enter leave left-down left-up middle-down middle-up right-down right-up motion

set-left-down

Sets whether the left mouse button was down (but not pressed) during the event.

- (send a-mouse-event set-left-down down?) ⇒ void
down?: boolean

set-meta-down

Sets whether the Meta (X), Alt (Windows), or Command (Mac OS X) key was down for the event.

- (send a-mouse-event set-meta-down down?) ⇒ void
down?: boolean
set-middle-down
Sets whether the middle mouse button was down (but not pressed) for the event. Under Mac OS X, a middle-button click is impossible.

- (send a-mouse-event set-middle-down down?) ⇒ void
down?: boolean

set-right-down
Sets whether the right mouse button was down (but not pressed) for the event. Under Mac OS X, a control-click combination by the user is treated as a right-button click.

- (send a-mouse-event set-right-down down?) ⇒ void
down?: boolean

set-shift-down
Sets whether the Shift key was down for the event.

- (send a-mouse-event set-shift-down down?) ⇒ void
down?: boolean

set-x
Sets the x-position of the mouse at the time of the event in the target’s window’s (client-area) coordinate system.

- (send a-mouse-event set-x pos) ⇒ void
  pos: exact integer

set-y
Sets the y-position of the mouse at the time of the event in the target’s window’s (client-area) coordinate system.

- (send a-mouse-event set-y pos) ⇒ void
  pos: exact integer

3.36 pane%
Implements: subarea<%>

Implements: area-container<%>

A pane is a both a container and a containee area. It serves only as a geometry management device. A pane% cannot be hidden or disabled like a panel% object.
A `panel%` object has a degenerate placement strategy for managing its children; it places them all in the upper left corner and does not stretch any of them. The `horizontal-pane%` and `vertical-pane%` classes provide useful geometry management.

See also `grow-box-spacer-pane%`.

```
- (new panel% (parent _) [(vert-margin _)][(horiz-margin _)] [(border _)] [(spacing _)] [(alignment _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ pane% object
  parent: frame%, dialog%, panel%, or pane% object
  vert-margin = 0: exact integer in [0, 1000]
  horiz-margin = 0: exact integer in [0, 1000]
  border = 0: exact integer in [0, 1000]
  spacing = 0: exact integer in [0, 1000]
  alignment = '(center center): two-element list: 'left,' center, or 'right and 'top,' center, or 'bottom
  min-width = 0: exact integer in [0, 10000]
  min-height = 0: exact integer in [0, 10000]
  stretchable-width = #t: boolean
  stretchable-height = #t: boolean
```

For information about the `horiz-margin` and `vert-margin` arguments, see `subarea<%>`. For information about the `border`, `spacing`, and `alignment` arguments, see `area-container<%>`. For information about the `min-width`, `min-height`, `stretchable-width`, and `stretchable-height` arguments, see `area<%>`.

### 3.37 `panel%`

**Implements:** `area-container-window<%>`

**Implements:** `subwindow<%>`

A panel is a both a container and a containee window. It serves mainly as a geometry management device, but the `border` creates a container with a border. Unlike a `pane%` object, a `panel%` object can be hidden or disabled.

A `panel%` object has a degenerate placement strategy for managing its children; it places them all in the upper left corner and does not stretch any of them. The `horizontal-panel%` and `vertical-panel%` classes provide useful geometry management.

```
- (new panel% (parent _) [(style _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(border _)] [(spacing _)] [(alignment _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ panel% object
  parent: frame%, dialog%, panel%, or pane% object
  style = null: list of symbols in ('border deleted)
  enabled = #t: boolean
  vert-margin = 0: exact integer in [0, 1000]
  horiz-margin = 0: exact integer in [0, 1000]
  border = 0: exact integer in [0, 1000]
  spacing = 0: exact integer in [0, 1000]
  alignment = '(center center): two-element list: 'left,' center, or 'right and 'top,' center, or 'bottom
  min-width = 0: exact integer in [0, 10000]
  min-height = 0: exact integer in [0, 10000]
```
3.38 popup-menu%

Implements: menu-item-container<%>

A popup-menu% object is created without a parent. Dynamically display a popup-menu% with, popup-menu in window<%>, or popup-menu in editor-admin<%>.

A popup menu is not a control. A choice% control, however, displays a single value that the user selects from a popup menu. A choice% control’s popup menu is built into the control, and it is not accessible to the programmer.

- (new popup-menu% [(title _)] [(popdown-callback _)] [(demand-callback _)] [(font _)]) ⇒ popup-menu% object
  title = #f: string (up to 200 characters) or #f
  popdown-callback = (lambda (m e) (void)): procedure of two arguments: a popup-menu% object and a control-event% object
  demand-callback = void: procedure of one argument: a popup-menu% object
  font = normal-control-font: font% object

If title is not #f, it is used as a displayed title at the top of the popup menu.

If title contains an ampersand ("&"), it is handled specially, the same as for menu% titles. A popup menu mnemonic is not useful, but it is supported for consistency with other menu labels.

The popdown-callback procedure is invoked when a popup menu is dismissed. If the popup menu is dismissed without an item being selected, popdown-callback is given a control-event% object with the event type ‘menu-popdown-none. If the popup menu is dismissed via an item selection, the item’s callback is invoked first, and then popdown-callback is given a control-event% object with the event type ‘menu-popdown.

The demand-callback procedure is called by the default on-demand method with the object itself.

The font argument determines the font for the popup menu’s items.

get-font

Returns the font used for the popup menu’s items, which is optionally supplied when a popup menu is created.

- (send a-popup-menu get-font) ⇒ font% object

get-popup-target

Returns the context in which the popup menu is currently displayed, or #f if it is not popped up in any window.
The context is set before the on-demand method is called, and it is not removed until after the popup-menu’s callback is invoked. (Consequently, it is also set while an item callback is invoked, if the user selected an item.)

- (send a-popup-menu get-popup-target) ⇒ window% or editor% object or #f

set-min-width

Sets the popup menu’s minimum width in pixels.

- (send a-popup-menu set-min-width width) ⇒ void
  width: exact integer in [0, 10000]

### 3.39 radio-box%

Implements: control%  

A radio-box% control allows the user to select one of number of mutually exclusive items. The items are displayed as a vertical column or horizontal row of labelled radio buttons. Unlike a list-control%, the set of items in a radio-box% cannot be changed dynamically.

Whenever the user changes the selected radio button, the radio box’s callback procedure is invoked. A callback procedure is provided as an initialization argument when each radio box is created.

- (new radio-box% (label ...) (choices ...) (parent ...) [(callback ...)] [(style ...)] [(selection ...)] [(font ...)] [(enabled ...)] [(vert-margin ...)] [(horiz-margin ...)] [(min-width ...)] [(min-height ...)] [(stretchable-width ...)] [(stretchable-height ...)]) ⇒ radio-box% object

  label: string (up to 200 characters) or #f
  choices: list of strings (up to 200 characters each) or bitmap% objects
  parent: frame%, dialog%, panel%, or pane% object
  callback = (lambda (rb e) (void)): procedure of two arguments: a radio-box% object and a control-event% object
  style = '(vertical): list of symbols in ' (horizontal vertical vertical-label horizontal-label deleted)
  selection = 0: exact non-negative integer
  font = normal-control-font: font% object
  enabled = #t: boolean
  vert-margin = 2: exact integer in [0, 1000]
  horiz-margin = 2: exact integer in [0, 1000]
  min-width = 0: exact integer in [0, 10000]
  min-height = 0: exact integer in [0, 10000]
  stretchable-width = #f: boolean
  stretchable-height = #f: boolean

Creates a radio button set with string or bitmap labels. The choices list specifies the radio button labels; the list of choices must be homogeneous, either all strings or all bitmaps.

If an ampersand (“&”) occurs in label, it is specially parsed; under Windows and X, the character following an ampersand is underlined in the displayed control to indicate a keyboard mnemonic. (Under Mac OS X, mnemonic underlines are not shown.) The underlined mnemonic character must be a letter or a digit. The user can move the keyboard focus to the radio box by typing the mnemonic when the control’s top-level-window contains the keyboard focus. The user must also hold down the Meta or Alt key if the keyboard focus is currently in a control that handles normal alphanumeric input. The ampersand itself is removed from label
before it is displayed for the control; a double-ampersand in label is converted to a single ampersand (with no mnemonic underlining). Under Mac OS X, a parenthesized mnemonic character is removed (along with any surrounding space) before the label is displayed, since a parenthesized mnemonic is often used for non-Roman languages. Finally, any text after a tab character is removed on all platforms. Mnemonic keyboard events are handled by on-traverse-char (but not under Mac OS X).

Each string in choices can also contain an ampersand, which creates a mnemonic for clicking the corresponding radio button. As for label, a double ampersand is converted to a single ampersand.

If choices is a list of bitmaps, then the bitmaps must be valid (see ok? in bitmap%) and not installed in a bitmap-dc% object; otherwise, an exn:fail:contract exception is raised. If the bitmap has a mask (see get-loaded-mask in bitmap%) that is the same size as the bitmap, then the mask is used for the label; furthermore, in contrast to the limitations of draw-bitmap in dc<%>, non-monochrome label masks work consistently on all platforms.

If label is a string, it is used as the label for the radio box. Otherwise, the radio box does not display its label.

The callback procedure is called (with the event type ’radio-box) when the user changes the radio button selection.

The style argument must include either ’vertical for a collection of radio buttons vertically arranged, or ’horizontal for a horizontal arrangement. If style includes ’vertical-label, then the radio box is created with a label above the control; if style does not include ’vertical-label (and optionally includes ’horizontal-label), then the label is created to the left of the radio box. If style includes ’deleted, then the radio box is created as hidden, and it does not affect its parent’s geometry; the radio box can be made active later by calling parent’s add-child method.

By default, the first radio button is initially selected. If selection is positive, it is passed to set-selection to set the initial radio button selection.

The font argument determines the font for the control. For information about the enabled argument, see window<%>. For information about the horiz-margin and vert-margin arguments, see subarea<%>. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area<%>.

enable

Enables or disables a window so that input events are ignored. (Input events include mouse events, keyboard events, and close-box clicks, but not focus or update events.) When a window is disabled, input events to its children are also ignored.

The enable state of a window can be changed by enabling a parent window, and such changes do not go through this method; use on-superwindow-enable to monitor enable state changes.

- (send a-radio-box enable enable?) ⇒ void
  enable?: boolean

  If enable? is #f, the entire radio box is disabled, otherwise it is enabled.

- (send a-radio-box enable n enable?) ⇒ void
  n: exact non-negative integer
  enable?: boolean

  If enable? is #f, the nth radio button is disabled, otherwise it is enabled (assuming the entire radio box is enabled). Radio buttons are numbered from 0. If n is equal to or larger than the number of radio buttons in the radio box, an exn:fail:contract exception is raised.
get-item-label

Gets the label of a radio button by position. Radio buttons are numbered from 0.

- (send a-radio-box get-item-label n) ⇒ string
  n: exact non-negative integer
  If n is equal to or larger than the number of radio buttons in the radio box, an exn:fail:contract exception is raised.

get-item-plain-label

Like get-item-label, except that the label must be a string and ampersands in the label are removed.

- (send a-radio-box get-item-plain-label n) ⇒ string
  n: exact non-negative integer
  If n is equal to or larger than the number of radio buttons in the radio box, an exn:fail:contract exception is raised.

get-number

Returns the number of radio buttons in the radio box.

- (send a-radio-box get-number) ⇒ exact non-negative integer

get-selection

Gets the position of the selected radio button. Radio buttons are numbered from 0.

- (send a-radio-box get-selection) ⇒ exact non-negative integer

is-enabled?

Returns #t if the window is enabled when all of its ancestors are enabled, #f otherwise.

- (send a-radio-box is-enabled?) ⇒ boolean
  Returns #f if the entire radio box is disabled, #t otherwise.

- (send a-radio-box is-enabled? n) ⇒ boolean
  n: exact non-negative integer
  Returns #f if n\textsuperscript{th} radio button is disabled (independent of disabling the entire radio box), #t otherwise. Radio buttons are numbered from 0. If n is equal to or larger than the number of radio buttons in the radio box, an exn:fail:contract exception is raised.

set-selection

Sets the selected radio button by position. (The control’s callback procedure is not invoked.) Radio buttons are numbered from 0.

A radio box’s selection can be changed by the user clicking the control, and such changes do not go through this method; use the control callback procedure (provided as an initialization argument) to monitor selection changes.
- (send a-radio-box set-selection n) ⇒ void
  n: exact non-negative integer

  If n is equal to or larger than the number of radio buttons in the radio box, an exn:fail:contract exception is raised.

3.40 scroll-event%

Superclass: event%

A scroll-event% object contains information about a scroll event. An instance of scroll-event% is always provided to on-scroll.

See get-event-type for a list of the scroll event types.

- (new scroll-event% [(event-type _)] [(direction _)] [(position _)] [(time-stamp _)] ) ⇒ scroll-event% object
  event-type = 'thumb: symbol in ' (top bottom line-up line-down page-up page-down thumb)
  direction = 'vertical: symbol in ' (horizontal vertical)
  position = 0: exact integer in [0, 10000]
  time-stamp = 0: exact integer

  See the corresponding get- and set- methods for information about event-type, direction, position, and time-stamp.

class get-direction

  Gets the identity of the scrollbar that was modified by the event, either the horizontal scrollbar or the vertical scrollbar, as 'horizontal or 'vertical, respectively. See also set-direction.

- (send a-scroll-event get-direction) ⇒ symbol in ' (horizontal vertical)

class get-event-type

  Returns the type of the event, one of the following:

  • 'top — user clicked a scroll-to-top button
  • 'bottom — user clicked a scroll-to-bottom button
  • 'line-up — user clicked an arrow to scroll up or left one step
  • 'line-down — user clicked an arrow to scroll down or right one step
  • 'page-up — user clicked an arrow to scroll up or left one page
  • 'page-down — user clicked an arrow to scroll down or right one page
  • 'thumb — user dragged the scroll position indicator

- (send a-scroll-event get-event-type) ⇒ symbol in ' (top bottom line-up line-down page-up page-down thumb)
3. Windowing Class Reference

3.41 selectable-menu-item

get-position

Returns the position of the scrollbar after the action triggering the event. See also set-position.

- (send a-scroll-event get-position) ⇒ exact integer in [0, 10000]

set-direction

Sets the identity of the scrollbar that was modified by the event, either the horizontal scrollbar or the vertical scrollbar, as 'horizontal or 'vertical, respectively. See also get-direction.

- (send a-scroll-event set-direction direction) ⇒ void
direction: symbol in ' (horizontal vertical)

set-event-type

Sets the type of the event. See get-event-type for information about each event type.

- (send a-scroll-event set-event-type type) ⇒ void
type: symbol in ' (top bottom line-up line-down page-up page-down thumb)

set-position

Records the position of the scrollbar after the action triggering the event. (The scrollbar itself is unaffected). See also get-position.

- (send a-scroll-event set-position position) ⇒ void
position: exact integer in [0, 10000]

3.41 selectable-menu-item

Extends: labelled-menu-item

A selectable-menu-item object is a labelled-menu-item that the user can select. It may also have a keyboard shortcut; the shortcut is displayed in the menu, and the default on-subwindow-char method in the menu’s frame dispatches to the menu item when the shortcut key combination is pressed.

command

Invoke’s the menu item’s callback procedure, which is supplied when an instance of menu-item% or checkable-menu-item% is created.

- (send a-selectable-menu-item command event) ⇒ void
event: control-event% object
get-shortcut

Gets the keyboard shortcut character for the menu item. Under Mac OS X, this character is always prefixed with the command modifier. Under Windows, the character is prefixed with the control modifier. Under X, the modifier depends on the shortcut prefix returned by get-x-shortcut-prefix.

If the menu item has no shortcut, #f is returned.

The shortcut part of a menu item name is not included in the label returned by get-label.

- (send a-selectable-menu-item get-shortcut) ⇒ character or #f

get-x-shortcut-prefix

Returns a symbol that indicates the keyboard prefix used for the menu item’s keyboard shortcut. The possible values are the following:

- ‘meta — Meta with the shortcut character
- ‘alt — Alt with the shortcut character
- ‘ctl — Ctl with the shortcut character
- ‘ctl-m — Ctl-M followed by the shortcut character

See get-shortcut for more information.

- (send a-selectable-menu-item get-x-shortcut-prefix) ⇒ symbol in ‘(meta alt ctl ctl-m)

set-shortcut

Sets the keyboard shortcut character for the menu item. See get-shortcut for more information.

If the shortcut character is set to #f, then menu item has no keyboard shortcut.

- (send a-selectable-menu-item set-shortcut shortcut) ⇒ void
  shortcut : character or #f

set-x-shortcut-prefix

Sets a symbol that indicates the keyboard prefix used for the menu item’s keyboard shortcut.

See get-x-shortcut-prefix for more information.

- (send a-selectable-menu-item set-x-shortcut-prefix prefix) ⇒ void
  prefix : symbol in ‘(meta alt ctl ctl-m)

3.42 separator-menu-item%

Implements: menu-item<%>
A separator is an unselectable line in a menu. Its parent must be a menu% or popup-menu%.

- (new separator-menu-item% (parent _)) ⇒ separator-menu-item% object
  parent: menu% or popup-menu% object
  Creates a new separator in the menu.

3.43 slider%

Implements: control<%>

A slider object is a panel item with a handle that the user can drag to change the control’s value. Each slider has a fixed minimum and maximum value.

Whenever the user changes the value of a slider, its callback procedure is invoked. A callback procedure is provided as an initialization argument when each slider is created.

- (new slider% (label _) (min-value _) (max-value _) (parent _) [(callback _)] [(init-value _)] [(style _)] [(font _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ slider% object
  label: string (up to 200 characters) or #f
  min-value: exact integer in [-10000, 10000]
  max-value: exact integer in [-10000, 10000]
  parent: frame%, dialog%, panel%, or pane% object
  callback = (lambda (s e) (void)): procedure of two arguments: a slider% object and a control-event% object
  init-value = min-value: exact integer in [-10000, 10000]
  style = ’(horizontal): list of symbols in ’(horizontal vertical plain vertical-label horizontal-label deleted)
  font = normal-control-font: font% object
  enabled = #t: boolean
  vert-margin = 2: exact integer in [0, 1000]
  horiz-margin = 2: exact integer in [0, 1000]
  min-width = 0: exact integer in [0, 10000]
  min-height = 0: exact integer in [0, 10000]
  stretchable-width = #t for ’horizontal style, #f for ’vertical: boolean
  stretchable-height = #t for ’vertical style, #f for ’horizontal: boolean

If label is a string, it is used as the label for the slider. Otherwise, the slider does not display its label.

If an ampersand (“&”) occurs in label, it is specially parsed; under Windows and X, the character following an ampersand is underlined in the displayed control to indicate a keyboard mnemonic. (Under Mac OS X, mnemonic underlines are not shown.) The underlined mnemonic character must be a letter or a digit. The user can move the keyboard focus to the slider by typing the mnemonic when the control’s top-level-window contains the keyboard focus. The user must also hold down the Meta or Alt key if the keyboard focus is currently in a control that handles normal alphanumeric input. The ampersand itself is removed from label before it is displayed for the control; a double-ampersand in label is converted to a single ampersand (with no mnemonic underlining). Under Mac OS X, a parenthesized mnemonic character is removed (along with any surrounding space) before the label is displayed, since a parenthesized mnemonic is often used for non-Roman languages. Finally, any text after a tab character is removed on all platforms. Mnemonic keyboard events are handled by on-traverse-char (but not under Mac OS X).

The min-value and max-value arguments specify the range of the slider, inclusive. The init-value argument optionally specifies the slider’s initial value. If the sequence [min-value, init-value, maximum-value] is not increasing, an exn:fail:contract exception is raised.
The callback procedure is called (with the event type ‘slider’) when the user changes the slider’s value.

The style argument must include either ‘vertical’ for a vertical slider, or ‘horizontal’ for a horizontal slider. If style includes ‘plain’, the slider does not display numbers for its range and current value to the user. If style includes ‘vertical-label’, then the slider is created with a label above the control; if style does not include ‘vertical-label’ (and optionally includes ‘horizontal-label’), then the label is created to the left of the slider. If style includes ‘deleted’, then the slider is created as hidden, and it does not affect its parent’s geometry; the slider can be made active later by calling parent’s add-child method.

The font argument determines the font for the control. For information about the enabled argument, see window%. For information about the horiz-margin and vert-margin arguments, see subarea%. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area%.

get-value

Gets the current slider value.

- (send a-slider get-value) ⇒ exact integer in [-10000, 10000]

set-value

Sets the value (and displayed position) of the slider. (The control’s callback procedure is not invoked.)

A slider’s value can be changed by the user clicking the control, and such changes do not go through this method; use the control callback procedure (provided as an initialization argument) to monitor value changes.

- (send a-slider set-value value) ⇒ void
  value: exact integer in [-10000, 10000]

  If value is outside the slider’s minimum and maximum range, an exn:fail:contract exception is raised.

3.44 subarea%

Extends: area%

A subarea% is a containee area%.

All subarea% classes accept the following named instantiation arguments:

- horiz-margin — default is 2 for control% classes and group-box-panel%, 0 for others; passed to horiz-margin
- vert-margin — default is 2 for control% classes and group-box-panel%, 0 for others; passed to vert-margin

horiz-margin

Gets or sets the area’s horizontal margin, which is added both to the right and left, for geometry management. See §2.2 Geometry Management for more information.
3. Windowing Class Reference

3.45 subwindow

- (send a-subarea horiz-margin) ⇒ exact integer in [0, 1000]
  Returns the current horizontal margin.

- (send a-subarea horiz-margin margin) ⇒ void
  margin: exact integer in [0, 1000]
  Sets the horizontal margin.

vert-margin

Gets or sets the area’s vertical margin, which is added both to the right and left, for geometry management. See §2.2 Geometry Management for more information.

- (send a-subarea vert-margin) ⇒ exact integer in [0, 1000]
  Returns the current vertical margin.

- (send a-subarea vert-margin margin) ⇒ void
  margin: exact integer in [0, 1000]
  Sets the vertical margin.

3.46 tab-panel

Superclass: vertical-panel

A tab panel arranges its subwindows in a single column, but also includes a horizontal row of tabs at the top of the panel. See also panel.

The tab-panel class does not implement the virtual swapping of the panel content when a new tab is selected. Instead, it merely invokes a callback procedure to indicate that a user changed the tab selection.

- (new tab-panel% (choices _) (parent _) [(callback _)] [(style _)] [(font _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(border _)] [(spacing _)] [(alignment _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ tab-panel% object
  choices: list of strings (up to 200 characters each)
  parent: frame%, dialog%, panel%, or pane% object
  callback = (lambda (tp e) (void)): procedure of two arguments: a tab-panel% object and a control-event%
  style = null: list of symbols in ’(no-border deleted)
  font = normal-control-font: font% object
  enabled = #t: boolean
  vert-margin = 0: exact integer in [0, 1000]
horiz-margin = 0: exact integer in [0, 1000]
border = 0: exact integer in [0, 1000]
spacing = 0: exact integer in [0, 1000]
alignment = "(center top)" : two-element list: 'left', 'center, or 'right and 'top, 'center, or 'bottom
min-width = 0: exact integer in [0, 10000]
min-height = 0: exact integer in [0, 10000]
stretchable-width = #t: boolean
stretchable-height = #t: boolean

Creates a tab pane, where the choices list specifies the tab labels.

Each string in choices can contain an ampersand, which (in the future) may create a mnemonic for clicking the corresponding tab. A double ampersand is converted to a single ampersand.

The callback procedure is called (with the event type 'tab-pane) when the user changes the tab selection.

If the style list includes 'no-border, no border is drawn around the panel content. If style includes 'deleted, then the tab panel is created as hidden, and it does not affect its parent’s geometry; the tab panel can be made active later by calling parent’s add-child method.

The font argument determines the font for the control. For information about the enabled argument, see window<%>. For information about the horiz-margin and vert-margin arguments, see subarea<%. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area<%>.

append

Adds a tab to the right end of panel’s top row of tabs.

- (send a-tab-panel append choice) ⇒ void
  choice : string (up to 200 characters)

  The label string choice can contain an ampersand, which (in the future) may create a mnemonic for clicking the new tab. A double ampersand is converted to a single ampersand.

delete

Deletes an existing tab.

- (send a-tab-panel delete n) ⇒ void
  n : exact non-negative integer

  If n is equal to or larger than the number of tabs on the panel, an exn:fail:contract exception is raised.

get-item-label

Gets the label of a tab by position. Tabs are numbered from 0.

- (send a-tab-panel get-item-label n) ⇒ string
  n : exact non-negative integer

  If n is equal to or larger than the number of tabs in the panel, an exn:fail:contract exception is raised.
get-number
Returns the number of tabs on the panel.

- (send a-tab-panel get-number) ⇒ exact non-negative integer

get-selection
Returns the index (counting from 0) of the currently selected tab. If the panel has no tabs, the result is #f.

- (send a-tab-panel get-selection) ⇒ exact non-negative integer or #f

set
Removes all tabs from the panel and installs tabs with the given labels.

- (send a-tab-panel set choices) ⇒ void
  choices: list of strings (up to 200 characters each)

set-item-label
Sets the label of a tab by position. Tabs are numbered from 0.

- (send a-tab-panel set-item-label n label) ⇒ string
  n: exact non-negative integer
  label: string (up to 200 characters)
  Set the label for tab n to label. If n is equal to or larger than the number of tabs in the panel, an exn:fail:contract exception is raised.

set-selection
Sets the currently selected tab by index (counting from 0).

- (send a-tab-panel set-selection n) ⇒ void
  n: exact non-negative integer
  If n is equal to or larger than the number of tabs in the panel, an exn:fail:contract exception is raised.

3.47 text-field%
Implements: control<%>

A text-field% object is an editable text field with an optional label displayed in front of it. There are two text field styles:

- A single line of text is visible, and a special control event is generated when the user presses Enter (when the text field has the focus) and the event is not handled by the text field’s frame or dialog (see on-traverse-char in top-level-window%).
- Multiple lines of text are visible, and Enter is not handled specially.

Whenever the user changes the content of a text field, its callback procedure is invoked. A callback procedure is provided as an initialization argument when each text field is created.

The text field is implemented using a text% editor (with an inaccessible display). Thus, whereas text-field% provides only get-value and set-value to manipulate the text in a text field, the get-editor returns the field's editor, which provides a vast collection of methods for more sophisticated operations on the text.

The keymap for the text field's editor is initialized by calling the current keymap initializer procedure, which is determined by the current-text-keymap-initializer parameter.

- (new text-field% (label _) (parent _) [(callback _)] [(init-value _)] [(style _)] [(font _)] [(enabled _)] [(vert-margin _)] [(horiz-margin _)] [(min-width _)] [(min-height _)] [(stretchable-width _)] [(stretchable-height _)]) ⇒ text-field% object

  label : string (up to 200 characters) or #f
  parent : frame%, dialog%, panel%, or pane% object
  callback = (lambda (tf e) (void)) : procedure of two arguments: a text-field% object and a control-event%
  init-value = "" : string
  style = ' (single) : list of symbols in ' (single multiple hscroll password vertical-label horizontal-label deleted)
  font = normal-control-font : font% object
  enabled = #t : boolean
  vert-margin = 2 : exact integer in [0, 1000]
  horiz-margin = 2 : exact integer in [0, 1000]
  min-width = 0 : exact integer in [0, 10000]
  min-height = 0 : exact integer in [0, 10000]
  stretchable-width = #t : boolean
  stretchable-height = #t : boolean

If label is not #f, it is used as the text field label. Otherwise, the text field does not display its label.

If an ampersand ("&") occurs in label, it is specially parsed; under Windows and X, the character following an ampersand is underlined in the displayed control to indicate a keyboard mnemonic. (Under Mac OS X, mnemonic underlines are not shown.) The underlined mnemonic character must be a letter or a digit. The user can move the keyboard focus to the text field by typing the mnemonic when the control’s top-level-window contains the keyboard focus. The user must also hold down the Meta or Alt key if the keyboard focus is currently in a control that handles normal alphanumeric input. The ampersand itself is removed from label before it is displayed for the control; a double-ampersand in label is converted to a single ampersand (with no mnemonic underlining). Under Mac OS X, a parenthesized mnemonic character is removed (along with any surrounding space) before the label is displayed, since a parenthesized mnemonic is often used for non-Roman languages. Finally, any text after a tab character is removed on all platforms. Mnemonic keyboard events are handled by on-traverse-char (but not under Mac OS X).

The callback procedure is called when the user changes the text in the text field or presses the Enter key (and Enter is not handled by the text field's frame or dialog: see on-traverse-char in top-level-window<%> ). If the user presses Enter, the type of event passed to the callback is 'text-field-enter, otherwise it is 'text-field.

If init-value is not ", the minimum width of the text item is made wide enough to show init-value. Otherwise, a built-in default width is selected. For a text field in single-line mode, the minimum height is set to show one line and only the control’s width is stretchable. For a multiple-line text field, the minimum height shows three lines of text and is stretchable in both directions.

The style must contain exactly one of ‘single or ‘multiple; the former specifies a single-line field and the latter specifies a multiple-line field. The ‘hscroll style applies only to multiple-line fields; when
Windowing Class Reference

3.48 timer%

'hscroll is specified, the field has a horizontal scrollbar and autowrapping is disabled; otherwise, the field has no horizontal scrollbar and autowrapping is enabled. A multiple-line text field always has a vertical scrollbar. The 'password style indicates that the field should draw each character of its content using a generic symbol instead of the actual character. If style includes 'vertical-label, then the text field is created with a label above the control; if style does not include 'vertical-label (and optionally includes 'horizontal-label), then the label is created to the left of the text field. If style includes 'deleted, then the text field is created as hidden, and it does not affect its parent’s geometry; the text field can be made active later by calling parent’s add-child method.

The font argument determines the font for the control. For information about the enabled argument, see window<%. For information about the horiz-margin and vert-margin arguments, see subarea<%. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area<%>.

get-editor

Returns the editor used to implement the text field.

For a text field, the most useful methods of a text% object are the following:

- (send a-text get-text) returns the current text of the editor.
- (send a-text erase) deletes all text from the editor.
- (send a-text insert string) inserts string into the editor at the current caret position.

-get-editor ⇒ text% object

get-value

Returns the text currently in the text field.

- (send a-text-field get-value) ⇒ string

set-value

Sets the text currently in the text field. (The control’s callback procedure is not invoked.)

A text field’s value can be changed by the user typing into the control, and such changes do not go through this method; use the control callback procedure (provided as an initialization argument) to monitor value changes.

- (send a-text-field set-value val) ⇒ void
  val: string

3.48 timer%

A timer% object encapsulates an event-based alarm. To use a timer, either instantiate it with a timer-callback thunk to perform the alarm-based action, to derive a new class and override the notify method to perform the alarm-based action. Start a timer with start and stop it with stop. Supplying an initial interval (in milliseconds) when creating a timer also starts the timer.
Timers have a relatively high priority in the event queue. Thus, if the timer delay is set low enough, repeated notification for a timer can preempt user activities (which might be directed at stopping the timer). For timers with relatively short delays, call \texttt{yield} within the \texttt{notify} procedure to allow guaranteed event processing.

See §2.4 Eventspaces for more information about event priorities.

\begin{verbatim}
- (new timer% [(notify-callback _)] [(interval _)] [(just-once? _)]) ⇒ timer% object
  notify-callback = void: procedure of no arguments
  interval = #f: exact integer in [0, 1000000000] or #f
  just-once? = #f: boolean

  Creates a timer.
  The \texttt{notify-callback} thunk is called by the default \texttt{notify} method when the timer expires.
  If \texttt{interval} is #f (the default), the timer is not started; in that case, \texttt{start} must be called explicitly. If \texttt{interval} is a number (in milliseconds), then \texttt{start} is called with \texttt{interval} and \texttt{just-once?}.

interval

  Returns the number of milliseconds between each timer expiration (when the timer is running).

  - (send a-timer interval) ⇒ exact integer in [0, 1000000000]

notify

  Called (on an event boundary) when the timer’s alarm expires.

  - (send a-timer notify) ⇒ void

    Calls the \texttt{notify-callback} procedure that was provided when the object was created.

start

  Starts (or restarts) the timer. If the timer is already running, its alarm time is not changed.

  - (send a-timer start msec just-once?) ⇒ void

    \texttt{msec}: exact integer in [0, 1000000000]
    \texttt{just-once?} = #f: boolean

    The timer’s alarm expires after \texttt{msec} milliseconds, at which point \texttt{notify} is called (on an event boundary). If \texttt{just-once?} is #f, the timer expires \texttt{every msec} milliseconds until the timer is explicitly stopped;\textsuperscript{\textdagger} otherwise, the timer expires only once.

stop

  Stops the timer. A stopped timer never calls \texttt{notify}. If the timer has expired but the call to \texttt{notify} has not yet been dispatched, the call is removed from the event queue.

  - (send a-timer stop) ⇒ void
\end{verbatim}

\textsuperscript{\textdagger}More precisely, the timer expires \texttt{msec} milliseconds after \texttt{notify} returns each time
3.49 top-level-window

Extends: area-container-window

A top-level window is either a frame or dialog object.

can-close? (augmentable only)

Called just before the window might be closed (e.g., by the window manager). If #f is returned, the window is not closed, otherwise on-close is called and the window is closed (i.e., the window is hidden, like calling show with #f).

This method is not called by show.

- (send a-top-level-window can-close?) ⇒ boolean

can-exit?

Called before on-exit to check whether an exit is allowed. See on-exit for more information.

- (send a-top-level-window can-exit?) ⇒ boolean

Calls can-close? and returns the result.

center

Centers the window on the screen if it has no parent. If it has a parent, the window is centered with respect to its parent’s location.

- (send a-top-level-window center direction) ⇒ void
  
  direction = ’both: symbol in ’(horizontal vertical both)

  If direction is ’horizontal, the window is centered horizontally. If direction is ’vertical, the window is centered vertically. If direction is ’both, the window is centered in both directions.

get-edit-target-object

Like get-edit-target-window, but if an editor canvas had the focus and it also displays an editor, the editor is returned instead of the canvas. Further, if the editor’s focus is delegated to an embedded editor, the embedded editor is returned.

See also get-focus-object.

- (send a-top-level-window get-edit-target-object) ⇒ window or editor object or #f

get-edit-target-window

Returns the window that most recently had the keyboard focus, either the top-level window or one of its currently-shown children. If neither the window nor any of its currently-shown children has even owned the keyboard focus, #f is returned.
See also `get-focus-window` and `get-edit-target-object`.

- `(send a-top-level-window get-edit-target-window) ⇒ window object or #f`  

`get-eventspace`

Returns the window’s eventspace.

- `(send a-top-level-window get-eventspace) ⇒ eventspace`  

`get-focus-object`

Like `get-focus-window`, but if an editor canvas has the focus and it also displays an editor, the editor is returned instead of the canvas. Further, if the editor’s focus is delegated to an embedded editor, the embedded editor is returned.

See also `get-edit-target-object`.

- `(send a-top-level-window get-focus-object) ⇒ window or editor object or #f`  

`get-focus-window`

Returns the window that has the keyboard focus, either the top-level window or one of its children. If neither the window nor any of its children has the focus, #f is returned.

See also `get-edit-target-window` and `get-focus-object`.

- `(send a-top-level-window get-focus-window) ⇒ window object or #f`  

`move`

Moves the window to the given position on the screen.

A window’s position can be changed by the user dragging the window, and such changes do not go through this method; use `on-move` to monitor position changes.

- `(send a-top-level-window move x y) ⇒ void`  
  
  `x`: exact integer in [-10000, 10000]
  
  `y`: exact integer in [-10000, 10000]  

`on-activate`

Called when a window is activated or deactivated. A top-level window is activated when the keyboard focus moves from outside the window to the window or one of its children. It is deactivated when the focus moves back out of the window. Under Mac OS X, a child of a floating frames can have the focus instead of a child of the active non-floating frame; in other words, floating frames act as an extension of the active non-frame for keyboard focus.

The method’s argument is #t when the window is activated, #f when it is deactivated.

- `(send a-top-level-window on-activate active?) ⇒ void`  
  
  `active?:` boolean
on-close (augmentable only)

Called just before the window is closed (e.g., by the window manager). This method is not called by show.

See also can-close?.

- (send a-top-level-window on-close) ⇒ void

on-exit

Called by the default application quit handler (as determined by the application-quit-handler parameter) when the operating system requests that the application shut down (e.g., when the Quit menu item is selected in the main application menu under Mac OS X). In that case, this method is called for the most recently active top-level window in the initial eventspace, but only if the window’s can-exit? method first returns true.

- (send a-top-level-window on-exit) ⇒ void

Calls on-close and then show to hide the window.

on-message

A generic message method, usually called by send-message-to-window.

If the method is invoked by send-message-to-window, then it is invoked in the thread where send-message-to-window was called (which is possibly not the handler thread of the window’s eventspace).

- (send a-top-level-window on-message message) ⇒ value

message: value

Returns void.

on-system-menu-char

Checks whether the given event pops open the system menu in the top-left corner of the window (Windows only). If the window’s system menu is opened, #t is returned, otherwise #f is returned.

- (send a-top-level-window on-system-menu-char event) ⇒ boolean

event: key-event% object

on-traverse-char

Attempts to handle the given keyboard event as a navigation event, such as a Tab key event that moves the keyboard focus. If the event is handled, #t is returned, otherwise #f is returned.

- (send a-top-level-window on-traverse-char event) ⇒ boolean

event: key-event% object

The following rules determine, in order, whether and how event is handled:

- If the window that currently owns the focus specifically handles the event, then #f is returned. The following describes window types and the keyboard events they specifically handle:
* **editor-canvas** — tab-exit is disabled (see `allow-tab-exit`): all keyboard events, except alphanumeric key events when the Meta (X) or Alt (Windows) key is pressed; when tab-exit is enabled: all keyboard events except Tab, Enter, Escape, and alphanumeric Meta/Alt events.

* **canvas** — when tab-focus is disabled (see `accept-tab-focus`): all keyboard events, except alphanumeric key events when the Meta (X) or Alt (Windows) key is pressed; when tab-focus is enabled: no key events

* **text-field**, `'single` style — arrow key events and alphanumeric key events when the Meta (X) or Alt (Windows) key is not pressed and all alphanumeric events under Mac OS X

* **text-field**, `'multiple` style — all keyboard events, except alphanumeric key events when the Meta (X) or Alt (Windows) key is pressed

* **choice** — arrow key events and alphanumeric key events when the Meta (X) or Alt (Windows) key is not pressed

* **list-box** — arrow key events and alphanumeric key events when the Meta (X) or Alt (Windows) key is not pressed

- If `event` is a Tab or arrow key event, the keyboard focus is moved within the window and `#t` is returned. Across platforms, the types of windows that accept the keyboard focus via navigation may vary, but `text-field` windows always accept the focus, and `message`, `gauge`, and `panel` windows never accept the focus.

- If `event` is a Space key event and the window that currently owns the focus is a `button`, `check-box`, or `radio-box` object, the event is handled in the same way as a click on the control and `#t` is returned.

- If `event` is an Enter key event and the current top-level window contains a border button, the button’s callback is invoked and `#t` is returned. (The `border` style for a `button` object indicates to the user that pressing Enter is the same as clicking the button.) If the window does not contain a border button, `#t` is returned if the window with the current focus is not a text field or editor canvas.

- In a dialog, if `event` is an Escape key event, the event is handled the same as a click on the dialog’s close box (i.e., the dialog’s `can-close` and `on-close` methods are called, and the dialog is hidden) and `#t` is returned.

- If `event` is an alphanumeric key event and the current top-level window contains a control with a mnemonic matching the key (which is installed via a label that contains “&”; see `get-label` for more information), then the keyboard focus is moved to the matching control. Furthermore, if the matching control is a `button`, `check-box`, or `radio-box` button, the keyboard event is handled in the same way as a click on the control.

- Otherwise, `#f` is returned.

### resize

Sets the size of the window (in pixels), but only if the given size is larger than the window’s minimum size.

A window’s size can be changed by the user, and such changes do not go through this method; use `on-size` to monitor size changes.

```
(send a-top-level-window resize width height) ⇒ void
width: exact integer in [0, 10000]
height: exact integer in [0, 10000]
```

### show

Shows or hides a window.

The visibility of a window can be changed by the user clicking the window’s close box, for example, and such changes do not go through this method; use `on-superwindow-show` or `on-close` to monitor visibility changes.
3. Windowing Class Reference

3.50 vertical-pane%

Superclass: pane%

A vertical pane arranges its subwindows in a single column. See also pane%.

- (new vertical-pane% (parent _)) \[(vert-margin _)\] \[(horiz-margin _)\] \[(border _)\] \[(spacing _)\] \[(alignment _)\] \[(min-width _)\] \[(min-height _)\] \[(stretchable-width _)\] \[(stretchable-height _)\]) ⇒ vertical-pane% object

parent: frame%, dialog%, panel%, or pane% object
vert-margin = 0: exact integer in [0, 1000]
horiz-margin = 0: exact integer in [0, 1000]
border = 0: exact integer in [0, 1000]
spacing = 0: exact integer in [0, 1000]
alignment = ‘(center top): two-element list: ‘left, ‘center, or ‘right and ‘top,’ center, or ‘bottom
min-width = 0: exact integer in [0, 10000]
min-height = 0: exact integer in [0, 10000]
stretchable-width = #t: boolean
stretchable-height = #t: boolean

For information about the horiz-margin and vert-margin arguments, see subarea<%>. For information about the border, spacing, and alignment arguments, see area-container<%>. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area<%>.

3.51 vertical-panel%

Superclass: panel%

A vertical panel arranges its subwindows in a single column. See also panel%.

- (new vertical-panel% (parent _) \[(style _)\] \[(enabled _)\] \[(vert-margin _)\] \[(horiz-margin _)\] \[(border _)\] \[(spacing _)\] \[(alignment _)\] \[(min-width _)\] \[(min-height _)\] \[(stretchable-width _)\] \[(stretchable-height _)\]) ⇒ vertical-panel% object

parent: frame%, dialog%, panel%, or pane% object
style = null: list of symbols in ‘(border deleted)
enabled = #t: boolean
vert-margin = 0: exact integer in [0, 1000]
horiz-margin = 0: exact integer in [0, 1000]
border = 0: exact integer in [0, 1000]
spacing = 0: exact integer in [0, 1000]
alignment = ‘(left center): two-element list: ‘left,’ center, or ‘right and ‘top,’ center, or ‘bottom
min-width = 0: exact integer in [0, 10000]
min-height = 0: exact integer in [0, 10000]
stretchable-width = #t: boolean
stretchable-height = #t: boolean
If the 'border style is specified, the window is created with a thin border (only in this case, the client size of the panel may be less than its total size). If style includes 'deleted, then the panel is created as hidden, and it does not affect its parent’s geometry; the panel can be made active later by calling parent’s add-child method.

For information about the enabled argument, see window. For information about the horiz-margin and vert-margin arguments, see subarea. For information about the border, spacing, and alignment arguments, see area-container. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area.

## 3.52 window

Extends: area

A window object is an area with a graphical representation that can respond to events.

All window classes accept the following named instantiation arguments:

- **enabled** — default is #t; passed to enable if #f

accept-drop-files

Enables or disables drag-and-drop dropping for the window (on platforms that support drag-and-drop), or gets the enable state. Dropping is initially disabled. See also on-drop-file.

- (send a-window accept-drop-files) ⇒ boolean
  
  Returns #t if file-dropping is enabled, #f otherwise.

- (send a-window accept-drop-files accept-files?) ⇒ void
  
  accept-files?: boolean

  Enables file-dropping if accept-files? is true, disables file-dropping otherwise.

client->screen

Converts local window coordinates to screen coordinates.

- (send a-window client->screen x y) ⇒ two exact integers in [-10000, 10000]
  
  x: exact integer in [-10000, 10000]
  
  y: exact integer in [-10000, 10000]

enable

Enables or disables a window so that input events are ignored. (Input events include mouse events, keyboard events, and close-box clicks, but not focus or update events.) When a window is disabled, input events to its children are also ignored.

The enable state of a window can be changed by enabling a parent window, and such changes do not go through this method; use on-superwindow-enable to monitor enable state changes.
- (send a-window enable enable?) ⇒ void
  
  enable? : boolean
  
  If enable? is true, the window is enabled, otherwise it is disabled.

focus

Moves the keyboard focus to the window, relative to its top-level window. If the focus is in the window’s top-level window, then the focus is immediately moved to this window. Otherwise, the focus is not immediately moved, but when the window’s top-level window gets the keyboard focus, it is delegated to this window.

See also on-focus.

Note that under X, keyboard focus can move to the menu bar when the user is selecting a menu item.

The current keyboard focus window can be changed by the user, and such changes do not go through this method; use on-focus to monitor focus changes.

- (send a-window focus) ⇒ void

get-client-size

Gets the interior size of the window in pixels. For a container, the interior size is the size available for placing subwindows (including the border margin). For a canvas, this is the visible drawing area.

The client size is returned as two values: width and height (in pixels).

See also reflow-container.

- (send a-window get-client-size) ⇒ two exact integers in [0, 10000]

get-cursor

Returns the window’s cursor, or #f if this window’s cursor defaults to the parent’s cursor. See set-cursor for more information.

- (send a-window get-cursor) ⇒ cursor% object or #f

get-handle

Returns an exact integer representing a handle to the window in the current platform’s GUI toolbox. Cast this number from a C long to a platform-specific C type:

- Windows: HWND
- Mac OS X: WindowRef for a top-level-window object, ControlRef for other windows
- X: Widget*

Some windows may not have a representation in the platform’s GUI level, in which case the result of this method is 0.

- (send a-window get-handle) ⇒ exact integer
get-height

Returns the window’s total height (in pixels).

See also reflow-container.

- (send a-window get-height) ⇒ exact integer in [0, 10000]

get-label

Gets a window’s label, if any. Control windows generally display their label in some way. Frames and dialogs display their label as a window title. Panels do not display their label, but the label can be used for identification purposes. Messages, buttons, and check boxes can have bitmap labels (only when they are created with bitmap labels), but all other windows have string labels. In addition, a message label can be an icon symbol ’app’, ’caution’, or ’stop’.

The label string may contain ampersands (“&”), which serve as keyboard navigation annotations for controls under Windows and X. The ampersands are not part of the displayed label of a control; instead, ampersands are removed in the displayed label (under all platforms), and any character preceding an ampersand is underlined (Windows and X) indicating that the character is a mnemonic for the control. Double ampersands are converted into a single ampersand (with no displayed underline). See also on-traverse-char.

If the window does not have a label, #f is returned.

- (send a-window get-label) ⇒ string (up to 200 characters), bitmap% object, ’app’, ’caution’, ’stop’, or #f

get-plain-label

Like get-label, except that ampersands in the label are removed. If the window has no label or the window’s label is not a string, #f is returned.

- (send a-window get-plain-label) ⇒ string or #f

get-size

Gets the current size of the entire window in pixels, not counting horizontal and vertical margins. (Under X, this size does not include a title bar or borders for a frame/dialog.) See also get-client-size.

The geometry is returned as two values: width and height (in pixels).

See also reflow-container.

- (send a-window get-size) ⇒ two exact integers in [0, 10000]

get-width

Returns the window’s current total width (in pixels).

See also reflow-container.

- (send a-window get-width) ⇒ exact integer in [0, 10000]
get-x

Returns the position of the window’s left edge in its parent’s coordinate system.

See also reflow-container.

- `(send a-window get-x)` ⇒ exact integer in [-10000, 10000]

get-y

Returns the position of the window’s top edge in its parent’s coordinate system.

See also reflow-container.

- `(send a-window get-y)` ⇒ exact integer in [-10000, 10000]

has-focus?

Indicates whether the window currently has the keyboard focus. See also on-focus.

- `(send a-window has-focus?)` ⇒ boolean

is-enabled?

Returns #t if the window is enabled when all of its ancestors are enabled, #f otherwise.

- `(send a-window is-enabled?)` ⇒ boolean

is-shown?

Indicates whether the window is currently shown or not (when all of its ancestors are also shown).

The result is #t if this window is shown when its ancestors are shown, or #f if this window remains hidden when its ancestors are shown.

- `(send a-window is-shown?)` ⇒ boolean

on-drop-file

For platforms that support drag-and-drop, this method is called when the user drags a file onto the window. Drag-and-drop must first be enabled for the window with accept-drop-files.

Under Mac OS X, when the application is running and user double-clicks an application-handled file or drags a file onto the application’s icon, the main thread’s application file handler is called (see application-file-handler). The default handler calls the on-drop-file method of the most-recently activated frame if drag-and-drop is enabled for that frame, independent of the frame’s eventspace (but the method is called in the frame’s eventspace’s handler thread). When the application is not running, the filenames will be provided as command-line arguments.

- `(send a-window on-drop-file pathname)` ⇒ void
  
  `pathname`: path
on-focus

Called when a window receives or loses the keyboard focus. If the argument is \#t, the keyboard focus was received, otherwise it was lost.

Note that under X, keyboard focus can move to the menu bar when the user is selecting a menu item.

- \(\text{(send } \text{a-window on-focus on?)} \Rightarrow \text{void}\)
  \(\text{on?}: \text{boolean}\)
  
  Does nothing.

on-move

Called when the window is moved. (For windows that are not top-level windows, “moved” means moved relative to the parent’s top-left corner.) The new position is provided to the method.

- \(\text{(send } \text{a-window on-move x y)} \Rightarrow \text{void}\)
  
  \(\text{x}: \text{exact integer in [-10000, 10000]}\)
  
  \(\text{y}: \text{exact integer in [-10000, 10000]}\)

  Does nothing.

on-size

Called when the window is resized. The window’s new size (in pixels) is provided to the method. The size values are for the entire window, not just the client area.

- \(\text{(send } \text{a-window on-size width height)} \Rightarrow \text{void}\)
  
  \(\text{width}: \text{exact integer in [0, 10000]}\)
  
  \(\text{height}: \text{exact integer in [0, 10000]}\)

  Does nothing.

on-subwindow-char

Called when this window or a child window receives a keyboard event. The \text{on-subwindow-char} method of the receiver’s top-level window is called first (see \text{get-top-level-window}); if the return value is \#f, then the \text{on-subwindow-char} method is called for the next child in the path to the receiver, and so on. Finally, if the receiver’s \text{on-subwindow-char} method returns \#f, the event is passed on to the receiver’s normal key-handling mechanism.

BEWARE: The default \text{on-subwindow-char in frame%} and \text{on-subwindow-char in dialog%} methods consume certain keyboard events (e.g., arrow keys, Enter) used for navigating within the window. Because the top-level window gets the first chance to handle the keyboard event, some events never reach the “receiver” child unless the default frame or dialog method is overridden.

- \(\text{(send } \text{a-window on-subwindow-char receiver event)} \Rightarrow \text{boolean}\)
  
  \(\text{receiver}: \text{window<%} \text{ object}\)
  
  \(\text{event}: \text{key-event% object}\)

  The \text{event} argument is the event that was generated for the \text{receiver} window. Returns \#f.
on-subwindow-event

Called when this window or a child window receives a mouse event. The on-subwindow-event method of the receiver’s top-level window is called first (see get-top-level-window); if the return value is #f, the on-subwindow-event method is called for the next child in the path to the receiver, and so on. Finally, if the receiver’s on-subwindow-event method returns #f, the event is passed on to the receiver’s normal mouse-handling mechanism.

```
- (send a-window on-subwindow-event receiver event) => boolean
  receiver: window object
  event: mouse-event object
```

The event argument is the event that was generated for the receiver window. Returns #f.

on-superwindow-enable

Called via the event queue whenever the enable state of a window has changed, either through a call to the window’s enable method, or through the enabling/disabling of one of the window’s ancestors. The method’s argument indicates whether the window is now enabled or not.

This method is not called when the window is initially created; it is called only after a change from the window’s initial enable state. Furthermore, if an enable notification event is queued for the window and it reverts its enabled state before the event is dispatched, then the dispatch is canceled.

If the enable state of a window’s ancestor changes while the window is deleted (e.g., because it was removed with delete-child), then no enable events are queued for the deleted window. But if the window is later re-activated into an enable state that is different from the window’s state when it was de-activated, then an enable event is immediately queued.

```
- (send a-window on-superwindow-enable enabled?) => void
  enabled?: boolean
```

on-superwindow-show

Called via the event queue whenever the visibility of a window has changed, either through a call to the window’s show, through the showing/hiding of one of the window’s ancestors, or through the activating or deactivating of the window or its ancestor in a container (e.g., via delete-child). The method’s argument indicates whether the window is now visible or not.

This method is not called when the window is initially created; it is called only after a change from the window’s initial visibility. Furthermore, if a show notification event is queued for the window and it reverts its visibility before the event is dispatched, then the dispatch is canceled.

```
- (send a-window on-superwindow-show shown?) => void
  shown?: boolean
```

popup-menu

Pops up the given popup-menu object at the specified coordinates (in this window’s coordinates), and returns after handling an unspecified number of events; the menu may still be popped up when this method returns. If a menu item is selected from the popup-menu, the callback for the menu item is called. (The eventspace for menu item’s callback is the window’s eventspace.)
While the menu is popped up, its target is set to the window. See \texttt{get-popup-target} for more information.

\begin{verbatim}
- (send a-window popup-menu menu x y) ⇒ void
  menu: popup-menu% object
  x : exact integer in [0, 10000]
  y : exact integer in [0, 10000]

  The \texttt{menu} is popped up within the window at position \((x, y)\).
\end{verbatim}

\texttt{refresh}

Enqueues an event to repaint the window.

\begin{verbatim}
- (send a-window refresh) ⇒ void
\end{verbatim}

\texttt{screen->client}

Converts global coordinates to window local coordinates.

\begin{verbatim}
- (send a-window screen->client x y) ⇒ two exact integers in [-10000, 10000]
  x : exact integer in [-10000, 10000]
  y : exact integer in [-10000, 10000]
\end{verbatim}

\texttt{set-cursor}

Sets the window’s cursor. Providing \texttt{#f} instead of a cursor value removes the window’s cursor.

If a window does not have a cursor, it uses the cursor of its parent. Frames and dialogs start with the standard arrow cursor, and text fields start with an I-beam cursor. All other windows are created without a cursor.

\begin{verbatim}
- (send a-window set-cursor cursor) ⇒ void
  cursor: cursor% object or #f
\end{verbatim}

\texttt{set-label}

Sets a window’s label. The window’s natural minimum size might be different after the label is changed, but the window’s minimum size is not recomputed.

See \texttt{get-label} for more information.

\begin{verbatim}
- (send a-window set-label l) ⇒ void
  l : string (up to 200 characters)

  If the window was not created with a label, or if the window was created with a non-string label, \texttt{l} is ignored.
\end{verbatim}

\texttt{show}

Shows or hides a window.

The visibility of a window can be changed by the user clicking the window’s close box, for example, and such changes do not go through this method; use \texttt{on-superwindow-show} or \texttt{on-close} to monitor visibility changes.
- (send a-window show show?) ⇒ void
  show?: boolean

  If show? is #f, the window is hidden. Otherwise, the window is shown.
4. Windowing Procedures

4.1 Dialogs

These functions get input from the user and/or display messages.

can-get-page-setup-from-user?

Returns #t if the current platform (Mac OS X) supports a page-layout dialog for use with printer-dc% printing, and if the page-layout dialog is different from the print-job dialog that is automatically shown when a printer-dc% is created. Returns #f if no separate page-layout dialog is needed (Windows and Unix).

- (can-get-page-setup-from-user?) => boolean

get-choices-from-user

- (get-choices-from-user title message choices parent init-choices style) => list of exact non-negative integers or #f
title: string
message: string or #f
choices: list of strings
parent = #f: frame% or dialog% object or #f
init-choices = null: list of exact non-negative integers
style = '(single): list of symbols in '(single multiple extended)

Gets a list box selection from the user via a modal dialog, using parent as the parent window if it is specified. The dialog’s title is title. The dialog’s list box is labelled with message and initialized by selecting the items in init-choices.

The style must contain exactly one of ‘single, ‘multiple, or ‘extended. The styles have the same meaning as for creating a list-box% object. (For the single-selection style, only the last selection in init-choices matters.)

The result is #f if the user cancels the dialog, the list of selections otherwise.

get-color-from-user

- (get-color-from-user message parent init-color style) => color% object or #f
message = #f: string or #f
parent = #f: frame% or dialog% object or #f
init-color = #f: color% object or #f
style = null: an empty list of symbols

Lets the user select a color though the platform-specific (modal) dialog, using parent as the parent window if it is specified. The message string is displayed as a prompt in the dialog if possible. If init-color is provided, the dialog is initialized to the given color.
The \texttt{style} argument is provided for future extensions. Currently, \texttt{style} must be the empty list.

The result is \texttt{#f} if the user cancels the dialog, the selected color otherwise.

\begin{verbatim}
get-directory
- (get-directory message parent directory style) ⇒ path or #f
  message = #f: string or #f
  parent = #f: frame% or dialog% object or #f
  directory = #f: path or #f
  style = null: list of symbols in ’(enter-packages)

Obtains a directory pathname from the user via the platform-specific standard (modal) dialog, using \texttt{parent} as the parent window if it is specified.

If \texttt{directory} is not \texttt{#f}, it is used on some platforms as the starting directory for the directory selector (otherwise the starting directory is chosen automatically in a platform-specific manner, usually based on the current directory and the user’s interactions in previous calls to \texttt{get-file, put-file, etc.}).

The \texttt{style} argument is treated as for \texttt{get-file} except that only ’common or ’enter-packages can be specified. The latter matters only under Mac OS X, where ’enter-packages enables the user to select package directory or a directory within a package. A package is a directory with a special suffix (e.g., ".app") that the Finder normally displays like a file.

See also \texttt{path-dialog%}.
\end{verbatim}

\begin{verbatim}
get-file
- (get-file message parent directory filename extension style filters) ⇒ path or #f
  message = #f: string or #f
  parent = #f: frame% or dialog% object or #f
  directory = #f: path or #f
  filename = #f: path or #f
  extension = #f: string or #f
  style = null: list of symbols in’ (packages enter-packages)
  filters = ’(("Any" "*.*")): list of 2-string lists

Obtains a file pathname from the user via the platform-specific standard (modal) dialog, using \texttt{parent} as the parent window if it is specified, and using \texttt{message} as a message at the top of the dialog if it is not \texttt{#f}.

The result is \texttt{#f} if the user cancels the dialog, the selected pathname otherwise. The returned pathname may or may not exist, although the style of the dialog is directed towards selecting existing files.

If \texttt{directory} is not \texttt{#f}, it is used as the starting directory for the file selector (otherwise the starting directory is chosen automatically in a platform-specific manner, usually based on the current directory and the user’s interactions in previous calls to \texttt{get-file, put-file, etc.}). If \texttt{filename} is not \texttt{#f}, it is used as the default filename when appropriate, and it should \texttt{not} contain a directory path prefix.

Under Windows, if \texttt{extension} is not \texttt{#f}, the returned path will use the extension if the user does not supply one; the \texttt{extension} string should not contain a period. The extension is ignored on other platforms.

The \texttt{style} list can contain ’common, a platform-independent version of the dialog is used instead of a native dialog. Under Mac OS X, if the \texttt{style} list contains ’packages, a user is allowed to select a package directory, which is a directory with a special suffix (e.g., ".app") that the Finder normally displays like a file. If the list contains ’enter-packages, a user is allowed to select a file within a package directory. If the list contains both ’packages and ’enter-packages, the former is ignored.

Under Windows and X, \texttt{filters} determines a set of filters from which the user can choose in the dialog. Each element of the \texttt{filters} list contains two strings: a description of the filter as seen by the user, and a filter pattern matched against file names.
See also `path-dialog%`.

**get-file-list**

Like `get-file`, except that the user can select multiple files, and the result is either a list of file paths or `#f`.

```lisp
- (get-file-list message parent directory filename extension style filters) ⇒
  list of paths or `#f`
  message = `#f`: string or `#f`
  parent = `#f`: frame% or dialog% object or `#f`
  directory = `#f`: path or `#f`
  filename = `#f`: path or `#f`
  extension = `#f`: string or `#f`
  style = null: an empty list of symbols
  filters = `'(("Any" "*.*"))`: list of 2-string lists
```

**get-font-from-user**

```lisp
- (get-font-from-user message parent init-font style) ⇒
  font% object or `#f`
  message = `#f`: string or `#f`
  parent = `#f`: frame% or dialog% object or `#f`
  init-font = `#f`: font% object or `#f`
  style = null: an empty list of symbols
```

Lets the user select a font though the platform-specific (modal) dialog, using `parent` as the parent window if it is specified. The `message` string is displayed as a prompt in the dialog if possible. If `init-font` is provided, the dialog is initialized to the given font.

The `style` argument is provided for future extensions. Currently, `style` must be the empty list.

The result is `#f` if the user cancels the dialog, the selected font otherwise.

**get-page-setup-from-user**

```lisp
- (get-page-setup-from-user message parent init-setup style) ⇒
  ps-setup% object or `#f`
  message = `#f`: string or `#f`
  parent = `#f`: frame% or dialog% object or `#f`
  init-setup = `#f`: ps-setup% object or `#f`
  style = null: an empty list of symbols
```

Like `get-ps-setup-from-user`, but the dialog configures page layout for native printing with `printer-dc%`. A dialog is shown only if `can-get-page-setup-from-user?` returns `#t`, otherwise no dialog is shown and the result is `#f`.

The `parent` argument is used as the parent window for a dialog if it is specified. The `message` string might be displayed as a prompt in the dialog. If `init-setup` is provided, the dialog is initialized to the given configuration, otherwise the current configuration from `current-ps-setup` is used.

The `style` argument is provided for future extensions. Currently, `style` must be the empty list.

The result is `#f` if the user cancels the dialog, a `ps-setup%` object that encapsulates the selected configuration otherwise.
get-ps-setup-from-user

- (get-ps-setup-from-user message parent init-setup style) ⇒ ps-setup% object or #f
  
  message = #f: string or #f
  parent = #f: frame% or dialog% object or #f
  init-setup = #f: ps-setup% object or #f
  style = null : an empty list of symbols

Lets the user select a PostScript configuration though a (modal) dialog, using parent as the parent window if it is specified. The message string is displayed as a prompt in the dialog. If init-setup is provided, the dialog is initialized to the given configuration, otherwise the current configuration from current-ps-setup is used.

The style argument is provided for future extensions. Currently, style must be the empty list.

The result is #f if the user cancels the dialog, , a ps-setup% object that encapsulates the selected PostScript configuration otherwise.

get-text-from-user

- (get-text-from-user title message parent init-val style) ⇒ string or #f
  
  title : string
  message : string or #f
  parent = #f: frame% or dialog% object or #f
  init-val = "": string
  style = null : list of symbols in ‘(password)

Gets a text string from the user via a modal dialog, using parent as the parent window if it is specified. The dialog’s title is title. The dialog’s text field is labelled with message and initialized to init-val (but init-val does not determine the size of the dialog).

The result is #f if the user cancels the dialog, the user-provided string otherwise.

If style includes ‘password, the dialog’s text field draws each character of its content using a generic symbol, instead of the actual character.

message+check-box

See also message+check-box/custom.

- (message+check-box title message check-label parent style) ⇒ symbol in ‘(ok cancel yes no)
  
  title : string (up to 200 characters)
  message : string
  check-label : string (up to 200 characters)
  parent = #f: frame% or dialog% object or #f
  style = ’(ok) : list of symbols in ’(ok ok-cancel yes-no caution stop checked)

Like message-box, except that

- the dialog contains a check box whose label is check-label;
- the result is two values: the message-box result, and a boolean indicating whether the box was checked;
  and
- style can contain ’checked to indicate that the check box should be initially checked.
message+check-box/custom

- (message+check-box/custom title message check-label button1-label button2-label button3-label parent style close-result) ⇒ 1, 2, 3, or close-result
  title: string (up to 200 characters)
  message: string
  check-label: string (up to 200 characters)
  button1-label: string (up to 200 characters), bitmap% object, or #f
  button2-label: string (up to 200 characters), bitmap% object, or #f
  button3-label: string (up to 200 characters), bitmap% object, or #f
  parent = #f: frame% or dialog% object or #f
  style = '(no-default): list of symbols in '(default=1 default=2 default=3 no-default disallow-close number-order caution stop checked)
  close-result = #f: value

Like message-box/custom, except that
- the dialog contains a check box whose label is check-label;
- the result is two values: the message-box result, and a boolean indicating whether the box was checked;
  and
- style can contain 'checked to indicate that the check box should be initially checked.

message-box

See also message-box/custom.

- (message-box title message parent style) ⇒ symbol in '(ok cancel yes no)
  title: string (up to 200 characters)
  message: string
  parent = #f: frame% or dialog% object or #f
  style = '(ok): list of symbols in '(ok ok-cancel yes-no caution stop)

Displays a message to the user in a (modal) dialog, using parent as the parent window if it is specified. The
dialog’s title is title. The message string can be arbitrarily long, and can contain explicit linefeeds or
carriage returns for breaking lines.

The style must include exactly one of the following:
- 'ok — the dialog only has an “OK” button and always returns 'ok.
- 'ok-cancel — the message dialog has “Cancel” and “OK” buttons. If the user clicks “Cancel”, the
  result is ‘cancel, otherwise the result is ‘ok.
- 'yes-no — the message dialog has “Yes” and “No” buttons. If the user clicks “Yes”, the result is ‘yes,
  otherwise the result is ‘no. Note: instead of a “Yes”/“No” dialog, best-practice GUI design is to use
  message-box/custom and give the buttons meaningful labels, so that the user does not have to read
  the message text carefully to make a selection.

In addition, style can contain 'caution to make the dialog use a caution icon instead of the application (or
generic “info”) icon. Alternately, it can contain 'stop to make the dialog use a stop icon. If style contains
both 'caution and 'stop, then 'caution is ignored.

The class that implements the dialog provides a get-message method that takes no arguments and returns the
text of the message as a string. (The dialog is accessible through the get-top-level-windows function.)
Displays a message to the user in a (modal) dialog, using parent as the parent window if it is specified. The dialog’s title is title. The message string can be arbitrarily long, and can contain explicit linefeeds or carriage returns for breaking lines.

The dialog contains up to three buttons for the user to click. The buttons have the labels button1-label, button2-label, and button3-label, where #f for a label indicates that the button should be hidden.

If the user clicks the button labelled button1-label, a 1 is returned, and so on for 2 and 3. If the user closes the dialog some other way—which is only allowed when style does not contain ‘disallow-close’—then the result is the value of close-result. For example, the user can usually close a dialog by typing an Escape. Often, 2 is an appropriate value for close-result, especially when Button 2 is a “Cancel” button.

If style does not include ‘number-order’, the order of the buttons is platform-specific, and labels should be assigned to the buttons based on their role:

- Button 1 is the normal action, and it is usually the default button. For example, if the dialog has an “OK” button, it is this one. Under Windows and X, this button is leftmost; under Mac OS X, it is rightmost. Use this button for dialogs that contain only one button.
- Button 2 is next to Button 1, and it often plays the role of “Cancel” (even when the default action is to cancel, such as when confirming a file replacement).
- Button 3 tends to be separated from the other two (under Mac OS X, it is left-aligned in the dialog). Use this button only for three-button dialogs.

Despite the above guidelines, any combination of visible buttons is allowed in the dialog.

If style includes ‘number-order’, then the buttons are displayed in the dialog left-to-right with equal spacing between all buttons, though aligned within the dialog (centered or right-aligned) in a platform-specific manner. Use ‘number-order’ sparingly.

The style list must contain exactly one of ‘default=1’, ‘default=2’, ‘default=3’, and ‘no-default’ to determine which button (if any) is the default. The default button is “clicked” when the user types Return. If ‘default=n’ is supplied but button n has no label, then it is equivalent to ‘no-default’.

In addition, style can contain ‘caution’ to make the dialog use a caution icon instead of the application (or generic “info”) icon. Alternately, it can contain ‘stop’ to make the dialog use a stop icon. If style contains both ‘caution’ and ‘stop’, then ‘caution’ is ignored.

The class that implements the dialog provides a get-message method that takes no arguments and returns the text of the message as a string. (The dialog is accessible through the get-top-level-windows function.)
Obtains a file pathname from the user via the platform-specific standard (modal) dialog, using \texttt{parent} as the parent window if it is specified, and using \texttt{message} as a message at the top of the dialog if it is not \#f. The result is \#f if the user cancels the dialog, the selected pathname otherwise. The returned pathname may or may not exist, although the style of the dialog is directed towards creating a new file.

If \texttt{directory} is not \#f, it is used as the starting directory for the file selector (otherwise the starting directory is chosen automatically in a platform-specific manner, usually based on the current directory and the user's interactions in previous calls to \texttt{get-file, put-file, etc.}). If \texttt{filename} is not \#f, it is used as the default filename when appropriate, and it should not contain a directory path prefix.

Under Windows, if \texttt{extension} is not \#f, the returned path will gets a default extension if the user does not supply one. If \texttt{extension} is the empty string, then the extension is derived from the user's \texttt{filters} choice if the corresponding pattern is of the form \texttt{"*.extension"}; if the pattern is \texttt{".*"}, then no default extension is added. Finally, if \texttt{extension} is any string other than the empty string, \texttt{extension} is used as the default extension when the user's \texttt{filters} choice has the pattern \texttt{".*"}. Meanwhile, the \texttt{filters} argument has the same format and auxiliary role as for \texttt{get-file}. In particular, if the only pattern in \texttt{filters} is \texttt{"*.extension"}, then the result pathname is guaranteed to have an extenson mapping \texttt{extension}.

Under Mac OS X, if \texttt{extension} is not \#f and \texttt{filters} contains the single pattern \texttt{"*.extension"}, then the result pathname is guaranteed to have an extenson mapping \texttt{extension}. Otherwise, \texttt{extension} and \texttt{filters} are ignored.

The \texttt{extension} argument is ignored under X, and \texttt{filters} can be used to specify glob-patterns.

\texttt{style} list is treated as for \texttt{get-file}.

See also \texttt{path-dialog%}.

### 4.2 Eventspaces

\texttt{check-for-break}

Inspects the event queue of the current eventspace, searching for a Shift-Ctl-C (X, Windows) or Cmd-. (Mac OS X) key combination. Returns \#t if such an event was found (and the event is dequeued) or \#f otherwise.

\begin{verbatim}
- (check-for-break) ⇒ boolean
\end{verbatim}

\texttt{current-eventspace}

This is a parameter (see parameters, §7.9 in \textit{PLT MzScheme: Language Manual}) that obtains or sets the current eventspace.

See “Eventspaces” (section 2.4, page 13) for more information about eventspaces.

\begin{verbatim}
- (current-eventspace) ⇒ eventspace
  Gets the current eventspace.

- (current-eventspace e) ⇒ void
  e : eventspace
  Sets the current eventspace to \texttt{e}.
\end{verbatim}
event-dispatch-handler

This parameter (see parameters, §7.9 in PLT MzScheme: Language Manual) gets or installs the current event dispatch handler. The event dispatch handler is called by an eventspace’s handler thread for every queue-based event to be processed in the eventspace. The only argument to the handler is the eventspace in which an event should be dispatched. The event dispatch handler gives the programmer control over the timing of event dispatching, but not the order in which events are dispatched within a single eventspace.

An event dispatch handler must ultimately call the primitive event dispatch handler. If an event dispatch handler returns without calling the primitive handler, then the primitive handler is called directly by the eventspace handler thread.

- (event-dispatch-handler) ⇒ procedure of one argument: an eventspace
  Returns the current handler.

- (event-dispatch-handler handler) ⇒ void
  handler: procedure of one argument: an eventspace
  Sets the current handler.

eventspace-handler-thread

Returns the handler thread of the given eventspace. If the handler thread has terminated (e.g., because the eventspace was shut down), the result is #f.

- (eventspace-handler-thread e) ⇒ thread or #f
  e: eventspace

eventspace-shutdown?

Returns #t if the given eventspace has been shut down by its custodian, #f otherwise. Attempting to create a new window, timer, or explicitly queued event in a shut-down eventspace raises the exn:misc exception.

Attempting to use certain methods of windows and timers in a shut-down eventspace also raises the exn:misc exception, but the get-top-level-window in area<%> and get-eventspace in top-level-window<%> methods work even after the area’s eventspace is shut down.

- (eventspace-shutdown? e) ⇒ boolean
  e: eventspace

eventspace?

Tests whether a value is an eventspace.

See “Eventspaces” (section 2.4, page 13) for more information about eventspaces.

- (eventspace? v) ⇒ boolean
  v: value
  Returns #t if v is an eventspace value or #f otherwise.
get-top-level-edit-target-window

Returns the top level window in the current eventspace that is visible and most recently had the keyboard focus (or contains the window that had the keyboard focus), or #f if there is no visible window in the current eventspace.

- (get-top-level-edit-target-window) ⇒ frame% or dialog% object or #f

get-top-level-focus-window

Returns the top level window in the current eventspace that has the keyboard focus (or contains the window with the keyboard focus), or #f if no window in the current eventspace has the focus.

- (get-top-level-focus-window) ⇒ frame% or dialog% object or #f

get-top-level-windows

Returns a list of visible top-level frames and dialogs in the current eventspace.

- (get-top-level-windows) ⇒ list of frame% or dialog% objects

make-eventspace

Creates and returns a new eventspace value. The new eventspace is created as a child of the current eventspace. The eventspace is used by making it the current eventspace with the current-eventspace parameter.

See “Eventspaces” (section 2.4, page 13) for more information about eventspaces.

- (make-eventspace) ⇒ eventdata

queue-callback

Installs a procedure to be called via the current eventspace’s event queue. The procedure is called once in the same way and under the same restrictions that a callback is invoked to handle a method.

A second (optional) boolean argument indicates whether the callback has a high or low priority in the event queue. See “Eventspaces” (section 2.4, page 13) for information about the priority of events.

- (queue-callback callback high-priority?) ⇒ void
  callback: procedure of no arguments
  high-priority?= #t: boolean

sleep/yield

Blocks for at least the specified number of seconds, handling events meanwhile if the current thread is the current eventspace’s handler thread (otherwise, sleep/yield is equivalent to sleep).

- (sleep/yield secs) ⇒ void
  secs: non-negative real number
special-control-key

Enables or disables special Control key handling (Mac OS X). When Control is treated as a special key, the system’s key-mapper is called without Control for keyboard translations. For some languages, Control key presses must be seen by the system translation, so this mode should be turned off, but the default is on.

- (special-control-key on?) ⇒ void
  on?: boolean
  If on? is #f, Control is passed to the system translation as normal. This setting affects all windows and eventspaces.
- (special-control-key) ⇒ boolean
  Returns #t if Control is currently treated specially, #f otherwise.

special-option-key

Enables or disables special Option key handling (Mac OS X). When Option is treated as a special key, the system’s key-mapper is called without Option for keyboard translations. By default, Option is not special.

- (special-option-key on?) ⇒ void
  on?: boolean
  If on? is #f, Option is passed to the system translation as normal. This setting affects all windows and eventspaces.
- (special-option-key) ⇒ boolean
  Returns #t if Option is currently treated specially, #f otherwise.

yield

Yields control to event dispatching. See §2.4 Eventspaces for details.

A handler procedure invoked by the system during a call to yield can itself call yield, creating an additional level of nested (but single-threaded) event handling.

See also sleep/yield.

- (yield) ⇒ boolean
  Dispatches an unspecified number of events, but only if the current thread is the current eventspace’s handler thread (otherwise, there is no effect). The result is #t if any events may have been handled, #f otherwise.
- (yield v) ⇒ value
  v: ‘wait or waitable
  If v is ‘wait, and yield is called in the handler thread of an eventspace, it starts processing events in that eventspace until
  – no top-level windows in the eventspace are visible;
  – no timers in the eventspace are running;
  – no callbacks are queued in the eventspace; and
  – no menu-bar% has been created for the eventspace with ‘root (i.e., creating a ‘root menu bar prevents an eventspace from ever unblocking).
4.3 System Menus

When called in a non-handler thread, returns immediately. In either case, the result is \#t.

Evaluating \(\text{(yield 'wait)}\) is thus similar to \(\text{(yield (current-eventspace)}\), except that it is sensitive to whether the current thread is a handler thread, instead of the value of the current-eventspace parameter.

If \(v\) is a waitable, \(\text{yield}\) blocks on \(v\) in the same way as MzScheme's \text{object-wait-multiple}, §7.7 in PLT MzScheme: Language Manual, except that it may poll or wait on the waitable multiple times. If the current thread is the current eventspace's handler thread, events are dispatched until a \(v\) wait succeeds on an event boundary. For other threads, calling \(\text{yield}\) with a waitable is equivalent to calling \text{object-wait-multiple} with \#f as the timeout. In either case, the result is the same that of \text{object-wait-multiple}; however, if a wrapper procedure is associated with \(v\) (via \text{make-wrapped-waitable}), it is not called in tail position with respect to the \text{yield}.

Always use \(\text{(yield v)}\) instead of a busy-wait loop.

4.3 System Menus

application-about-handler

When the current eventspace is the initial eventspace, this procedure retrieves or installs a thunk that is called when the user selects the application About menu item in Mac OS X. The thunk is always called in the initial eventspace’s handler thread (as a callback).

The default handler displays a generic PLT Scheme dialog.

- \(\text{(application-about-handler)} \Rightarrow \text{procedure of no arguments}\)
  
  If the current eventspace is the initial eventspace, returns the current handler, otherwise returns \textit{void}.

- \(\text{(application-about-handler handler-thunk)} \Rightarrow \text{void}\)
  
  \(\text{handler-thunk}: \text{procedure of no arguments}\)
  
  If the current eventspace is the initial eventspace, sets the current handler, otherwise does nothing.

application-file-handler

When the current eventspace is the initial eventspace, this procedure retrieves or installs a procedure that is called under Mac OS X and Windows when the application is running and user double-clicks an application-handled file or drags a file onto the application’s icon. The procedure is always called in the initial eventspace’s handler thread (as a callback), and the argument is a filename.

The default handler queues a callback to the \textit{on-drop-file} method of the most-recently activated frame in the main eventspace, if drag-and-drop is enabled for that frame.

When the application is \textit{not} running and user double-clicks an application-handled file or drags a file onto the application’s icon, the filename is provided as a command-line argument to the application.

- \(\text{(application-file-handler)} \Rightarrow \text{procedure of one argument: a path}\)
  
  If the current eventspace is the initial eventspace, returns the current handler, otherwise returns \textit{void}.

- \(\text{(application-file-handler handler-proc)} \Rightarrow \text{void}\)
  
  \(\text{handler-proc}: \text{procedure of one argument: a path}\)
  
  If the current eventspace is the initial eventspace, sets the current handler, otherwise does nothing.
application-preferences-handler

When the current eventspace is the initial eventspace, this procedure retrieves or installs a thunk that is called when the user selects the application Preferences menu item in Mac OS X. The thunk is always called in the initial eventspace’s handler thread (as a callback). If the handler is set to #f, the Preferences item is disabled.

The default handler is #f.

- (application-preferences-handler) ⇒ procedure of no arguments or #f
  If the current eventspace is the initial eventspace, returns the current handler, otherwise returns #f.

- (application-preferences-handler handler-thunk) ⇒ void
  handler-thunk: procedure of no arguments or #f
  If the current eventspace is the initial eventspace, sets the current handler or disables the Preferences item, otherwise does nothing.

application-quit-handler

When the current eventspace is the initial eventspace, this procedure retrieves or installs a thunk that is called when the user requests that the application quit (e.g., through the Quit menu item in Mac OS X, or when shutting down the machine in Windows). The thunk is always called in the initial eventspace’s handler thread (as a callback). If the result of the thunk is #f, then the operating system is explicitly notified that the application does not intend to quit (under Windows).

The default handler queues a call to the can-exit? method of the most recently active frame in the initial eventspace (and then calls the frame’s on-exit method if the result is true). The result is is #t if the eventspace is left with no open frames after on-exit returns, #f otherwise.

- (application-quit-handler) ⇒ procedure of no arguments
  If the current eventspace is the initial eventspace, returns the current handler, otherwise returns void.

- (application-quit-handler handler-thunk) ⇒ void
  handler-thunk: procedure of no arguments
  If the current eventspace is the initial eventspace, sets the current handler, otherwise does nothing.

current-eventspace-has-menu-root?

Returns #t for Mac OS X when the current eventspace is the initial one, since that eventspace can supply a menu bar to be active when no frame is visible. For any other system or eventspace, the result is #f.

This procedure is intended for use in deciding whether to create a menu-bar% instance with ’root as its parent.

- (current-eventspace-has-menu-root?) ⇒ boolean

current-eventspace-has-standard-menus?

Returns #t for Mac OS X when the current eventspace is the initial one, since that eventspace is the target for the standard application menus. For any other system or eventspace, the result is #f.

This procedure is intended for use in deciding whether to include a Quit, About, and Preferences menu item in a frame’s menu. Under Mac OS X, the application Quit menu triggers a call to a frame’s on-exit method, the About
menu item is controlled by `application-about-handler`, and the Preferences menu item is controlled by `application-preferences-handler`.

- `(current-eventspace-has-standard-menus?) ⇒ boolean`

## 4.4 Miscellaneous

### begin-busy-cursor

- `(begin-busy-cursor) ⇒ void`

Changes the cursor to a watch cursor for all windows in the current eventspace. Use `end-busy-cursor` to revert the cursor back to its previous state. Calls to `begin-busy-cursor` and `end-busy-cursor` can be nested arbitrarily.

The cursor installed by `begin-busy-cursor` overrides any window-specific cursors installed with `set-cursor`.

See also `is-busy?`.

### bell

- `(bell) ⇒ void`

Rings the system bell.

### end-busy-cursor

- `(end-busy-cursor) ⇒ void`

See `begin-busy-cursor`.

### file-creator-and-type

Gets or sets the creator and type of a file in Mac OS X.

The get operation always returns #"????" and #"????" for Unix or Windows. The set operation has no effect under Unix or Windows.

- `(file-creator-and-type filename creator-string type-string) ⇒ void`

  `filename`: `path`

  `creator-string`: 4-character byte string

  `type-string`: 4-character byte string

  Sets the creator and type signatures of `filename`.

- `(file-creator-and-type filename) ⇒ two 4-character byte strings`

  `filename`: `path`

  Returns the current creator and type signatures of `filename`.

### find-graphical-system-path

Finds a platform-specific (and possibly user- or machine-specific) standard filename or directory.

See also `find-system-path`, §11.3.2 in *PLT MzScheme: Language Manual*. 
- (find-graphical-system-path what) ⇒ path or #f
  what: symbol in ’(init-file setup-file x-display)

  The result depends on what, and a #f result is only possible when what is ’x-display:
  - ’init-file returns the path to the user-specific initialization file (containing Scheme code). The directory part of the path is the same path as returned for ’init-dir by MzScheme’s find-system-path (see Pathnames, §11.3.2 in PLT MzScheme: Language Manual). The file name is platform-specific:
    * Unix and Mac OS X: .mredrc
    * Windows: mredrc.ss
  - ’setup-file returns the path to the file containing resources used by get-resource; obsolete.
  - ’x-display returns a “path” whose string identifies the X display if specified by either the -display flag or the "DISPLAY" environment variable when MrEd starts under X. For other platforms, or when neither -display nor "DISPLAY" was specified, the result is #f.

get-panel-background

Returns the background color of a panel (usually some shade of gray) for the current platform.

- (get-panel-background) ⇒ color% object

get-resource

- (get-resource section entry value file) ⇒ boolean
  section: string
  entry: string
  value: boxed string or boxed exact integer
  file = #f: path or #f

  Gets a resource value from the resource database. The resource value is keyed on the combination of section and entry. The return value is #t if a value is found, #f if it is not. The type of the value initially in the value box determines the way that the resource is interpreted, and value is filled with a new value of the same type if one is found.

  If file is #f, platform-specific resource files are read, as determined by find-graphical-system-path with ’setup-file. (Under X, when file is #f, the user’s .Xdefaults file is also read, or the file specified by the XENVIRONMENT environment variable.)

  The format of a resource entry depends on the platform. Windows resources use the standard .INI format. X and Mac OS X resources use the standard X resource format, where each entry consists of a section.entry resource name, a colon, and the resource value, terminated by a newline. Section and entry names are case-sensitive.

  Under Windows, if section is one of the following strings, then file is ignored, and entry is used as a resource path:
    - "HKEY_CLASSES_ROOT"
    - "HKEY_CURRENT_CONFIG"
    - "HKEY_CURRENT_USER"
    - "HKEY_LOCAL_MACHINE"
    - "HKEY_USERS"

  In that case, the entry argument is parsed as a resource entry path, followed by a backslash, followed by a value name. To get the “default” value for an entry, use the empty name. For example, the following expression gets a command line for starting a browser:

```scheme
(let ([b (box "")])
  (get-resource "HKEY_CLASSES_ROOT" "htmlfile\shell\open\command\" b)
  (unbox b))
```
See also **write-resource**.

### get-window-text-extent

Returns the pixel size of a string drawn as a window’s label or value.

See also **get-text-extent**.

```scheme
- (get-window-text-extent string font) ⇒ two exact non-negative integers: width and height
  string: string
  font: font% object
```

Returns the extent of the given string drawn with the given font.

### graphical-read-eval-print-loop

Similar to MzScheme’s **read-eval-print-loop**, except that none of **read-eval-print-loop**’s configuration parameters are used (such as `current-read`) and the interaction occurs in a GUI window instead of using the current input and output ports.

Expressions entered into the graphical read-eval-print loop can be evaluated in an eventspace (and thread) that is distinct from the one implementing the **graphical-read-eval-print-loop** window (i.e., the current eventspace when **graphical-read-eval-print-loop** is called).

If no eventspace is provided, or if symbol **#f** is provided, an evaluation eventspace is created using (make-eventspace) with a new custodian; the eventspace and its threads are be shut down when the user closes the **graphical-read-eval-print-loop** window. If an eventspace is provided, closing the window performs no shut-down actions on eventspace.

When `redirect-ports?` is true, the following parameters are initialized in the created eventspace’s handler thread:

- **current-output-port** — writes to the frame
- **current-error-port** — writes to the frame
- **current-input-port** — always returns `eof`

See (see parameters, §7.9 in *PLT MzScheme: Language Manual*) for more information about these parameters.

The keymap for the read-eval-print loop’s editor is initialized by calling the current keymap initializer procedure, which is determined by the `current-text-keymap-initializer` parameter.

```scheme
- (graphical-read-eval-print-loop eval-eventspace redirect-ports?) ⇒ void
  eval-eventspace = #f: eventspace
  redirect-ports? = (not eval-eventspace): boolean
```

### hide-cursor-until-moved

```scheme
- (hide-cursor-until-moved) ⇒ void
```

Hides the cursor until the user moves the mouse or clicks the mouse button. (For some platforms, the cursor is not hidden if it is over a window in a different eventspace or application.)
is-busy?

- \((\text{is-busy?})\) ⇒ boolean

Returns \#t if a busy cursor has been installed with \textit{begin-busy-cursor} and not removed with \textit{end-busy-cursor}.

label->plain-label

- \((\text{label->plain-label} \ label)\) ⇒ string

\textit{label}: string

Strips shortcut ampersands from \textit{label}, removes parenthesized ampersand–character combinations along with any surrounding space, and removes anything after a tab. Overall, it returns the label as it would appear on a button on a platform without support for menmonics.

make-namespace-with-mred

Like \textit{make-namespace}, §8 in \textit{PLT MzLib: Libraries Manual}, but the \texttt{(lib "mred.ss" "mred")} module of the current namespace is attached. In addition, by default, the namespace is initialized by importing the \texttt{mred.ss} module and MzLib’s \texttt{class.ss} module into the namespace’s top-level environment.

- \((\text{make-namespace-with-mred} \ flag)\) ⇒ namespace

\textit{flag}=’mred: symbol in ’ (mred initial empty)

The ‘initial and ‘empty flags control the namespace creation in the same way as for \textit{make-namespace}, §8 in \textit{PLT MzLib: Libraries Manual}, except that the \texttt{mred.ss} module is attached to the created namespace (along with the transitive closure of its imports). The ‘mred flag is like ‘initial, but also imports the \texttt{mred.ss} module and MzLib’s \texttt{class.ss} module into the namespace’s top-level environment.

play-sound

- \((\text{play-sound} \ filename \ async?)\) ⇒ boolean

\textit{filename}: path

\textit{async?: boolean}

Plays a sound file. If \textit{async?} is false, the function does not return until the sound completes. Otherwise, it returns immediately. The result is \#t if the sound plays successfully, \#f otherwise.

Under Windows, only .wav files are supported.

Under X, the function invokes an external sound-playing program; under Linux, the default is the \texttt{play} program. Under Solaris, the default is audioplay. Other X platforms do not have a default. For any X platform, a play command can be defined through the ‘[MrEd:playcmd] preference preference (see “Preferences” (section 12, page 365)). The command string is formatted with the input filename—so the command string should contain a “~a” where the filename should be substituted—then executed as a shell command. (Don’t use “~s”, since the string that is used with the format string will be properly quoted and wrapped in double quotes.)

Under Mac OS X, Quicktime is used to play sounds; most sound formats (.wav, .aiff, .mp3) are supported in recent versions of Quicktime. In order to play .wav files, Quicktime 3.0 (compatible with OS 7.5 and up) is required.

send-event

Sends an AppleEvent under Mac OS X. (This procedure is not supported for Unix or Windows.)
- (send-event receiver-string event-class-string event-id-string direct-arg-v argument-list) ⇒ value
  receiver-string: 4-character byte string
  event-class-string: 4-character byte string
  event-id-string: 4-character byte string
  direct-arg-v = (void): value
  argument-list = null: list


send-message-to-window

- (send-message-to-window x y message) ⇒ value
  x: exact integer in [-10000, 10000]
  y: exact integer in [-10000, 10000]
  message: value

  Finds the frontmost top-level window at (x, y) in global coordinates. If a window is there, this function calls
  the window’s on-message method, providing message as the method’s argument; the result of the function
  call is the result returned by the method. If no MrEd window is at the given coordinates, or if it is covered by a
  non-MrEd window at (x, y), #f is returned.

the-clipboard

  See clipboard<%>.

- the-clipboard ⇒ clipboard<%> object
  Initial value: the clipboard

the-x-selection-clipboard

  See clipboard<%>.

- the-x-selection-clipboard ⇒ clipboard<%> object
  Initial value: a clipboard

write-resource

- (write-resource section entry value file) ⇒ boolean
  section: string
  entry: string
  value: string or exact integer
  file = #f: path or #f

  Writes a resource value to the specified resource database. The resource value is keyed on the combination of
  section and entry, with the same special handling of entry for under Windows as for get-resource.
  If file is #f, the platform-specific resource database is read, as determined by find-graphical-system-path
  with ‘setup-file.
  The return value is #t if the write succeeds, #f otherwise. (A failure indicates that the resource file cannot be
  written.)
  If value is an integer outside a platform-specific range, an exn:fail:contract exception is raised.
  See also get-resource.
Part II

Drawing Toolbox
5. Drawing Toolbox Overview

Drawing in MrEd requires a device context (DC), which is an instance of the \( \text{dc}\) interface. For example, the \text{get-dc}\ method of a canvas returns a \( \text{dc}\) instance for drawing into the canvas window. Other kinds of DCs draw to different kinds of devices:

- \text{bitmap-dc} — a bitmap DC draws to an offscreen bitmap.
- \text{post-script-dc} — a PostScript DC records drawing commands to a PostScript file.
- \text{printer-dc} — a printer DC draws to a platform-specific printer device (Windows, Mac OS X).

Tools that are used for drawing include the following: \text{pen} objects for drawing lines and shape outlines, \text{brush} objects for filling shapes, \text{bitmap} objects for storing bitmaps, and \text{dc-path} objects for describing paths to draw and fill.

The following example creates a frame with a drawing canvas, and then draws a round, blue face with square, yellow eyes and a smiling, red mouth:

```Scheme
;; Make a 300 × 300 frame
(define frame (instantiate frame% ("Drawing Example") (width 300) (height 300)))
;; Make the drawing area
(define canvas (instantiate canvas% (frame)))
;; Get the canvas’s drawing context
(define dc (send canvas get-dc))

;; Make some pens and brushes
(define no-pen (instantiate pen% ("BLACK" 1 ’transparent)))
(define no-brush (instantiate brush% ("BLACK" ’transparent)))
(define blue-brush (instantiate brush% ("BLUE" ’solid)))
(define yellow-brush (instantiate brush% ("YELLOW" ’solid)))
(define red-pen (instantiate pen% ("RED" 2 ’solid)))

;; Define a procedure to draw a face
(define (draw-face dc)
  (send dc set-pen no-pen)
  (send dc set-brush blue-brush)
  (send dc draw-ellipse 50 50 200 200)

  (send dc set-brush yellow-brush)
  (send dc draw-rectangle 100 100 10 10)
  (send dc draw-rectangle 200 100 10 10)

  (send dc set-brush no-brush)
  (send dc set-pen red-pen)
  (let ((pi (atan 0 -1)))
    (send dc draw-arc 75 75 150 150 (* 5/4 pi) (* 7/4 pi)))
)
5. Drawing Toolbox Overview

;; Show the frame
(send frame show #t)
;; Wait a second to let the window get ready
(sleep/yield 1)
;; Draw the face
(draw-face dc)

The sleep/yield call is necessary under X because drawing to the canvas has no effect when the canvas is not shown. Although the (send frame show #t) expression queues a show request for the frame, the actual display of the frame and its canvas requires handling several events. The sleep/yield procedure pauses for a specified number of seconds, handling events while it pauses.

One second is plenty of time for the frame to show itself, but a better solution is to create a canvas with a paint callback function (or overriding on-paint). Using a paint callback function is better for all platforms; when the canvas in the above example is resized or temporarily covered by another window, the face disappears. To ensure that the face is redrawn whenever the canvas itself is repainted, we provide a paint callback when creating the canvas:

;; Make a 300 × 300 frame
(define frame (instantiate frame% ("Drawing Example") (width 300) (height 300)))

;; Make the drawing area with a paint callback
(define canvas (instantiate canvas% (frame)
  (paint-callback (lambda (canvas dc) (draw-face dc))))))

;; ... pens, brushes, and draw-face are the same as above ... 

;; Show the frame
(send frame show #t)

Suppose that draw-face creates a particularly complex face that takes a long time to draw. We might want to draw the face once into an offscreen bitmap, and then have the paint callback copy the cached bitmap image onto the canvas whenever the canvas is updated. To draw into a bitmap, we first create a bitmap% object, and then we create a bitmap-dc% to direct drawing commands into the bitmap:

;; ... pens, brushes, and draw-face are the same as above ...

;; Create a 300 × 300 bitmap
(define face-bitmap (instantiate bitmap% (300 300)))

;; Create a drawing context for the bitmap
(define bm-dc (instantiate bitmap-dc% (face-bitmap)))

;; A new bitmap's initial content is undefined, so clear it before drawing
(send bm-dc clear)

;; Draw the face into the bitmap
(draw-face bm-dc)

;; Make a 300 × 300 frame
(define frame (instantiate frame% ("Drawing Example") (width 300) (height 300)))

;; Make the drawing area with a paint callback that copies the bitmap
(define canvas (instantiate canvas% (frame)
  (paint-callback (lambda (canvas dc) (send dc draw-bitmap face-bitmap 0 0)))))
For all types of DCs, the drawing origin is the top-left corner of the DC. When drawing to a window or bitmap, DC units initially correspond to pixels, but the set-scale method changes the scale. When drawing to a PostScript or printer device, DC units initially correspond to points (1/72 of an inch).

More complex shapes are typically best implemented with paths. The following example uses paths to draw the PLT Scheme logo. It also enables smoothing, so that the logo’s curves are anti-aliased when smoothing is available. (Smoothing is always available under Mac OS X, smoothing is available under Windows XP or when gdiplus.dll is installed, and smoothing is available under X when Cairo is installed before MrEd is compiled.)

```
(require (lib "math.ss")); for pi

;; Construct paths for a 630 x 630 logo

(define left-lambda-path ;; left side of the lambda
  (let ([p (new dc-path%)])
    (send p move-to 153 44)
    (send p line-to 161.5 60)
    (send p curve-to 202.5 49 230 42 245 61)
    (send p curve-to 280.06 105.41 287.5 141 296.5 186)
    (send p curve-to 301.12 209.08 299.11 223.38 293.96 244)
    (send p curve-to 281.34 294.54 259.18 331.61 233.5 375)
    (send p curve-to 198.21 434.63 164.68 505.6 125.5 564)
    (send p line-to 135 572)
    p))

(define left-logo-path ;; left side of the lambda plus left part of circle
  (let ([p (new dc-path%)])
    (send p append left-lambda-path)
    (send p arc 0 0 630 630 (* 235/360 2 pi) (* 121/360 2 pi) #f)
    p))

(define bottom-lambda-path
  (let ([p (new dc-path%)])
    (send p move-to 135 572)
    (send p line-to 188.5 564)
    (send p curve-to 208.5 517 230.91 465.21 251 420)
    (send p curve-to 267 384 278.5 348 296.5 312)
    (send p curve-to 301.01 302.98 318 258 329 274)
    (send p curve-to 338.89 288.39 351 314 358 332)
    (send p curve-to 377.28 381.58 395.57 429.61 414 477)
    (send p curve-to 428 513 436.5 540 449.5 573)
    (send p line-to 465 580)
    (send p line-to 529 545)
    p))

(define bottom-logo-path
  (let ([p (new dc-path%)])
    (send p append bottom-lambda-path)
    (send p arc 0 0 630 630 (* 314/360 2 pi) (* 235/360 2 pi) #f)
    p))
```
(define right-lambda-path
  (let ([p (new dc-path%)])
    (send p move-to 153 44)
    (send p curve-to 192.21 30.69 233.21 14.23 275 20)
    (send p curve-to 378.75 202.32 400.5 244 418 151)
    (send p curve-to 378.75 202.32 400.5 244 418 151)
    (send p line-to 529 545)
    p))

(define right-logo-path
  (let ([p (new dc-path%)])
    (send p append right-lambda-path)
    (send p arc 0 0 630 630 (* 314/360 2 pi) (* 121/360 2 pi) #t)
    p))

(define lambda-path ;; the lambda by itself (no circle)
  (let ([p (new dc-path%)])
    (send p append left-lambda-path)
    (send p append bottom-lambda-path)
    (let ([t (make-object dc-path%)])
      (send t append right-lambda-path)
      (send t reverse)
      (send p append t))
    (send p close)
    p))

;; This function draws the paths with suitable colors:
(define (paint-plt dc)
  ;; Paint white lambda, no outline:
  (send dc set-pen "BLACK" 0 'transparent)
  (send dc set-brush "WHITE" 'solid)
  (send dc draw-path lambda-path)
  ;; Paint outline and colors...
  (send dc set-pen "BLACK" 0 'solid)
  ;; Draw red regions
  (send dc set-brush "RED" 'solid)
  (send dc draw-path left-logo-path)
  (send dc draw-path bottom-logo-path)
  ;; Draw blue region
  (send dc set-brush "BLUE" 'solid)
  (send dc draw-path right-logo-path))

;; Create a frame to display the logo on a light-purple background:
(define f (new frame% [label "PLT Logo"]))
(define c (new canvas% [parent f]
    [paint-callback
      (lambda (c dc)
        (send dc set-background (make-object color% 220 200 255))
        (send dc clear)
        (send dc set-smoothing 'smoothed)
        (send dc set-origin 5 5))
    [parent f]
    [label "PLT Logo"]
    [x 2.5]
    [y 2.5]
    [width 500]
    [height 500])

;; Add the logo to the canvas
(send f append c)

;; Display the frame
(display f)

Drawing effects are not completely portable across platforms or across types of DC. Drawing in smoothed mode tends to produce more reliable and portable results than in unsmoothed mode, and drawing with paths tends to produce more reliable results even in unsmoothed mode. Drawing with a pen of width 0 or 1 in unsmoothed mode in an unscaled DC produces relatively consistent results for all platforms, but a pen width of 2 or drawing to a scaled DC looks significantly different in unsmoothed mode on different platforms and destinations.
6. Drawing Class Reference

6.1 Class Listing

Device Contexts

\[
\text{dc} \\
| \text{- bitmap-dc} \\
| \text{- post-script-dc} \\
| \text{- printer-dc}
\]

Drawing Tools

\[
\text{pen} \\
\text{brush} \\
\text{font} \\
\text{color} \\
\text{bitmap} \\
\text{point} \\
\text{dc-path} \\
\text{region}
\]

Miscellaneous

\[
\text{pen-list} \\
\text{brush-list} \\
\text{font-list} \\
\text{font-name-directory} \\
\text{color-database} \\
\text{ps-setup}
\]

6.2 bitmap%

A bitmap% object is a pixel-based image, either monochrome or color.

Sometimes, a bitmap object creation fails in a low-level manner. In that case, the ok? method returns #f, and the bitmap cannot be supplied to methods that consume or operate on bitmaps (otherwise, an \texttt{exn:fail:contract} exception is raised).

\[
\begin{align*}
- \text{(make-object bitmap% bits width height) } & \Rightarrow \text{bitmap% object} \\
\text{bits:} & \text{ byte string} \\
\text{width:} & \text{ exact integer in [1, 10000]} \\
\text{height:} & \text{ exact integer in [1, 10000]}
\end{align*}
\]
6.2. bitmap%

Creates a monochrome bitmap from an array of bit values, where each byte in \texttt{bits} specifies eight bits, and padding bits are added so that each bitmap line starts on a character boundary. A 1 bit value indicates black, and 0 indicates white. If \texttt{width}\times\texttt{height} is larger than 8 times the length of \texttt{bits}, an \texttt{exn:fail:contract} exception is raised.

\begin{verbatim}
- (make-object bitmap% width height monochrome?) \Rightarrow \texttt{bitmap\% object}
  \hspace{1em}width: exact integer in \[1, 10000]\)
  \hspace{1em}height: exact integer in \[1, 10000]\)
  \hspace{1em}monochrome?: \#f: boolean

Creates a new bitmap. If \texttt{monochrome?} is \#f, the bitmap matches the display depth of the screen. The initial content of the bitmap is undefined.

- (make-object bitmap% name kind bg-color) \Rightarrow \texttt{bitmap\% object}
  \hspace{1em}name: path
  \hspace{1em}kind=’unknown: symbol in ’\{unknown unknown/mask gif gif/mask jpeg png png/mask xbm xpm bmp pict\)
  \hspace{1em}bg-color = \#f: \texttt{color\% object} or \#f

Creates a bitmap from a file, where \texttt{kind} specifies the kind of image file. See \texttt{load-file} for details.
\end{verbatim}

\texttt{get-depth}

Gets the color depth of the bitmap. See also \texttt{is-color?}.

\begin{verbatim}
- (send a-bitmap get-depth) \Rightarrow \texttt{exact non-negative integer}
\end{verbatim}

\texttt{get-gl-config}

Returns a copy of this bitmap’s requested OpenGL configuration. See also \texttt{set-gl-config}.

\begin{verbatim}
- (send a-bitmap get-gl-config config) \Rightarrow \texttt{void}
  \hspace{1em}config: gl-config\% object
\end{verbatim}

\texttt{get-height}

Gets the height of the bitmap in pixels.

\begin{verbatim}
- (send a-bitmap get-height) \Rightarrow \texttt{exact integer in \[1, 10000]\}
\end{verbatim}

\texttt{get-loaded-mask}

Returns a mask bitmap that is stored with this bitmap.

When a GIF file is loaded with \texttt{‘gif/mask} or \texttt{‘unknown/mask} and the file contains a transparent “color”, a mask bitmap is generated to identify the transparent pixels. The mask bitmap is monochrome, with white pixels where the loaded bitmap is transparent and black pixels everywhere else.

When a PNG file is loaded with \texttt{‘png/mask} or \texttt{‘unknown/mask} and the file contains a mask or alpha channel, a mask bitmap is generated to identify the mask or alpha channel. If the file contains a mask or an alpha channel with only extreme values, the mask bitmap is monochrome, otherwise it is grayscale (representing the alpha channel inverted).
The mast bitmap is not used automatically by drawing routines. The mask bitmap can be extracted and supplied explicitly as a mask (e.g., as the sixth argument to \texttt{draw-bitmap}). The mask bitmap is used by \texttt{save-file} when saving a bitmap as \texttt{'png} if the mask has the same dimensions as the saved bitmap. The mask bitmap is also used automatically when the bitmap is a control label.

\begin{quote}
- (send a-bitmap get-loaded-mask) $\Rightarrow$ \texttt{bitmap\% object or #f}
\end{quote}

\texttt{get-width}

Gets the width of the bitmap in pixels.

\begin{quote}
- (send a-bitmap get-width) $\Rightarrow$ exact integer in \([1, 10000]\)
\end{quote}

\texttt{is-color?}

Returns \texttt{#f} if the bitmap is monochrome, \texttt{#t} otherwise.

\begin{quote}
- (send a-bitmap is-color?) $\Rightarrow$ boolean
\end{quote}

\texttt{load-file}

Loads a bitmap from a file. If the bitmap is in use by a \texttt{bitmap-dc\%} object or a control, the bitmap file is not loaded.

\begin{quote}
- (send a-bitmap load-file name kind bg-color) $\Rightarrow$ boolean
\quad name : path
\quad kind = \texttt{'unknown} symbol in \{'unknown unknown/mask gif gif/mask jpeg png png/mask xbm xpm bmp pict\}
\quad bg-color = \#f: \texttt{color\%} object or \#f
\end{quote}

The \texttt{kind} parameter specifies the file’s format:

- \texttt{'unknown} — examine the file to determine its format
- \texttt{'unknown/mask} — like \texttt{'unknown}, but see \texttt{get-loaded-mask}
- \texttt{'gif} — load a GIF bitmap file (X, Windows, Mac OS X)
- \texttt{'gif/mask} — like \texttt{'gif}, but see \texttt{get-loaded-mask} (X, Windows, Mac OS X)
- \texttt{'jpeg} — load a JPEG bitmap file (X, Windows, Mac OS X)
- \texttt{'png} — load a PNG bitmap file (X, Windows, Mac OS X)
- \texttt{'png/mask} — like \texttt{'png}, but see \texttt{get-loaded-mask} (X, Windows, Mac OS X)
- \texttt{'xbm} — load an X bitmap file (X, Windows, Mac OS X); creates a monochrome bitmap
- \texttt{'xpm} — load an XPM bitmap file (X, Windows, Mac OS X)
- \texttt{'bmp} — load a Windows bitmap file (X, Windows, Mac OS X)
- \texttt{'pict} — load a PICT bitmap file (Mac OS X)

An XBM image is always loaded as a monochrome bitmap. A 1-bit grayscale PNG without a mask or alpha channel is also loaded as a monochrome bitmap. An image in any other format is always loaded as a bitmap that matches the depth of the screen.

For PNG loading, if \texttt{bg-color} is not \texttt{#f}, then it is combined with the file’s alpha channel or mask (if any) while loading the image; in this case, no separate mask bitmap is generated, even if \texttt{'unknown/mask} or \texttt{'png/mask} is specified for the format. If the format is specified as \texttt{'unknown} or \texttt{'png} and \texttt{bg-color} is not specified, the PNG file is consulted for a background color to use for loading, and white is used if no background color is indicated in the file.

In all PNG-loading modes, gamma correction is applied when the file provides a gamma value, otherwise gamma correction is not applied. The current display’s gamma factor is determined by the \texttt{'[MrEd:gamma]} preference.
bitmap%

(see “Preferences” (section 12, page 365)) if it is set, or else by the SCREEN_GAMMA environment variable if it is defined. If the preference and environment variable are both undefined, a platform-specific default is used.

ok?

Returns #t if the bitmap is usable (created or changed successfully). If #f is returned, the bitmap cannot be supplied to methods that consume or operate on bitmaps (otherwise, an exn:fail:contract exception is raised).

- (send a-bitmap ok?) ⇒ boolean

save-file

Saves a bitmap in the named file.

- (send a-bitmap save-file name kind quality) ⇒ boolean
  name: path
  kind: symbol in ’(png jpeg xbm xpm bmp)
  quality = 75: exact integer in [0, 100]

The kind argument determined the type of file that is created, one of:
- ’png — save a PNG file (X, Windows, Mac OS X)
- ’jpeg — save a JPEG file (X, Windows, Mac OS X)
- ’xbm — save an X bitmap file (X, Windows, Mac OS X)
- ’xpm — save an XPM bitmap file (X, Windows, Mac OS X)
- ’bmp — save a Windows bitmap file (Windows)

The quality argument is used only for saving as ’jpeg, in which case it specifies the trade-off between image precision (high quality matches the content of the bitmap% object more precisely) and size (low quality is smaller).

When saving as ’png, if get-loaded-mask returns a bitmap of the same size as this one, a grayscale version is included in the PNG file as the alpha channel.

A monochrome bitmap saved as ’png without a mask bitmap produces a 1-bit grayscale PNG file (which, when read with load-file, creates a monochrome bitmap% object.)

set-gl-config

Sets the requested OpenGL configuration for this bitmap. The configuration is used when the bitmap selected into a drawing context, and then a GL context is created for the drawing context.

The given gl-config% object is copied, so that changes to the object do not affect the bitmap’s configuration.

- (send a-bitmap set-gl-config config) ⇒ void
  config: gl-config% object

set-loaded-mask

See get-loaded-mask.

- (send a-bitmap set-loaded-mask mask) ⇒ void
  mask: bitmap% object or #f
6.3  bitmap-dc%

Implements: dc<%>

A bitmap-dc% object allows drawing directly into a bitmap. A bitmap% object must be supplied at initialization or installed into a bitmap DC using set-bitmap before any other method of the DC is called, except get-text-extent, get-char-height, or get-char-width. If any other bitmap-dc% method is called before a bitmap is selected, the method call is ignored.

Drawing to a bitmap-dc% with a color bitmap is guaranteed to produce the same result as drawing into a canvas% instance (with appropriate clipping and offsets). Thus, a bitmap-dc% can be used for offscreen staging of canvas content.

- (new bitmap-dc% (bitmap ,)) ⇒ bitmap-dc% object
  bitmap: bitmap% object or #f

  Creates a new memory DC. If bitmap is not #f, it is installed into the DC so that drawing commands on the DC draw to bitmap. Otherwise, no bitmap is installed into the DC and set-bitmap must be called before any other method of the DC is called.

draw-bitmap-section-smooth

Display part of a bitmap with smooth scaling. For most platforms, this method produces better results than adjusting the scale of a drawing context before using draw-bitmap and draw-bitmap-section, but this method is much slower.

- (send a-bitmap-dc draw-bitmap-section-smooth source dest-x dest-y dest-width dest-height src-x src-y src-width src-height mask) ⇒ boolean
  source: bitmap% object
  dest-x: real number
  dest-y: real number
  dest-width: non-negative real number
  dest-height: non-negative real number
  src-x: real number
  src-y: real number
  src-width: non-negative real number
  src-height: non-negative real number
  mask: bitmap% object or #f

get-argb-pixels

Gets a rectangle of pixels in the bitmap, subject to the same rules and performance characteristics of get-pixel, except that the block get is likely to be faster than the sequence of individual gets.

- (send a-bitmap-dc get-argb-pixels x y width height pixels alpha?) ⇒ void
  x: real number
  y: real number
  width: exact integer in [1, 10000]
  height: exact integer in [1, 10000]
  pixels: mutable byte string
  alpha?: = #f: boolean
The pixel RGB values are copied into pixels. The first byte represents an alpha value of the pixel at \((x, y)\), the second byte represents a red value of the pixel at \((x, y)\), the third byte is the blue value, etc. In this way, the first \(width \times height \times 4\) bytes of pixels are set to reflect the current pixel values in the DC. The pixels are in row-major order, left to right then top to bottom.

If \(alpha?\) is false, then the alpha value for each pixel is set to 255. If \(alpha?\) is true, then only the alpha value is set for each pixel, based on each pixel’s value. Thus, the same pixels byte string is in general filled from two bitmaps, one (the main image) for the pixel values and one (the mask) for the alpha values.

**get-bitmap**

Gets the bitmap currently installed in the DC, or \#f if no bitmap is installed. See set-bitmap for more information.

- (send a-bitmap-dc get-bitmap) \⇒ bitmap% object or \#f

**get-pixel**

Gets the current color of a pixel in the bitmap.

Under X, interleaving drawing commands with get-pixel calls (for the same bitmap-dc% object) incurs a substantial performance penalty, except for interleaved calls to set-pixel, set-argb-pixels, and get-argb-pixels.

- (send a-bitmap-dc get-pixel \(x\ \ y\ \ \) color) \⇒ boolean
  
  \(x\): real number
  \(y\): real number
  color: color% object

  Fills color with the color of the current pixel at position \((x, y)\) in the drawing context. If the color is successfully obtained, the return value is \#t, otherwise the result is \#f.

**set-argb-pixels**

Sets a rectangle of pixels in the bitmap, subject to the same rules and performance characteristics of set-pixel, except that the block set is likely to be faster than the sequence of individual sets.

- (send a-bitmap-dc set-argb-pixels \(x\ \ y\ \ width\ \ height\ \ pixels\ \ \) alpha?) \⇒ void
  
  \(x\): real number
  \(y\): real number
  \(width\): exact integer in \([1, 10000]\)
  \(height\): exact integer in \([1, 10000]\)
  pixels: byte string
  alpha? = \#f: boolean

  The pixel RGB values are taken from pixels. The first byte represents an alpha value, the second byte represents a red value to used for the pixel at \((x, y)\), the third byte is a blue value, etc. In this way, the first \(width \times height \times 4\) bytes of pixels determine the new pixel values in the DC. The pixels are in row-major order, left to right then top to bottom.

  If \(alpha?\) is false, then the alpha value for each pixel is ignored. If \(alpha?\) is true, then only the each pixel is set based only on the alpha value. Thus, the same pixels byte string is in general used with two bitmaps, one (the main image) for the pixel values and one (the mask) for the alpha values.
set-bitmap

Installs a bitmap into the DC, so that drawing operations on the bitmap DC draw to the bitmap. A bitmap is removed from a DC by setting the bitmap to \$f\$.

A bitmap can be selected into at most one bitmap DC, and only when it is not used by a control (as a label) or in a pen% or brush% (as a stipple). If the argument to set-bitmap is already in use by another DC, a control, a pen%, or a brush%, an exn:fail:contract exception is raised.

- (send a-bitmap-dc set-bitmap bitmap) ⇒ void
  bitmap: bitmap% object or \$f\$

set-pixel

Sets a pixel in the bitmap.

The current clipping region might not affect the pixel change. Under X, interleaving drawing commands with set-pixel calls (for the same bitmap-dc% object) incurs a substantial performance penalty, except for interleaved calls to get-pixel, get-argb-pixels, and set-argb-pixels.

- (send a-bitmap-dc set-pixel x y color) ⇒ void
  x: real number
  y: real number
  color: color% object

6.4 brush%

A brush is a drawing tool with a color and a style that is used for filling in areas, such as the interior of a rectangle or ellipse. On a monochrome display, all non-white brushes are drawn as black.

In addition to its color and style, a brush can have a stipple bitmap. This stipple is used only in unsmoothed mode (see set-smoothing) or in a PostScript drawing context. Painting with a stipple brush is similar to calling draw-bitmap with the stipple bitmap in the filled region, except that the bitmap may not be scaled in the same way (depending on the platform and device).

A brush’s style is one of the following:

- ‘transparent — Draws with no effect (on the interior of the drawn shape).
- ‘solid — Draws using the brush’s color. If a monochrome stipple is installed into the brush, black pixels from the stipple are transferred to the destination using the brush’s color, and white pixels from the stipple are not transferred.
- ‘opaque — Same as ‘solid, except when a monochrome stipple is installed for unsmoothed or PostScript drawing: in that case, white pixels from the stipple are transferred to the destination using the destination’s background color.
- ‘xor — In a smoothing mode or if a color stipple is installed, ‘xor is treated as ‘solid. Otherwise, the brush’s color or colored (monochrome) stipple is xored with existing destination pixel values. The ‘xor mapping is unspecified for arbitrary color combinations, but the mapping provides two guarantees:
  - Black-and-white drawing to a color or monochrome destination always works as expected: black xor white
    = black, white xor black = black, black xor black = white, and white xor white = white.
Performing the same drawing operation twice in a row with ‘xor’ is equivalent to a no-op.

- ‘hilite’ — In unsmoothed mode, existing destination pixels are “highlighted” in a platform-specific way when the brush color is black. Under Windows and X for a color drawing context, the inverted RGB components of destination pixel are combined with the RGB components of the system-wide highlight color¹ using a bitwise “or”, and the combination is used. Under Mac OS X for a color drawing context, the inverted RGB components of the system-wide highlight color are subtracted from the RGB components of each destination pixel, and the difference (or 0 for a negative result) is used. For any monochrome drawing context, ‘hilite’ is the same as ‘xor’. For PostScript output, ‘hilite’ uses a stipple that is an array of small dots (essentially a halftone), otherwise ‘hilite’ is treated like ‘solid’ in a smoothing mode.

- ‘panel’ — In unsmoothed mode, draws with the same color and pattern as a top-level panel background, if the brush’s color is the same as the color returned by get-panel-background and if the brush has no stipple. To create a canvas% object that is drawn like a control, use the ‘transparent canvas style instead, because certain kinds of nested panels have different background colors (e.g., a tab-panel% under Mac OS X). In a smoothing mode, ‘panel’ is treated as ‘solid’.

The following modes correspond to built-in stipples drawn in ‘solid’ mode:

- ‘bdiagonal-hatch’ — diagonal lines, top-left to bottom-right
- ‘crossdiag-hatch’ — crossed diagonal lines
- ‘fdiagonal-hatch’ — diagonal lines, top-right to bottom-left
- ‘cross-hatch’ — crossed horizontal and vertical lines
- ‘horizontal-hatch’ — horizontal lines
- ‘vertical-hatch’ — vertical lines

However, when a specific stipple is installed into the brush for when drawing with a smoothing mode into a non-PostScript context, the above modes are ignored and ‘solid’ is used, instead.

To draw outline shapes (such as unfilled boxes and ellipses), use the ‘transparent brush style. See set-style for more information about styles.

To avoid creating multiple brushes with the same characteristics, use the global brush-list% object the-brush-list, or provide a color and style to set-brush in dc<%>.

- (make-object brush%) ⇒ brush% object
  Creates a solid black brush.

- (make-object brush% color style) ⇒ brush% object
  color: color% object
  style: symbol in (transparent solid opaque xor hilite panel
  bdiagonal-hatch crossdiag-hatch fdiagonal-hatch cross-hatch
  horizontal-hatch vertical-hatch)
  Creates a brush with the given color and style.

- (make-object brush% color-name style) ⇒ brush% object
  color-name: string
  style: symbol in (transparent solid opaque xor hilite panel
  bdiagonal-hatch crossdiag-hatch fdiagonal-hatch cross-hatch
  horizontal-hatch vertical-hatch)
  Creates a brush with the given color and style, where the color is specified using a name; see color-database<%> for information about color names. If the name is not known, the brush’s color is set to black.

¹Under X, the color is specified by the ‘MrEd:hiliteColor’ preference preference; see “Preferences” (section 12, page 365).
get-color

Returns the brush’s color.

- (send a-brush get-color) ⇒ color% object

get-stipple

Gets the stipple bitmap, or #f if the brush has no stipple.

- (send a-brush get-stipple) ⇒ bitmap% object or #f

get-style

Returns the brush’s style. See brush% for information about brush styles.

- (send a-brush get-style) ⇒ symbol in 
  (transparent solid opaque xor hilite
   panel bdiagonal-hatch crossdiag-hatch fdiagonal-hatch cross-hatch horizontal-hatch
   vertical-hatch)

set-color

Sets the brush’s color.

A brush cannot be modified if it was obtained from a brush-list% or while it is selected into a drawing context.

- (send a-brush set-color color) ⇒ void
  color: color% object
  Sets the brush’s color to match the given color.

- (send a-brush set-color color-name) ⇒ void
  color-name: string
  Set’s the brushes color to color-name if the name is known; see color-database<%> for information about color names.

- (send a-brush set-color red green blue) ⇒ void
  red: exact integer in [0, 255]
  green: exact integer in [0, 255]
  blue: exact integer in [0, 255]
  Sets the RGB values of the brush’s color.

set-stipple

Sets or removes the stipple bitmap, where #f removes the stipple. See brush% for information about drawing with stipplers.

A bitmap cannot be used as a stipple if it is selected into a bitmap-dc% object; if the given bitmap is selected into a bitmap-dc% object, an exn:fail:contract exception is raised. A brush cannot be modified if it was obtained from a brush-list% or while it is selected into a drawing context.
A pen’s stipple is not used in a smoothing mode, except for a post-script-dc% (which is always in a smoothing mode).

- (send a-brush set-stipple bitmap) ⇒ void
  bitmap: bitmap% object or #f

set-style
Sets the brush’s style. See brush% for information about the possible styles.

A brush cannot be modified if it was obtained from a brush-list% or while it is selected into a drawing context.

- (send a-brush set-style style) ⇒ void
  style: symbol in ’(transparent solid opaque xor hilite panel bdiagonal-hatch crossdiag-hatch fdiagonal-hatch cross-hatch horizontal-hatch vertical-hatch)

6.5 brush-list%

A brush-list% object maintains a list of brush% objects to avoid creating brushes repeatedly. A brush% object in a brush list cannot be mutated.

A global brush list, the-brush-list, is created automatically.

- (make-object brush-list%) ⇒ brush-list% object
  Creates an empty brush list.

find-or-create-brush
Finds a brush of the given specification, or creates one and adds it to the list.

- (send a-brush-list find-or-create-brush color style) ⇒ brush% object
  color: color% object
  style: symbol in ’(transparent solid opaque xor hilite panel bdiagonal-hatch crossdiag-hatch fdiagonal-hatch cross-hatch horizontal-hatch vertical-hatch)
  See brush%.

- (send a-brush-list find-or-create-brush color-name style) ⇒ brush% object or #f
  color-name: string
  style: symbol in ’(transparent solid opaque xor hilite panel bdiagonal-hatch crossdiag-hatch fdiagonal-hatch cross-hatch horizontal-hatch vertical-hatch)
  See brush%.
  The return value is #f when no color matching color-name can be found in the color database.

6.6 color%

A color is an object representing a red-green-blue (RGB) combination of primary colors, and is used to determine drawing colors. Each red, green, or blue component of the color is in the range 0 to 255, inclusive. For example, (0, 0,
0) is black, (255, 255, 255) is white, and (255, 0, 0) is red.

See color-database<%> for information about obtaining a color object using a color name.

- (make-object color% red green blue) ⇒ color% object
  red: exact integer in [0, 255]
  green: exact integer in [0, 255]
  blue: exact integer in [0, 255]

  Creates a new color with the given RGB values.

- (make-object color% color-name) ⇒ color% object
  color-name: string

  Creates a new color by name, using the-color-database. (See color-database<%> for more information.)

blue

Returns the blue component of the color.

- (send a-color blue) ⇒ exact integer in [0, 255]

copy-from

Copies the RGB values of another color object to this one, returning this object as the result.

- (send a-color copy-from src) ⇒ color% object
  src: color% object

green

Returns the green component of the color.

- (send a-color green) ⇒ exact integer in [0, 255]

ok?

Returns #t if the color object is valid.

- (send a-color ok?) ⇒ boolean

red

Returns the red component of the color.

- (send a-color red) ⇒ exact integer in [0, 255]
set

Sets the three (red, green, and blue) component values of the color.

- (send a-color set red green blue) \Rightarrow void
  red: exact integer in [0, 255]
  green: exact integer in [0, 255]
  blue: exact integer in [0, 255]

6.7 color-database

The global the-color-database object is an instance of color-database. It maintains a database of standard RGB colors for a predefined set of named colors (such as “black” and “light grey”).

The following colors are in the database:

Orange Red
OrangeRed
Tomato
DarkRed
Red
Firebrick
Crimson
DeepPink
Maroon
Indian Red
IndianRed
Medium Violet Red
MediumVioletRed
Violet Red
VioletRed
LightCoral
HotPink
PaleVioletRed
LightPink
RosyBrown
Pink
Orchid
LavenderBlush
Snow
Chocolate
SaddleBrown
Brown
DarkOrange
Coral
Sienna
Orange
Salmon
Peru
DarkGoldenrod
Goldenrod
SandyBrown
LightSalmon
DarkSalmon
Gold
Yellow
Olive
Burlywood
Tan
NavajoWhite
PeachPuff
Khaki
DarkKhaki
Moccasin
Wheat
Bisque
PaleGoldenrod
BlanchedAlmond
Medium Goldenrod
MediumGoldenrod
PapayaWhip
MistyRose
LemonChiffon
AntiqueWhite
Cornsilk
LightGoldenrodYellow
OldLace
Linen
LightYellow
SeaShell
Beige
FloralWhite
Ivory
Green
LawnGreen
Chartreuse
Green Yellow
GreenYellow
Yellow Green
YellowGreen
Medium Forest Green
OliveDrab
MediumForestGreen
Dark Olive Green
DarkOliveGreen
DarkSeaGreen
Lime
Dark Green
DarkGreen
Lime Green
LimeGreen
Forest Green
ForestGreen
Spring Green
SpringGreen
Medium Spring Green
<table>
<thead>
<tr>
<th>Color Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>MediumSpringGreen</td>
</tr>
<tr>
<td>Sea Green</td>
</tr>
<tr>
<td>SeaGreen</td>
</tr>
<tr>
<td>Medium Sea Green</td>
</tr>
<tr>
<td>MediumSeaGreen</td>
</tr>
<tr>
<td>Aquamarine</td>
</tr>
<tr>
<td>LightGreen</td>
</tr>
<tr>
<td>Pale Green</td>
</tr>
<tr>
<td>PaleGreen</td>
</tr>
<tr>
<td>Medium Aquamarine</td>
</tr>
<tr>
<td>MediumAquamarine</td>
</tr>
<tr>
<td>Turquoise</td>
</tr>
<tr>
<td>LightSeaGreen</td>
</tr>
<tr>
<td>Medium Turquoise</td>
</tr>
<tr>
<td>MediumTurquoise</td>
</tr>
<tr>
<td>Honeydew</td>
</tr>
<tr>
<td>MintCream</td>
</tr>
<tr>
<td>RoyalBlue</td>
</tr>
<tr>
<td>DodgerBlue</td>
</tr>
<tr>
<td>DeepSkyBlue</td>
</tr>
<tr>
<td>CornflowerBlue</td>
</tr>
<tr>
<td>Steel Blue</td>
</tr>
<tr>
<td>SteelBlue</td>
</tr>
<tr>
<td>LightSkyBlue</td>
</tr>
<tr>
<td>Dark Turquoise</td>
</tr>
<tr>
<td>DarkTurquoise</td>
</tr>
<tr>
<td>Cyan</td>
</tr>
<tr>
<td>Aqua</td>
</tr>
<tr>
<td>DarkCyan</td>
</tr>
<tr>
<td>Teal</td>
</tr>
<tr>
<td>Sky Blue</td>
</tr>
<tr>
<td>SkyBlue</td>
</tr>
<tr>
<td>Cadet Blue</td>
</tr>
<tr>
<td>CadetBlue</td>
</tr>
<tr>
<td>Dark Slate Gray</td>
</tr>
<tr>
<td>DarkSlateGray</td>
</tr>
<tr>
<td>LightSlateGray</td>
</tr>
<tr>
<td>SlateGray</td>
</tr>
<tr>
<td>Light Steel Blue</td>
</tr>
<tr>
<td>LightSteelBlue</td>
</tr>
<tr>
<td>Light Blue</td>
</tr>
<tr>
<td>LightBlue</td>
</tr>
<tr>
<td>PowderBlue</td>
</tr>
<tr>
<td>PaleTurquoise</td>
</tr>
<tr>
<td>LightCyan</td>
</tr>
<tr>
<td>AliceBlue</td>
</tr>
<tr>
<td>Azure</td>
</tr>
<tr>
<td>Medium Blue</td>
</tr>
<tr>
<td>MediumBlue</td>
</tr>
<tr>
<td>DarkBlue</td>
</tr>
<tr>
<td>Midnight Blue</td>
</tr>
<tr>
<td>MidnightBlue</td>
</tr>
<tr>
<td>Navy</td>
</tr>
</tbody>
</table>
Blue
Indigo
Blue Violet
BlueViolet
Medium Slate Blue
MediumSlateBlue
Slate Blue
SlateBlue
Purple
Dark Slate Blue
DarkSlateBlue
DarkViolet
Dark Orchid
DarkOrchid
MediumPurple
Cornflower Blue
Medium Orchid
MediumOrchid
Magenta
Fuchsia
DarkMagenta
Violet
Plum
Lavender
Thistle
GhostWhite
White
WhiteSmoke
Gainsboro
Light Gray
LightGray
Silver
Gray
Dark Gray
DarkGray
Dim Gray
DimGray
Black

The names are not case-sensitive.

See also color%.

find-color

Finds a color by name (character case is ignored). If no color is found for the name, #f is returned.

- (send a-color-database find-color color-name) ⇒ color% object or #f
  color-name : string

See color-database<%> for the list of color names.
6.8 dc<%>

A dc<%> object is a drawing context for drawing graphics and text. It represents output devices in a generic way; e.g., a canvas has a drawing context, as does a printer.

The drawing methods, such as draw-rectangle, accept real number values as arguments, but the results are only well-defined when the drawing coordinates are in the range \(-16383\) to \(16383\). This restriction applies to the coordinates both before and after offsets and scaling factors are applied.

clear

Clears the drawing region (fills it with the current background color, as determined by get-background).

  - (send a-dc clear) ⇒ void

draw-arc

Draws an arc. The current pen is used for the arc and the current brush for filling a wedge.

If both the pen and brush are non-transparent, the wedge is filled with the brush before the arc is drawn with the pen. The wedge and arc meet so that no space is left between them, but the precise overlap between the wedge and arc is platform- and size-specific. Typically, the regions drawn by the brush and pen overlap. More generally, the pen is centered over the outline of the arc, rounding toward the center in unsmoothed mode.

  - (send a-dc draw-arc x y width height start-radians end-radians) ⇒ void
    
    \(x\) : real number
    \(y\) : real number
    \(width\) : non-negative real number
    \(height\) : non-negative real number
    \(start-radians\) : real number
    \(end-radians\) : real number

    Draws a counter-clockwise circular arc, a part of the ellipse inscribed in the rectangle specified by \(x\) (left), \(y\) (top), \(width\), and \(height\). The arc starts at the angle specified by \(start-radians\) (0 is three o’clock and half-pi is twelve o’clock) and continues counter-clockwise to \(end-radians\). If \(start-radians\) and \(end-radians\) are the same, a full ellipse is drawn.

    If the current brush is not transparent, it is used to fill the wedge bounded by the arc plus lines (not drawn) extending to the center of the inscribed ellipse.

    Restrictions on the magnitude of drawing coordinates are described with dc<%>.

draw-bitmap

Displays a bitmap. For color bitmaps, the drawing style and color arguments are ignored. For monochrome bitmaps, draw-bitmap uses the style and color arguments in the same way that a brush uses its style and color settings to draw a monochrome stipple (see brush% for more information).

If a mask bitmap is supplied, it must have the same width and height as the bitmap to display, and its ok? must return true, otherwise an exn:fail:contract exception is raised. The bitmap to draw and the mask bitmap can be the same object, but if the drawing context is a bitmap-dc object, both bitmaps must be distinct from the destination bitmap, otherwise an exn:fail:contract exception is raised.
If the mask bitmap is monochrome, drawing occurs in the target `dc` only where the mask bitmap contains black pixels.

If the mask bitmap is grayscale and the bitmap to draw is not monochrome, then the blackness of each mask pixel controls the opacity of the drawn pixel (i.e., the mask acts as an inverted alpha channel), at least on most platforms. Other combinations involving a non-monochrome mask (i.e., a non-grayscale mask or a monochrome bitmap to draw) produce platform-specific results.

See also `draw-bitmap-section`.

The current brush, current pen, and current text settings for the DC have no effect on how the bitmap is drawn, but the bitmap is scaled if the DC has a scale.

For `post-script-dc` output, the mask bitmap is currently ignored, and the `solid` style is treated the same as `opaque`. (However, mask bitmaps and `solid` drawing may become supported for `post-script-dc` in the future.)

The result is `#t` if the bitmap is successfully drawn, `#f` otherwise (possibly because the bitmap’s `ok?` method returns `#f`).

```
- (send a-dc draw-bitmap source dest-x dest-y style color mask) ⇒ boolean
  source: bitmap% object
  dest-x: real number
  dest-y: real number
  style='solid: symbol in '(solid opaque xor)
  color = black: color% object
  mask = #f: bitmap% object or #f

The `dest-x` and `dest-y` arguments are in DC coordinates.
Restrictions on the magnitude of drawing coordinates are described with `dc`.
```

draw-bitmap-section

Display part of a bitmap. See also `draw-bitmap`.

```
- (send a-dc draw-bitmap-section source dest-x dest-y src-x src-y src-width src-height style color mask) ⇒ boolean
  source: bitmap% object
  dest-x: real number
  dest-y: real number
  src-x: real number
  src-y: real number
  src-width: non-negative real number
  src-height: non-negative real number
  style='solid: symbol in '(solid opaque xor)
  color = black: color% object
  mask = #f: bitmap% object or #f

The `src-x`, `src-y`, `src-width`, and `src-height` arguments specify a rectangle in the source bitmap to copy into this drawing context.
```

See `draw-bitmap` for information about `dest-x`, `dest-y`, `style`, `color`, and `mask`.

---

2Non-monochrome masks are collapsed to monochrome under X when the RENDER extension is not available, and under Windows 95 and NT when `msing32.dll` is not available.
draw-ellipse

Draws an ellipse contained in a rectangle. The current pen is used for the outline, and the current brush is used for filling the shape.

If both the pen and brush are non-transparent, the ellipse is filled with the brush before the outline is drawn with the pen. The filling and outline meet so that no space is left between them, but the precise overlap between the filling and outline is platform- and size-specific. Typically, the regions drawn by the brush and pen overlap. More generally, the pen is centered over the outline of the ellipse, rounding toward the center in unsmoothed mode.

- (send a-dc draw-ellipse x y width height) ⇒ void
  x : real number
  y : real number
  width : non-negative real number
  height : non-negative real number

  Draws an ellipse that fits within a rectangle with the given top-left corner and size.
  Restrictions on the magnitude of drawing coordinates are described with dc<%>.

draw-line

Draws a line from one point to another. The current pen is used for drawing the line.

In unsmoothed mode, the points correspond to pixels, and the line covers both the start and end points. For a pen whose scaled width is larger than 1, the line is drawn centered over the start and end points.

See also set-smoothing for information on the ‘aligned smoothing mode.

- (send a-dc draw-line x1 y1 x2 y2) ⇒ void
  x1 : real number
  y1 : real number
  x2 : real number
  y2 : real number

  Restrictions on the magnitude of drawing coordinates are described with dc<%>.

draw-lines

Draws multiple connected lines. The current pen is used for drawing the lines.

See also set-smoothing for information on the ‘aligned smoothing mode.

- (send a-dc draw-lines points xoffset yoffset) ⇒ void
  points : list of point% objects
  xoffset = 0 : real number
  yoffset = 0 : real number

  Draws lines using a list of points, adding xoffset and yoffset to each point.
  Restrictions on the magnitude of drawing coordinates are described with dc<%>.

draw-path

Draws the sub-paths of the given dc-path% object. The current pen is used for drawing the path as a line, and the current brush is used for filling the area bounded by the path.
If both the pen and brush are non-transparent, the path is filled with the brush before the outline is drawn with the pen. The filling and outline meet so that no space is left between them, but the precise overlap between the filling and outline is platform- and size-specific. Thus, the regions drawn by the brush and pen may overlap. More generally, the pen is centered over the path, rounding left and down in unsmoothed mode.

See also `set-smoothing` for information on the `aligned` smoothing mode.

```lisp
- (send a-dc draw-path path xoffset yoffset fill-style) ⇒ void
  path: dc-path% object
  xoffset = 0 : real number
  yoffset = 0 : real number
  fill-style = 'odd-even: symbol in' (odd-even winding)

Draw a path, adding `xoffset` and `yoffset` to each point.

The `fill-style` argument specifies the fill rule: `odd-even` or `winding`. In `odd-even` mode, a point is considered enclosed within the path if it is enclosed by an odd number of sub-path loops. In `winding` mode, a point is considered enclosed within the path if it is enclosed by more or less clockwise sub-path loops than counter-clockwise sub-path loops. In unsmoothed mode, the `winding` fill rule is not supported under Mac OS X and it is not supported when `path` contains multiple sub-paths; the `winding` fill rules is always supported when smoothing is enabled (see `set-smoothing`).

Restrictions on the magnitude of drawing coordinates are described with `dc<%>`.```

```lisp
draw-point
```

Plots a single point using the current pen.

```lisp
- (send a-dc draw-point x y) ⇒ void
  x: real number
  y: real number

Restrictions on the magnitude of drawing coordinates are described with `dc<%>`.```

```lisp
draw-polygon
```

Draws and paints a polygon from a list of points. The current pen is used for drawing the outline, and the current brush for filling the shape.

If both the pen and brush are non-transparent, the polygon is filled with the brush before the outline is drawn with the pen. The filling and outline meet so that no space is left between them, but the precise overlap between the filling and outline is platform- and shape-specific. Thus, the regions drawn by the brush and pen may overlap. More generally, the pen is centered over the polygon lines, rounding left and down in unsmoothed mode.

See also `set-smoothing` for information on the `aligned` smoothing mode.

```lisp
- (send a-dc draw-polygon points xoffset yoffset fill-style) ⇒ void
  points: list of point% objects
  xoffset = 0: real number
  yoffset = 0: real number
  fill-style = 'odd-even: symbol in' (odd-even winding)

Draw a filled polygon using a list of `points`, adding `xoffset` and `yoffset` to each point. The polygon is automatically closed, so the first and last point can be different.
The *fill-style* argument specifies the fill rule: `'odd-even` or `'winding`. In `'odd-even` mode, a point is considered enclosed within the polygon if it is enclosed by an odd number of loops. In `'winding` mode, a point is considered enclosed within the polygon if it is enclosed by more or less clockwise loops than counter-clockwise loops. The `'winding` fill rule is not supported under Mac OS X, except when smoothing is enabled (see `set-smoothing`).

Restrictions on the magnitude of drawing coordinates are described with `dc<%>`.

draw-rectangle

Draws a rectangle. The current pen is used for the outline and the current brush for filling the shape.

If both the pen and brush are non-transparent, the rectangle is filled with the brush before the outline is drawn with the pen. In unsmoothed mode, when the pen is size 0 or 1, the filling precisely overlaps the entire outline. As a result, if a rectangle is drawn with a size-0 or size-1 `'xor pen%` and an `'xor brush%`, the outline is xored twice (first by the brush, then by the pen), leaving it unchanged. More generally, the pen is centered over the outline of the rectangle, rounding toward the center in unsmoothed mode.

See also `set-smoothing` for information on the `'aligned` smoothing mode.

- `(send a-dc draw-rectangle x y width height) ⇒ void
  x : real number
  y : real number
  width : non-negative real number
  height : non-negative real number
  Draws a rectangle with the given top-left corner and size.
  Restrictions on the magnitude of drawing coordinates are described with `dc<%>`.

draw-rounded-rectangle

Draws a rectangle with rounded corners. The current pen is used for the outline and the current brush for filling the shape.

If both the pen and brush are non-transparent, the rectangle is filled with the brush before the outline is drawn with the pen. The filling and outline meet so that no space is left between them, but the precise overlap between the filling and outline is platform- and size-specific. Thus, the regions drawn by the brush and pen may partially overlap. More generally, the pen is centered over the outline of the rounded rectangle, rounding toward the center in unsmoothed mode.

See also `set-smoothing` for information on the `'aligned` smoothing mode.

- `(send a-dc draw-rounded-rectangle x y width height radius) ⇒ void
  x : real number
  y : real number
  width : non-negative real number
  height : non-negative real number
  radius = -0.25 : real number
  Draws a rectangle with the given top-left corner, and with the given size. The corners are quarter-circles using the given radius.
  If `radius` is positive, the value is used as the radius of the rounded corner. If `radius` is negative, the absolute value is used as the the proportion of the smallest dimension of the rectangle.
If $radius$ is less than $-0.5$ or more than half of $width$ or $height$, an exn:fail:contract exception is raised.

Restrictions on the magnitude of drawing coordinates are described with dc<%>.

draw-spline

Draws a three-point spline using the current pen.

See also set-smoothing for information on the 'aligned smoothing mode.

- (send a-dc draw-spline x1 y1 x2 y2 x3 y3) ⇒ void
  x1 : real number
  y1 : real number
  x2 : real number
  y2 : real number
  x3 : real number
  y3 : real number

Draws a spline from $(x1, y1)$ to $(x3, y3)$ using $(x2, y2)$ as the control point.

Restrictions on the magnitude of drawing coordinates are described with dc<%>.

draw-text

Draws a text string at a specified point, using the current text font, and the current text foreground and background colors. For unrotated text, the specified point is used as the starting top-left point for drawing characters (e.g., if “W” is drawn, the point is roughly the location of the top-left pixel in the “W”). Rotated text is rotated around this point.

See get-text-extent for information on the size of the drawn text.

See also set-text-foreground, set-text-background, and set-text-mode.

The current brush and current pen settings for the DC have no effect on how the text is drawn.

- (send a-dc draw-text text x y combine? offset angle) ⇒ void
  text : string
  x : real number
  y : real number
  combine? = #f : boolean
  offset = 0 : exact non-negative integer
  angle = 0 : real number

Restrictions on the magnitude of drawing coordinates are described with dc<%>.

The text string is drawn starting from the offset character, and continuing until the end of text or the first null character.

If combine? is #t, then text may be measured with adjacent characters combined to ligature glyphs, with Unicode combining characters as a single glyph, with kerning, with right-to-left rendering of characters, etc. If combine? is #f, then the result is the same as if each character is measured separately, and Unicode control characters are ignored.

The string is rotated by angle radians counter-clockwise. If angle is not zero, then the text is always drawn in transparent mode (see set-text-mode).
end-doc

Ends a document, relevant only when drawing to a printer or PostScript device (including to a PostScript file).

- (send a-dc end-doc) ⇒ void

end-page

Ends a single page, relevant only when drawing to a printer or PostScript device (including to a PostScript file).

- (send a-dc end-page) ⇒ void

get-background

Gets the color used for painting the background. See also `set-background`.

- (send a-dc get-background) ⇒ color% object

get-brush

Gets the current brush. See also `set-brush`.

- (send a-dc get-brush) ⇒ brush% object

get-char-height

Gets the height of a character using the current font.

Unlike most methods, this method can be called for a `bitmap-dc%` object without a bitmap installed.

- (send a-dc get-char-height) ⇒ non-negative real number

get-char-width

Gets the average width of a character using the current font.

Unlike most methods, this method can be called for a `bitmap-dc%` object without a bitmap installed.

- (send a-dc get-char-width) ⇒ non-negative real number

get-clipping-region

Gets the current clipping region, returning #f if the drawing context is not clipped (i.e., the clipping region is the entire drawing region).

- (send a-dc get-clipping-region) ⇒ region% object or #f
get-font

Gets the current font. See also set-font.

- (send a-dc get-font) ⇒ font% object

get-gl-context

Returns a gl-context<> object for this drawing context if it supports OpenGL, #f otherwise.
See gl-context<> for more information.

- (send a-dc get-gl-context) ⇒ gl-context<> object or #f

get-origin

Returns the device origin, i.e., the location in device coordinates of (0, 0) in logical coordinates.
See also set-origin.

- (send a-dc get-origin) ⇒ two real numbers: x-offset and y-offset

get-pen

Gets the current pen. See also set-pen.

- (send a-dc get-pen) ⇒ pen% object

get-scale

Returns the scaling factor that maps logical coordinates to device coordinates.
See also set-scale.

- (send a-dc get-scale) ⇒ two non-negative real numbers: x-scale and y-scale

get-size

Gets the size of the destination drawing area. For a dc<> object obtained from a canvas<>, this is the (virtual client) size of the destination window; for a bitmap-dc% object, this is the size of the selected bitmap (or 0 if no bitmap is selected); for a post-script-dc% or printer-dc% drawing context, this gets the horizontal and vertical size of the drawing area.

- (send a-dc get-size) ⇒ two non-negative real numbers: width and height

get-smoothing

Returns the current smoothing mode. See set-smoothing.

- (send a-dc get-smoothing) ⇒ symbol in ’(unsmoothed smoothed aligned)
get-text-background

Gets the current text background color. See also set-text-background.

- (send a-dc get-text-background) ⇒ color% object

get-text-extent

Gets the dimensions of a string drawn into this drawing context. The result is four real numbers:

- the total width of the text (depends on both the font and the text);
- the total height of the font (depends only on the font);
- the distance from the baseline of the font to the bottom of the descender (included in the height, depends only on the font); and
- extra vertical space added to the font by the font designer (included in the height, and often zero; depends only on the font).

The returned width and height define a rectangle that is guaranteed to contain the text string when it is drawn, but the fit is not necessarily tight. Some undefined number of pixels on the left, right, top, and bottom of the drawn string may be “whitespace,” depending on the whims of the font designer and the platform-specific font-scaling mechanism.

Unlike most methods, this method can be called for a bitmap-dc% object without a bitmap installed.

- (send a-dc get-text-extent string font combine? offset) ⇒ four non-negative real numbers: width, height, descent, and space
  string: string
  font = #f: font% object or #f
  combine? = #f: boolean
  offset = 0: exact non-negative integer

Returns the size of string at it would be drawn in the drawing context, starting from the offset character of string, and continuing until the end of string or the first null character. The font argument specifies the font to use in measuring the text; if it is #f, the current font of the drawing area is used. (See also set-font.)

If combine? is #t, then text may be drawn with adjacent characters combined to ligature glyphs, with Unicode combining characters as a single glyph, with kerning, with right-to-left ordering of characters, etc. If combine? is #f, then the result is the same as if each character is drawn separately, and Unicode control characters are ignored.

get-text-foreground

Gets the current text foreground color. See also set-text-foreground.

- (send a-dc get-text-foreground) ⇒ color% object

get-text-mode

Reports how text is drawn; see set-text-mode.

- (send a-dc get-text-mode) ⇒ symbol in ’(solid transparent)
glyph-exists?

Returns #t if the given character has a corresponding glyph for this drawing context, #f otherwise.

Due to automatic font substitution when drawing or measuring text, the result of this method does not depend on the given font, which merely provides a hint for the glyph search. If the font is #f, the drawing context’s current font is used. The result depends on the type of the drawing context, but the result for canvas-dc instances and bitmap-dc instances is always the same for a given platform and a given set of installed fonts.

See also screen-glyph-exists?.

- (send a-dc glyph-exists? c font) ⇒ boolean
c : char
font = #f : font% object or #f

ok?

Returns #t if the drawing context is usable.

- (send a-dc ok?) ⇒ boolean

set-background

Sets the background color for drawing in this object (e.g., using clear or using a stippled brush with the mode 'opaque). On a monochrome display, all non-black colors are treated as white.

- (send a-dc set-background color) ⇒ void
color : color% object

set-brush

Sets the current brush for drawing in this object. While a brush is selected into a drawing context, it cannot be modified.

- (send a-dc set-brush brush) ⇒ void
brush : brush% object

Installs the given brush as the current brush.

- (send a-dc set-brush color style) ⇒ void
color : color% object
style : symbol in '(transparent solid opaque xor hilite panel bdiagonal-hatch crossdiag-hatch fdiagonal-hatch cross-hatch horizontal-hatch vertical-hatch)

Obtains a pen by providing all arguments to the-pen-list’s find-or-create-brush method and installs the result as the current brush.

- (send a-dc set-brush color-name style) ⇒ void
color-name : string
style : symbol in '(transparent solid opaque xor hilite panel bdiagonal-hatch crossdiag-hatch fdiagonal-hatch cross-hatch horizontal-hatch vertical-hatch)
Obtains a brush by providing all arguments to the-brush-list’s find-or-create-brush method. If a brush is returned, it is installed as the current brush. Otherwise, the color must be bad, so an exn:fail:contract exception is raised.

set-clipping-rect

Sets the clipping region to a rectangular region.

See also set-clipping-region and get-clipping-region.

- (send a-dc set-clipping-rect x y width height) ⇒ void
  x : real number
  y : real number
  width : non-negative real number
  height : non-negative real number

Restrictions on the magnitude of drawing coordinates are described with dc<%>.

set-clipping-region

Sets the clipping region for the drawing area, turning off all clipping within the drawing region if #f is provided.

The clipping region must be reset after changing a dc<%> object’s origin or scale (unless it is #f); see region% for more information.

See also set-clipping-rect and get-clipping-region.

- (send a-dc set-clipping-region rgn) ⇒ void
  rgn : region% object or #f

set-font

Sets the current font for drawing text in this object.

- (send a-dc set-font font) ⇒ void
  font : font% object

set-origin

Sets the device origin, i.e., the location in device coordinates of (0, 0) in logical coordinates.

Changing a dc<%> object’s origin or scale does not affect region% objects that were previously created. See region% for more information.

Restrictions on the magnitude of drawing coordinates are described with dc<%>.

- (send a-dc set-origin x y) ⇒ void
  x : real number
  y : real number
set-pen

Sets the current pen for this object.

The current pen does not affect text drawing; see also set-text-foreground.

While a pen is selected into a drawing context, it cannot be modified.

- (send a-dc set-pen pen) ⇒ void
  pen: pen% object
  Installs the given pen as the current pen.

- (send a-dc set-pen color width style) ⇒ void
  color: color% object
  width: real number in [0, 255]
  style: symbol in ' (transparent solid xor hilite dot long-dash
  short-dash dot-dash xor-dot xor-long-dash xor-short-dash
  xor-dot-dash)
  Obtains a pen by providing all arguments to the-pen-list’s find-or-create-pen method and installs
  the result as the current pen.

- (send a-dc set-pen color-name width style) ⇒ void
  color-name: string
  width: real number in [0, 255]
  style: symbol in ' (transparent solid xor hilite dot long-dash
  short-dash dot-dash xor-dot xor-long-dash xor-short-dash
  xor-dot-dash)
  Obtains a pen by providing all arguments to the-pen-list’s find-or-create-pen method. If a pen
  is returned, it is installed as the current pen. Otherwise, the color must be bad, so an exn:fail:contract
  exception is raised

set-scale

Sets a scaling factor that maps logical coordinates to device coordinates.

Changing a dc<%> object’s origin or scale does not affect region% objects that were previously created. See
region% for more information.

Restrictions on the magnitude of drawing coordinates are described with dc<%>.

- (send a-dc set-scale x-scale y-scale) ⇒ void
  x-scale: non-negative real number
  y-scale: non-negative real number

set-smoothing

Enables or disables anti-aliased smoothing of lines, curves, rectangles, rounded rectangles, ellipses, polygons, paths,
and clear operations. (Text smoothing is not affected by this method, and is instead controlled through the font% object.)

Smoothing is supported under Windows only when Microsoft’s gdipplus.dll is installed (which is always the case for
Windows XP). Smoothing is supported under Mac OS X always. Smoothing is supported under X only when Cairo is
installed when MrEd is compiled. Smoothing is never supported for black-and-white contexts. Smoothing is always supported (and cannot be disabled) for PostScript output.

The smoothing mode is either ‘unsmoothed’, ‘smoothed’, or ‘aligned’. Both ‘aligned’ and ‘smoothed’ are smoothing modes.

In ‘smoothed’ mode for a canvas or bitmap drawing context, integer drawing coordinates correspond to the boundary between pixels, and pen-based drawing is centered over a given line or curve. Thus, drawing with pen width 1 from (0,10) to (10,10) draws a 2-pixel wide line with 50% opacity.

The ‘aligned’ smoothing mode is like ‘smoothed’, but it paints pixels more like ‘unsmoothed’ mode. Since it aligns shapes to pixel boundaries, ‘aligned’ mode often produces better results than ‘smoothed’, but the results depend on the application. The ‘aligned’ mode is defined in terms of ‘smoothed’ mode, except that drawing coordinates are rounded down (via floor, after scaling and origin translation). For line drawing, coordinates are then shifted right and down by the floor of half a pen width. In addition, for pen drawing through draw-rectangle, draw-ellipse, draw-rounded-rectangle, and draw-arc, the given width and height are each decreased by 1.0.

In either smoothing mode, brush and pen stipples are ignored (except for PostScript drawing), and ‘hilite’ and ‘xor’ drawing modes are treated as ‘solid’. If smoothing is not supported, then attempting to set the smoothing mode to ‘smoothed’ or ‘aligned’ will have no effect, and get-smoothing will always return ‘unsmoothed’. Similarly, get-smoothing for a post-script-dc% always returns ‘smoothed’.

- (send a-dc set-smoothing mode) ⇒ void
  mode: symbol in ‘(unsmoothed smoothed aligned)

Sets the smoothing mode for the drawing context.

set-text-background

Sets the current text background color for this object. The text background color is painted behind text that is drawn with draw-text, but only for the ‘solid’ text mode (see set-text-mode).

On a monochrome display, all non-white colors are treated as black.

- (send a-dc set-text-background color) ⇒ void
  color: color% object

set-text-foreground

- (send a-dc set-text-foreground color) ⇒ void
  color: color% object

Sets the current text foreground color for this object, used for drawing text with draw-text.

On a monochrome display, all non-black colors are treated as white.

set-text-mode

Determines how text is drawn:

- ‘solid’ — Before text is drawn, the destination area is filled with the text background color (see set-text-background).
• ’transparent — Text is drawn directly over any existing image in the destination, as if overlaying text written on transparent film.

  - (send a-dc set-text-mode mode) ⇒ void
    \textit{mode: symbol in ’(solid transparent)}

\textbf{start-doc}

Starts a document, relevant only when drawing to a printer or PostScript device (including to a PostScript file).

  - (send a-dc start-doc message) ⇒ boolean
    \textit{message: string}
    For some platforms, the \textit{message} string is displayed in a dialog until \texttt{end-doc} is called.

\textbf{start-page}

Starts a page, relevant only when drawing to a printer or PostScript device (including to a PostScript file).

  - (send a-dc start-page) ⇒ void

\textbf{try-color}

Determines the actual color used for drawing requests with the given color.

  - (send a-dc try-color try result) ⇒ void
    \textit{try: color% object}
    \textit{result: color% object}
    The \textit{result} color is set to the RGB values that are actually produced for this drawing context to draw the color \textit{try}.

\textbf{6.9 dc-path%}

A path is a set of figures defined by curves. A path can be used with the \texttt{draw-path} method of a \texttt{dc<%>} object to draw the path’s curves as lines, fill the region bounded by the path’s curves, or both. A path can also be used with the \texttt{set-path} method of a \texttt{region%} object to generate a region bounded by the path’s curves.

A path consists of zero or more closed sub-paths, and possibly one open sub-path. Some \texttt{dc-path%} methods extend the open sub-path, some \texttt{dc-path%} methods close the open sub-path, and some \texttt{dc-path%} methods add closed sub-paths.

When a path is drawn as a line, a closed sub-path is drawn as a closed figure, analogous to a polygon. An open sub-path is drawn with disjoint start and end points, analogous lines drawn with \texttt{draw-lines in dc<%>}

When a path is filled or used as a region, the open sub-path (if any) is treated as if it were closed. The content of a path is determined either through the ’even-odd rule or the ’winding rule, as selected at the time when the path is filled or used to generate a region.

  - (make-object dc-path%) ⇒ dc-path% object
    Creates a new path that contains no sub-paths (and no open sub-path).
append

Adds the sub-paths of a given path to this one. Closed sub-paths of the given path are added as as closed sub-paths to this one. If both paths have an open sub-path, then this path’s sub-path is extended by the given path’s open sub-path, adding a line from this path’s current ending point to the given path’s starting point. If only one of the paths has an open sub-path, then it becomes (or remains) this path’s open sub-path.

- (send a-dc-path append path) ⇒ void
  path: dc-path% object

arc

Extends or starts the path’s open sub-path with a curve that corresponds to a section of an ellipse. The ellipse is the one bounded by a rectangle whose top-left corner is \((x, y)\) and whose dimensions are \(\text{width}\) by \(\text{height}\). The ellipse section starts a the angle \(\text{start-radians}\) (0 is three o’clock and half-pi is twelve o’clock) and continues to the angle \(\text{end-radians}\); if \(\text{counter-clockwise}\?\) is true, then the arc runs counter-clockwise from \(\text{start-radians}\) to \(\text{end-radians}\), otherwise it runs clockwise.

If the path has no open sub-path, a new one is started with the arc’s starting point. Otherwise, the arc extends the existing sub-path, and the existing path is connected with a line to the arc’s starting point.

A path is not connected to any particular dc<> object, so setting a dc<> origin or scale does not affect path operations. Instead, a dc<>’s origin and scale apply at the time that the path is drawn or used to set a region.

- (send a-dc-path arc x y width height start-radians end-radians counter-clockwise?) ⇒ void
  x : real number
  y : real number
  width : non-negative real number
  height : non-negative real number
  start-radians : real number
  end-radians : real number
  counter-clockwise? = #t : boolean

close

Closes the path’s open sub-path. If the path has no open sub-path, an exn:fail:contract exception is raised.

- (send a-dc-path close) ⇒ void

curve-to

Extends the path’s open sub-path with a Bezier curve to the given point \((x3, y3)\), using the points \((x1, y1)\) and \((x2, y2)\) as control points. If the path has no open sub-path, an exn:fail:contract exception is raised.

A path is not connected to any particular dc<> object, so setting a dc<> origin or scale does not affect path operations. Instead, a dc<>’s origin and scale apply at the time that the path is drawn or used to set a region.

- (send a-dc-path curve-to x1 y1 x2 y2 x3 y3) ⇒ void
  x1 : real number
  y1 : real number


\[ x_2 : \text{real number} \]
\[ y_2 : \text{real number} \]
\[ x_3 : \text{real number} \]
\[ y_3 : \text{real number} \]

**ellipse**

Closes the open sub-path, if any, and adds a closed path that represents an ellipse bounded by a rectangle whose top-left corner is \((x, y)\) and whose dimensions are \(width\) by \(height\). (This convenience method is implemented in terms of close and arc.)

A path is not connected to any particular \(\text{dc} \) object, so setting a \(\text{dc} \)'s origin or scale does not affect path operations. Instead, a \(\text{dc} \)'s origin and scale apply at the time that the path is drawn or used to set a region.

\[- (\text{send } a-\text{dc-path ellipse } x \ y \ \text{width} \ \text{height}) \Rightarrow \text{void} \]
\[ x : \text{real number} \]
\[ y : \text{real number} \]
\[ width : \text{non-negative real number} \]
\[ height : \text{non-negative real number} \]

**get-bounding-box**

Returns a rectangle that encloses the path’s points. The return values are the left, top, width, and height of the rectangle.

For curves within the path, the bounding box enclosed the two control points as well as the start and end points. Thus, the bounding box does not always tightly bound the path.

A path is not connected to any particular \(\text{dc} \) object, so setting a \(\text{dc} \)'s origin or scale does not affect path operations. Instead, a \(\text{dc} \)'s origin and scale apply at the time that the path is drawn or used to set a region.

\[- (\text{send } a-\text{dc-path get-bounding-box}) \Rightarrow \text{four real numbers} \]

**line-to**

Extends the path’s open sub-path with a line to the given point. If the path has no open sub-path, an \(\text{exn:fail:contract} \) exception is raised.

A path is not connected to any particular \(\text{dc} \) object, so setting a \(\text{dc} \)'s origin or scale does not affect path operations. Instead, a \(\text{dc} \)'s origin and scale apply at the time that the path is drawn or used to set a region.

\[- (\text{send } a-\text{dc-path line-to } x \ y) \Rightarrow \text{void} \]
\[ x : \text{real number} \]
\[ y : \text{real number} \]

**lines**

Extends the path’s open sub-path with a sequences of lines to the given points. If the path has no open sub-path, an \(\text{exn:fail:contract} \) exception is raised. (This convenience method is implemented in terms of line-to.)

A path is not connected to any particular \(\text{dc} \) object, so setting a \(\text{dc} \)'s origin or scale does not affect path operations. Instead, a \(\text{dc} \)'s origin and scale apply at the time that the path is drawn or used to set a region.
- (send a-dc-path lines points xoffset yoffset) ⇒ void
  points: list of point objects
  xoffset = 0: real number
  yoffset = 0: real number

move-to
After closing the open sub-path, if any, starts a new open sub-path with the given initial point.

A path is not connected to any particular dc object, so setting a dc origin or scale does not affect path operations. Instead, a dc’s origin and scale apply at the time that the path is drawn or used to set a region.

- (send a-dc-path move-to x y) ⇒ void
  x: real number
  y: real number

open?
Returns #t if the path has an open sub-path, #f otherwise.

- (send a-dc-path open?) ⇒ boolean

rectangle
Closes the open sub-path, if any, and adds a closed path that represents a rectangle whose top-left corner is \((x, y)\) and whose dimensions are width by height. (This convenience method is implemented in terms of close, move-to, and line-to.)

- (send a-dc-path rectangle x y width height) ⇒ void
  x: real number
  y: real number
  width: non-negative real number
  height: non-negative real number

reset
Removes all sub-paths of the path.

- (send a-dc-path reset) ⇒ void

reverse
Reverses the order of all points in all sub-paths. If the path has an open sub-path, the starting point becomes the ending point, and extensions to the open sub-path build on this new ending point. Reversing a closed sub-path affects how it combines with other sub-paths when determining the content of a path in ‘winding mode.

- (send a-dc-path reverse) ⇒ void
rotate

Adjusts all points within the path (including all sub-paths), rotating them radians counter-clockwise around (0, 0). Future additions to the path are not rotated by this call.

A path is not connected to any particular dc<%> object, so setting a dc<%> origin or scale does not affect path operations. Instead, a dc<%>’s origin and scale apply at the time that the path is drawn or used to set a region.

- (send a-dc-path rotate radians) ⇒ void
  radians: real number

rounded-rectangle

Closes the open sub-path, if any, and adds a closed path that represents a round-cornered rectangle whose top-left corner is (x, y) and whose dimensions are width by height. (This convenience method is implemented in terms of close, move-to, arc, and line-to.)

A path is not connected to any particular dc<%> object, so setting a dc<%> origin or scale does not affect path operations. Instead, a dc<%>’s origin and scale apply at the time that the path is drawn or used to set a region.

- (send a-dc-path rounded-rectangle x y width height radius) ⇒ void
  x: real number
  y: real number
  width: non-negative real number
  height: non-negative real number
  radius = -0.25: real number

  If radius is positive, the value is used as the radius of the rounded corner. If radius is negative, the absolute value is used as the proportion of the smallest dimension of the rectangle.

  If radius is less than −0.5 or more than half of width or height, an exn:fail:contract exception is raised.

scale

Adjusts all points within the path (including all sub-paths), multiplying each x-coordinate by x and each y-coordinate by y. Scaling by a negative number flips the path over the corresponding axis. Future additions to the path are not scaled by this call.

A path is not connected to any particular dc<%> object, so setting a dc<%> origin or scale does not affect path operations. Instead, a dc<%>’s origin and scale apply at the time that the path is drawn or used to set a region.

- (send a-dc-path scale x y) ⇒ void
  x: real number
  y: real number

translate

Adjusts all points within the path (including all sub-paths), shifting them x to the right and y down. Future additions to the path are not translated by this call.

A path is not connected to any particular dc<%> object, so setting a dc<%> origin or scale does not affect path operations. Instead, a dc<%>’s origin and scale apply at the time that the path is drawn or used to set a region.
- (send a-dc-path translate x y) ⇒ void
  x: real number
  y: real number

6.10 font%

A font is an object which determines the appearance of text, primarily when drawing text to a device context. A font is determined by seven properties:

- size — The size of the text, either in points (the default) or logical drawing units, depending on the “size-in-pixels?” property (see below).
- family — A platform- and device-independent font designation. The families are:
  - 'default
  - 'decorative
  - 'roman
  - 'script
  - 'swiss
  - 'modern (fixed width)
  - 'symbol (Greek letters and more)
  - 'system (used to draw control labels)

The ‘modern designation is special under Mac OS X and X with fontconfig/Xft; characters in the “ASCII” range 0-255 are converted to Unicode characters that match Adobe symbols. For example, “a” is converted to the Greek letter alpha.
- face — A string face name, such as "Courier" (under Windows and Mac OS X), "*-courier" (under X), or " Luxi Sans" (under X with fontconfig/Xft; note the leading space). The format and meaning of a face name is platform- and device-specific. If a font’s face name is #f, then the font’s appearance depends only on the family. If a face is provided but no mapping is available for the face name (for a specific platform or device), then the face name is ignored and the family is used. See font-name-directory for information about how face names are mapped for drawing text.
- style — The slant style of the font, one of:
  - 'normal
  - 'slant (Windows, Mac OS X: same as ‘italic; X: tries ‘italic if ‘slant font does not exist)
  - ‘italic (X: tries ‘slant if ‘italic font does not exist)
- weight — The weight of the font, one of:
  - 'normal
  - 'light
  - 'bold
- underline? — #t for underlined, #f for plain.
- smoothing — Amount of anti-alias smoothing, one of:
  - 'default (platform-specific, sometimes user-configurable)
  - ‘partly-smoothed (Windows: TrueType when available; Mac OS X: 4-bit, pixel-aligned smoothing; X: fontconfig/Xft when available)
  - ‘smoothed (Windows: ClearType when available, XP and up; Mac OS X: Quartz smoothing; X: fontconfig/Xft when available)
  - ‘unsmoothed

Special case: ‘default corresponds to ‘partly-smoothed when used with the ‘modern family and a font size between 9 and 13 (inclusive).
• size-in-pixels? — #t if the size of the font is in logical drawing units (i.e., pixels for an unscaled screen or bitmap drawing context), #f if the size of the font is in points (which can depend on screen resolution).

To avoid creating multiple fonts with the same characteristics, use the global font-list% object the-font-list.

See also font-name-directory<%>.

- (make-object font%) ⇒ font% object
  Creates an instance of the default font.

- (make-object font% size family style weight underline? smoothing size-in-pixels?) ⇒ font% object
  size: exact integer in [1, 255]
  family: symbol in '(default decorative roman script swiss modern symbol system)
  style: 'normal: symbol in '(normal italic slant)
  weight: 'normal: symbol in '(normal bold light)
  underline?: #f: boolean
  smoothing: 'default: symbol in '(default partly-smoothed smoothed unsmoothed)
  size-in-pixels?: #f: boolean

  Creates a font with a family, but no face name.
  See font% for information about family, style, and weight. See also font-name-directory<%>.

- (make-object font% size face family style weight underline? smoothing size-in-pixels?) ⇒ font% object
  size: exact integer in [1, 255]
  face: string
  family: symbol in '(default decorative roman script swiss modern symbol system)
  style: 'normal: symbol in '(normal italic slant)
  weight: 'normal: symbol in '(normal bold light)
  underline?: #f: boolean
  smoothing: 'default: symbol in '(default partly-smoothed smoothed unsmoothed)
  size-in-pixels?: #f: boolean

  See font% for information about family, style, and weight. See also font-name-directory<%> for information about the way face is interpreted for drawing text on various platforms and devices. When a platform- or device-specific interpretation of face is not available, the family is used to draw text.

get-face

Gets the font’s face name, or #f if none is specified.

- (send a-font get-face) ⇒ string or #f

get-family

Gets the font’s family. See font% for information about families.

- (send a-font get-family) ⇒ symbol in '(default decorative roman script swiss modern symbol system)
6.10. font%

get-font-id

Gets the font’s ID, for use with a font-name-directory<%>. The ID is determined by the font’s face and family specifications, only.

- (send a-font get-font-id) ⇒ exact integer

get-point-size

Gets the font’s size (roughly the height). Despite the method name, the size may be in logical units instead of points, depending on the result of get-size-in-pixels.

Due to space included in a font by a font designer, a font tends to generate text that is slightly taller than the nominal size.

- (send a-font get-point-size) ⇒ exact integer in [1, 255]

get-size-in-pixels

Returns #t if the size reported by get-point-size is in logical drawing units, #f if it is in points.

For a size in points and a screen or bitmap drawing context, the logical height depends on the resolution of the screen.

- (send a-font get-size-in-pixels) ⇒ boolean

get-smoothing

Gets the font’s anti-alias smoothing mode. See font% for information about smoothing.

- (send a-font get-smoothing) ⇒ symbol in ’(default partly-smoothed smoothed unsmoothed)

get-style

Gets the font’s slant style. See font% for information about styles.

- (send a-font get-style) ⇒ symbol in ’(normal italic slant)

get-underlined

Returns #t if the font is underlined or #f otherwise.

- (send a-font get-underlined) ⇒ boolean

get-weight

Gets the font’s weight. See font% for information about weights.

- (send a-font get-weight) ⇒ symbol in ’(normal bold light)
screen-glyph-exists?

Returns \#t if the given character has a corresponding glyph when drawing to the screen or a bitmap, \#f otherwise.

If the second argument is true, the result indicates whether the glyph is available for control labels. Otherwise, it indicates whether the glyph is available for dc<%> drawing.

For dc<%> drawing, due to automatic font substitution when drawing or measuring text, the result of this method does not depend on this font’s attributes (size, face, etc.). The font’s attributes merely provide a hint for the glyph search.

See also glyph-exists?.

- (send a-font screen-glyph-exists? c for-label?) \⇒ boolean
  c: char
  for-label? = \#f: boolean

6.11 font-list%

A font-list% object maintains a list of font% objects to avoid repeatedly creating fonts.

A global font list, the-font-list, is created automatically.

- (make-object font-list%) \⇒ font-list% object
  Creates an empty font list.

find-or-create-font

Finds an existing font in the list or creates a new one (that is automatically added to the list).

- (send a-font-list find-or-create-font size family style weight underline? smoothing size-in-pixels?) \⇒ font% object
  size: exact integer in [1, 255]
  family: symbol in ’(default decorative roman script swiss modern symbol system)
  style: symbol in ’(normal italic slant)
  weight: symbol in ’(normal bold light)
  underline? = \#f: boolean
  smoothing = ’default: symbol in ’(default partly-smoothed smoothed unsmoothed)
  size-in-pixels? = \#f: boolean
  See font% for information about family, style, weight, and smoothing.

- (send a-font-list find-or-create-font size face family style weight underline smoothing size-in-pixels?) \⇒ void
  size: exact integer in [1, 255]
  face: string
  family: symbol in ’(default decorative roman script swiss modern symbol system)
  style: symbol in ’(normal italic slant)
  weight: symbol in ’(normal bold light)
  underline = \#f: boolean
  smoothing = ’default: symbol in ’(default partly-smoothed smoothed unsmoothed)
  size-in-pixels? = \#f: boolean
See `font%` for information about `family`, `style`, `weight`, and `smoothing`. See also `font-name-directory<%>` about the use of `face`.

### 6.12 font-name-directory<%>

There is one font-name-directory<%> object: `the-font-name-directory`. It implements the mapping from font specifications (face, family, style, and weight) to information for rendering text on a specific device. The mapping is different for each platform. For example, when drawing to a bitmap in Windows, the rendering information is simply the name of a Windows font. When drawing to a PostScript file, the rendering information is a PostScript font name, which encapsulates the style and weight. When drawing to a bitmap in X, the rendering information is an X font string, which encapsulates the style and weight, parameterized over the size (using a “%d” placeholder).

Programmers rarely need to directly invoke methods of the-font-name-directory. It is used automatically when drawing text to a `dc<%>` object. Nevertheless, the-font-name-directory is available so that programmers can query or modify the mapping manually. A programmer may also need to understand how the face-and-family mapping works.

To extract mapping information from the-font-name-directory, first obtain a font ID, which is an index based on a family and an optional face string. Font IDs are returned by `find-or-create-font-id` and `get-font-id`. A Font ID can be combined with a weight and style to obtain a specific mapping value via `get-screen-name` or `get-post-script-name`.

For a family without a face string, the corresponding font ID has a useful built-in mapping for every platform and device. (The built-in mapping can be overridden through the user’s preferences; see “Font Preferences” (section 13, page 367) for information.) For a family with a face string, the-font-name-directory interprets the string (in a platform-specific way) to generate a mapping for “screen” drawing (to a canvas’s `dc<%>`, a `bitmap-dc%`, or a `printer-dc%`). When drawing to a `post-script-dc%` object, the face-specific mapping defaults to the family’s mapping.

Under Windows and Mac OS X, a face name is interpreted simply as a system font name for drawing to the screen, bitmap, or printer. The mapping succeeds if the system provides a font with the given name, and fails otherwise. For example, under Windows, "MS Sans Serif" maps to the font that is typically used for button labels. Under X, a face name has a more complex interpretation:

- If the string begins with " " (a space), then the remainder of the string is interpreted as a fontconfig/Xft font name, but only if fontconfig/Xft support is enabled at compile time (which is the default when available), and only if the RENDER extension is available at run time. Multiple fontconfig/Xft font names can appear after the initial space, separated by commas; the first available font is used to draw text, and later fonts are substituted for missing characters in earlier fonts.

- If the string begins with "+", then the remainder of the string is interpreted as an X font name. These names are usually long, such as "+-b&h-lucidatypewriter-medium-r-normal-sans-24-240-75-75-m-140-iso8859-1". As usual for X font names, asterisks may appear in the string as wildcards. Furthermore, the size of the font can be parameterized by using "%d" in the place of a specific point size; if an asterisk appears in place of the pixel size, the asterisk and "%d" are swapped when the font size is specified in pixels (otherwise the size is always interpreted as points). For rotated text, "%d" will be replaced by a transformation matrix.

- A string of the form "+-provider-font" is equivalent to "+-provider-font-weight-style-normal-+-+-%d-+-", where `weight` is either medium, light or bold (depending on the requested weight mapping) and `style` is either r, i, or l (depending on the requested style mapping).

- A string of the form "-font" is equivalent to "-+-font".

- A string of any other format is interpreted as an X font name, optionally parameterized with "%d".
The mapping for face names can be overridden (on all platforms) through the user’s preferences, as described in “Font Preferences” (section 13, page 367).

find-family-default-font-id

Gets the font ID representing the default font for a family. See font% for information about font families.

- (send a-font-name-directory find-family-default-font-id family) ⇒ exact integer
  family : symbol in ’(default decorative roman script swiss modern symbol system)

find-or-create-font-id

Gets the face name for a font ID, initializing the mapping for the face name if necessary.
Font ID are useful only as mapping indices for the-font-name-directory.

- (send a-font-name-directory find-or-create-font-id name family) ⇒ exact integer
  name : string
  family : symbol in ’(default decorative roman script swiss modern symbol system)

get-face-name

Gets the face name for a font ID. If the font ID corresponds to the default font for a particular family, #f is returned.

- (send a-font-name-directory get-face-name font-id) ⇒ string or #f
  font-id : exact integer

get-family

Gets the family for a font ID. See font% for information about font families.

- (send a-font-name-directory get-family font-id) ⇒ symbol in ’(default decorative roman script swiss modern symbol system)
  font-id : exact integer

get-font-id

Gets the font ID for a face name paired with a default family. If the mapping for the given pair is not already initialized, 0 is returned. See also find-or-create-font-id.
Font ID are useful only as mapping indices for the-font-name-directory.

- (send a-font-name-directory get-font-id name family) ⇒ exact integer
  name : string
  family : symbol in ’(default decorative roman script swiss modern symbol system)
6.12. font-name-directory

get-post-script-name

Gets a PostScript font name for a font ID, weight, and style combination. The PostScript font name is used both for the font name in PostScript output (sans character set) and as the Adobe Font Metrics file name; see also “PostScript Fonts” (section 13.6, page 371).

- (send a-font-name-directory get-post-script-name font-id weight style) ⇒ string or #f
  font-id: exact integer
  weight: symbol in ’(normal bold light)
  style: symbol in ’(normal italic slant)

  See font% for information about weight and style.

get-screen-name

Gets a platform-dependent screen font name (used for drawing to a canvas’s dc, a bitmap-dc, or a printer-dc) for a font ID, weight, and style combination.

- (send a-font-name-directory get-screen-name font-id weight style) ⇒ string or #f
  font-id: exact integer
  weight: symbol in ’(normal bold light)
  style: symbol in ’(normal italic slant)

  See font% for information about weight and style.

set-post-script-name

Sets a PostScript font name for a font ID, weight, and style combination. See also get-post-script-name.

- (send a-font-name-directory set-post-script-name font-id weight style name) ⇒ void
  font-id: exact integer
  weight: symbol in ’(normal bold light)
  style: symbol in ’(normal italic slant)
  name: string

  See font% for information about weight and style.

set-screen-name

Sets a platform-dependent screen font name (used for drawing to a canvas’s dc, a bitmap-dc, or a printer-dc) for a font ID, weight, and style combination.

Under X, if the screen name contains “%d,” it is replaced by the size of the font (point size times 10) to obtain the full screen font name.

- (send a-font-name-directory set-screen-name font-id weight style name) ⇒ void
  font-id: exact integer
  weight: symbol in ’(normal bold light)
  style: symbol in ’(normal italic slant)
  name: string
See `font%` for information about `weight` and `style`.

### 6.13 gl-config%

A `gl-config%` object encapsulates configuration information for an OpenGL drawing context. Use a `gl-config%` object as an initialization argument for `canvas%`, or provide it to `set-gl-config in bitmap%`.

- `(new gl-config% ) ⇒ gl-config% object`

  Creates a GL configuration that indicates double buffering, a depth buffer of size one, no stencil buffer, no accumulation buffer, no multisampling, and not stereo.

#### get-accum-size

Reports the accumulation-buffer size (for each of red, green, blue, and alpha) that the configuration requests, where zero means no accumulation buffer is requested.

- `(send a-gl-config get-accum-size) ⇒ exact integer in [0, 256]`

#### get-depth-size

Reports the depth-buffer size that the configuration requests, where zero means no depth buffer is requested.

- `(send a-gl-config get-depth-size) ⇒ exact integer in [0, 256]`

#### get-double-buffered

Reports whether the configuration requests double buffering or not.

- `(send a-gl-config get-double-buffered) ⇒ boolean`

#### get-multisample-size

Reports the multisampling size that the configuration requests, where zero means no multisampling is requested.

- `(send a-gl-config get-multisample-size) ⇒ exact integer in [0, 256]`

#### get-stencil-size

Reports the stencil-buffer size that the configuration requests, where zero means no stencil buffer is requested.

- `(send a-gl-config get-stencil-size) ⇒ exact integer in [0, 256]`

#### get-stereo

Reports whether the configuration requests stereo or not.

- `(send a-gl-config get-stereo) ⇒ boolean`
set-accum-size

Adjusts the configuration to request a particular accumulation-buffer size for every channel (red, green, blue, and alpha), where zero means no accumulation buffer is requested.

- (send a-gl-config set-accum-size on?) ⇒ void
  on? : exact integer in [0, 256]

set-depth-size

Adjusts the configuration to request a particular depth-buffer size, where zero means no depth buffer is requested.

- (send a-gl-config set-depth-size on?) ⇒ void
  on? : exact integer in [0, 256]

set-double-buffered

Adjusts the configuration to request double buffering or not.

- (send a-gl-config set-double-buffered on?) ⇒ void
  on? : boolean

set-multisample-size

Adjusts the configuration to request a particular multisample size, where zero means no multisampling is requested. If a multisampling context is not available, this request will be ignored.

- (send a-gl-config set-multisample-size on?) ⇒ void
  on? : exact integer in [0, 256]

set-stencil-size

Adjusts the configuration to request a particular stencil-buffer size, where zero means no stencil buffer is requested.

- (send a-gl-config set-stencil-size on?) ⇒ void
  on? : exact integer in [0, 256]

set-stereo

Adjusts the configuration to request stereo or not.

- (send a-gl-config set-stereo on?) ⇒ void
  on? : boolean

6.14 gl-context<%>

A gl-context<%> object represents a context for drawing with OpenGL to a specific dc<%> instance. To obtain a gl-context<%> object, call get-gl-context of the target drawing context.
Only canvas `dc` and bitmap-`dc` objects support OpenGL (always under Windows and Mac OS X, sometimes under X), and in the case of a bitmap-`dc`, the context is usable only when the target bitmap is non-monochrome. When the target bitmap for a bitmap-`dc` context is changed via `set-bitmap`, the associated OpenGL context is reset, but the `gl-context` keeps its identity. Canvas contexts are double buffered, and bitmap contexts are single buffered.

MrEd provides no OpenGL routines. Instead, they must be obtained from a separate library, such as (lib "sgl.ss" "sgl"). MrEd merely manages the current OpenGL context, connecting it to windows and bitmaps.

Only one OpenGL context can be active at a time across all threads and eventspaces. Except under Mac OS X, OpenGL contexts are not protected against interference among threads; that is, if a thread selects one of its OpenGL contexts, then other threads can write into the context via OpenGL commands. However, if all threads issue OpenGL commands only within a thunk passed to `call-as-current`, then drawing from the separate threads will not interfere, because `call-as-current` uses a lock to serialize context selection across all threads in MrEd.

call-as-current

Calls a thunk with this OpenGL context as the current context for OpenGL commands.

The method blocks to obtain a lock that protects the global OpenGL context, and it releases the lock when the thunk returns or escapes. The lock is re-entrannt, so a nested use of the method in the same thread with the same OpenGL context does not obtain or release the lock.

The lock prevents interference among OpenGL-using threads. If a thread is terminated while holding the context lock, the lock is released. Continuation jumps into the thunk do not grab the lock or set the OpenGL context. See `gl-context` for more information on interference.

The method accepts an alternate waitable for use while blocking for the context lock; see `sync`, §7.7 in PLT MzScheme: Language Manual for more information on waitables.

The result of the method call is the result of the thunk if it is called, or the result of the alternate waitable if it is chosen instead of the context lock.

If `ok?` returns #f at the time that this method is called, then an `exn:fail:contract` exception is raised.

- (send a-gl-context call-as-current thunk alternate enable-breaks?) ⇒ return
  value of thunk or waitable
  thunk : a procedure of no arguments
  alternate = permanently blocked waitable : waitable
  enable-breaks? = #f: boolean

  If `enable-breaks?` is true, then the method uses `sync/enable-break`, §7.7 in PLT MzScheme: Language Manual while blocking for the context-setting lock instead of `sync`.

ok?

Returns #t if this context is available OpenGL drawing, #f otherwise.

A context is unavailable if OpenGL support is disabled at compile time or run time, if the context is associated with a bitmap-`dc` with no selected bitmap or with a monochrome selected bitmap, if the context is for a canvas that no longer exists, or if there was a low-level error when preparing the context.
6.15 pen%

A pen is a drawing tool with a color, width, and style. A pen draws lines and outlines, such as the outline of a rectangle. On a monochrome display, all non-white pens are drawn as black.

In addition to its color, width, and style, a pen can have a stipple bitmap that is a 8 x 8 monochrome bitmap. This stipple is used only in unsmoothed mode (see \texttt{set-smoothing}) or in a PostScript drawing context. Painting with a stipple pen is similar to calling \texttt{draw-bitmap} with the stipple bitmap in region painted by the pen.

A pen’s style is one of the following:

- `'transparent` — Draws with no effect (on the outline of the drawn shape).
- `'solid` — Draws using the pen’s color. If a (monochrome) stipple is installed into the pen, black pixels from the stipple are transferred to the destination using the brush’s color, and white pixels from the stipple are not transferred.
- `'xor` — In unsmoothed mode, the pen’s color or colored stipple is \texttt{xor}-ed with existing destination pixel values. The `'xor` mapping is unspecified for arbitrary color combinations, but the mapping provides two guarantees:
  - Black-and-white drawing to a color or monochrome destination always works as expected: black \texttt{xor} white = black, white \texttt{xor} black = black, black \texttt{xor} black = white, and white \texttt{xor} white = white.
  - Performing the same drawing operation twice in a row with `'xor` is equivalent to a no-op.

  In a smoothing mode, `'xor` is equivalent to `'solid`.
- `'hilite` — In unsmoothed mode, existing destination pixels are “highlighted” in a platform-specific way when the pen color is black. Under Windows for a color drawing context, the inverted RGB components of destination pixel are combined with the RGB components of the system-wide highlight color using a bitwise “or”, and the combination is used. Under Mac OS X for a color drawing context, the inverted RGB components of the system-wide highlight color are subtracted from the RGB components of each destination pixel, and the difference (or 0 for a negative result) is used. Under X or for any monochrome drawing context, `'hilite` is the same as `'xor`. In a smoothing mode, `'hilite` is treated like `'solid`.

- The following special pen modes use the pen’s color, and they only apply when a stipple is not used:
  - `'dot`
  - `'long-dash`
  - `'short-dash`
  - `'dot-dash`
  - `'xor-dot`
  - `'xor-long-dash`
  - `'xor-short-dash`
  - `'xor-dot-dash`
To avoid creating multiple pens with the same characteristics, use the global pen-list% object the-pen-list, or provide a color, width, and style to set-pen in dc<>.

A pen of size 0 uses the minimum line size for the destination drawing context. In (unscaled) canvases and bitmaps in unsmoothed mode, a zero-width pen behaves the nearly same as a pen of size 1. In a smoothing mode (including all post-script-dc% drawing), a pen of size 0 draws a line thinner than a pen of size 1. If the pen’s width is not an integer, then the width is truncated to an integer (even before scaling) in unsmoothed mode.

- (make-object pen%) ⇒ pen% object

- (make-object pen% color width style) ⇒ pen% object
  color: color% object
  width: real number in [0, 255]

Creates a pen using a color object.

- (make-object pen% color-name width style) ⇒ pen% object
  color-name: string
  width: real number in [0, 255]

Creates a pen using a color name; a color is found for the name through the global color-database% object the-color-database. If the color name is not known, the pen is initialized to black.

get-cap

Returns the pen cap style (Windows unsmoothed, X unsmoothed, all smoothing). The default is ’round.

- (send a-pen get-cap) ⇒ symbol in ’(round projecting butt)

get-color

Returns the pen’s color object.

- (send a-pen get-color) ⇒ color% object

get-join

Returns the pen join style (Windows unsmoothed, X unsmoothed, all smoothing). The default is ’round.

- (send a-pen get-join) ⇒ symbol in ’(round bevel miter)

get-stipple

Gets the current stipple bitmap, or returns #f if no stipple bitmap is installed.

- (send a-pen get-stipple) ⇒ bitmap% object or #f
get-style

Returns the pen style. See pen% for information about possible styles.

- (send a-pen get-style) ⇒ symbol in ’(transparent solid xor hilite dot long-dash short-dash dot-dash xor-dot xor-long-dash xor-short-dash xor-dot-dash)

get-width

Returns the pen width.

- (send a-pen get-width) ⇒ real number in [0, 255]

set-cap

Sets the pen cap style (Windows unsmoothed, X unsmoothed, all smoothing). See get-cap for information about cap styles.

A pen cannot be modified if it was obtained from a pen-list% or while it is selected into a drawing context.

- (send a-pen set-cap cap-style) ⇒ void
cap-style: symbol in ’(round projecting butt)

set-color

Sets the pen color.

A pen cannot be modified if it was obtained from a pen-list% or while it is selected into a drawing context.

- (send a-pen set-color color) ⇒ void
color: color% object
Sets the color to match the given color.

- (send a-pen set-color color-name) ⇒ void
color-name: string
Sets the pen color by looking up a color name in the global color-database<%> object the-color-database. The pen is not changed if the color is unknown.

- (send a-pen set-color red green blue) ⇒ void
red: exact integer in [0, 255]
green: exact integer in [0, 255]
blue: exact integer in [0, 255]
Sets the pen color to specific RGB values.

set-join

Sets the pen join style (Windows unsmoothed, X unsmoothed, all smoothing). See get-join for information about join styles.

A pen cannot be modified if it was obtained from a pen-list% or while it is selected into a drawing context.
set-stipple

Sets the pen stipple bitmap, which must be an 8 x 8 monochrome bitmap or #f, which turns off the stipple bitmap.

A bitmap cannot be used as a stipple if it is selected into a bitmap-dc% object; if the given bitmap is selected into a bitmap-dc% object, an exn:fail:contract exception is raised. A pen cannot be modified if it was obtained from a pen-list% or while it is selected into a drawing context.

A pen’s stipple is not used in a smoothing mode, except for a post-script-dc% (which is always in smoothed mode).

set-style

Sets the pen style. See pen% for information about the possible styles.

A pen cannot be modified if it was obtained from a pen-list% or while it is selected into a drawing context.

set-width

Sets the pen width.

A pen cannot be modified if it was obtained from a pen-list% or while it is selected into a drawing context.

6.16 pen-list%

A pen-list% object maintains a list of pen% objects to avoid repeatedly creating pen objects. A pen% object in a pen list cannot be mutated.

A global pen list the-pen-list is created automatically.

find-or-create-pen

Finds a pen of the given specification, or creates one and adds it to the list.
6.17. point%

A point% is used for certain drawing commands. It encapsulates two real numbers, $x$ and $y$.

- (make-object point%) ⇒ point% object
  Creates a point with 0 $x$ and $y$ values.

- (make-object point% $x$ $y$) ⇒ point% object
  $x$: real number
  $y$: real number
  Creates a point.

get-x

Gets the point $x$-value.

- (send a-point get-x) ⇒ real number

get-y

Gets the point $y$-value.

- (send a-point get-y) ⇒ real number

set-x

Sets the point $x$-value.

- (send a-point set-x $x$) ⇒ void
  $x$: real number
set-y

Sets the point y-value.

- (send a-point set-y y) ⇒ void
  
  \( y : \text{real number} \)

6.18 post-script-dc%

Implements: dc<%>

A post-script-dc% object is a PostScript device context, that can write PostScript files on any platform. See also ps-setup%.

Be sure to use the following methods to start/end drawing:

- start-doc
- start-page
- end-page
- end-doc

See also printer-dc%.

- (new post-script-dc% [(interactive .)] [(parent .)] [(use-paper-bbox .)] [(as-eps .)]) ⇒ post-script-dc% object
  
  \[ \text{interactive} = \#t : \text{boolean} \]
  
  \[ \text{parent} = \#f : \text{frame% or dialog% object or \#f} \]
  
  \[ \text{use-paper-bbox} = \#f : \text{boolean} \]
  
  \[ \text{as-eps} = \#t : \text{boolean} \]

If interactive is true, the user is given a dialog for setting printing parameters (see get-ps-setup-from-user); the resulting configuration is installed as the current configuration). If the user chooses to print to a file (the only possibility under Windows and Mac OS X), another dialog is given to select the filename. If the user hits cancel in either of these dialogs, then ok? returns \#f.

If parent is not \#f, it is used as the parent window of the configuration dialog.

If interactive is \#f, then the settings returned by current-ps-setup are used. A file dialog is still presented to the user if the get-file method returns \#f, and the user may hit cancel in that case so that ok? returns \#f.

If use-paper-bbox is \#f, then the PostScript bounding box for the output is determined by drawing commands issued to the object; such a bounding box encloses all parts of the drawing ignoring clipping regions (so the bounding box may be approximate). If use-paper-bbox is not \#f, then the bounding box is determined by the current paper size (as specified by current-ps-setup), and the bounding box does not include the margin (also specified by current-ps-setup).

If as-eps is \#f, then the generated PostScript does not include an Encapsulated PostScript (EPS) header, and instead includes a generic PostScript header. Otherwise, the generated PostScript includes a header that identifiers it as EPS.

See also ps-setup% and current-ps-setup. The settings for a particular post-script-dc% object are fixed to the values in the current configuration when the object is created (after the user has interactively adjusted them when interactive is true).
6.19 printer-dc%

Implements: dc<%>

A printer-dc% object is a Windows or Mac OS X printer device context. The class cannot be instantiated under X (an exn:misc:unsupported exception is raised).

Under Mac OS X, a newly created printer-dc% object obtains orientation information (portrait versus landscape) from the current ps-setup% object, as determined by the current-ps-setup parameter. This information can be configured by the user through a dialog shown by get-page-setup-from-user.

Be sure to use the following methods to start/end drawing:

- start-doc
- start-page
- end-page
- end-doc

See also post-script-dc%.

When a printer-dc% object is created, the user gets platform-specific modal dialogs for configuring the output.

- (new printer-dc% [(parent _)]) ⇒ printer-dc% object

  parent = #f: frame% or dialog% object or #f

  If parent is not #f, it is used as the parent window of the configuration dialog.

6.20 ps-setup%

A ps-setup% object contains configuration information for producing PostScript files using a post-script-dc% object. To a lesser extent, it contains information for printing with a printer-dc% object.

When a post-script-dc% object is created, its configuration is determined by the current-ps-setup parameter’s ps-setup% value. After a post-script-dc% object is created, it is unaffected by changes to the current-ps-setup parameter or mutations to the ps-setup% object.

- (new ps-setup% ) ⇒ ps-setup% object

  Creates a new ps-setup% object with the (platform-specific) default configuration.

  copy-from

  Copies the settings from the given ps-setup% object to this one.

  - (send a-ps-setup copy-from source) ⇒ void

    source: ps-setup% object
get-command

- (send a-ps-setup get-command) ⇒ string
  Gets the printer command used to print a file in X. The default is "lpr". This value is not used by other platforms.

get-editor-margin

- (send a-ps-setup get-editor-margin h-margin v-margin) ⇒ void
  h-margin: boxed exact non-negative integer
  v-margin: boxed exact non-negative integer
  Returns the current settings for horizontal and vertical margins when printing an editor<%>. See also set-editor-margin.

get-file

- (send a-ps-setup get-file) ⇒ path or #f
  Gets the PostScript output filename. A #f value (the default) indicates that the user should be prompted for a filename when a post-script-dc% object is created.

get-level-2

- (send a-ps-setup get-level-2) ⇒ boolean
  Reports whether Level 2 commands are output in PostScript files.
  Currently, Level 2 commands are only needed to include color bitmap images in PostScript output (drawn with draw-bitmap), or bitmap pen and brush stipples. When Level 2 commands are disabled, bitmaps are converted to grayscale images and stipples are not supported.

get-margin

- (send a-ps-setup get-margin h-margin v-margin) ⇒ void
  h-margin: boxed non-negative real number
  v-margin: boxed non-negative real number
  Returns the current settings for horizontal and vertical PostScript margins. See also set-margin.

get-mode

- (send a-ps-setup get-mode) ⇒ symbol in ’(preview file printer)
  Gets the printing mode that determines where output is sent: ’preview, ’file, or ’printer. The default for X is ’preview. The value in Windows and Mac OS X is always ’file.

get-orientation

- (send a-ps-setup get-orientation) ⇒ symbol in ’(portrait landscape)
  Gets the orientation: ’portrait or ’landscape. The default is ’portrait. Unlike most other settings, this one affects native printing (via printer-dc%) as well as PostScript output.
  Landscaped orientation affects the size of the drawing area as reported by get-size: the horizontal and vertical sizes determined by the selected paper type are transposed and then scaled.
get-paper-name

- (send a-ps-setup get-paper-name) ⇒ string

Returns the name of the current paper type: "A4 210 x 297 mm", "A3 297 x 420 mm", "Letter 8 1/2 x 11 in", or "Legal 8 1/2 x 14 in". The default is "Letter 8 1/2 x 11 in".

The paper name determines the size of the drawing area as reported by get-size (along with landscape transformations from get-orientation and/or the scaling factors of get-scaling). It also determines the bounding box of PostScript output when a post-script-dc% context is created with a true value for the use-paper-bbox? initialization argument.

get-preview-command

- (send a-ps-setup get-preview-command) ⇒ string

Gets the command used to view a PostScript file for X. The default is "gv". This value is not used by other platforms.

get-scaling

- (send a-ps-setup get-scaling x y) ⇒ void
  
  x : boxed non-negative real number
  y : boxed non-negative real number

Gets the scaling factor for PostScript output. The x box is filled with the horizontal scaling factor. The y box is filled with the vertical scaling factor. The default is 0.8 by 0.8.

This scale is in addition to a scale that can be set by set-scale in a post-script-dc% context. The size reported by get-size is the size of the selected paper type (transposed for landscaped mode) divided by this scale.

get-translation

- (send a-ps-setup get-translation x y) ⇒ void
  
  x : boxed real number
  y : boxed real number

Gets the translation (from the bottom left corner) for PostScript output. The x box is filled with the horizontal offset. The y box is filled with the vertical offset. The default is 0.0 and 0.0.

The translation is not scaled by the numbers returned from get-scaling and the translation does not affect the size of the drawing area.

set-command

- (send a-ps-setup set-command command) ⇒ void
  
  command : string

Sets the printer command used to print a file under X. See get-command.

set-editor-margin

- (send a-ps-setup set-editor-margin h v) ⇒ void
  
  h : exact non-negative integer
  v : exact non-negative integer
Sets the horizontal and vertical margins used when when printing an editor with the print method. These margins are always used for printing, whether the drawing destination is a post-script-dc% or printer-dc%. The margins are in the units of the destination printer-dc% or post-script-dc%. In the case of post-script-dc% printing, the editor margin is in addition to the PostScript margin that is determined by set-margin.

**set-file**

- (send a-ps-setup set-file filename) ⇒ void
  
  filename: path or #f

  Sets the PostScript output filename. See get-file.

**set-level-2**

- (send a-ps-setup set-level-2 on?) ⇒ void
  
  on?: boolean

  Sets whether Level 2 commands are output in PostScript files. See get-level-2.

**set-margin**

- (send a-ps-setup set-margin h v) ⇒ void
  
  h: non-negative real number
  v: non-negative real number

  Sets the horizontal and vertical PostScript margins. When drawing to a post-script-dc%, the page size reported by get-size subtracts these margins from the normal page area (before taking into account scaling affects). In addition, drawing into the post-script-dc% produces PostScript output that is offset by the margins.

  When using the output of a post-script-dc% as Encapsulated PostScript, the margin values are effectively irrelevant. Changing the margins moves the PostScript image in absolute coordinates, but it also moves the bounding box.

  The margins are in unscaled post-script-dc% units, which are points. The default margins are 16 points.

**set-mode**

- (send a-ps-setup set-mode mode) ⇒ void
  
  mode: symbol in ’(preview file printer)

  Sets the printing mode controlling where output is sent. See get-mode.

  Under Windows and Mac OS X, if ’preview or ’printer is provided, an exn:fail:contract exception is raised.

**set-orientation**

- (send a-ps-setup set-orientation orientation) ⇒ void
  
  orientation: symbol in ’(portrait landscape)

  Sets the orientation. See get-orientation.
set-paper-name

- (send a-ps-setup set-paper-name type) ⇒ void
  type : string

Sets the name of the current paper type. See get-paper-name.

set-preview-command

- (send a-ps-setup set-preview-command command) ⇒ void
  command : string

Sets the command used to view a PostScript file under X. See get-preview-command.

set-scaling

- (send a-ps-setup set-scaling x y) ⇒ void
  x : non-negative real number
  y : non-negative real number

Sets the scaling factor for PostScript output. See get-scaling.

set-translation

- (send a-ps-setup set-translation x y) ⇒ void
  x : real number
  y : real number

Sets the translation (from the bottom left corner) for PostScript output. See get-translation.

6.21 region%

A region% object specifies a portion of a drawing area (possibly discontinuous). It is normally used for clipping drawing operations.

Each region% object is associated to a particular dc<> object, specified when the region is created. A region can only be used with its associated dc<> object. The origin and scale of a drawing context determine the bounding box and drawing location of a region at the time that a region is created (or set); a region is independent of the current scale and origin when the region is used. For an auto-scrolled canvas, the canvas’s current scrolling applies when the region is used (and it does not affect the region’s bounding box).

See also set-clipping-region in dc<> and get-clipping-region in dc<>.

- (new region% (dc _)) ⇒ region% object
  dc : dc<> object

  Creates an empty region.

get-bounding-box

Returns a rectangle that encloses the region. The return values are the left, top, width, and height of the rectangle. The bounding box is precisely correct for unsmoothed drawing, but it is only approximate for smoothed drawing.

- (send a-region get-bounding-box) ⇒ four real numbers
get-dc

Returns the region’s drawing context.

- (send a-region get-dc) \(\Rightarrow\) dc\%

in-region?

Returns \#t if the given point is approximately within the region, \#f otherwise. The given point is scaled and translated according to the region’s dc\%’s current scale and translation.

The approximate in-region test represents the true result for unsmoothed drawing, but it not necessarily for smoothed drawing.

- (send a-region in-region? x y) \(\Rightarrow\) boolean
  
  x : real number
  y : real number

intersect

Sets the region to the intersection of itself with the given region.

This region’s DC and given region’s DC must be the same.

The result is always reliable for unsmoothed and smoothed drawing. For smoothed drawing, an intersect corresponds to clipping with this region’s path, and then clipping with the given region’s path. Further combining sends to this region correspond to combination with the original path before initial clip, and further combination with this region as an argument correspond to a combination with the given path after the initial clip. Thus, an intersecting region is a poor input for union, subtract, or xor, but it intersects properly in further calls to intersect.

- (send a-region intersect rgn) \(\Rightarrow\) void
  
  rgn : region%

is-empty?

Returns \#t if the region is approximately empty, \#f otherwise. An approximately empty region is truly empty for unsmoothed drawing, but it may contain points for smoothed drawing.

- (send a-region is-empty?) \(\Rightarrow\) boolean

set-arc

Sets the region to the interior of the specified wedge.

See also draw-ellipse in dc\%, since the region content is determined the same way as brush-based filling in a dc\%.

The result is reliable for both unsmoothed and smoothed drawing. For smoothed drawing, the region corresponds to a clockwise path with a ‘winding fill. The region is also atomic for the purposes of region combination.

- (send a-region set-arc x y width height start-radians end-radians) \(\Rightarrow\) void
  
  x : real number
6.21. region% 6. Drawing Class Reference

\[ y : \text{real number} \]
\[ width: \text{non-negative real number} \]
\[ height: \text{non-negative real number} \]
\[ start\text{-radians}: \text{real number} \]
\[ end\text{-radians}: \text{real number} \]

set-ellipse

Sets the region to the interior of the specified ellipse.

See also \texttt{draw-ellipse in dc<%>}, since the region content is determined the same way as brush-based filling in a \texttt{dc<%>}

The result is reliable for both unsmoothed and smoothed drawing. For smoothed drawing, the region corresponds to a clockwise path with a `winding fill. The region is also \textit{atomic} for the purposes of region combination.

\[- (\text{send a-region set-ellipse } x y width height) \Rightarrow \text{void} \]
\[ x : \text{real number} \]
\[ y : \text{real number} \]
\[ width: \text{non-negative real number} \]
\[ height: \text{non-negative real number} \]

Restrictions on the magnitude of drawing coordinates are described with \texttt{dc<%>}

set-path

Sets the region to the content of the given path.

See also \texttt{draw-path in dc<%>}, since the region content is determined the same way as brush-based filling in a \texttt{dc<%>}

The result is reliable for both unsmoothed and smoothed drawing. For smoothed drawing, the fill style affects how well the region reliably combines with other regions (via \texttt{union, xor, and subtract}). The region is also \textit{atomic} for the purposes of region combination.

\[- (\text{send a-region set-path } path xoffset yoffset fill\text{-style}) \Rightarrow \text{void} \]
\[ path: \text{dc-path% object} \]
\[ xoffset = 0: \text{real number} \]
\[ yoffset = 0: \text{real number} \]
\[ fill\text{-style} = \textquote{odd-even}: \text{symbol in } \textquote{(odd-even winding)} \]

set-polygon

Sets the region to the interior of the specified polygon.

See also \texttt{draw-polygon in dc<%>}, since the region content is determined the same way as brush-based filling in a \texttt{dc<%>}

The result is reliable for both unsmoothed and smoothed drawing. For smoothed drawing, the fill style affects how well the region reliably combines with other regions (via \texttt{union, xor, and subtract}). The region is also \textit{atomic} for the purposes of region combination.

\[- (\text{send a-region set-polygon } points xoffset yoffset fill\text{-style}) \Rightarrow \text{void} \]
points: list of point objects
xoffset = 0: real number
yoffset = 0: real number
fill-style = ’odd-even:symbol in’ (odd-even winding)

set-rectangle
Sets the region to the interior of the specified rectangle.

See also draw-rectangle in dc<%>, since the region content is determined the same way as brush-based filling in a dc<%>.

The result is reliable for both unsmoothed and smoothed drawing. For smoothed drawing, the region corresponds to a clockwise path with a ‘winding’ fill. The region is also atomic for the purposes of region combination.

- (send a-region set-rectangle x y width height) ⇒ void
  x: real number
  y: real number
  width: non-negative real number
  height: non-negative real number

  Restrictions on the magnitude of drawing coordinates are described with dc<%>.

set-rounded-rectangle
Sets the region to the interior of the specified rounded rectangle.

See also draw-rounded-rectangle in dc<%>, since the region content is determined the same way as brush-based filling in a dc<%>.

The result is reliable for both unsmoothed and smoothed drawing. For smoothed drawing, the region corresponds to a clockwise path with a ‘winding’ fill. The region is also atomic for the purposes of region combination.

- (send a-region set-rounded-rectangle x y width height radius) ⇒ void
  x: real number
  y: real number
  width: non-negative real number
  height: non-negative real number
  radius = -0.25: real number

  Restrictions on the magnitude of drawing coordinates are described with dc<%>.

subtract
Sets the region to the subtraction of itself minus the given region. In other words, a point is removed from the region if it is included in the given region. (The given region may contain points that are not in the current region; such points are ignored.)

This region’s DC and given region’s DC must be the same.

The result is always reliable for unsmoothed drawing. For smoothed drawing, the result is consistent across platforms and devices, but it is never a true subtraction. A subtraction corresponds to combining the sub-paths of this region with the reversed sub-paths of the given region, then intersecting the result with this region. This fails as a true subtraction, because the boundary of loops (with either ‘odd-even or ‘winding filling) is ambiguous.
- (send a-region subtract rgn) ⇒ void
  rgn: region% object

union

Sets the region to the union of itself with the given region.

This region’s DC and given region’s DC must be the same.

The result is always reliable for unsmoothed drawing. For smoothed drawing, a union corresponds to combining the sub-paths of each region into one path, using an ‘odd–even fill if either of the region uses an ‘odd–even fill (otherwise using a ‘winding fill). Consequently, while the result is consistent across platforms and devices, it is a true union only for certain input regions. For example, it is a true union for non-overlapping atomic and union regions. It is also a true union for atomic and union regions (potentially overlapping) that are all clockwise and use ‘winding fill.

- (send a-region union rgn) ⇒ void
  rgn: region% object

xor

Sets the region to the xoring of itself with the given region (i.e., contains points that are enclosed by exactly one of the two regions).

This region’s DC and given region’s DC must be the same.

The result is always reliable for unsmoothed drawing. For smoothed drawing, the result is consistent across platforms and devices, but it is not necessarily a true xoring. An xoring corresponds to combining the sub-paths of this region with the reversed sub-paths of the given region. The result uses an ‘odd–even fill if either of the region uses an ‘odd–even fill (otherwise using a ‘winding fill). Consequently, the result is a reliable xoring only for certain input regions. For example, it is reliable for atomic and xoring regions that all use ‘even–odd fill.

- (send a-region xor rgn) ⇒ void
  rgn: region% object
7. Drawing Procedures

7.1 Global Graphics

flush-display

Under X and Mac OS X, flushes pending display messages such that the user’s display reflects the actual state of the windows. Under Windows, the procedure has no effect.

- (flush-display) ⇒ void

get-display-depth

- (get-display-depth) ⇒ exact non-negative integer
  Returns the depth of the main display (a value of 1 denotes a monochrome display).

get-display-left-top-inset

When the optional argument is #f (the default), this function returns the offset of the main screen’s origin from the top-left of the physical screen. Under X and Windows, the result is always 0 and 0; under Mac OS X, the result is 0 and the height of the menu bar.

When the optional argument is true, this function returns the amount space at the left and top of the main screen that is occupied by the task bar (Windows) or menu bar and dock (Mac OS X). Under X, the result is always 0 and 0.

- (get-display-left-top-inset avoid-bars?) ⇒ two exact non-negative integers
  avoid-bars? = #f: bool

get-display-size

Gets the physical size of the display in pixels. Under Windows, this size does not include the task bar by default. Under Mac OS X, this size does not include the menu bar or dock area by default.

Under Windows and Mac OS X, if the optional argument is true, then the task bar, menu bar, and dock area are included in the result.

- (get-display-size full-screen?) ⇒ two exact non-negative integers
  full-screen? = #f: bool
  Returns the screen’s width and height.

is-color-display?

- (is-color-display?) ⇒ boolean
Returns #t if the main display has color, #f otherwise.

register-collecting-blit

Registers a blit to occur when garbage collection starts or ends.

- (register-collecting-blit canvas x y w h on off on-x on-y off-x off-y) ⇒ void
  
  canvas: canvas% object
  x: real number
  y: real number
  w: non-negative real number
  h: non-negative real number
  on: bitmap% object
  off: bitmap% object
  on-x = 0: real number
  on-y = 0: real number
  off-x = 0: real number
  off-y = 0: real number

When garbage collection starts, (send (send canvas get-dc) draw-bitmap-section on on-x on-y x y w h) is called. When garbage collection ends, (send (send canvas get-dc) draw-bitmap-section off off-x off-y x y w h) is called. If canvas's device context has a scale, the scale may or may not be temporarily disabled during the bitmap drawing.

The canvas is registered weakly, so it will be automatically unregistered if the canvas becomes invisible and inaccessible. Multiple registrations can be installed for the same canvas.

See also unregister-collecting-blit.

unregister-collecting-blit

Unregisters a blit request installed with See also register-collecting-blit.

- (unregister-collecting-blit canvas) ⇒ void
  
  canvas: canvas% object

  Unregisters all blits for canvas.

7.2  PostScript

current-ps-afm-file-paths

Sets the list of paths that is used to find AFM files. See “PostScript Fonts” (section 13.6, page 371) for more information.

- (current-ps-afm-file-paths) ⇒ immutable list of paths

  Returns the current path list.

- (current-ps-afm-file-paths paths) ⇒ void
  
  paths: list of paths/strings

  Sets the current path list.
current-ps-cmap-file-paths

Sets the list of paths that is used to find CMap files. See “PostScript Fonts” (section 13.6, page 371) for more information.

- (current-ps-cmap-file-paths) ⇒ immutable list of paths
  Returns the current path list.

- (current-ps-cmap-file-paths paths) ⇒ void
  paths: list of paths/strings
  Sets the current path list.

current-ps-setup

Sets the object that contains the current PostScript configuration settings.

- (current-ps-setup) ⇒ ps-setup% object
  Returns the current PostScript configuration object.

- (current-ps-setup ps-setup) ⇒ void
  ps-setup: ps-setup% object
  Sets the current PostScript configuration object.

7.3 Drawing Object Lists

the-brush-list

See brush-list%.

- the-brush-list ⇒ brush-list% object
  Initial value : empty brush list

the-color-database

See color-database<%>.

- the-color-database ⇒ color-database<%> object
  Initial value : basic color database

the-font-list

See font-list%.

- the-font-list ⇒ font-list% object
  Initial value : empty font list
the-font-name-directory

See font-name-directory%.

- the-font-name-directory ⇒ font-name-directory% object
  Initial value : the font name directory

the-pen-list

See pen-list%.

- the-pen-list ⇒ pen-list% object
  Initial value : empty pen list

7.4 Fonts

get-face-list

Returns a list of font face names available on the current system. If 'mono' is provided as the argument, then faces that are known to correspond to variable-width fonts are omitted from the list (Windows, X with fontconfig/Xft).

- (get-face-list family) ⇒ list of strings
  family = 'all: symbol in' (mono all)

get-family-builtin-face

Returns the built-in default face mapping for a particular font family. The built-in default can be overridden via preferences, as described in “Font Preferences” (section 13, page 367).

- (get-family-builtin-face family) ⇒ string
  family : symbol in’ (default decorative roman script swiss modern symbol system)
  See font% for information about family.

menu-control-font

This font is the default for popup-menu% objects.

Under Mac OS X, this font is slightly larger than normal-control-font. Under Windows and X, it is the same size as normal-control-font.

- menu-control-font ⇒ font% object
  Initial value : large ‘system font

normal-control-font

This font is the default for most controls, except list-box% and group-box-panel% objects.

- normal-control-font ⇒ font% object
  Initial value : standard ‘system font
small-control-font

This font is the default for group-box-panel objects, and it is a suitable for controls in a floating window and other contexts that need smaller controls.

Under Windows, this font is the same size as normal-control-font, since the Windows control font is already relatively small. Under X and Mac OS X, this font is slightly smaller than normal-control-font.

- small-control-font ⇒ font object
  Initial value: small 'system font

tiny-control-font

This font is for tiny controls.

- tiny-control-font ⇒ font object
  Initial value: tiny 'system font

view-control-font

This font is the default for list-box objects (but not list box labels, which use normal-control-font).

Under Mac OS X, this font is slightly smaller than normal-control-font, and slightly larger than small-control-font. Under Windows and X, it is the same size as normal-control-font.

- view-control-font ⇒ font object
  Initial value: medium 'system font
Part III

Editor Toolbox
8. Editor Toolbox

The editor toolbox provides a foundation for two common kinds of applications:

1. **Programs that need a sophisticated text editor** — The simple text field control is inadequate for text-intensive applications. Many programs need editors that can handle multiple fonts and non-text items.

2. **Programs that need a canvas with draggable objects** — The drawing toolbox provides a generic drawing surface for plotting lines and boxes, but many applications need an interactive canvas, where the user can drag and resize individual objects.

Both kinds of applications need an extensible editor that can handle text, images, programmer-defined items, and even embedded editors. The difference between them is the layout of items. MrEd therefore provides two kinds of editors via two classes:

- **text%** — in a text editor, items are automatically positioned in a paragraph flow.
- **pasteboard%** — in a pasteboard editor, items are explicitly positioned and draggable.

MrEd’s editor architecture addresses the full range of real-world issues for an editor—including cut-and-paste, extensible file formats, and layered text styles—while supporting a high level of extensibility. Unfortunately, the system is fairly complex as a result, and using the editor classes effectively requires a solid understanding of the structure and terminology of the editor toolbox. Nevertheless, enough applications fit one (or both) of the descriptions above to justify the depth and complexity of the toolbox and the learning investment required to use it.

A brief example illustrates how MrEd editors work. To start, an editor needs an editor-canvas% to display its contents. Then, we can create a text editor and install it into the canvas:

```scheme
(define f (instantiate frame% ("Simple Edit" #f 200 200)))
(define c (instantiate editor-canvas% (f)))
(define t (instantiate text% ()))
(send c set-editor t)
(send f show #t)
```

At this point, the editor is fully functional: the user can type text into the editor, but no cut-and-paste operations are available. We can support all of the standard operations on an editor via the menu bar:

```scheme
(define mb (instantiate menu-bar% (f)))
(define m-edit (instantiate menu% ("Edit" mb)))
(define m-font (instantiate menu% ("Font" mb)))
(append-editor-operation-menu-items m-edit)
(append-editor-font-menu-items m-font)
```

---

1 Nearly half of this manual is dedicated to documenting the editor classes.
Now, the standard cut and paste operations work, and the user can even set font styles. The user can also insert an embedded editor by selecting Insert Text from the Edit menu; after selecting the menu item, a box appears in the editor with the caret inside. Typing with the caret in the box stretches the box as text is added, and font operations apply wherever the caret is active. Text on the outside of the box is rearranged as the box changes sizes. Note that the box itself can be copied and pasted.

The content of an editor is made up of snips. An embedded editor is a single snip from the embedding editor’s point-of-view. To encode immediate text, a snip can be a single character, but more often a snip is a sequence of adjacent characters on the same line. The find-snip method extracts a snip from a text editor:

\[(\text{send } t \text{ find-snip } 0 \ 'after)\]

The above expression returns the first snip in the editor, which may be a string snip (for immediate text) or an editor snip (for an embedded editor).

An editor is not permanently attached to any display. We can take the text editor out of our canvas and put a pasteboard editor in the canvas, instead:

\[
\begin{align*}
&\text{(define } pb \text{ instantiate pasteboard\% ()}) \\
&\text{(send } c \text{ set-editor } pb)
\end{align*}
\]

With the pasteboard editor installed, the user can no longer type characters directly into the editor (because a pasteboard does not support directly entered text). However, the user can cut text from elsewhere and paste it into pasteboard, or select one of the Insert menu items in the Edit menu. Snips are clearly identifiable in a pasteboard editor (unlike a text editor) because each snip is separately dragable.

We can insert the old text editor (which we recently removed from the canvas) as an embedded editor in the pasteboard by explicitly creating an editor snip:

\[
\begin{align*}
&\text{(define } s \text{ instantiate editor-snip\% (t)) } t \text{ is the old text editor} \\
&\text{(send } pb \text{ insert } s)
\end{align*}
\]

An individual snip cannot be inserted into different editors at the same time, or inserted multiple times in the same editor:

\[
\text{(send } pb \text{ insert } s) \text{ ; no effect}
\]

However, we can make a deep copy of the snip and insert the copy into the pasteboard:

\[
\text{(send } pb \text{ insert } (\text{send } s \text{ copy}))
\]

Applications that use the editor classes typically derive new versions of the text\% and pasteboard\% classes. For example, to implement an append-only editor (which allows insertions only at the end and never allows deletions), derive a new class from text\% and override the can-insert? and can-delete? methods:

\[
\begin{align*}
&\text{(define append-only-text\%} \\
&\text{(class text\%} \\
&(\text{inherit last-position}) \\
&(\text{override can-insert? can-delete?}) \\
&(\text{define (can-insert? s l) } (= s (last-position))) \\
&(\text{define (can-delete? s l) } \#f) \\
&(\text{super-instantiate ()}))
\end{align*}
\]

8.1 Editor Structure and Terminology

MrEd supports extensible and nestable editors by decomposing an editor assembly into three functional parts:
The editor itself stores the state of the text or pasteboard and handles most events and editing operations. The editor interface defines the core editor functionality, but editors are created as instances of text or pasteboard.

A snip is a segment of information within the editor. Each snip can contain a sequence of characters, a picture, or an interactive object (such as an embedded editor). In a text editor, snips are constrained to fit on a single line and generally contain data of a single type. The snip class implements a basic snip. Other snip classes include string-snip for managing text, image-snip for managing pictures, and editor-snip for managing embedded editors.

A display presents the editor on the screen. The display lets the user scroll around an editor or change editors. Most displays are instances of the editor-canvas class, but the editor-snip class also acts as a display for embedded editors.

These three parts are illustrated by a simple word processor. The editor corresponds to the text document. The editor object receives keyboard and mouse commands for editing the text. The text itself is distributed among snips. Each character could be a separate snip, or multiple characters on a single line could be grouped together into a snip. The display roughly corresponds to the window in which the text is displayed. While the editor manages the arrangement of the text as it is displayed into a window, the display determines which window to draw into and which part of the editor to display.

Each selectable entity in an editor is an item. In a pasteboard, all selection and dragging operations work on snips, so there is a one-to-one correspondence between snips and items. In an editor, one snip contains one or more consecutive items, and every item belongs to some snip. For example, in a simple text editor, each character is an item, but multiple adjacent characters may be grouped into a single snip. The number of items in a snip is the snip’s count.

Each place where the insertion point can appear in a text editor is a position. A text editor with n items contains n + 1 positions: one position before each item, and one position after the last item.

The order of snips within a pasteboard determines each snip’s drawing plane. When two snips overlap within the pasteboard, the snip that is earlier in the order is in front of the other snip (i.e., the former is drawn after the latter, such that the former snip may cover part of the latter snip).

When an editor is drawn into a display, each snip and position has a location. The location of a position or snip is specified in coordinates relative to the top-left corner of the editor. Locations in an editor are only meaningful when the editor is displayed.

8.1.1 Administrators

Two extra layers of administration manage the display-editor and editor-snip connections. An editor never communicates directly with a display; instead, it always communicates with an editor administrator, an instance of the editor-admin class, which relays information to the display. Similarly, a snip communicates with a snip administrator, an instance of the snip-admin class.

The administrative layers make the editor hierarchy flexible without forcing every part of an editor assembly to contain the functionality of several parts. For example, a text editor can be a single item within another editor; without administrators, the text class would also have to contain all the functionality of a display (for the containing editor) and a snip (for the embedded editor). Using administrators, an editor class can serve as both a containing and an embedded editor without directly implementing the display and snip functionality.

A snip belongs to at most one editor via a single administrator. An editor also has only one administrator at a time. However, the administrator that connects the an editor to the standard display (i.e., an editor canvas) can work with other such administrators. In particular, the administrator of an editor-canvas (each one has its own administrator) can work with other editor-canvas administrators, allowing an editor to be displayed in multiple editor-canvas windows at the same time.
When an editor is displayed by multiple canvases, one of the canvases’ administrators is used as the editor’s primary administrator. To handle user and update events for other canvases, the editor’s administrator is temporarily changed and then restored through the editor’s set-admin method. The return value of the editor’s get-admin method thus depends on the context of the call.

8.1.2 Styles

A style, an instance of the style<%> interface, parameterizes high-level display information that is common to all snip classes. This includes the font, color, and alignment for drawing the item. A single style is attached to each snip.

Styles are hierarchical: each style is defined in terms of another style. There is a single root style, named "Basic", from which all other styles in an editor are derived. The difference between a base style and each of its derived style is encoded in a style delta (or simply delta). A delta encodes changes such as

- change the font family to X;
- enlarge the font by adding Y to the point size;
- toggle the boldness of the font; or
- change everything to match the style description Z.

Style objects are never created separately; rather, they are always created through a style list, an instance of the style-list% class. A style list manages the styles, servicing external requests to find a particular style, and it manages the hierarchical relationship between styles. A global style list is available, the-style-list, but new style lists can be created for managing separate style hierarchies. For example, each editor will typically have its own style list.

Each new style is defined in one of two ways:

- A derived style is defined in terms of a base style and a delta. Every style (except for the root style) has a base style, even if it does not depend on the base style in any way (i.e., the delta describes a fixed style rather than extensions to an existing style).\(^2\)

- A join style is defined in terms of two other styles: a base style and a shift style. The meaning of a join style is determined by reinterpreting the shift style; in the reinterpretation, the base style is used as the root style for the shift style.\(^3\)

Usually, when text is inserted into a text editor, it inherits the style of the preceding snip. If text is inserted into an empty editor, the text is usually assigned a style called "Standard". By default, the "Standard" style is unmodified from the root style. The default style name can be changed by overriding default-style-name.

The exception to the above is when change-style in text% is called with the current selection position (when the selection is a position and not a range). In that case, the style is remembered, and if the next editor-modifying action is a text insertion, the inserted text gets the remembered style.

See get-styles-sticky in text% for more information about the style of inserted text.

\(^2\)This is the usual kind of style inheritance, as found in word processors such as Microsoft Word.

\(^3\)This is analogous to multi-level styles, like the paragraph and character styles in FrameMaker. In this analogy, the paragraph style is the base style, and the character style is the shift style. However, FrameMaker allows only those two levels; with join styles support any number of levels.
8.2 File Format

To allow editor content to be saved to a file, the editor classes implement a special file format. (The format is used when cutting and pasting between applications or eventspaces, too). The file format is not documented, except that it begins “WXME01nn ## ”. Otherwise, the load-file and save-file methods define the format internally. The file format is the same for text and pasteboard editors. When a pasteboard saves its content to a file, it saves the snips from front to back, and also includes extra location information.

Editor data is read and written using editor-stream-in% and editor-stream-out% objects. Editor information can only be read from or written to one stream at a time. To write one or more editors to a stream, first call the function write-editor-global-header to write initialization data into an output stream. When all editors are written to the stream, call write-editor-global-footer. Similarly, reading editors from a stream is initialized with read-editor-global-header and finalized with read-editor-global-footer. Optionally, to support streams that span versions of MrEd, use write-editor-version and read-editor-version before the header operations.

The editor file data format can be embedded within another file, and it can be extended with new kinds of data. The editor file format can be extended in two ways: with snip- or content-specific data, and with editor-specific global data. These are described in the remainder of this section.

8.2.1 Encoding Snips

The generalized notion of a snip allows new snip types to be defined and immediately used in any editor class. Also, when two applications support the same kinds of snips, snip data can easily be cut and pasted between them, and the same data files will be readable by each program. This interoperability is due to a consistent encoding mechanism that is built into the snip system.

Graceful and extensible encoding of snips requires that two issues are addressed:

- To convert a snip from an encoded representation (e.g., as bytes in a file) to a memory object, a decoding function must be provided for each type of snip. Furthermore, a list of such decoders must be available to the high-level decoding process. This decoding mapping is defined by associating a snip class object to every snip. A snip class is an instance of the snip-class% class.

- Some editors may require additional information to be stored about a snip; this information is orthogonal to the type-specific information stored by the snip itself. For example, a pasteboard needs to remember a snip’s location, while a text editor does not need this information. If a data is being cut and pasted from one pasteborder to another, then information about relative locations needs to be maintained, but this information should not inhibit pasting into an editor. Extra data is associated with a snip through editor data objects, instances of the editor-data% class; decoding requires that each editor data object has an editor data class, an instance of the editor-data-class% class.

Snip classes, snip data, and snip data classes solve problems related to encoding and decoding snips. In an application that has no need for saving files or cut-and-paste, these issues can be safely ignored.

**Snip Classes** Each snip can be associated to a snip class. This “class” is not a class description in the programmer’s language; it is an object which provides a way to create new snips of the appropriate type from an encoded snip specification.

Snip class objects can be added to the eventspace-specific snip class list, which is returned by get-the-snip-class-list. When a snip is encoded, the snip’s class name is associated with the encoding; when the snip needs to be decoded, then the snip class list is searched by name to find the snip’s class. The snip class will then provide a decoding function that can create a new snip from the encoding.
If a snip class’s name is of the form "(lib ...)", then the snip class implementation can be loaded on demand. The name is parsed using read; if the result has the form (lib string ...), then it is supplied to dynamic-require along with 'snip-class. If the result is a snip-class% object, it is inserted into the current eventspace’s snip class list, and loading or saving continues using the new class.

Editor Data While a snip belongs to an editor, the editor may store extra information about a snip in some specialized way. When the snip is to be encoded, this extra information needs to be put into an editor data object so that the extra information can be encoded as well. In a text editor, extra information can be associated with ranges of items, as well as snips.

Just as a snip must be associated with a snip class to be decoded (see “Snip Classes” (section 8.2.1, page 197)), an editor data object needs an editor data class for decoding. Every editor data class object can be added to the eventspace-specific editor data class list, returned by get-the-editor-data-class-list. Alternatively, like snip classes, editor data class names can use the form "(lib ...)" to enable on-demand loading. The corresponding module should export an editor-data-class% object named 'editor-data-class.

To store and load information about a snip or region in an editor:

1. derive new classes from editor-data% and editor-data-class%.
2. derive a new class from the text% or pasteboard% class, and override the get-snip-data and set-snip-data methods and/or the get-region-data and set-region-data methods.

Note: the get-region-data and set-region-data methods are called for cut-and-paste encoding, but not for file-saving encoding; see “Global Data: Headers and Footers” (section 8.2.2, page 198) for information on extending the file format.

8.2.2 Global Data: Headers and Footers

The editor file format provides for adding extra global data in special header and footer sections. To save and load special header and/or footer records:

1. Pick a name for each header/footer record. This name should not conflict with any other header/footer record name in use, and no one else should use these names. All names beginning with “wx” are reserved for internal use. By tagging extra header and footer records with a unique name, the file can be safely loaded under a system that does not support the records.
2. Derive a new class from the text% or pasteboard% class, and override the write-headers-to-file, write-footers-to-file, read-header-from-file and/or read-footer-from-file methods.

When an editor is saved, the methods write-headers-to-file and write-footers-to-file are invoked; at this time, the derived text% or pasteboard% object has a chance to save records. To write a header/footer record, first invoke the begin-write-header-footer-to-file method, at which point the record name is provided. Once the record is written, call end-write-header-footer-to-file.

When an editor is loaded and a header/footer record is encountered, the read-header-from-file or read-footer-from-file method is invoked, with the record name as the argument. If the name matches a known record type, then the data can be loaded.

See also write-headers-to-file and write-headers-to-file.
8.3 End of Line Ambiguity

Because an editor can force a line break even when there is no carriage return item, a position alone does not always specify a location for the caret. Consider the last position of a line that is soft-broken (i.e., no carriage return is present): there is no item between the last item of the line and the first item of the next line, so two locations (one end-of-line and one start-of-line) map to the same position.

For this reason, position-setting and position-getting methods often have an extra argument. In the case of a position-setting method, the argument specifies whether the caret should be drawn at the left or right side of the page (in the event that the location is doubly defined); #t means that the caret should be drawn on the right side. Similarly, methods which calculate a position from a location will take an extra boxed boolean; the box is filled with #t if the position is ambiguous and it came from a right-side location, or #f otherwise.

8.4 Flattened Text

In plain text editors, there is a simple correlation between positions and characters. In an editor object, this is not true much of the time, but it is still sometimes useful to just “get the text” of an editor.

Text can be extracted from an editor in either of two forms:

1. **Simple text**, where there is one character per item. Items that are characters are mapped to themselves, and all other items are mapped to a period. Line breaks are represented by carriage-return characters (ASCII 13).

2. **Flattened text**, where each item can map to an arbitrary string. Items that are characters are still mapped to themselves, but more complicated items can be represented with a useful string determined by the item’s snip. Newlines are mapped to platform-specific character sequences (linefeed under X, carriage return under Mac OS X, and linefeed-carriage return under Windows). This form is called “flattened” because the editor’s items have been reduced to a linear sequence of characters.

8.5 Caret Ownership

Within a frame, only one object can contain the keyboard focus. This property must be maintained when a frame contains multiple editors in multiple displays, and when a single editor contains other editors as items.

When an editor has the keyboard focus, it will usually display the current selection or a line indicating the insertion point; the line is called the caret.

When an editor contains other editors, it keeps track of caret ownership among the contained sub-editors. When the caret is taken away from the main editor, it will revoke caret ownership from the appropriate sub-editor.

When an editor or snip is drawn, an argument to the drawing method specifies whether the caret should be drawn with the data. This argument can be any of (in increasing order):

- ’no-caret — The caret should not be drawn at all.
- ’show-inactive-caret — The caret should be drawn as inactive; items may be identified as the local current selection, but the keyboard focus is elsewhere.
- ’show-caret — The caret should be drawn to show keyboard focus ownership.

The ’show-inactive-caret display mode is useful for showing selection ranges in text editors that do not have the focus. This ’show-inactive-caret mode is distinct from ’no-caret mode; when editors are embedded, only the locally-active editor shows its selection.
8.6 Cut and Paste Time Stamps

Methods of editor that use the clipboard — including copy, cut, paste, and do-edit-operation — consume a time stamp argument. This time stamp is generally extracted from the mouse-event or key-event object that triggered the clipboard action. X uses the time stamp to synchronize clipboard operations among the clipboard clients.

All instances of event include a time stamp, which can be obtained using get-time-stamp.

If the time stamp is 0, it defaults to the current time. Using 0 as the time stamp almost always works fine, but it is considered bad manners under X.

8.7 Clickbacks

Clickbacks in a text editor facilitate the creation of simple interactive objects, such as hypertext. A clickback is defined by associating a callback function with a range of items in the editor. When a user clicks on the items in that range, the callback function is invoked. For example, a hypertext clickback would associate a range to a callback function that changes the selection range in the editor.

By default, the callback function is invoked when the user releases the mouse button. The set-clickback method accepts an optional argument that causes the callback function to be invoked on the button press, instead. This behavior is useful, for example, for a clickback that creates a popup menu.

Note that there is no attempt to save clickback information when a file is saved, since a clickback will have an arbitrary procedure associated with it.

8.8 Internal Editor Locks

Instances of editor have three levels of internal locking:

- write locking — When an editor is internally locked for writing, the abstract content of the editor cannot be changed (e.g., insertion attempts fail silently). However, snips in a text editor can still be split and merged, and the text editor can be changed in ways that affect the flow of lines. The locked-for-write? method reports whether an editor is currently locked for writing.

- flow locking — When a text editor is internally locked for reflowing, it is locked for writing, the snip content of the editor cannot change, the location of a snip cannot be computed if it is not already known (see locations-computed? in editor), and the editor cannot be drawn to a display. A request for uncomputed location information during a flow lock produces undefined results. The locked-for-flow? method reports whether an editor is currently locked for flowing.

- read locking — When an editor is internally locked for reading, no operations can be performed on the editor (e.g., a request for the current selection position returns an undefined value). This extreme state is used only during callbacks to its snips for setting the snip’s administrator, splitting the snip, or merging snips. The locked-for-read? method reports whether an editor is currently locked for reading.

The internal lock for an editor is not affected by calls to lock.

Methods that report location-independent information about an editor never trigger a lock. A method that reports location information may trigger a flow lock or write lock if the relevant information has not been computed since the last modification to the editor (see locations-computed? in editor). A method that modifies the editor in any way, even setting the selection position, can trigger a read lock, flow lock, or write lock.
8.9 Editors and Threads

An editor is not tied to any particular thread or eventspace, except to the degree that it is displayed in a canvas (which has an eventspace). Concurrent access of an editor is always safe, in the sense that the editor will not become corrupted. However, because editor access can trigger locks, and because lock-rejected operations tend to fail silently, concurrent access can produce unexpected results.

Nevertheless, the editor supports certain concurrent patterns reliably. One relevant pattern is updating an editor in one thread while the editor is displayed in a canvas that is managed by a different (handler) thread. To ensure that canvas refreshes are not performed while the editor is locked for flowing, and to ensure that refreshes do not prevent editor modifications, the following are guaranteed:

- When an editor’s refresh method is called during an edit sequence (which is started by begin-edit-sequence and ended with end-edit-sequence), the requested refresh region is recorded, but the refresh is not performed. Instead, the refresh is delayed until the end of the edit sequence.
- Attempting to start an edit sequence while a refresh is in progress blocks until the refresh is complete.
- The on-display-size-when-ready method calls on-display-size only when the editor is not being refreshed and only when an edit sequence is not in progress. In the first case, the on-display-size call is delegated to the refreshing thread to be called after the refresh completes. In the second case, the on-display-size call is delegated to the edit-sequence thread, to be called when the edit sequence is complete.

Thus, disabling an editor-canvas object (using enable) is sufficient to ensure that a background thread can modify an editor displayed by the canvas, as long as all modifications are in edit sequences. The background modifications will impair canvas refreshes minimally and temporarily, and refreshes will not impair modifications in the background thread.

A second supported pattern is reading an editor in a background thread while the editor may be manipulated in other threads. Since no location-independent reads introduce locks, the such reads in the background thread will not impair other threads. However, other threads may interfere with the background thread, causing it to receive erroneous or out-of-date content information. This one-sided guarantee is useful if the background thread’s work can be discarded when the editor is modified.
9. Editor Class Reference

9.1 Class Listing

Editors

editor<%>
|- text%
|- pasteboard%

Displays

editor-canvas%
editor-snip%

Snips

snip%
|- string-snip%
| |- tab-snip%
|- image-snip%
|- editor-snip%

Administrators

editor-admin%
|- editor-snip-editor-admin<%>
snip-admin%

Styles

add-color<%>
mult-color<%>
style<%>
style-delta%
style-list%

File Reading/Writing and Cut-and-Paste

editor-data%
editor-data-class%
editor-data-class-list<%>
editor-stream-in%
editor-stream-in-base%
9.2 add-color

An add-color object is used to additively change the RGB values of a color object. An add-color object only exists within a style-delta object.

See also get-foreground-add and get-background-add.

get

Gets all of the additive values.

- (send an-add-color get r g b) ⇒ void
  r: boxed exact integer in [-1000, 1000]
  g: boxed exact integer in [-1000, 1000]
  b: boxed exact integer in [-1000, 1000]

  The r box is filled with the additive value for the red component of the color. The g box is filled with the additive value for the green component of the color. The b box is filled with the additive value for the blue component of the color.

get-b

Gets the additive value for the blue component of the color.

- (send an-add-color get-b) ⇒ exact integer in [-1000, 1000]

get-g

Gets the additive value for the green component of the color.

- (send an-add-color get-g) ⇒ exact integer in [-1000, 1000]

get-r

Gets the additive value for the red component of the color.

- (send an-add-color get-r) ⇒ exact integer in [-1000, 1000]
set

Sets all of the additive values.

- (send an-add-color set r g b) ⇒ void
  \[r: \text{exact integer in } [-1000, 1000]\]
  \[g: \text{exact integer in } [-1000, 1000]\]
  \[b: \text{exact integer in } [-1000, 1000]\]

set-b

Sets the additive value for the blue component of the color.

- (send an-add-color set-b v) ⇒ void
  \[v: \text{exact integer in } [-1000, 1000]\]

set-g

Sets the additive value for the green component of the color.

- (send an-add-color set-g v) ⇒ void
  \[v: \text{exact integer in } [-1000, 1000]\]

set-r

Sets the additive value for the red component of the color.

- (send an-add-color set-r v) ⇒ void
  \[v: \text{exact integer in } [-1000, 1000]\]

9.3 editor<%>

The editor<%> interface is implemented by text% and pasteboard%.

add-canvas

Adds a canvas to this editor’s list of displaying canvases. (See get-canvases.)

Normally, this method is called only by set-editor in editor-canvas%.

- (send an-editor add-canvas canvas) ⇒ void
  \[canvas: \text{editor-canvas% object}\]

add-undo

Adds an undoer procedure to the editor’s undo stack. If an undo is currently being performed, the undoer is added to the editor’s redo stack. The undoer is called by the system when it is undoing (or redoing) changes to an editor, and when this undoer is the first item on the undo (or redo) stack.
The system automatically installs undo records to undo built-in editor operations, such as inserts, deletes, and font changes. Install an undoer only when it is necessary to maintain state or handle operations that are not built-in. For example, in a program where the user can assign labels to snips in a pasteboard, the program should install an undoer to revert a label change. Thus, when a user changes a snip’s label and then selects Undo (from a standard menu bar), the snip’s label will revert as expected. In contrast, there is no need to install an undoer when the user moves a snip by dragging it, because the system installs an appropriate undoer automatically.

After an undoer returns, the undoer is popped off the editor’s undo (or redo) stack; if the return value is true, then the next undoer is also executed as part of the same undo (or redo) step. The undoer should return true if the action being undone was originally performed as part of a `begin-edit-sequence` and `end-edit-sequence` sequence. The return value should also be true if the undone action was implicitly part of a sequence. To extend the previous example, if a label change is paired with a move to realign the snip, then the label-change undoer should be added to the editor after the call to `move`, and it should return `#t` when it is called. As a result, the move will be undone immediately after the label change is undone. (If the opposite order is needed, use `begin-edit-sequence` and `end-edit-sequence` to create an explicit sequence.)

The system adds undoers to an editor (in response to other method calls) without calling this method.

- `(send an-editor add-undo undoer) ⇒ void`
  
  undoer: procedure of zero arguments

`adjust-cursor`

Gets a cursor to be used in the editor’s display. If the return value is `#f`, a default cursor is used.

See also `set-cursor`.

- `(send an-editor adjust-cursor event) ⇒ cursor% object or #f`
  
  event: mouse-event% object

  If an overriding cursor has been installed with `set-cursor`, then the installed cursor is returned.

  Otherwise, if the event is a dragging event, a snip in the editor has the focus, and the snip’s `adjust-cursor` method returns a cursor, that cursor is returned.

  Otherwise, if the cursor is over a snip and the snip’s `adjust-cursor` method returns a cursor, that cursor is returned.

  Otherwise, if a cursor has been installed with `set-cursor`, then the installed cursor is returned.

  Otherwise, if the cursor is over a clickback region in an editor, an arrow cursor is returned.

  Finally, if none of the above cases apply, a default cursor is returned. For a text editor, the default cursor is an I-beam. For a pasteboard editor, the default cursor is an arrow.

`after-edit-sequence (augmentable only)`

Called after a top-level edit sequence completes (involving unnested `begin-edit-sequence` and `end-edit-sequence`).

See also `on-edit-sequence`.

- `(send an-editor after-edit-sequence) ⇒ void`

`after-load-file`

Called just after the editor is loaded from a file.
The argument to the method originally specified whether the save was successful, but failures now trigger exceptions such that the method is not even called. Consequently, the argument is always \#t.

See also \texttt{can-load-file?} and \texttt{on-load-file}.

\begin{verbatim}
- \(\text{(send an-editor after-load-file success?) \to void}\)
  \(\text{success?: boolean}\)
\end{verbatim}

\textbf{after-save-file}

Called just after the editor is saved to a file.

The argument to the method originally specified whether the save was successful, but failures now trigger exceptions such that the method is not even called. Consequently, the argument is always \#t.

See also \texttt{can-save-file?} and \texttt{on-save-file}.

\begin{verbatim}
- \(\text{(send an-editor after-save-file success?) \to void}\)
  \(\text{success?: boolean}\)
\end{verbatim}

\textbf{auto-wrap}

Enables or disables automatically calling \texttt{set-max-width} in response to \texttt{on-display-size}, or gets the state of auto-wrapping. For text editors, this has the effect of wrapping the editor’s contents to fit in a canvas displaying the editor (the widest one if multiple canvases display the editor). For pasteboard editors, “auto-wrapping” merely truncates the area of the pasteboard to match its canvas display.

Auto-wrapping is initially disabled.

\begin{verbatim}
- \(\text{(send an-editor auto-wrap) \to boolean}\)
  \(\text{Returns \#t if auto-wrapping is enabled, \#f otherwise.}\)

- \(\text{(send an-editor auto-wrap auto-wrap?) \to void}\)
  \(\text{auto-wrap?: boolean}\)
  \(\text{Enables auto-wrapping if auto-wrap? is true, disables auto-wrapping otherwise. The on-display-size method is called immediately to update the editor’s maximum width.}\)
\end{verbatim}

\textbf{begin-edit-sequence}

The \texttt{begin-edit-sequence} and \texttt{end-edit-sequence} methods are used to bracket a set of editor modifications so that the results are all displayed at once. The commands may be nested arbitrarily deep. Using these functions can greatly speed up displaying the changes.

When an editor contains other editors, using \texttt{begin-edit-sequence} and \texttt{end-edit-sequence} on the main editor brackets some changes to the sub-editors as well, but it is not as effective when a sub-editor changes as calling \texttt{begin-edit-sequence} and \texttt{end-edit-sequence} for the sub-editor.

See also \texttt{refresh-delayed?} and \texttt{in-edit-sequence?}, and see “Editors and Threads” (section 8.9, page 201) for information about edit sequences and refresh requests.

\begin{verbatim}
- \(\text{(send an-editor begin-edit-sequence undoable? interrupt-streak?) \to void}\)
\end{verbatim}
undoable? = #t: boolean
interrupt-streak? = #t: boolean

If the undoable? flag is #f, then the changes made in the sequence cannot be reversed through the undo method. This flag is only effective for the outermost begin-edit-sequence when nested sequences are used. Note that, for a text% object, the character-inserting version of insert interferes with sequence-based undo groupings.

If the interrupt-streak? flag is #f and the sequence is outermost, then special actions before and after the sequence count as consecutive actions. For example, kills just before and after the sequence are appended in the copy buffer.

begin-write-header-footer-to-file

This method must be called before writing any special header data to a stream.

See “File Formats” (section 8.2, page 197) and write-headers-to-file for more information.

- (send an-editor begin-write-header-footer-to-file f name buffer) ⇒ void
  f: editor-stream-out% object
  name: string
  buffer: boxed exact integer

  The name string must be a unique name that can be used by a header reader to recognize the data. This method will store a value in buffer that should be passed on to end-write-header-footer-to-file.

blink-caret

Tells the editor to blink the selection caret. This method is called periodically when the editor’s display has the keyboard focus.

- (send an-editor blink-caret) ⇒ void

  Propagates the flag to any snip with the editor-local focus.

can-do-edit-operation?

Checks whether a generic edit command would succeed for the editor. This check is especially useful for enabling and disabling menus on demand.

- (send an-editor can-do-edit-operation? op recursive?) ⇒ boolean
  op: symbol in ' (undo redo clear cut copy paste kill select-all insert-text-box insert-pasteboard-box insert-image)
  recursive? = #t: boolean

  See do-edit-operation for information about the op and recursive? arguments.

can-load-file? (augmentable only)

Called just before the editor is loaded from a file. If the return value is #f, the file is not loaded. See also on-load-file and after-load-file.

- (send an-editor can-load-file? filename format) ⇒ boolean
  filename: path
  format: symbol in ‘ (guess standard text text-force-cr same copy)
The `filename` argument is the name the file will be loaded from. See `load-file` for information about `format`.

The `filename` argument cannot be a string; it must be a path value, §11.3.1 in *PLT MzScheme: Language Manual*.

can-save-file? (augmentable only)

Called just before the editor is saved to a file. If the return value is `#f`, the file is not saved. See also `on-save-file` and `after-save-file`.

- `(send an-editor can-save-file? filename format)` ⇒ `boolean`
  
  `filename`: `path`
  `format`: `symbol` in `’(guess standard text text-force-cr same copy)`

  The `filename` argument is the name the file will be saved to. See `load-file` for information about `format`.
  
  The `filename` argument cannot be a string; it must be a path value, §11.3.1 in *PLT MzScheme: Language Manual*.

change-style

Changes the style for items in the editor.

The style within an editor can be changed by the system (in response to other method calls), and such changes do not go through this method; use `on-change-style` in `text%` to monitor style changes.

- `(send an-editor change-style delta)` ⇒ `void`
  
  `delta`: `style-delta%` object or `#f`

  Changes the style of the selected items by applying a style delta.

  To change a large collection of snips from one style to another style, consider providing a `style%` instance rather than a `style-delta%` instance. Otherwise, `change-style` must convert the `style-delta%` instance to the `style%` instance for every snip; this conversion consumes both time and (temporary) memory.

- `(send an-editor change-style style)` ⇒ `void`
  
  `style`: `style%` object or `#f`

  Changes the style of the selected items to a specific style. The editor’s style list must contain `style`, otherwise the style is not changed. See also `convert in style-list%`.

clear

Deletes the currently selected items.

The content of an editor can be changed by the system in response to other method calls, and such changes do not go through this method; use `on-delete in text%` or `on-delete in pasteboard%` to monitor content deletions changes.

- `(send an-editor clear)` ⇒ `void`

clear-undos

Destroys the undo history of the editor.
- (send an-editor clear-undos) ⇒ void

copy

Copies items into the clipboard.

The system may execute a copy (in response to other method calls) without calling this method. To extend or re-implement copying, override the do-copy in text% or do-copy in pasteboard% method of an editor.

- (send an-editor copy extend? time) ⇒ void
  extend? = #f: boolean
time = 0: exact integer

  Copies the selected items into the clipboard. If extend? is not #f, the old clipboard contents are appended.
  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

copy-self

Creates a new editor with the same properties as this one.

- (send an-editor copy-self) ⇒ text% or pasteboard% object
  After an editor is created (either a text% or pasteboard% instance, as appropriate), the new editor is passed to copy-self-to.

copy-self-to

Copies the properties of this editor into an existing editor.

- (send an-editor copy-self-to dest) ⇒ void
  dest: text% or pasteboard% object

  Each snip in this editor is copied and inserted into dest. In addition, this editor’s filename, maximum undo history setting, keymap, interactive caret threshold, and overwrite-styles-on-load settings are installed into dest. This editor’s style list is copied and the copy is installed as the style list for dest.

cut

Copies and then deletes items in the editor.

The system may execute a cut (in response to other method calls) without calling this method. To extend or re-implement the copying portion of the cut, override the do-copy in text% or do-copy in pasteboard% method of an editor. To monitor deletions in an editor, override on-delete in text% or on-delete in pasteboard%.

- (send an-editor cut extend? time) ⇒ void
  extend? = #f: boolean
time = 0: exact integer

  Copies and then deletes the currently selected items. If extend? is not #f, the old clipboard contents are appended.
  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.
dc-location-to-editor-location

Converts the given coordinates from top-level display coordinates (usually canvas coordinates) to editor location coordinates. The same calculation is performed by global-to-local.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)).

See also editor-location-to-dc-location.

- (send an-editor dc-location-to-editor-location x y) ⇒ two real numbers
  x : real number
  y : real number

  Returns the equivalent of x and y translated from DC coordinates to editor drawing coordinates.

default-style-name

Returns the name of a style to be used for newly inserted text, etc. The default is "Standard".

- (send an-editor default-style-name) ⇒ string

do-edit-operation

Performs a generic edit command.

- (send an-editor do-edit-operation op recursive? time) ⇒ void
  op : symbol in  '(undo redo clear cut copy paste kill select-all
                  insert-text-box insert-pasteboard-box insert-image)
  recursive? = #t: boolean
  time = 0 : exact integer

  The op argument must be a valid edit command, one of:
  - 'undo — undoes the last operation
  - 'redo — undoes the last undo
  - 'clear — deletes the current selection
  - 'cut — cuts
  - 'copy — copies
  - 'paste — pastes
  - 'kill — cuts to the end of the current line, or cuts a newline if there is only whitespace between the
    selection and end of line
  - 'select-all — selects everything in the editor
  - 'insert-text-box — inserts a text editor as an item in this editor; see also on-new-box.
  - 'insert-pasteboard-box — inserts a pasteboard editor as an item in this editor; see also on-new-box.
  - 'insert-image — gets a filename from the user and inserts the image as an item in this editor; see
    also on-new-image-snip.

  If recursive? is not #f, then the command is passed on to any active snips of this editor (i.e., snips which
  own the caret).

  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the
  platform-specific range of times, an exn:fail:contract exception is raised.
editor-location-to-dc-location

Converts the given coordinates from editor location coordinates to top-level display coordinates (usually canvas coordinates). The same calculation is performed by local-to-global.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)).

See also dc-location-to-editor-location.

- (send an-editor editor-location-to-dc-location x y) ⇒ two real numbers
  x : real number
  y : real number

  Returns the equivalent of x and y translated from editor coordinates to DC drawing coordinates.

end-edit-sequence

See begin-edit-sequence.

- (send an-editor end-edit-sequence) ⇒ void

end-write-header-footer-to-file

This method must be called after writing any special header data to a stream.

- (send an-editor end-write-header-footer-to-file f buffer-value) ⇒ void
  f : editor-stream-out% object
  buffer-value : exact integer

  The buffer-value argument must be the value put in the buffer argument box by begin-write-header-footer-to-file.

  See “File Formats” (section 8.2, page 197) and write-headers-to-file for more information.

find-first-snip

Returns the first snip in the editor, or #f if the editor is empty. To get all of the snips in the editor, use the next in snip% on the resulting snip.

The first snip in a text editor is the one at position 0. The first snip in a pasteboard is the frontmost snip. (See “Basic Organization” (section 8.1, page 194) for information about snip order in pasteboards.)

- (send an-editor find-first-snip) ⇒ snip% object or #f

find-scroll-line

Maps a vertical location within the editor to a vertical scroll position.

For text% objects: Calling this method may force the recalculation of location information, even if the editor currently has delayed refreshing (see refresh-delayed?). The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)).

- (send an-editor find-scroll-line location) ⇒ exact non-negative integer
  location : real number
get-active-canvas

If the editor is displayed in a canvas, this method returns the canvas that most recently had the keyboard focus (while the editor was displayed). If no such canvas exists, \#f is returned.

```
- (send an-editor get-active-canvas) ⇒ editor-canvas% object or \#f
```

get-admin

Returns the editor-admin% object currently managing this editor or \#f if the editor is not displayed.

```
- (send an-editor get-admin) ⇒ editor-admin% object or \#f
```

get-canvas

If get-active-canvas returns a canvas, that canvas is also returned by this method. Otherwise, if get-canvases returns a non-empty list, the first canvas in the list is returned, otherwise \#f is returned.

```
- (send an-editor get-canvas) ⇒ editor-canvas% object or \#f
```

get-canvases

Returns a list of canvases displaying the editor. An editor may be displayed in multiple canvases and no other kind of display, or one instance of another kind of display and no canvases. If the editor is not displayed or the editor’s current display is not a canvas, null is returned.

```
- (send an-editor get-canvases) ⇒ list of editor-canvas% objects
```

get-dc

Typically used (indirectly) by snip objects belonging to the editor. Returns a destination drawing context which is suitable for determining display sizing information, or \#f if the editor is not displayed.

```
- (send an-editor get-dc) ⇒ dc% object or \#f
```

get-descent

Returns the font descent for the editor. This method is primarily used when an editor is an item within another editor. The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). For text% objects, calling this method may force the recalculation of location information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see refresh-delayed?).

```
- (send an-editor get-descent) ⇒ non-negative real number
```

get-extent

Gets the current extent of the editor’s graphical representation.
The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). For text objects, calling this method may force the recalculation of location information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see refresh-delayed?).

- (send an-editor get-extent w h) ⇒ void
  w : boxed non-negative real number or #f
  h : boxed non-negative real number or #f

  The w box is filled with the editor's width, unless w is #f. The h box is filled with the editor's height, unless h is #f.

get-file
Called when the user must be queried for a filename to load an editor. A starting-directory path is passed in, but is may be #f to indicate that any directory is fine.

- (send an-editor get-file directory) ⇒ path or #f
  directory : path or #f

  Calls the global get-file procedure. The directory argument cannot be a string; it must be a path value, §11.3.1 in PLT MzScheme: Language Manual.
  If the editor is displayed in a single canvas, then the canvas’s top-level frame is used as the parent for the file dialog. Otherwise, the file dialog will have no parent.

get-filename
Returns the path name of the last file saved from or loaded into this editor, #f if the editor has no filename.

- (send an-editor get-filename temp) ⇒ path or #f
  temp = #f : boxed boolean or #f

  The temp box is filled with #t if the filename is temporary or #f otherwise.

get-flattened-text
Returns the contents of the editor in text form. See “Getting Text” (section 8.4, page 199) for a discussion of flattened vs. non-flattened text.

  - (send an-editor get-flattened-text) ⇒ string

get-focus-snip
Returns the snip within the editor that gets the keyboard focus when the editor has the focus, or #f if the editor does not delegate the focus.

The returned snip might be an editor-snip% object. In that case, the embedded editor might delegate the focus to one of its own snips. However, the get-focus-snip method returns only the editor-snip% object, because it is the focus-owning snip within the immediate editor.

See also set-caret-owner.

- (send an-editor get-focus-snip) ⇒ snip% object or #f
get-inactive-caret-threshold

Returns the threshold for painting an inactive selection. This threshold is compared with the `draw-caret` argument to `refresh` and if the argument is as least as large as the threshold (but larger than `'show-caret`), the selection is drawn as inactive.

See also `set-inactive-caret-threshold` and “Caret” (section 8.5, page 199).

```lisp
- (send an-editor get-inactive-caret-threshold) ⇒ symbol in 'no-caret show-inactive-caret show-caret
```

get-keymap

Returns the main keymap currently used by the editor.

```lisp
- (send an-editor get-keymap) ⇒ keymap% object or #f
```

get-load-overwrites-styles

Reports whether named styles in the current style list are replaced by `load-file` when the loaded file contains style specifications.

See also `set-load-overwrites-styles`.

```lisp
- (send an-editor get-load-overwrites-styles) ⇒ boolean
```

get-max-height

Gets the maximum display height for the contents of the editor; zero or `'none` indicates that there is no maximum.

```lisp
- (send an-editor get-max-height) ⇒ non-negative real number or `'none
```

get-max-undo-history

Returns the maximum number of undoables that will be remembered by the editor. Note that undoables are counted by insertion, deletion, etc. events, not by the number of times that `undo` can be called; a single `undo` call often reverses multiple events at a time (such as when the user types a stream of characters at once).

```lisp
- (send an-editor get-max-undo-history) ⇒ exact integer in [0, 100000]
```

get-max-view-size

Returns the maximum visible area into which the editor is currently being displayed, according to the editor’s administrators. If the editor has only one `display`, the result is the same as for `get-view-size`. Otherwise, the maximum width and height of all the editor’s displaying canvases is returned.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)).

If the `display` is an editor canvas, see also `reflow-container`.

```lisp
- (send an-editor get-max-view-size) ⇒ two non-negative real numbers
```
get-max-width

Gets the maximum display width for the contents of the editor; zero or ’none indicates that there is no maximum. In a text editor, zero of ’none disables automatic line breaking.

- (send an-editor get-max-width) ⇒ non-negative real number or ’none

get-min-height

Gets the minimum display height for the contents of the editor; zero or ’none indicates that there is no minimum.

- (send an-editor get-min-height) ⇒ non-negative real number or ’none

get-min-width

Gets the minimum display width for the contents of the editor; zero or ’none indicates that there is no minimum.

- (send an-editor get-min-width) ⇒ non-negative real number or ’none

get-paste-text-only

If the result is #t, then the editor accepts only plain-text data from the clipboard. If the result is #f, the editor accepts both text and snip data from the clipboard.

- (send an-editor get-paste-text-only) ⇒ boolean

get-snip-data

Gets extra data associated with a snip (e.g., location information in a pasteboard) or returns #f is there is no information. See “Editor Data” (section 8.2.1, page 198) for more information.

- (send an-editor get-snip-data thesnip) ⇒ editor-data% object or #f
  thesnip: snip% object
Returns #f.

get-snip-location

Gets the location of the given snip. If the snip is found in the editor, #t is returned; otherwise, #f is returned.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). As a special case, however, a pasteboard% object always reports valid answers when bottom-right? is #f. For text% objects, calling this method may force the recalculation of location information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see refresh-delayed?).

- (send an-editor get-snip-location thesnip x y bottom-right?) ⇒ boolean
  thesnip: snip% object
  x = #f: boxed real number or #f
  y = #f: boxed real number or #f
  bottom-right? = #f: boolean
The x box is filled with the x-coordinate of the snip’s location, unless x is #f. The y box is filled with the y-coordinate of the snip’s location, unless y is #f.

If bottom-right? is not #f, the values in the x and y boxes are for the snip’s bottom right corner instead of its top-left corner.

Obtaining the location if the bottom-right corner may trigger delayed size calculations (including snips other than the one whose location was requested).

get-space

Returns the maximum font space for the editor. This method is primarily used when an editor is an item within another editor.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). For text% objects, calling this method may force the recalculation of location information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see refresh-delayed?).

- (send an-editor get-space) ⇒ non-negative real number

get-style-list

Returns the style list currently in use by the editor.

- (send an-editor get-style-list) ⇒ style-list% object

get-view-size

Returns the visible area into which the editor is currently being displayed (according to the editor’s administrator). See also get-view.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)).

If the display is an editor canvas, see also reflow-container.

- (send an-editor get-view-size w h) ⇒ void

  w: boxed non-negative real number or #f
  h: boxed non-negative real number or #f

  The w box is filled with the visible area width, unless w is #f. The h box is filled with the visible area height, unless h is #f.

global-to-local

Converts the given coordinates from top-level display coordinates (usually canvas coordinates) to editor location coordinates. The same calculation is performed by dc-location-to-editor-location.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)).

See also local-to-global.

- (send an-editor global-to-local x y) ⇒ void

  x: boxed real number or #f
  y: boxed real number or #f
The x box is filled with the translated x-coordinate of the value initially in x, unless x is #f. The y box is filled with the translated x-coordinate of the value initially in y, unless y is #f.

in-edit-sequence?

Returns #t if updating on this editor is currently delayed because begin-edit-sequence has been called for this editor.

See also refresh-delayed?.

- (send an-editor in-edit-sequence?) ⇒ boolean

insert

Inserts data into the editor.

The content of an editor can be changed by the system in response to other method calls, and such changes do not go through this method; use on-insert in text% or on-insert in pasteboard% to monitor content additions changes.

- (send an-editor insert snip) ⇒ void
  snip: snip% object

  Inserts a snip into the editor. A snip cannot be inserted into multiple editors or multiple times within a single editor.

insert-box

Inserts a box (a sub-editor) into the editor.

The content of an editor can be changed by the system in response to other method calls, and such changes do not go through this method; use on-insert in text% or on-insert in pasteboard% to monitor content additions changes.

- (send an-editor insert-box type) ⇒ void
  type = ’text :symbol in’ (text pasteboard)

  Calls on-new-box, passing along type and inserts the resulting snip into the editor.

insert-file

Inserts the content of a file or port into the editor (at the current selection position in text% editors). The result is #t; if an error occurs, an exception is raised.

The content of an editor can be changed by the system in response to other method calls, and such changes do not go through this method; use on-insert in text% or on-insert in pasteboard% to monitor content additions changes.

- (send an-editor insert-file filename format show-errors?) ⇒ boolean
  filename: path
  format = ’guess :symbol in’ (guess standard text text-force-cr same copy)
  show-errors? = #t: boolean
For information on format, see load-file.
The show-errors? argument is no longer used.

- (send an-editor insert-file port format show-errors?) ⇒ boolean
  port: input-port
  format = 'guess: symbol in ' (guess standard text text-force-cr same copy)
  show-errors? = #t: boolean

  The port must support position setting with file-position.
  For information on format, see load-file.
  The show-errors? argument is no longer used.

insert-image

Inserts an image into the editor.

The content of an editor can be changed by the system in response to other method calls, and such changes do not go
through this method; use on-insert in text% or on-insert in pasteboard% to monitor content additions
changes.

- (send an-editor insert-image filename type relative-path? inline?) ⇒ void
  filename = #f: path or #f
  type = 'unknown: symbol in ' (unknown gif jpeg xbm xpm bmp pict)
  relative-path? = #f: boolean
  inline? = #t: boolean

  If filename is #f, then the user is queried for a filename. The kind must one of the symbols that can be
  passed to load-file.
  After the filename has been determined, an image is created by calling on-new-image-snip. See also
  image-snip%.

divide

Inserts the content of a port into the editor (at the current selection position in text% editors) without wrapping the
insert operations as an edit sequence. The result is the actual format of the loaded content (which is different from the
given format type if the given format is 'guess,' 'same, or 'copy).

Use insert-file instead.

- (send an-editor insert-port port format show-errors?) ⇒ symbol in '(standard
text text-force-cr)
  port: input-port
  format = 'guess: symbol in ' (guess standard text text-force-cr same copy)
  show-errors? = #t: boolean

  The port must support position setting with file-position.
  For information on format, see load-file.
  The show-errors? argument is no longer used.

invalidate-bitmap-cache

When on-paint is overridden, call this method when the state of on-paint's drawing changes.
- (send an-editor invalidate-bitmap-cache x y width height) ⇒ void
  
  \[ \begin{array}{l}
  x = 0.0 : \text{real number} \\
  y = 0.0 : \text{real number} \\
  width = '{\text{end}} : \text{non-negative real number or 'end} \\
  height = '{\text{end}} : \text{non-negative real number or 'end}
  \end{array} \]

  The \textit{x}, \textit{y}, \textit{width}, and \textit{height} arguments specify the area that needs repainting in editor coordinates. If \textit{width/height} is '{\text{end}}, then the total height/width of the editor (as reported by \textit{get-extent}) is used.

  Note that the editor's size can be smaller than the visible region of its \textit{display}.

  The default implementation triggers a redraw of the editor, either immediately or at the end of the current edit sequence (if any) started by \textit{begin-edit-sequence}.

\textbf{is-locked?}

Returns \#t if the editor is currently locked, \#f otherwise. See \textit{lock} for more information.

- (send an-editor is-locked?) ⇒ boolean

\textbf{is-modified?}

Returns \#t if the editor has been modified since the last save or load (or the last call to \textit{set-modified} with \#f), \#f otherwise.

- (send an-editor is-modified?) ⇒ boolean

\textbf{kill}

In a text editor, cuts to the end of the current line, or cuts a newline if there is only whitespace between the selection and end of line. Multiple consecutive kills are appended. In a pasteboard editor, cuts the current selection.

See also \textit{cut}.

The content of an editor can be changed by the system in response to other method calls, and such changes do not go through this method; use \textit{on-delete in text%} or \textit{on-delete in pasteboard%} to monitor content deletions changes.

- (send an-editor kill time) ⇒ void
  
  \[ \begin{array}{l}
  time = 0 : \text{exact integer}
  \end{array} \]

  See “Cut and Paste” (section 8.6, page 200) for a discussion of the \textit{time} argument. If \textit{time} is outside the platform-specific range of times, an \textit{exn:fail:contract} exception is raised.

\textbf{load-file}

Loads a file into the editor and returns \#t. If an error occurs, an exception is raised.

The filename used to load the file can be retrieved with \textit{get-filename}. For a \textit{text%} instance, the format can be retrieved with \textit{get-file-format}. However, if an error occurs while loading the file, the filename is set to \#f.

See also \textit{on-load-file}, \textit{after-load-file}, \textit{can-load-file?}, and \textit{set-load-overwrites-styles}.

- (send an-editor load-file filename format show-errors?) ⇒ boolean
  
  \[ \begin{array}{l}
  filename = \#f : \text{path or \#f}
  \end{array} \]
format = 'guess: symbol in' (guess standard text text-force-cr same copy)
show-errors? = #t: boolean

If filename is #f, then the internally stored filename will be used; if filename is "" or if the internal name is unset or temporary, then the user will be prompted for a name.

The possible values for format are listed below. A single set of format values are used for loading and saving files:

- 'guess — guess the format based on extension and/or contents; when saving a file, this is the same as 'standard
- 'standard — read/write a standard file (binary format)
- 'text — read/write a text file (text% only)
- 'text-force-cr — read/write a text file (text% only); when writing, change automatic newlines (from word-wrapping) into real carriage returns
- 'same — read in whatever format was last loaded or saved
- 'copy — write using whatever format was last loaded or saved, but do not change the modification flag or remember filename (saving only)

In a text% instance, the format returned from get-file-format is always one of 'standard, 'text, or 'text-force-cr.

The show-errors? argument is no longer used.

local-to-global

Converts the given coordinates from editor location coordinates to top-level display coordinates (usually canvas coordinates). The same calculation is performed by editor-location-to-dc-location.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)).

See also global-to-local.

- (send an-editor local-to-global x y) ⇒ void
  x: boxed real number
  y: boxed real number

  The x box is filled with the translated x-coordinate of the value initially in x, unless x is #f. The y box is filled with the translated x-coordinate of the value initially in y, unless y is #f.

locations-computed?

Returns #t if all location information has been computed after recent changes to the editor’s content or to its snips, #f otherwise.

Location information is often computed on demand, and begin-edit-sequence tends to delay the computation.

When the editor is locked for reflowing, location information cannot be recomputed. See also “Locks” (section 8.8, page 200).

- (send an-editor locations-computed?) ⇒ boolean

lock

Locks or unlocks the editor for modifications. If an editor is locked, all modifications are blocked, not just user modifications.
See also \textit{is-locked?}.

This method does not affect internal locks, as discussed in “Locks” (section 8.8, page 200).

- (send \textit{an-editor lock} \textit{lock?}) $\Rightarrow$ \textbf{void}
  \textit{lock?} : \textbf{boolean}
  If \textit{lock?} is \#f, the editor is unlocked, otherwise it is locked.

\texttt{locked-for-flow?}

Reports whether the editor is internally locked for flowing. See “Locks” (section 8.8, page 200) for more information.

- (send \textit{an-editor locked-for-flow?}) $\Rightarrow$ \textbf{boolean}

\texttt{locked-for-read?}

Reports whether the editor is internally locked for reading. See “Locks” (section 8.8, page 200) for more information.

- (send \textit{an-editor locked-for-read?}) $\Rightarrow$ \textbf{boolean}

\texttt{locked-for-write?}

Reports whether the editor is internally locked for writing. See “Locks” (section 8.8, page 200) for more information.

- (send \textit{an-editor locked-for-write?}) $\Rightarrow$ \textbf{boolean}

\texttt{needs-update}

Typically called (indirectly) by a \texttt{snip} within the editor to force the editor to be redrawn.

For \texttt{text\%} objects, calling this method may force the recalculation of \texttt{location} information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see \texttt{refresh-delayed?}).

- (send \textit{an-editor needs-update snip localx localy w h}) $\Rightarrow$ \textbf{void}
  \texttt{snip} : \texttt{snip\% object}
  \texttt{localx} : \textbf{real number}
  \texttt{localy} : \textbf{real number}
  \texttt{w} : \textbf{non-negative real number}
  \texttt{h} : \textbf{non-negative real number}
  The \texttt{localx}, \texttt{localy}, \texttt{width}, and \texttt{height} arguments specify the area that needs repainting in the coordinate system of \texttt{snip}.

\texttt{num-scroll-lines}

Reports the number of scroll positions available within the editor.

For \texttt{text\%} objects: Calling this method may force the recalculation of \texttt{location} information, even if the editor currently has delayed refreshing (see \texttt{refresh-delayed?}). If the editor is not displayed and the editor has a maximum width, line breaks are calculated as for \texttt{line-start-position} (which handles specially the case of no display when the editor has a maximum width).
- (send an-editor num-scroll-lines) ⇒ exact non-negative integer

on-change (augmentable only)

Called whenever any change is made to the editor that affects the way the editor is drawn or the values reported for the location/size of some snip in the editor. The on-change method is called just before the editor calls its administrator’s needs-update method to refresh the editor’s display, and it is also called just before and after printing an editor.

The editor is locked for writing and reflowing during the call to on-change.

- (send an-editor on-change) ⇒ void

on-char

Handles keyboard input to the editor.

Consider overriding on-local-char or on-default-char instead of this method.

- (send an-editor on-char event) ⇒ void
  event : key-event% object
  Either passes this event on to a caret-owning snip or calls on-local-char. In the latter case, text% first calls hide-cursor-until-moved.

on-default-char

Called by on-local-char when the event is not handled by a caret-owning snip or by the keymap.

- (send an-editor on-default-char event) ⇒ void
  event : key-event% object
  Does nothing.

on-default-event

Called by on-local-event when the event is not handled by a caret-owning snip or by the keymap.

- (send an-editor on-default-event event) ⇒ void
  event : mouse-event% object
  Does nothing. See also on-default-event in text% and on-default-event in pasteboard%.

on-display-size (augmentable only)

This method is called by the editor’s display whenever the display’s size (as reported by get-view-size) changes, but it is called indirectly through on-display-size-when-ready.

- (send an-editor on-display-size) ⇒ void
  If automatic wrapping is enabled (see auto-wrap) then set-max-width is called with the maximum width of all of the editor’s canvases (according to the administrators: call-as-primary-owner in
editor-canvas% is used with each canvas to set the administrator and get the view size. If the editor is displayed but not in a canvas, the unique width is obtained from the editor’s administrator (there is only one). If the editor is not displayed, the editor’s maximum width is not changed.

on-display-size-when-ready

Calls on-display-size unless the editor is currently in an edit sequence or currently being refreshed. In the latter cases, the call to on-display-size is delegated to another thread; see “Editors and Threads” (section 8.9, page 201) for more information.

- (send an-editor on-display-size-when-ready) ⇒ void

on-edit-sequence (augmentable only)

Called just after a top-level (i.e., unnested) edit sequence starts.

During an edit sequence, all callbacks methods are invoked normally, but it may be appropriate for these callbacks to delay computation during an edit sequence. The callbacks must manage this delay manually. Thus, when overriding other callback methods, such as on-insert in text%, on-insert in pasteboard%, after-insert in text%, or after-insert in pasteboard%, consider overriding on-edit-sequence and after-edit-sequence as well.

“Top-level edit sequence” refers to an outermost pair of begin-edit-sequence and end-edit-sequence calls. The embedding of an editor within another editor does not affect the timing of calls to on-edit-sequence, even if the embedding editor is in an edit sequence.

Pairings of on-edit-sequence and after-edit-sequence can be nested if an after-edit-sequence starts a new edit sequence, since after-edit-sequence is called after an edit sequence ends. However, on-edit-sequence can never start a new top-level edit sequence (except through an unpaired end-edit-sequence), because it is called after a top-level edit sequence starts.

- (send an-editor on-edit-sequence) ⇒ void

on-event

Handles mouse input to the editor. The event’s x and y coordinates are in the display’s co-ordinate system; use the administrator’s get-dc method to obtain translation arguments (or use dc-location-to-editor-location).

Consider overriding on-local-event or on-default-event instead of this method.

- (send an-editor on-event event) ⇒ void
  event : mouse-event% object

  Either passes this event on to a caret-owning snip, selects a new caret-owning snip (text% only) and passes the event on to the selected snip, or calls on-local-event. A new caret-owning snip is selected in a text% object when the click is on an event-handling snip, and not too close to the space between snips (see get-between-threshold).

on-focus

Called when the keyboard focus changes into or out of this editor (and not to/from a snip within the editor) with #t: if the focus is being turned on, #f otherwise.
on-load-file (*augmentable only*)

Called just before the editor is loaded from a file, after calling `can-load-file?` to verify that the load is allowed. See also `after-load-file`.

```lisp
- (send an-editor on-load-file filename format) ⇒ void
  filename : path
  format : symbol in ’(guess standard text text-force-cr same copy)

  The `filename` argument is the name the file will be loaded from. See `load-file` for information about `format`.

  The `filename` argument cannot be a string; it must be a path value, §11.3.1 in *PLT MzScheme: Language Manual*.
```

on-local-char

Called by `on-char` when the event is *not* handled by a caret-owning snip.

Consider overriding `on-default-char` instead of this method.

```lisp
- (send an-editor on-local-char event) ⇒ void
  event : key-event% object

  Either lets the keymap handle the event or calls `on-default-char`.
```

on-local-event

Called by `on-event` when the event is *not* handled by a caret-owning snip.

Consider overriding `on-default-event` instead of this method.

```lisp
- (send an-editor on-local-event event) ⇒ void
  event : mouse-event% object

  Either lets the keymap handle the event or calls `on-default-event`.
```

on-new-box

Creates and returns a new snip for an embedded editor. This method is called by `insert-box`.

```lisp
- (send an-editor on-new-box type) ⇒ snip% object
  type : symbol in ’(text pasteboard)

  Creates a `editor-snip%` with either a sub-editor from `text%` or sub-pasteboard from `pasteboard%`, depending on whether `type` is ’text or ’pasteboard. The keymap (see `keymap%`) and style list (see `style-list%`) for of the new sub-editor are set to the keymap and style list of this editor.
```

on-new-image-snip

Creates and returns a new instance of `image-snip%` for `insert-image`.

```lisp
- (send an-editor on-focus on?) ⇒ void
  on? : boolean
```
- (send an-editor on-new-image-snip filename kind relative-path? inline?) ⇒
  image-snip% object
  filename: path or #f
  kind: symbol in '(unknown gif jpeg xbm xpm bmp pict)
  relative-path?: boolean
  inline?: boolean

The filename argument cannot be a string; it must be a path value, §11.3.1 in PLT MzScheme: Language Manual.

Returns (make-object image-snip% filename kind relative-path? inline?).

**on-paint**

Provides a way to add arbitrary graphics to an editor’s display. This method is called just before and just after every painting of the editor.

The on-paint method, together with the snips’ draw methods, must be able to draw the entire state of an editor. Never paint directly into an editor’s display canvas except from within on-paint or draw. Instead, put all extra drawing code within on-paint and call invalidate-bitmap-cache when part of the display needs to be repainted.

If an on-paint method uses cached location information, then the cached information should be recomputed in response to a call of invalidate-bitmap-cache.

The on-paint method must not make any assumptions about the state of the drawing context (e.g., the current pen), except that the clipping region is already set to something appropriate. Before on-paint returns, it must restore any drawing context settings that it changes.

The editor is internally locked for writing and reflowing during a call to this method (see also “Locks” (section 8.8, page 200)).

- (send an-editor on-paint before? dc left top right bottom dx dy draw-caret)
  ⇒ void
  before?: boolean
  dc: dc% object
  left: real number
  top: real number
  right: real number
  bottom: real number
  dx: real number
  dy: real number
  draw-caret: symbol in '(no-caret show-inactive-caret show-caret)

The before? argument is #t when the method is called just before a painting the contents of the editor or #f when it is called after painting. The left, top, right, and bottom arguments specify which region of the editor is being repainted, in editor coordinates. To get the coordinates for dc, offset editor coordinates by adding (dx, dy). See “Caret” (section 8.5, page 199) for information about draw-caret.

See also invalidate-bitmap-cache.

**on-save-file** *(augmentable only)*

Called just before the editor is saved to a file, after calling can-save-file? to verify that the save is allowed. See also after-save-file.
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- (send an-editor on-save-file filename format) ⇒ void
  
  filename : path
  format : symbol in ’(guess standard text text-force-cr same copy)

  The filename argument is the name the file will be saved to. See load-file for information about format.

  The filename argument cannot be a string; it must be a path value, §11.3.1 in PLT MzScheme: Language Manual.

on-snip-modified (augmentable only)

This method is called whenever a snip within the editor reports that it has been modified (by calling its administrator’s modified method). The method arguments are the snip that reported a modification-state change, and the snip’s new modification state.

See also set-modified.

- (send an-editor on-snip-modified snip modified?) ⇒ void
  
  snip : snip% object
  modified? : boolean

  If modified? is true and the editor was not already modified (i.e., its is-modified? method reports #f), then the set-modified method is called with #t. If the editor was already modified, then the internal modify-counter is incremented.

  If modified? is #f, and if the modify-counter is 1, then the set-modified method is called with #f (on the assumption that the modify-counter was set to 1 by an earlier call to this method for the same snip).

own-caret

Tells the editor to display or not display the selection.

The focus state of an editor can be changed by the system, and such changes do not go through this method; use on-focus to monitor focus changes.

- (send an-editor own-caret own?) ⇒ void
  
  own? : boolean

  Propagates the flag to any snip with the editor-local focus. If no sub-editors are active, the editor assumes the caret ownership.

paste

Pastes the current contents of the clipboard into the editor.

The system may execute a paste (in response to other method calls) without calling this method. To extend or re-implement copying, override the do-paste in text% or do-paste in pasteboard% method.

See also get-paste-text-only.

- (send an-editor paste time) ⇒ void
  
  time = 0 : exact integer

  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.
paste-x-selection

Like paste, but under X, uses the X selection instead of the X clipboard.

To extend or re-implement copying, override the do-paste-x-selection in text% or do-paste-x-selection in pasteboard% method.

- (send an-editor paste-x-selection time) ⇒ void
  
  time = 0 : exact integer

  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

print

Prints the editor.

- (send an-editor print interactive? fit-on-page? output-mode parent force-ps-page-bbox? as-eps?) ⇒ void
  
  interactive? = #t: boolean
  fit-on-page? = #t: boolean
  output-mode = 'standard: symbol in' (standard postscript)
  parent = #f: frame% or dialog% object or #f
  force-ps-page-bbox? = #t: boolean
  as-eps? = #f: boolean

  If interactive? is true and a PostScript file is created, the is given a dialog for adjusting printing parameters; see also get-ps-setup-from-user. Otherwise, if a PostScript file is created, the settings returned by current-ps-setup are used. (The user may still get a dialog to select an output file name; see post-script-dc% for more details.)

  If fit-on-page? is a true value, then during printing for a text% editor, the editor’s maximum width is set to the width of the page (less margins) and the autowrapping bitmap is removed.

  The output-mode setting is used for Windows and Mac OS X. It determines whether the output is generated directly as a PostScript file (using MrEd’s built-in PostScript system) or generated using the platform-specific standard printing mechanism. The possible values as

  - 'standard — print using the platform-standard mechanism (via a printer-dc%) under Windows and Mac OS X, PostScript for Unix (via a post-script-dc%)
  - 'postscript — print to a PostScript file (via a post-script-dc%)

  If parent is not #f, it is used as the parent window for configuration dialogs (for either PostScript or platform-standard printing). If parent is #f and if the editor is displayed in a single canvas, then the canvas’s top-level frame is used as the parent for configuration dialogs. Otherwise, configuration dialogs will have no parent.

  The force-ps-page-bbox? argument is used for PostScript printing, and is used as the third initialization argument when creating the post-script-dc% instance. Unless it is #f, the bounding-box of the resulting PostScript file is set to the current paper size.

  The as-eps? argument is used for PostScript printing, and is used as the fourth initialization argument when creating the post-script-dc% instance. Unless it is #f, the resulting PostScript file is identified as Encapsulated PostScript (EPS).

  The printing margins are determined by get-editor-margin in the current ps-setup% object (as determined by current-ps-setup).
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Prints the editor into the given drawing context. See also print .

- (send an-editor print-to-dc dc) ⇒ void
  dc: dc<%> object

put-file

Called when the user must be queried for a filename to save an editor. Starting-directory and default-name paths are passed in, but either may be #f to indicate that any directory is fine or there is no default name.

- (send an-editor put-file directory default-name) ⇒ path or #f
  directory: path or #f
  default-name: path or #f

Calls the global put-file procedure. The directory and filename arguments cannot be strings; each must be a path value, §11.3.1 in PLT MzScheme: Language Manual.

If the editor is displayed in a single canvas, then the canvas’s top-level frame is used as the parent for the file dialog. Otherwise, the file dialog will have no parent.

read-footer-from-file

See read-header-from-file.

- (send an-editor read-footer-from-file stream name) ⇒ boolean
  stream: editor-stream-in% object
  name: string

read-from-file

Reads new contents for the editor from a stream. The return value is #t if there are no errors, #f otherwise. See also “File Formats” (section 8.2, page 197).

The stream provides either new mappings for names in the editor’s style list, or it indicates that the editor should share a previously-read style list (depending on how style lists were shared when the editor was written to the stream; see also write-to-file).

- In the former case, if the overwrite-styles? argument is is #f, then each style name in the loaded file that is already in the current style list keeps its current style. Otherwise, existing named styles are overwritten with specifications from the loaded file.

- In the latter case, the editor’s style list will be changed to the previously-read list.

- (send an-editor read-from-file stream overwrite-styles?) ⇒ boolean
  stream: editor-stream-in% object
  overwrite-styles?: #t: boolean

read-header-from-file

Called to handle a named header that is found when reading editor data from a stream. The return value is #t if there are no errors, #f otherwise.

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Override this method only to embellish the file format with new header information. Always call the inherited method if the derived reader does not recognize the header.

- (send an-editor read-header-from-file stream name) ⇒ boolean
  stream: editor-stream-in% object
  name: string

  See also “File Formats” (section 8.2, page 197).

redo

Undoes the last undo, if no other changes have been made since. See undo for information about Emacs-style undo.

The system may perform a redo without calling this method in response to other method calls. Use methods such as on-change to monitor editor content changes.

See also add-undo.

- (send an-editor redo) ⇒ void
  If the editor is currently performing an undo or redo, the method call is ignored.

refresh

Repaints a region of the editor, generally called by an editor administrator. See “Editors and Threads” (section 8.9, page 201) for information about edit sequences and refresh requests.

- (send an-editor refresh x y width height draw-caret background) ⇒ void
  x: real number
  y: real number
  width: non-negative real number
  height: non-negative real number
  draw-caret: symbol in ’(no-caret show-inactive-caret show-caret)
  background: color% object or #f

  The x, y, width, and height arguments specify the area that needs repainting in editor coordinates.

  See “Caret” (section 8.5, page 199) for information about draw-caret.

  The background color corresponds to the background of the display; if it is #f, then the display is transparent. An editor should use the given background color as its own background (or not paint the background of background is #f).

refresh-delayed?

Returns #t if updating on this editor is currently delayed. Updating may be delayed because begin-edit-sequence has been called for this editor, or because the editor has no administrator, or because the editor’s administrator returns #t from its refresh-delayed? method. (The administrator might return #t because an enclosing editor’s refresh is delayed.)

See also in-edit-sequence?.

- (send an-editor refresh-delayed?) ⇒ boolean
release-snip

Requests that the specified snip be deleted and released from the editor. If this editor is not the snip’s owner or if the snip cannot be released, then \#f is returned. Otherwise, \#t is returned and the snip is no longer owned.

See also release-snip in snip-admin%.

- (send an-editor release-snip snip) ⇒ void
  snip: snip% object

remove-canvas

Removes a canvas from this editor’s list of displaying canvases. (See get-canvases.)

Normally, this method is called only by set-editor in editor-canvas%.

- (send an-editor remove-canvas canvas) ⇒ void
  canvas: editor-canvas% object

resized

Called (indirectly) by snips within the editor: it forces a recalculation of the display information in which the specified snip has changed its size.

- (send an-editor resized snip redraw-now?) ⇒ void
  snip: snip% object
  redraw-now?: boolean

  If redraw-now? is \#f, the editor will require another message to repaint itself. (See also needs-update.)

save-file

Saves the editor into a file and returns \#t. If an error occurs, an exception is raised.

The filename and format used to save the file can be retrieved with get-filename. In a text% instance, the format can be retrieved with get-file-format.

See also on-save-file, after-save-file, and can-save-file?.

Under Mac OS X, the file’s type signature is set to "TEXT" for a text-format file or "WXME" for a standard-format (binary) file.

- (send an-editor save-file filename format show-errors?) ⇒ boolean
  filename = \#f: path or \#f
  format = ‘same: symbol in ’ (guess standard text text-force-cr same copy)
  show-errors? = \#t: boolean

  If filename is \#f, then the internally stored filename will be used; if filename is "" or if the internal name is unset or temporary, then the user will be prompted for a name. The possible values for format are described at load-file.

  The show-errors? argument is no longer used.
save-port

Saves the editor into a port and returns \#t. If an error occurs, an exception is raised.

- (send an-editor save-port port format show-errors?) \Rightarrow boolean
  port: output-port
  format = ‘same: symbol in’ (guess standard text text-force-cr same copy)
  show-errors? = \#t: boolean

The possible values for format are described at load-file.
The show-errors? argument is no longer used.

scroll-line-location

Maps a vertical scroll position to a vertical location within the editor.

For text% objects: Calling this method may force the recalculation of location information, even if the editor currently has delayed refreshing (see refresh-delayed?). If the editor is not displayed and the editor has a maximum width, line breaks are calculated as for line-start-position (which handles specially the case of no display when the editor has a maximum width).

- (send an-editor scroll-line-location pos) \Rightarrow non-negative real number
  pos: exact integer

scroll-to

Called (indirectly) by snips within the editor: it causes the editor to be scrolled so that a given location range within a given snip is visible. If the editor is scrolled, \#t is returned, otherwise \#f is returned.

- (send an-editor scroll-to snip localx localy width height refresh? bias) \Rightarrow boolean
  snip: snip% object
  localx: real number
  localy: real number
  width: non-negative real number
  height: non-negative real number
  refresh?: boolean
  bias = Symbol none: symbol in ‘(start end none)

The localx, localy, width, and height arguments specify the area that needs to be visible in snip’s coordinate system.

When the specified region cannot fit in the visible area, bias indicates which end of the region to display. When bias is ‘start, then the top-left of the region is displayed. When bias is ‘end, then the bottom-right of the region is displayed. Otherwise, bias must be ‘none.

select-all

Selects all data in the editor

- (send an-editor select-all) \Rightarrow void
set-active-canvas

Sets the active canvas for this editor. (See \texttt{get-active-canvas}.)

Normally, this method is called only by \texttt{on-focus in editor-canvas\%} in an editor canvas that is displaying an editor.

\begin{verbatim}
 - (send an-editor set-active-canvas canvas) \Rightarrow void
   canvas: editor-canvas\% object
\end{verbatim}

set-admin

Sets the editor’s administrator. This method is only called by an administrator.

The administrator of an editor can be changed by the system, and such changes do not go through this method. A program cannot detect when the administrator changes except by polling \texttt{get-admin}.

\begin{verbatim}
 - (send an-editor set-admin admin) \Rightarrow void
   admin: editor-admin\% object or #f
\end{verbatim}

set-caret-owner

Sets the keyboard focus owner within an editor or globally.

If #f is provided as the new owner, then the local focus is moved to the editor itself. Otherwise, the local focus is moved to the specified snip.

The domain of focus-setting is one of:

\begin{itemize}
  \item \texttt{'immediate} — only set the focus owner within the editor
  \item \texttt{'display} — make this editor or the new focus owner get the keyboard focus among the editors in this editor’s display (if this is an embedded editor)
  \item \texttt{'global} — make this editor or the new focus owner get the keyboard focus among all elements in the editor’s frame
\end{itemize}

The focus state of an editor can be changed by the system, and such changes do not go through this method; use \texttt{on-focus} to monitor focus changes.

See also \texttt{get-focus-snip}.

\begin{verbatim}
 - (send an-editor set-caret-owner snip domain) \Rightarrow void
   snip: snip\% object or #f
   domain=’immediate’ symbol in ’(immediate display global)
\end{verbatim}

Attempts to give the keyboard focus to \texttt{snip}. If \texttt{snip} is #f, then the caret is taken away from any snip in the editor that currently has the caret and restored to this editor.

If the keyboard focus is moved to \texttt{snip} and the editor has the real keyboard focus, the \texttt{own-caret} method of the snip will be called.
set-cursor

Sets a custom cursor for the editor. If the custom cursor is #f, the current cursor is removed, and a cursor is selected automatically by the editor (depending on whether the cursor is pointing at a clickback). See adjust-cursor for more information about the default selection.

An embedding editor’s custom cursor can override the cursor of an embedded editor — even if the embedded editor has the caret — if the cursor is specified as an overriding cursor.

- (send an-editor set-cursor cursor override?) ⇒ void
cursor: cursor% object or #f
override? = #t: boolean

Sets the custom cursor for the editor to cursor. If override? is a true value and cursor is not #f, then this cursor overrides cursor settings in embedded editors.

set-filename

Set the path name for the file to be saved from or reloaded into this editor. This method is also called when the filename changes through any method (such as load-file).

- (send an-editor set-filename filename temporary?) ⇒ void
filename: path or #f
temporary? = #f: boolean

Sets the filename to filename. If filename is #f or temporary? is a true value, then the user will still be prompted for a name on future calls to save-file and load-file.

set-inactive-caret-threshold

Sets the threshold for painting an inactive selection. See get-inactive-caret-threshold for more information.

- (send an-editor set-inactive-caret-threshold threshold) ⇒ void
threshold: symbol in ’(no-caret show-inactive-caret show-caret)

set-keymap

Sets the current keymap for the editor. A #f argument removes all key mapping.

- (send an-editor set-keymap keymap) ⇒ void
keymap = #f: keymap% object or #f

set-load-overwrites-styles

Determines whether named styles in the current style list are replaced by load-file when the loaded file contains style specifications.

See also get-load-overwrites-styles and read-from-file.

- (send an-editor set-load-overwrites-styles overwrite?) ⇒ void
overwrite?: boolean
set-max-height
Sets the maximum display height for the contents of the editor. A value less or equal to 0 indicates that there is no maximum.

Setting the height is disallowed when the editor is internally locked for reflowing (see also “Locks” (section 8.8, page 200)).

- (send an-editor set-max-height width) ⇒ void
  width: non-negative real number or 'none

set-max-undo-history
Sets the maximum number of undoables that will be remembered by the editor. The default is 0, which disables undo. The symbol ‘forever is accepted as a synonym for a very large number.

- (send an-editor set-max-undo-history count) ⇒ void
  count: exact non-negative integer or 'forever

set-max-width
Sets the maximum display width for the contents of the editor; zero or 'none indicates that there is no maximum. In a text editor, having no maximum disables automatic line breaking, and the minimum (positive) maximum width depends on the width of the autowrap bitmap.

Setting the width is disallowed when the editor is internally locked for reflowing (see also “Locks” (section 8.8, page 200)).

See also set-autowrap-bitmap.

- (send an-editor set-max-width width) ⇒ void
  width: non-negative real number or 'none

set-min-height
Sets the minimum display height for the contents of the editor; zero or 'none indicates that there is no minimum.

Setting the height is disallowed when the editor is internally locked for reflowing (see also “Locks” (section 8.8, page 200)).

- (send an-editor set-min-height width) ⇒ void
  width: non-negative real number or 'none

set-min-width
Sets the minimum display width for the contents of the editor; zero or 'none indicates that there is no minimum.

Setting the width is disallowed when the editor is internally locked for reflowing (see also “Locks” (section 8.8, page 200)).

- (send an-editor set-min-width width) ⇒ void
  width: non-negative real number or 'none
set-modified

Sets the modified state of the editor. Usually, the state is changed automatically after an insertion, deletion, or style change by calling this method. (This method is also called when the modification state changes through any method.) This method is usually not called when the state of the flag is not changing.

See also is-modified? and on-snip-modified.

- `(send an-editor set-modified modified?) ⇒ void
  modified?: boolean`

  Sets the modification state to `modified?`. If `modified?` is true, then an internal modify-counter is set to 1.

  If `modified?` is `#f` and the editor’s undo or redo stack contains a system-created undoer that resets the modified state (because the preceding undo or redo action puts the editor back to a state where the modification state was `#f`), the undoer is disabled.

  Regardless of the value of `modified?`, the editor’s administrator’s `modified` method is called.

  Finally, if `modified?` is `#f` and the internal modify-counter is set to 0, then the `set-unmodified` method is called on every snip within the editor.

set-paste-text-only

Sets whether the editor accepts only text from the clipboard, or both text and snips. By default, an editor accepts both text and snips.

See also get-paste-text-only.

- `(send an-editor set-paste-text-only text-only?) ⇒ void
  text-only?: boolean`

set-snip-data

Sets extra data associated with the snip (e.g., location information in a pasteboard). See “Editor Data” (section 8.2.1, page 198) for more information.

- `(send an-editor set-snip-data thesnip data) ⇒ void
  thesnip: snip% object
  data: editor-data% object`

set-style-list

Sets the editor’s style list. Styles currently in use with the old style list will be “moved” to the new style list. In this “move”, if a named style already exists in the new style list, then the new style with the same name will be used in place of the old style.

Setting the style list is disallowed when the editor is internally locked for reflowing (see also “Locks” (section 8.8, page 200)).

- `(send an-editor set-style-list style-list) ⇒ void
  style-list: style-list% object`
9.3. editor

style-has-changed

Notifies the editor that a style in its style list has changed. This method is automatically registered with the editor's style list using \texttt{notify-on-change in style-list} and automatically deregistered when the style list is removed from the editor.

See \texttt{notify-on-change in style-list} for more information.

- \texttt{(send an-editor style-has-changed style) ⇒ void}
  \texttt{style: style object or #f}

undo

Undoes the last editor change, if undos have been enabled by calling \texttt{set-max-undo-history} with a non-zero integer.

The user may enable Emacs-style undo for editors; see "Preferences" (section 12, page 365). Normally, undo operations add to the redo stack (see \texttt{redo}), and any undoable (non-undo) operation clears the redo stack. With Emacs-style undo, the redo stack is added back to the undo stack, along with the original undos, so that a complete history is kept in the undo stack.

The system may perform an undo without calling this method in response to other method calls. Use methods such as \texttt{on-change} to monitor editor content changes.

See also \texttt{add-undo}.

- \texttt{(send an-editor undo) ⇒ void}
  \texttt{If the editor is currently performing an undo or redo, the method call is ignored.}

write-footers-to-file

See \texttt{write-headers-to-file}.

- \texttt{(send an-editor write-footers-to-file stream) ⇒ boolean}
  \texttt{stream: editor-stream-out object}

write-headers-to-file

Called when the editor is being saved to a file. The return value is \texttt{#t} if there are no errors, \texttt{#f} otherwise. Override this method to add custom header data to a file, but always call the inherited method so that it can write its own extra headers.

To write a header item, call \texttt{begin-write-header-footer-to-file}, passing a box for an integer. Then write the header data and end by calling \texttt{end-write-header-footer-to-file}, passing back the integer that was put into the box. Follow this procedure correctly or the file will be corrupted.

- \texttt{(send an-editor write-headers-to-file stream) ⇒ boolean}
  \texttt{stream: editor-stream-out object}

  Does nothing.
write-to-file

Writes the current editor contents to the given stream. The return value is #t if there are no errors, #f otherwise. See also “File Formats” (section 8.2, page 197).

If the editor’s style list has already been written to the stream, it is not re-written. Instead, the editor content indicates that the editor shares a previously-written style list. This sharing will be recreated when the stream is later read.

- (send an-editor write-to-file stream) ⇒ boolean
  stream: editor-stream-out% object

9.4 editor-admin%

See “Administrators” (section 8.1.1, page 195) for information about the role of administrators. The editor-admin% class is never instantiated directly. It is not even instantiated through derived classes by most programmers; each editor-canvas% and editor-snip% object creates its own administrator. However, it may be useful to derive a new instance of this class to display editors in a new context. Also, it may be useful to call the methods of an existing administrator from an owned editor.

To create a new editor-admin% class, all methods described here must be overridden. They are all invoked by the administrator’s editor.

- (make-object editor-admin%) ⇒ editor-admin% object
  Creates a (useless) editor administrator.

get-dc

Returns either the drawing context into which the editor is displayed, or the context into which it is currently being drawn. When the editor is not embedded, the returned context is always the drawing content into which the editor is displayed. If the editor is not displayed, #f is returned.

The origin of the drawing context is also returned, translated into the local coordinates of the editor. For an embedded editor, the returned origin is reliable only while the editor is being drawn, or while it receives a mouse or keyboard event.

- (send an-editor-admin get-dc x y) ⇒ dc<%> object or #f
  x = #f: boxed real number or #f
  y = #f: boxed real number or #f
  The x box is filled with the x-origin of the DC in editor coordinates, unless x is #f. The y box is filled with the y-origin of the DC in editor coordinates, unless y is #f.
  See also editor-location-to-dc-location in editor<%> and dc-location-to-editor-location in editor<%>.

get-max-view

Same as get-view unless the editor is visible in multiple standard displays. If the editor has multiple displays, a region is computed that includes the visible region in all displays.

- (send an-editor-admin get-max-view x y w h full?) ⇒ void
  x: boxed real number or #f
9.4. editor-admin

get-view

Gets the visible region of the editor within its display (in editor coordinates), or the overall size of the viewing region in the editor’s top-level display (for an embedded editor).

If the display is an editor canvas, see also reflow-container. The viewing area within an editor canvas is not the full client area of the canvas, because an editor canvas installs a whitespace border around a displayed editor within the client area.

The calculation of the editor’s visible region is based on the current size and scrollbar values of the top-level display. For an editor canvas display, the region reported by get-view does not depend on whether the canvas is hidden, obscured by other windows, or moved off the edge of the screen.

```
- (send an-editor-admin get-view x y w h full?) ⇒ void
  x: boxed real number or #f
  y: boxed real number or #f
  w: boxed non-negative real number or #f
  h: boxed non-negative real number or #f
  full? = #f : boolean

  The x box is filled with the left edge of the visible region in editor coordinates, unless x is #f. The y box is filled with the top edge of the visible region in editor coordinates, unless y is #f. The w box is filled with the width of the visible region, which may be larger than the editor itself, unless w is #f. The h box is filled with the height of the visible region, which may be larger than the editor itself, unless h is #f.

  If an editor is fully visible and full? is #f, then x and y will both be filled with 0.
  If full? is a true value, then the returned area is the view area of the top-level display for the editor. This result is different only when the editor is embedded in another editor; in that case, the x and y values may be meaningless, because they are in the coordinate system of the immediate editor within the top-level display.
```

grab-caret

Called by the editor to request the keyboard focus. If the request is granted, then the administered editor’s own-caret method will be called.

```
- (send an-editor-admin grab-caret domain) ⇒ void
  domain = 'global: symbol in '(immediate display global)

  See set-caret-owner for information about the possible values of domain.
```

modified

Called by the editor to report that its modification state has changed to either modified or unmodified.

See also set-modified in editor<%>.

```
- (send an-editor-admin modified modified?) ⇒ void
  modified?: boolean
```
needs-update

Called by the editor to request a refresh to its displayed representation. When the administrator decides that the displayed should be refreshed, it calls the editor’s refresh method.

- (send an-editor-admin needs-update localx localy w h) ⇒ void
  localx: real number
  localy: real number
  w: non-negative real number
  h: non-negative real number

  The localx, localy, w, and h arguments specify a region of the editor to be updated (in editor coordinates).

popup-menu

Pops up the given popup-menu% object at the specified coordinates (in this window’s coordinates), and returns after handling an unspecified number of events; the menu may still be popped up when this method returns. If a menu item is selected from the popup-menu, the callback for the menu item is called. (The eventspace for menu item’s callback is the administrator’s display’s eventspace.)

While the menu is popped up, its target is set to the top-level editor in this administrator’s display. See get-popup-target for more information.

The result is #t if the popup succeeds, #f otherwise (independent of whether the user selects an item in the popup menu).

- (send an-editor-admin popup-menu menu x y) ⇒ boolean
  menu: popup-menu% object
  x: real number
  y: real number

  The menu is displayed at x and y in editor coordinates.

refresh-delayed?

Returns #t if updating on this administrator’s display is currently delayed (usually by begin-edit-sequence in editor<%> in an enclosing editor).

- (send an-editor-admin refresh-delayed?) ⇒ boolean

resized

Called by the editor to notify its display that the editor’s size or scroll count has changed, so the scrollbars need to be adjusted to reflect the new size. The editor generally needs to be updated after a resize, but the editor decides whether the update should occur immediately.

- (send an-editor-admin resized refresh?) ⇒ void
  refresh?: boolean

  If refresh? is not #f, then the editor is requesting to be updated immediately.
scroll-to

Called by the editor to request scrolling so that the given region is visible. The editor generally needs to be updated after a scroll, but the editor decides whether the update should occur immediately.

- \( (\text{send an-editor-admin scroll-to localx localy w h refresh? bias}) \Rightarrow \text{boolean} \)
  - localx: real number
  - localy: real number
  - w: non-negative real number
  - h: non-negative real number
  - refresh? = \#t: boolean
  - bias = ‘none: symbol in (start end none)

The \( \text{localx}, \text{localy}, \text{w}, \text{and} \ h \) arguments specify a region of the editor to be made visible by the scroll (in editor coordinates).

If \( \text{refresh?} \) is not \#f, then the editor is requesting to be updated immediately.

The \( \text{bias} \) argument is one of:
- ‘start — if the range doesn’t fit in the visible area, show the top-left region
- ‘none — no special scrolling instructions
- ‘end — if the range doesn’t fit in the visible area, show the bottom-right region

The return value is \#t if the \text{display} is scrolled, \#f if not (either because the requested region is already visible, because the \text{display} has zero size, or because the editor is currently printing.)

update-cursor

Queues an update for the cursor in the \text{display} for this editor. The actual cursor used will be determined by calling the editor’s \text{adjust-cursor} method.

- \( (\text{send an-editor-admin update-cursor}) \Rightarrow \text{void} \)

9.5 editor-canvas%

Implements: \text{canvas<%}>

An \text{editor-canvas%} object manages and displays a \text{text%} or \text{pasteboard%} object.

- \( (\text{new editor-canvas% (parent.}) (\text{editor.}) (\text{style.}) (\text{scrolls-per-page.}) (\text{label.}) (\text{wheel-step.}) (\text{line-count.}) (\text{horizontal-inset.}) (\text{vertical-inset.}) (\text{enabled.}) (\text{stretchable-width.}) (\text{stretchable-height.})) \Rightarrow \text{editor-canvas% object} \)
  - parent: \text{frame%, dialog%, panel%, or pane% object}
  - editor = \#f: \text{text% or pasteboard% object or #f}
  - style = null: list of symbols in ‘(no-border control-border combo no-hscroll no-vscroll hide-hscroll hide-vscroll auto-hscroll auto-vscroll resize-corner deleted transparent)
  - scrolls-per-page = 100: exact integer in \([1, 10000]\)
  - label = \#f: string (up to 200 characters) or \#f
  - wheel-step = 3: exact integer in \([1, 10000]\) or \#f
  - line-count = \#f: exact integer in \([1, 1000]\) or \#f
  - horizontal-inset = 5: exact integer in \([0, 1000]\)
If a canvas is initialized with #f for editor, install an editor later with set-editor.

The style list can contain the following flags:

- ‘no-border — omits a border around the canvas
- ‘control-border — gives the canvas a border that is like a text-field% control
- ‘combo — gives the canvas a combo button that is like a combo-field% control; this style is intended for use with ‘control-border,’ ‘hide-hscroll,’ and ‘hide-vscroll
- ‘no-hscroll — disallows horizontal scrolling and hides the horizontal scrollbar
- ‘no-vscroll — disallows vertical scrolling and hides the vertical scrollbar
- ‘hide-hscroll — allows horizontal scrolling, but hides the horizontal scrollbar
- ‘hide-vscroll — allows vertical scrolling, but hides the vertical scrollbar
- ‘auto-hscroll — automatically hides the horizontal scrollbar when unneeded (unless ‘no-hscroll or ‘hide-hscroll is specified)
- ‘auto-vscroll — automatically hides the vertical scrollbar when unneeded (unless ‘no-vscroll or ‘hide-vscroll is specified)
- ‘resize-corner — leaves room for a resize control at the canvas’s bottom right when only one scrollbar is visible
- ‘deleted — creates the canvas as initially hidden and without affecting parent’s geometry; the canvas can be made active later by calling parent’s add-child method
- ‘transparent — the canvas is “erased” before an update using it’s parent window’s background

While vertical scrolling of text editors is based on lines, horizontal scrolling and pasteboard vertical scrolling is based on a fixed number of steps per horizontal page. The scrolls-per-page argument sets this value.

If provided, the wheel-step argument is passed on to the wheel-step method. The default wheel step can be overridden globally though the ‘|MrEd:wheelStep| preference; see “Preferences” (section 12, page 365).

If line-count is not #f, it is passed on to the set-line-count method.

If horizontal-inset is not 5, it is passed on to the horizontal-inset method. Similarly, if vertical-inset is not 5, it is passed on to the vertical-inset method.

For information about the enabled argument, see window<%. For information about the horiz-margin and vert-margin arguments, see subarea<%. For information about the min-width, min-height, stretchable-width, and stretchable-height arguments, see area<%>.

allow-scroll-to-last

Enables or disables last-line scrolling, or gets the current enable state. If last-line scrolling is enabled, then an editor displayed in this canvas can be scrolled so that the last line of text is at the top of the canvas (or bottom of the canvas when bottom-based scrolling is enabled; see scroll-with-bottom-base). By default, an editor can only be scrolled until the last line is at the bottom (or top) of the canvas.

- (send an-editor-canvas allow-scroll-to-last) ⇒ boolean

Returns #t if last-line scrolling is enabled, #f otherwise.

- (send an-editor-canvas allow-scroll-to-last on?) ⇒ void
  on?: boolean
9.5. editor-canvas%

If `on?` is `#f`, last-line scrolling is disabled, otherwise it is enabled.

`allow-tab-exit`

Gets or sets whether tab-exit is enabled for the editor canvas. When tab-exit is enabled, the user can move the keyboard focus out of the editor using the Tab and arrow keys, or invoke the default button using the Enter/Return key. By default, tab-exit is disabled.

When tab-exit is enabled for an editor canvas, Tab, arrow, and Enter keyboard events are consumed by a frame’s default `on-traverse-char` method. (In addition, a dialog’s default method consumes Escape key events.) Otherwise, `on-traverse-char` allows the keyboard events to be propagated to the canvas.

```scheme
- (send an-editor-canvas allow-tab-exit) ⇒ boolean
  Returns `#t` if tab-exit is enabled for the canvas, `#f` otherwise.
- (send an-editor-canvas allow-tab-exit on?) ⇒ void
  on? : boolean
  Enables or disables tab-exit for the canvas.
```

call-as-primary-owner

Calls a thunk and returns the value. While the thunk is being called, if the canvas has an editor, the editor’s `get-admin` method returns the administrator for this canvas. This method is only useful when an editor is displayed in multiple canvases.

```scheme
- (send an-editor-canvas call-as-primary-owner f) ⇒ return value of f
  f : procedure of zero arguments
  Returns `(f)`.
```

`force-display-focus`

Enables or disables force-focus mode. In force-focus mode, the caret of the editor displayed in this canvas will always be visible, even when the canvas does not actually have the keyboard focus.

```scheme
- (send an-editor-canvas force-display-focus) ⇒ boolean
  Returns `#t` if force-focus mode is enabled, `#f` otherwise.
- (send an-editor-canvas force-display-focus on?) ⇒ void
  on? : boolean
  If `on?` is `#f`, the focus is displayed normally, otherwise the focus display is forced.
```

get-editor

Returns the editor currently displayed by this canvas, or `#f` if the canvas does not have an editor.

```scheme
- (send an-editor-canvas get-editor) ⇒ text% or pasteboard% object or #f
```
get-line-count

Returns a line count installed with `set-line-count`, or `#f` if no minimum line count is set.

- `(send an-editor-canvas get-line-count)` ⇒ `exact integer in [1, 1000] or #f`

horizontal-inset

Gets or sets the number of pixels within the canvas reserved to the left and right of editor content. The default is 5.

- `(send an-editor-canvas horizontal-inset)` ⇒ `exact integer in [1, 10000]`
  Gets the current inset.

- `(send an-editor-canvas horizontal-inset step)` ⇒ `void`
  `step`: `exact integer in [1, 10000]`
  Sets the inset.

lazy-refresh

Enables or disables lazy-refresh mode, or gets the current enable state. In lazy-refresh mode, the canvas’s `refresh` method is called when the window needs to be updated, rather than `on-paint`. By default, an `editor-canvas%` object is not in lazy-refresh mode.

- `(send an-editor-canvas lazy-refresh)` ⇒ `boolean`
  Returns `#t` if lazy-refresh mode is enabled, `#f` otherwise.

- `(send an-editor-canvas lazy-refresh on?)` ⇒ `void`
  `on?`: `boolean`
  If `on?` if `#f`, lazy-refresh mode is disabled, otherwise it is enabled.

on-char

Called when the canvas receives a keyboard event. See also “Mouse and Keyboard Events” (section 2.3, page 12).

- `(send an-editor-canvas on-char event)` ⇒ `void`
  `event`: `key-event% object`
  Usually handles ’wheel-up and ’wheel-down events by scrolling vertically. See also `wheel-step`.
  Otherwise, passes the event to the canvas’s editor, if any, by calling its `on-char` method.
  See also `get-editor`.

on-event

Called when the canvas receives a mouse event. See also “Mouse and Keyboard Events” (section 2.3, page 12), noting in particular that certain mouse events can get dropped.

- `(send an-editor-canvas on-event event)` ⇒ `void`
  `event`: `mouse-event% object`
  Passes the event to the canvas’s editor, if any, by calling its `on-event` method.
  See also `get-editor`.
on-focus

Called when a window receives or loses the keyboard focus. If the argument is #t, the keyboard focus was received, otherwise it was lost.

Note that under X, keyboard focus can move to the menu bar when the user is selecting a menu item.

- (send an-editor-canvas on-focus on?) ⇒ void
  on?: boolean
  Enables or disables the caret in the display’s editor, if there is one.

on-paint

Called when the canvas is exposed or resized so that the image in the canvas can be repainted.

When on-paint is called in response to a system expose event and only a portion of the canvas is newly exposed, any drawing operations performed by on-paint are clipped to the newly-exposed region; however, the clipping region as reported by get-clipping-region does not change.

- (send an-editor-canvas on-paint) ⇒ void
  Repaints the editor.

on-scroll

Called when the user changes one of the canvas’s manual scrollbars. A scroll-event% argument provides information about the scroll action.

This method is not called when automatic scrollbars are changed; the on-paint method is called instead.

- (send an-editor-canvas on-scroll event) ⇒ void
  event: scroll-event% object
  Repaints the editor.

on-size

Called when the window is resized. The window’s new size (in pixels) is provided to the method. The size values are for the entire window, not just the client area.

- (send an-editor-canvas on-size width height) ⇒ void
  width: exact integer in [0, 10000]
  height: exact integer in [0, 10000]
  If the canvas is displaying an editor, its on-display-size method is called.

scroll-to

Requests scrolling so that the given region in the currently displayed editor is made visible.

- (send an-editor-canvas scroll-to localx localy w h refresh? bias) ⇒ boolean
  localx: real number
localy: real number
w: non-negative real number
h: non-negative real number
refresh?: boolean
bias = 'none: symbol in '(start end none)

The localx, localy, w, and h arguments specify a region of the editor to be made visible by the scroll (in editor coordinates).

If refresh? is not #f, then the editor is updated immediately after a successful scroll.

The bias argument is one of:
- 'start — if the range doesn’t fit in the visible area, show the top-left region
- 'none — no special scrolling instructions
- 'end — if the range doesn’t fit in the visible area, show the bottom-right region

The return value is #t if the display is scrolled, #f if not (either because the requested region is already visible, because the display has zero size, or because the editor is currently printing.)

scroll-with-bottom-base

Enables or disables bottom-base scrolling, or gets the current enable state. If bottom-base scrolling is on, then scroll positions are determined by line boundaries aligned with the bottom of the viewable area (rather than with the top of the viewable area). If last-line scrolling is also enabled (see allow-scroll-to-last), then the editor is bottom-aligned in the display area even when the editor does not fill the viewable area.

- (send an-editor-canvas scroll-with-bottom-base) ⇒ boolean
  Returns #t if bottom-based scrolling is enabled, #f otherwise.

- (send an-editor-canvas scroll-with-bottom-base on? on?) ⇒ void
  on?: boolean
  If on? is #f, bottom-based scrolling is disabled, otherwise it is enabled.

set-editor

Sets the editor that is displayed by the canvas, releasing the current editor (if any). If the new editor already has an administrator that is not associated with an editor-canvas%, then the new editor is not installed into the canvas.

- (send an-editor-canvas set-editor edit redraw?) ⇒ void
  edit: text% or pasteboard% object or #f
  redraw? = #t: boolean
  If redraw? is #f, then the editor is not immediately drawn; in this case, something must force a redraw later (e.g., a call to the on-paint method).
  If the canvas has a line count installed with set-line-count, the canvas’s minimum height is adjusted.

set-line-count

Sets the canvas’s graphical minimum height to display a particular number of lines of text. The line height is determined by measuring the difference between the top and bottom of a displayed editor’s first line. The minimum height is not changed until the canvas gets an editor. When the canvas’s editor is changed, the minimum height is recalculated.

If the line count is set to #f, then the canvas’s graphical minimum height is restored to its original value.
9.6. editor-data%

An editor-data% object contains extra data associated to a snip or region in an editor. See also “Editor Data” (section 8.2.1, page 198).

- (make-object editor-data%) ⇒ editor-data% object
  The element returned by get-next is initialized to #f.

get-dataclass

Gets the class for this data.

- (send an-editor-data get-dataclass) ⇒ editor-data-class% object or #f

get-next

Gets the next editor data element in a list of editor data elements. A #f terminates the list.

- (send an-editor-data get-next) ⇒ editor-data% object or #f
set-dataclass

Sets the class for this data.

- (send an-editor-data set-dataclass v) ⇒ void
  v: editor-data-class% object

set-next

Sets the next editor data element in a list of editor data elements. A #f terminates the list.

- (send an-editor-data set-next v) ⇒ void
  v: editor-data% object or #f

write

Writes the data to the specified stream, returning #t if data is written successfully or #f otherwise.

- (send an-editor-data write f) ⇒ boolean
  f: editor-stream-out% object

9.7 editor-data-class%

An editor-data-class% object defines a type for editor-data% objects. See also “Editor Data” (section 8.2.1, page 198).

- (make-object editor-data-class%) ⇒ editor-data-class% object

get-classname

Gets the name of the class. Names starting with “wx” are reserved for internal use.

- (send an-editor-data-class get-classname) ⇒ string

read

Reads a new data object from the given stream, returning #f if there is an error.

- (send an-editor-data-class read f) ⇒ editor-data% object or #f
  f: editor-stream-in% object

set-classname

Sets the name of the class. Names starting with “wx” are reserved for internal use.

An editor data class name should usually have the form "(lib ...)" to enable on-demand loading of the class; see “Editor Data” (section 8.2.1, page 198) for details.
9.8 editor-data-class-list

Each eventspace has an instance of `editor-data-class-list`, obtained with `(get-the-editor-data-class-list)`. New instances cannot be created directly. This list keeps a list of editor data classes; this list is needed for loading snips from a file. See also “Editor Data” (section 8.2.1, page 198).

add

Adds a snip data class to the list. If a class with the same name already exists in the list, this one will not be added.

```lisp
- (send an-editor-data-class-list add snipclass) ⇒ void
  snipclass: editor-data-class% object
```

find

Finds a snip data class from the list with the given name, returning `#f` if none can be found.

```lisp
- (send an-editor-data-class-list find name) ⇒ snip-class% object or #f
  name: string
```

find-position

Returns an index into the list for the specified class.

```lisp
- (send an-editor-data-class-list find-position class) ⇒ exact non-negative integer
  class: editor-data-class% object
```

nth

Returns the nth class in the list (counting from 0), returning `#f` if the list has n or less classes.

```lisp
- (send an-editor-data-class-list nth n) ⇒ editor-data-class% object or #f
  n: exact non-negative integer
```

number

Returns the number of editor data classes in the list.

```lisp
- (send an-editor-data-class-list number) ⇒ exact non-negative integer
```

9.9 editor-snip%

Superclass: `snip%`
An `editor-snip%` object is a `snip%` object that contains and displays an `editor<%>` object. This snip class is used to insert an editor as a single item within another editor.

- (new editor-snip% [(editor _) [(with-border? _) [(left-margin _)] [(right-margin _)] [(top-margin _)] [(bottom-margin _)] [(left-inset _)] [(right-inset _)] [(top-inset _)] [(bottom-inset _)] [(min-width _)] [(max-width _)] [(min-height _)] [(max-height _)]) ⇒ editor-snip% object
  
editor = #f: text% object or #f
  with-border? = #t: boolean
  left-margin = 5: exact non-negative integer
  top-margin = 5: exact non-negative integer
  right-margin = 5: exact non-negative integer
  bottom-margin = 5: exact non-negative integer
  left-inset = 1: exact non-negative integer
  top-inset = 1: exact non-negative integer
  right-inset = 1: exact non-negative integer
  bottom-inset = 1: exact non-negative integer
  min-width = 'none: non-negative real number or 'none
  max-width = 'none: non-negative real number or 'none
  min-height = 'none: non-negative real number or 'none
  max-height = 'none: non-negative real number or 'none

If `editor` is non-#f, then it will be used as the editor contained by the snip. See also `set-editor`. If `with-border?` is not #f, then a border will be drawn around the snip. The editor display will be inset in the snip area by the amounts specified in the -margin arguments. The border will be drawn with an inset specified by the -inset arguments.

See `get-inset` and `get-margin` for information about the inset and margin arguments.

adjust-cursor

Called to determine the cursor image used when the cursor is moved over the snip in an editor. If #f is returned, a default cursor is selected by the editor. (See `adjust-cursor` in `editor<%>` for more information.)

- (send an-editor-snip adjust-cursor dc x y editorx editory event) ⇒ cursor% object or #f
  
dc: dc<%> object
  x: real number
  y: real number
  editorx: real number
  editory: real number
  event: mouse-event% object

Gets a cursor from the embedded editor by calling its `adjust-cursor` method.

border-visible?

Returns #t if the snip has a border draw around it, #f otherwise.

- (send an-editor-snip border-visible?) ⇒ boolean
get-align-top-line

Reports whether the snip is in align-top-line mode. See get-extent for more information.

See also set-align-top-line.

- (send an-editor-snip get-align-top-line) ⇒ boolean

get-editor

Returns the editor contained by the snip or #f if there is no editor.

- (send an-editor-snip get-editor) ⇒ text% or pasteboard% object or #f

get-extent

Calculates the snip’s width, height, descent (amount of height which is drawn below the baseline), space (amount of height which is “filler” space at the top), and horizontal spaces (amount of width which is “filler” space at the left and right).

This method is called by the snip’s administrator; it should not be called directly by others. To get the extent of a snip, use get-snip-location in editor<%>.

A drawing context is provided for the purpose of finding font sizes, but no drawing should occur. The get-extent and partial-offset methods must not make any assumptions about the state of the drawing context, except that it is scaled properly. In particular, the font for the snip’s style is not automatically set in the drawing context before the method is called. If get-extent or partial-offset changes the drawing context’s setting, it must restore them before returning. However, the methods should not need to change the drawing context; only font settings can affect measurement results from a device context, and get-text-extent in dc<%> accepts a font% argument for sizing that overrides that device context’s current font.

The snip’s left and top locations are provided in editor coordinates. In a text editor, the y-coordinate is the line’s top location; the snip’s actual top location is potentially undetermined until its height is known.

If a snip caches the result size for future replies, it should invalidate its cached size when size-cache-invalid is called (especially if the snip’s size depends on any device context properties).

If a snip’s size changes after receiving a call to get-extent and before receiving a call to size-cache-invalid, then the snip must notify its administrator of the size change, so that the administrator can recompute its derived size information. Notify the administrator of a size change by call its resized method.

The snip’s editor is usually internally locked for writing and reflowing when this method is called (see also “Locks” (section 8.8, page 200)).

- (send an-editor-snip get-extent dc x y w h descent space lspace rspace) ⇒ void
  dc: dc<%> object
  x: real number
  y: real number
  w = #f: boxed non-negative real number or #f
  h = #f: boxed non-negative real number or #f

1Many snips cache their size information, so automatically setting the font would be wasteful.
Calls its editor’s `get-extent` method, then adds the editor snip’s margins.

The top space always corresponds to the space of the editor’s top line, plus the snip’s top margin. Normally, the descent corresponds to the descent of the editor’s last line plus the snip’s bottom margin. However, if the snip is in align-top-line mode (see `set-align-top-line`), the descent corresponds to the descent of the top line, plus the height rest of the editor’s lines, plus the snip’s bottom margin.

If the editor is a text editor, then 1 is normally subtracted from the editor’s width as returned by `get-extent`, because the result looks better for editing. If the snip is in tight-text-fit mode (see `set-tight-text-fit`) then 2 is subtracted from a text editor’s width, eliminating the two pixels that the text editor reserves for the blinking caret. In addition, tight-text-fit mode subtracts an amount equal to the line spacing from the editor’s height. By default, tight-text-fit mode is disabled.

### get-inset

Gets the current border insets for the snip. The inset sets how much space is left between the edge of the snip and the border.

- `(send an-editor-snip get-inset l t r b) ⇒ void`

  ```
  l : boxed exact non-negative integer
  t : boxed exact non-negative integer
  r : boxed exact non-negative integer
  b : boxed exact non-negative integer
  ```

  The `l` box is filled with left inset. The `t` box is filled with top inset. The `r` box is filled with right inset. The `b` box is filled with bottom inset.

### get-margin

Gets the current margins for the snip. The margin sets how much space is left between the edge of the editor’s contents and the edge of the snip.

- `(send an-editor-snip get-margin l t r b) ⇒ void`

  ```
  l : boxed exact non-negative integer
  t : boxed exact non-negative integer
  r : boxed exact non-negative integer
  b : boxed exact non-negative integer
  ```

  The `l` box is filled with left margin. The `t` box is filled with top margin. The `r` box is filled with right margin. The `b` box is filled with bottom margin.

### get-max-height

Gets the maximum display height of the snip; zero or `'none` indicates that there is no maximum.

- `(send an-editor-snip get-max-height) ⇒ non-negative real number or `'none`

### get-max-width

Gets the maximum display width of the snip; zero or `'none` indicates that there is no maximum.
- (send an-editor-snip get-max-width) ⇒ non-negative real number or ’none

get-min-height

Gets the minimum display height of the snip; zero or ’none indicates that there is no minimum.

- (send an-editor-snip get-min-height) ⇒ non-negative real number or ’none

get-min-width

Gets the minimum display width of the snip; zero or ’none indicates that there is no minimum.

- (send an-editor-snip get-min-width) ⇒ non-negative real number or ’none

get-tight-text-fit

Reports whether the snip is in tight-text-fit mode. See get-extent for more information.
See also set-tight-text-fit.

- (send an-editor-snip get-tight-text-fit) ⇒ boolean

resize

Resizes the snip. The snip can refuse to be resized by returning #f. Otherwise, the snip will resize (it must call its administrator’s resized method) and return #t.
See also on-interactive-resize in pasteboard%.

- (send an-editor-snip resize w h) ⇒ boolean
  w : non-negative real number
  h : non-negative real number

  Sets the snip’s minimum and maximum width and height to the specified values minus the snip border space.
  See also set-min-width set-max-width set-max-height set-min-height.
  Also sets the minimum and maximum width of the editor owned by the snip to the given width (minus the snip border space) via set-max-width and set-min-width.

set-align-top-line

Enables or disables align-top-line mode. See get-extent for more information.
See also get-align-top-line.

- (send an-editor-snip set-align-top-line tight?) ⇒ void
  tight? : boolean

set-editor

Sets the editor contained by the snip, releasing the old editor in the snip (if any). If the new editor already has an administrator, then the new editor is not installed into the snip.
When an `editor-snip` object is not inserted in an editor, it does not have an administrator. During this time, it does not give its contained editor an administrator, either. The administratorless contained editor can therefore “defect” to some other display with an administrator. When a contained editor defects and the snip is eventually inserted into a different editor, the snip drops the traitor contained editor, setting its contained editor to `#f`.

- `(send an-editor-snip set-editor editor) ⇒ void
editor: text% or pasteboard% object or #f

`set-inset`

Sets the current border insets for the snip. The inset sets how much space is left between the edge of the snip and the border.

- `(send an-editor-snip set-inset l t r b) ⇒ void
  l: exact non-negative integer
t: exact non-negative integer
r: exact non-negative integer
b: exact non-negative integer

`set-margin`

Sets the current margins for the snip. The margin sets how much space is left between the edge of the editor’s contents and the edge of the snip.

- `(send an-editor-snip set-margin l t r b) ⇒ void
  l: exact non-negative integer
t: exact non-negative integer
r: exact non-negative integer
b: exact non-negative integer

`set-max-height`

An `editor-snip` normally stretches to wrap around the size of the editor it contains. This method limits the height of the snip (and if the editor is larger, only part of the editor is displayed).

Zero or ‘none disables the limit.

- `(send an-editor-snip set-max-height h) ⇒ void
  h: non-negative real number or ‘none

`set-max-width`

An `editor-snip` normally stretches to wrap around the size of the editor it contains. This method limits the width of the snip (and if the editor is larger, only part of the editor is displayed). The contained editor’s width limits are not changed by this method.

Zero or ‘none disables the limit.

- `(send an-editor-snip set-max-width w) ⇒ void
  w: non-negative real number or ‘none

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set-min-height

An editor-snip% normally stretches to wrap around the size of the editor it contains. This method sets the minimum height of the snip (and if the editor is smaller, the editor is top-aligned in the snip).

Zero or ‘none disables the limit.

```
- (send an-editor-snip set-min-height h) ⇒ void
  h: non-negative real number or ‘none
```

set-min-width

An editor-snip% normally stretches to wrap around the size of the editor it contains. This method sets the minimum width of the snip (and if the editor is smaller, the editor is left-aligned in the snip). The contained editor’s width limits are not changed by this method.

Zero or ‘none disables the limit.

```
- (send an-editor-snip set-min-width w) ⇒ void
  w: non-negative real number or ‘none
```

set-tight-text-fit

Enables or disables tight-text-fit mode. See get-extent for more information.

See also get-tight-text-fit.

```
- (send an-editor-snip set-tight-text-fit tight?) ⇒ void
  tight?: boolean
```

show-border

Shows or hides the snip’s border.

```
- (send an-editor-snip show-border show?) ⇒ void
  show?: boolean
  If show? is #f, the border is hidden, otherwise is it shown.
```

9.10 editor-snip-editor-admin<%>

Extends: (class->interface editor-admin%)

An instance of this administrator interface is created with each editor-snip% object; new instances cannot be created directly.

get-snip

Returns the snip that owns this administrator (and displays the editor controlled by the administrator, if any).
9. Editor Class Reference

9.11 editor-stream-in%

An editor-stream-in% object is used to read editor information from a file or other input stream (such as the clipboard).

- (make-object editor-stream-in% base) ⇒ editor-stream-in% object
  
  base: editor-stream-in-base% object

  An in-stream base — possible an editor-stream-in-bytes-base% object — must be supplied in base.

get

Reads data from the stream, returning itself. Reading from a bad stream always gives 0.

- (send an-editor-stream-in% get v) ⇒ editor-stream-in% object
  
  v: boxed exact integer

  The v box is filled with the next integer in the stream.

- (send an-editor-stream-in% get v) ⇒ editor-stream-in% object
  
  v: boxed real number

  The v box is filled with the next floating-point value in the stream.

get-bytes

Like get-unterminated-bytes, but the last read byte is assumed to be a nul terminator and discarded. Use this method when data is written by a call to put without an explicit byte count, and use get-unterminated-bytes when data is written with an explicit byte count.

- (send an-editor-stream-in% get-bytes len) ⇒ byte string or #f
  
  len = #f: boxed exact non-negative integer or #f

  The len box is filled with the length of the byte string plus one (to indicate the terminator), unless len is #f.

get-exact

Returns the next integer value in the stream.

- (send an-editor-stream-in% get-exact) ⇒ exact integer

get-fixed

Gets a fixed-sized integer from the stream. See put-fixed for more information. Reading from a bad stream always gives 0.

- (send an-editor-stream-in% get-fixed v) ⇒ editor-stream-in% object
  
  v: boxed exact integer

  The v box is filled with the fixed-size integer from the stream.
get-inexact
Returns the next floating-point value in the stream.

- (send an-editor-stream-in get-inexact) ⇒ real number

get-unterminated-bytes
Returns the next byte string from the stream. Reading from a bad stream returns #f or "".

Note that when put is not given a byte length, it includes an extra byte for a nul terminator; use get-bytes to read such byte strings.

- (send an-editor-stream-in get-unterminated-bytes len) ⇒ byte string or #f
  len = #f: boxed exact non-negative integer or #f
  The len box is filled with the length of the byte string, unless len is #f.

jump-to
Jumps to a given position in the stream.

- (send an-editor-stream-in jump-to pos) ⇒ void
  pos: exact non-negative integer

ok?
Returns #t if the stream is ready for reading, #f otherwise. Reading from a bad stream always returns 0 or "".

- (send an-editor-stream-in ok?) ⇒ boolean

remove-boundary
See set-boundary.

- (send an-editor-stream-in remove-boundary) ⇒ void

set-boundary
Sets a file-reading boundary at a position in the stream. If there is an attempt to read past this boundary, an error is signaled. The boundary is removed with a call to remove-boundary. Every call to set-boundary must be balanced by a call to remove-boundary.

Boundaries help keep a subroutine from reading too much data leading to confusing errors. However, a malicious subroutine can call remove-boundary on its own.

- (send an-editor-stream-in set-boundary n) ⇒ void
  n: exact non-negative integer
  Sets a file-reading boundary at n bytes past the current stream location.
skip

Skips forward in the stream.

- (send an-editor-stream-in skip n) ⇒ void
  n: exact non-negative integer
  Skips past the next n bytes in the stream.

tell

Returns the current stream position.

- (send an-editor-stream-in tell) ⇒ exact non-negative integer

9.12 editor-stream-in-base%

An editor-stream-in-base% object is used by an editor-stream-in% object to perform low-level reading of data.

The editor-stream-in-base% class is never instantiated directly, but the derived class editor-stream-in-bytes-base% can be instantiated. New derived classes must override all of the methods described in this section.

bad?

Returns #t if there has been an error reading from the stream, #f otherwise.

- (send an-editor-stream-in-base bad?) ⇒ boolean

read

Reads characters to fill the supplied vector. The return value is the number of characters read, which may be less than the number requested if the stream is emptied. If the stream is emptied, the next call to bad? must return #t.

- (send an-editor-stream-in-base read data) ⇒ exact non-negative integer
  data: vector for characters

seek

Moves to the specified absolute position in the stream.

- (send an-editor-stream-in-base seek pos) ⇒ void
  pos: exact non-negative integer

skip

Skips over characters in the stream.
- (send an-editor-stream-in-base skip n) ⇒ void
  n: exact non-negative integer
  Skips past the next n characters in the stream.

tell

Returns the current stream position.

- (send an-editor-stream-in-base tell) ⇒ exact non-negative integer

### 9.13 editor-stream-in-bytes-base%

**Superclass:** editor-stream-in-base%

An editor-stream-in-bytes-base% object can be used to read editor data from a byte string.

- (make-object editor-stream-in-bytes-base% s) ⇒ editor-stream-in-bytes-base% object
  s: byte string
  Creates a stream base that reads from s.

### 9.14 editor-stream-out%

An editor-stream-out% object is used to write editor information to a file or other output stream (such as the clipboard).

- (make-object editor-stream-out% base) ⇒ editor-stream-out% object
  base: editor-stream-out-base% object
  An out-stream base — possibly an editor-stream-out-bytes-base% object — must be supplied in base.

jump-to

Jumps to a given position in the stream.

- (send an-editor-stream-out jump-to pos) ⇒ void
  pos: exact non-negative integer

ok?

Returns #t if the stream is ready for writing, #f otherwise. Writing to a bad stream has no effect.

- (send an-editor-stream-out ok?) ⇒ boolean

pretty-finish

Ensures that the stream ends with a newline. This method is called by write-editor-global-footer.
- (send an-editor-stream-out pretty-finish) ⇒ void

**pretty-start**

Writes "comment" into the stream that identifies the file format. This method is called by `write-editor-global-header`.

- (send an-editor-stream-out pretty-start) ⇒ void

**put**

Writes data to a stream. Writing to a bad stream has no effect.

- (send an-editor-stream-out put n v) ⇒ editor-stream-out% object
  
  \n  n: exact non-negative integer
  \n  v: byte string

  Writes \( n \) bytes of the string \( v \). Use `get-unterminated-bytes` to read the bytes later.

- (send an-editor-stream-out put v) ⇒ editor-stream-out% object
  
  \n  v: byte string

  Writes \( v \). For historical reasons, the actual number of bytes written includes a nul terminator, so use `get-bytes` instead of `get-unterminated-bytes` to read the bytes later.

- (send an-editor-stream-out put v) ⇒ editor-stream-out% object
  
  \n  v: exact integer

  Writes an integer.

- (send an-editor-stream-out put v) ⇒ editor-stream-out% object
  
  \n  v: real number

  Writes a floating-point number.

**put-fixed**

Puts a fixed-sized integer into the stream. This method is needed because numbers are usually written in a compressed form (for example, 1 takes one byte, and 512 takes up two bytes, regardless of the C++ type that the number had). In many cases it is useful to temporary write a 0 to a stream, write more data, and then go back and change the 0 to another number; this requires a fixed-size number.

Numbers written to a stream with `put-fixed` must be read with `get-fixed`.

- (send an-editor-stream-out put-fixed v) ⇒ editor-stream-out% object
  
  \n  v: exact integer

**tell**

Returns the current stream position.

- (send an-editor-stream-out tell) ⇒ exact non-negative integer
9.15 editor-stream-out-base%

An editor-stream-out-base% object is used by an editor-stream-out% object to perform low-level writing of data.

The editor-stream-out-base% class is never instantiated directly, but the derived class editor-stream-out-bytes-base can be instantiated. New derived classes must override all of the methods described in this section.

bad?

- (send an-editor-stream-out-base bad?) ⇒ boolean
  Returns #t if there has been an error writing to the stream, #f otherwise.

seek

Moves to the specified absolute position in the stream.

- (send an-editor-stream-out-base seek pos) ⇒ void
  pos: exact non-negative integer

tell

Returns the current stream position.

- (send an-editor-stream-out-base tell) ⇒ exact non-negative integer

write

Writes data to the stream.

- (send an-editor-stream-out-base write data) ⇒ void
  data: list of characters

9.16 editor-stream-out-bytes-base%

Superclass: editor-stream-out-base%

An editor-stream-out-bytes-base% object can be used to write editor data into a byte string.

- (make-object editor-stream-out-bytes-base%) ⇒ editor-stream-out-bytes-base% object
  Creates an empty stream.

get-bytes

Returns the current contents of the stream.

- (send an-editor-stream-out-bytes-base get-bytes) ⇒ bytes
9.17 editor-wordbreak-map%

An editor-wordbreak-map% objects is used with a text% objects to specify word-breaking criteria for the default wordbreaking function. See also set-wordbreak-map, get-wordbreak-map, find-wordbreak, and set-wordbreak-func.

A global object the-editor-wordbreak-map is created automatically and used as the default map for all text% objects.

A wordbreak objects implements a mapping from each character to a list of symbols. The following symbols are legal elements of the list:

- 'caret,
- 'line,
- 'selection,
- 'user1,
- 'user2

The presence of a flag in a character’s value indicates that the character does not break a word when searching for breaks using the corresponding reason. For example, if 'caret is present, then the character is a non-breaking character for caret-movement words. (Each stream of non-breaking characters is a single word.)

- (make-object editor-wordbreak-map%) ⇒ editor-wordbreak-map% object
  All alpha-numeric characters are initialized with '(caret line selection). All other non-space characters except “-” are initialized with '(line). All space characters and “-” are initialized with null.

get-map

Gets the mapping value for a character. See editor-wordbreak-map% for more information.

- (send an-editor-wordbreak-map get-map char) ⇒ list of symbols
  char: character
  Gets the mapping value for char.

set-map

Sets the mapping value for a character. See editor-wordbreak-map% for more information.

- (send an-editor-wordbreak-map set-map char value) ⇒ void
  char: character
  value: list of symbols
  Sets the mapping value for char to value.

9.18 image-snip%

Superclass: snip%
An `image-snip%` is a snip that can display bitmap images (usually loaded from a file). When the image file cannot be found, a box containing an “X” is drawn.

```scheme
(make-object image-snip% filename kind relative-path? inline?) ⇒ image-snip% object
  filename = #f: path or #f
  kind = ‘unknown: symbol in ’(unknown unknown/mask gif gif/mask jpeg png png/mask xbm xpm bmp pict)
  relative-path? = #f: boolean
  inline? = #t: boolean
```

Creates an image snip, loading the image `filename` if specified. See also `load-file`.

```scheme
(make-object image-snip% bitmap mask) ⇒ image-snip% object
  bitmap = bitmap% object
  mask = #f: bitmap% object or #f
```

Creates an image snip with the given bitmap. See `set-bitmap`.

**get-bitmap**

Returns the bitmap that is displayed by the snip, whether set through `set-bitmap` or `load-file`. If no bitmap is displayed, the result is `#f`.

The returned bitmap cannot be selected into a `bitmap-dc%` as long as it belongs to the snip, but it can be used as a pen or brush stipple.

```scheme
(send an-image-snip get-bitmap) ⇒ bitmap% object or #f
```

**get-bitmap-mask**

Returns the mask bitmap that is used for displaying by the snip, if one was installed with `set-bitmap`. If no mask is used, the result is `#f`.

The returned bitmap cannot be selected into a `bitmap-dc%` as long as it belongs to the snip, but it can be used as a pen or brush stipple.

```scheme
(send an-image-snip get-bitmap-mask) ⇒ bitmap% object or #f
```

**get-filename**

Returns the name of the currently loaded, non-inlined file, or `#f` if a file is not loaded or if a file was loaded with inlining (the default).

```scheme
(send an-image-snip get-filename relative-path) ⇒ path or #f
  relative-path = #f: boxed boolean or #f
```

The `relative-path` box is filled with `#t` if the loaded file’s path is relative to the owning editor’s path, unless `relative-path` is `#f`.

**get-filetype**

Returns the kind used to load the currently loaded, non-inlined file, or ‘unknown if a file is not loaded or if a file was loaded with inlining (the default).
- (send an-image-snip get-filetype) ⇒ symbol in ’(unknown unknown/mask gif gif/mask jpeg png png/mask xbm xpm bmp pict)

load-file

Loads a new bitmap into the snip.

- (send an-image-snip load-file filename kind relative-path? inline?) ⇒ void
  filename : path or #f
  kind = ’unknown: symbol in ’(unknown unknown/mask gif gif/mask jpeg png png/mask xbm xpm bmp pict)
  relative-path? = #f: boolean
  inline? = #t: boolean

Loads the file by passing filename and kind to load-file If a bitmap had previously been specified with set-bitmap, that bitmap (and mask) will no longer be used. If filename is #f, then the current image is cleared.

When ’unknown/mask, ’gif/mask, or ’png/mask is specified and the loaded bitmap object includes a mask (see get-loaded-mask), the mask is used for drawing the bitmap (see draw-bitmap).

If relative-path? is not #f and filename is a relative path, then the file will be read using the path of the owning editor’s filename. If the image is not inlined, it will be saved as a relative pathname.

If inline? is not #f, the image data will be saved directly to the file or clipboard when the image is saved or copied (preserving the bitmap’s mask, if any). The source filename and kind is no longer relevant.

resize

Resizes the snip. The snip can refuse to be resized by returning #f. Otherwise, the snip will resize (it must call its administrator’s resized method) and return #t.

See also on-interactive-resize in pasteboard%.

- (send an-image-snip resize w h) ⇒ void
  w : non-negative real number
  h : non-negative real number

The bitmap will be cropped to fit in the given dimensions.

set-bitmap

Sets the bitmap that is displayed by the snip. This method also accepts an optional mask to be used when drawing the bitmap (see draw-bitmap), but supplying the mask directly is now deprecated. Instead, if no mask is supplied but the bitmap’s get-loaded-mask method produces a bitmap of the same dimensions, it is used as the mask. Furthermore, such a mask is saved with the snip when it is saved to a file or copied (whereas a directly supplied mask is not saved).

The supplied bitmap must not be selected into a bitmap-dc% object, otherwise an exn:fail:contract exception is raised, and it cannot be selected into a bitmap-dc% as long as it belongs to the snip, but it can be used as a pen or brush stipple.

- (send an-image-snip set-bitmap bm mask) ⇒ void
  bm : bitmap% object
  mask = #f: bitmap% object or #f
set-offset

Sets a graphical offset for the bitmap within the image snip.

- (send an-image-snip set-offset dx dy) ⇒ void
  dx : real number
  dy : real number

9.19  keymap%

A keymap% object is used by editor objects to map keyboard and mouse sequences to arbitrary functions in an extensible way. Keymaps can be used without editors, as well. A keymap% object contains

- a mapping from function names to event-handling procedures; and
- a mapping from key and mouse sequences to function names.

A handler procedure in a keymap is invoked with a key-event% object or a mouse-event% object. It is also given another value that depends on the context in which the keymap is used (or, more specifically, the arguments to handle-key-event or handle-mouse-event). For keymaps associated with editor objects, the extra parameter is generally the editor object that received the keyboard or mouse event.

- (make-object keymap%) ⇒ keymap% object
  Creates an empty keymap.

add-function

Names a new function to handle events, called in response to handle-key-event, handle-key-event, or call-function. The return value is of the procedure is ignored.

If there was already a function mapped to this name, it will be replaced with the given function.

When the function is called, it gets the arguments that were passed to handle-key-event, handle-mouse-event, or call-function. For keymaps associated with an editor, this is normally the target editor.

- (send a-keymap add-function name func) ⇒ void
  name : string
  func : procedure of two arguments: an arbitrary value and an event% object

break-sequence

Clears the state of the keymap if it is in the middle of a key sequence. For example, the user may have hit escape, and then changed to another window; if escape is part of a keyboard sequence, the keymap state needs to be cleared because the user is not going to complete the sequence.

A break callback function can be installed with set-break-sequence-callback.

- (send a-keymap break-sequence) ⇒ void
call-function

Calls a named event handler directly. If the function cannot be found or the found handler did not want to handle the event, #f is returned. Otherwise, the return value is the return value of the event handler.

- (send a-keymap call-function name in event try-chain?) ⇒ boolean
  name : string
  in : value
  event : event% object
  try-chain? = #f : boolean

  The in and event arguments are passed on to the keymap handler procedure if one is found.
  If try-chain? is not #f, keymaps chained to this one are searched for the function name. If the function is not found and try-chain? is #f; an exception is also raised, but the exception handler cannot escape (see §2.4.4 Exceptions and Continuation Jumps).

chain-to-keymap

Chains a keymap off this one.

Multiple keymaps can be chained off one keymap using chain-to-keymap. When keymaps are chained off a main keymap, events not handled by the main keymap are passed to the chained keymaps until some chained keymap handles the events. Keymaps can be chained together in an arbitrary acyclic graph.

Keymap chaining is useful because multiple-event sequences are handled correctly for chained groups. Without chaining, a sequence of events can produce state in a keymap that must be reset when a callback is invoked in one of the keymaps. This state can be manually cleared with break-sequence, though calling the break-sequence method also invokes the handler installed by set-break-sequence-callback.

- (send a-keymap chain-to-keymap next prefix?) ⇒ void
  next : keymap% object
  prefix? : boolean

  The next keymap will be used to handle events which are not handled by this keymap. If prefix? is a true value, then next will take precedence over other keymaps already chained to this one.

get-double-click-interval

Returns the maximum number of milliseconds that can separate the clicks of a double-click.

The default interval is determined in a platform-specific way, but it can be overridden globally though the ‘|MrEd:doubleClickTime| preference; see “Preferences” (section 12, page 365).

- (send a-keymap get-double-click-interval) ⇒ exact integer in [0, 1000000]

handle-key-event

Attempts to handle a keyboard event, returning #t if the event was handled (i.e., a handler was found and it returned a true value), #f otherwise.

- (send a-keymap handle-key-event in event) ⇒ boolean
  in : value
  event : key-event% object
9.19. keymap%

Searches for a mapping that matches `event`. See also `call-function`.

handle-mouse-event

Attempts to handle a mouse event, returning `#t` if the event was handled (i.e., a handler was found and it returned a true value), `#f` otherwise.

- `(send a-keymap handle-mouse-event in event) => boolean
  in : value
  event : mouse-event% object`

Searches for a mapping that matches `event`. See also `call-function`.

map-function

Maps an input state to the name of an event handler.

- `(send a-keymap map-function keyname fname) => void
  keyname : string
  fname : string`

Maps an input state sequence to a function name using a string-encoded sequence in `keyname`. The format of `keyname` is a sequence of semicolon-delimited input states; each state is made up of a sequence of modifier identifiers followed by a key identifier.

The modifier identifiers are:
- "s:" — All platforms: Shift
- "c:" — All platforms: Control
- "a:" — Mac OS X: Option
- "m:" — Windows: Alt; X: Meta
- "d:" — Mac OS X: Command

If a particular modifier is not mentioned in a state string, it matches states whether that modifier is pressed or not pressed. A tilde (~) preceding a modifier makes the string match only states where the corresponding modifier is not pressed. If the state string begins with a colon, then the string only matches a state if modifiers not mentioned in the string are not pressed.

A key identifier can be either a character on the keyboard (e.g., "a", "2", "?") or a special name. The special names are:
- "leftbutton" (button down)
- "rightbutton"
- "middlebutton"
- "leftbuttondouble" (button down for double-click)
- "rightbuttondouble"
- "middlebuttondouble"
- "leftbuttontriple" (button down for triple-click)
- "rightbuttontriple"
- "middlebuttontriple"
- "leftbuttonseq" (all events from button down through button up)
- "rightbuttonseq"
- "middlebuttonseq"
- "wheellup"
- "wheeldown"
- "esc"
- "delete"
- "del" (same as "delete")
- "insert"
- "ins" (same as "insert")
- "add"
- "subtract"
- "multiply"
- "divide"
- "backspace"
- "back"
- "return"
- "enter" (same as "return")
- "tab"
- "space"
- "right"
- "left"
- "up"
- "down"
- "home"
- "end"
- "pageup"
- "pagedown"
- "semicolon"
- "colon"
- "numpad0"
- "numpad1"
- "numpad2"
- "numpad3"
- "numpad4"
- "numpad5"
- "numpad6"
- "numpad7"
- "numpad8"
- "numpad9"
- "numpadenter"
- "f1"
- "f2"
- "f3"
- "f4"
- "f5"
- "f6"
- "f7"
- "f8"
- "f9"
- "f10"
- "f11"
- "f12"
- "f13"
- "f14"
- "f15"
- "f16"
- "f17"
- "f18"
- "f19"
- "f20"
- "f21"
- "f22"
- "f23"
- "f24"

For a special keyword, the capitalization does not matter. However, capitalization is important for single-letter keynames (e.g., "A" is interpreted as "s:a").

A state can match multiple state strings mapped in a keymap (or keymap chain); when a state matches multiple state strings, a mapping is selected by ranking the strings according to specificity. A state string that mentions more pressed modifiers has a higher rank than other state strings, and if two strings mention the same number of pressed modifiers, the one that mentions more unpressed modifiers has a higher rank. In that case that multiple matching strings have the same rank, one string is selected arbitrarily.

Examples:
- "space" — matches whenever the space bar is pressed, regardless of the state of modifiers keys.
- ",:space" — matches whenever the space bar is pressed and the Control key is not pressed.
- ",:a" — matches whenever “a” is typed, regardless of the state of modifiers keys other than Shift.
- ",:a" — matches only when “a” is typed with no modifier keys pressed.
- ",:a" — matches whenever “a” is typed and neither the Shift key nor the Control key is pressed.
- ",:esc,:c:c" — matches an Escape key press (no modifiers) followed by a Control-C press (no modifiers other than Control).

A call to map-function that would map a particular key sequence both as a prefix and as a complete sequence raises an exception, but the exception handler cannot escape (see §2.4.4 Exceptions and Continuation Jumps).

A function name does not have to be mapped to a handler before input states are mapped to the name; the handler is dispatched by name at the time of invocation. The event handler mapped to a function name can be changed without affecting the map from input states to function names.

remove-chained-keymap

Unchains a keymap from this keymap.

- (send a-keymap remove-chained-keymap keymap) ⇒ void

remove-grab-key-function

Removes a callback installed with set-grab-key-function.

- (send a-keymap remove-grab-key-function) ⇒ void

remove-grab-mouse-function

Removes a callback installed with set-grab-mouse-function.

- (send a-keymap remove-grab-mouse-function) ⇒ void
set-break-sequence-callback

Installs a callback procedure that is invoked when `break-sequence` is called. After it is invoked once, the callback is removed from the keymap. If another callback is installed before `break-sequence` is called, the old callback is invoked immediately before the new one is installed.

- `(send a-keymap set-break-sequence-callback f) ⇒ void`
  
  `f`: procedure of no arguments

set-double-click-interval

Sets the maximum number of milliseconds that can separate the clicks of a double-click.

- `(send a-keymap set-double-click-interval n) ⇒ void`
  
  `n`: exact integer in [0, 100000]

set-grab-key-function

Installs a callback procedure that is invoked after the keymap matches input to a function name or fails to match an input. Only one keyboard grab function can be installed at a time. When keymaps are chained to a keymap with a grab callback, the callback is invoked for matches in the chained keymap (when the chained keymap does not have its own grab callback).

If a grab callback returns a true value for a matching or non-matching callback, the event is considered handled. If the callback returns a true value for a matching callback, then the matching keymap function is not called by the keymap.

- `(send a-keymap set-grab-key-function f) ⇒ void`
  
  `f`: procedure of four arguments — a string or #f, a `keymap%` object, an arbitrary value, and a `key-event%` object — that returns a boolean

  The callback procedure will be invoked as:

  ```lisp
  (f str km editor event)
  ```

  The `str` argument is the name of a function for a matching callback, or #f for a non-matching callback. The `km` argument is the keymap that matched (possibly a keymap chained to the one in which the callback was installed) or the keymap in which the callback was installed. The `editor` and `event` arguments are the same as passed on to the matching keymap function.

  Key grab callback functions are de-installed with `remove-grab-key-function`.

set-grab-mouse-function

Like `set-grab-key-function`, but for mouse events.

- `(send a-keymap set-grab-mouse-function f) ⇒ void`
  
  `f`: procedure of four arguments — a string or #f, a `keymap%` object, an arbitrary value, and a `mouse-event%` object — that returns a boolean

  See `set-grab-key-function`.

9.20 mult-color<%>

A `mult-color<%>` object is used to scale the RGB values of a `color%` object. A `mult-color<%>` object exist only within a `style-delta%` object.
See also \texttt{get-foreground-mult} and \texttt{get-background-mult}.

\textbf{get}

Gets all of the scaling values.

\begin{verbatim}
- (send a-mult-color get r g b) ⇒ void
  r: boxed real number
  g: boxed real number
  b: boxed real number

  The \( r \) box is filled with the scaling value for the red component of the color. The \( g \) box is filled with the scaling value for the green component of the color. The \( b \) box is filled with the scaling value for the blue component of the color.
\end{verbatim}

\textbf{get-b}

Gets the multiplicative scaling value for the blue component of the color.

\begin{verbatim}
- (send a-mult-color get-b) ⇒ real number
\end{verbatim}

\textbf{get-g}

Gets the multiplicative scaling value for the green component of the color.

\begin{verbatim}
- (send a-mult-color get-g) ⇒ real number
\end{verbatim}

\textbf{get-r}

Gets the multiplicative scaling value for the red component of the color.

\begin{verbatim}
- (send a-mult-color get-r) ⇒ real number
\end{verbatim}

\textbf{set}

Sets all of the scaling values.

\begin{verbatim}
- (send a-mult-color set r g b) ⇒ void
  r: real number
  g: real number
  b: real number
\end{verbatim}

\textbf{set-b}

Sets the multiplicative scaling value for the blue component of the color.

\begin{verbatim}
- (send a-mult-color set-b v) ⇒ void
  v: real number
\end{verbatim}
set-g

Sets the multiplicative scaling value for the green component of the color.

- (send a-mult-color set-g v) ⇒ void
  v: real number

set-r

Sets the additive value for the red component of the color.

- (send a-mult-color set-r v) ⇒ void
  v: real number

9.21 pasteboard%

Implements: editor<%>

A pasteboard% object is an editor for displaying snips with arbitrary locations.

- (new pasteboard% ) ⇒ pasteboard% object

  The editor will not be displayed until it is attached to an editor-canvas% object or some other display.
  A new keymap% object is created for the new editor. See also get-keymap and set-keymap.
  A new style-list% object is created for the new editor. See also get-style-list and set-style-list.

add-selected

Selects snips without deselecting other snips.

The selection in a pasteboard can be changed by the system in response to other method calls, and such changes do not go through this method; use on-select to monitor selection changes.

- (send a-pasteboard add-selected snip) ⇒ void
  snip: snip% object

  Selects snip.

- (send a-pasteboard add-selected x y w h) ⇒ void
  x: real number
  y: real number
  w: non-negative real number
  h: non-negative real number

  Selects all snips that intersect with the given rectangle (in editor coordinates).

after-delete (augmentable only)

Called after a snip is deleted from the editor (and after the display is refreshed; use on-delete and begin-edit-sequence to avoid extra refreshes when after-delete modifies the editor).
See also `can-delete?` and `on-edit-sequence`.

No internals locks are set when this method is called.

- `(send a-pasteboard after-delete snip) ⇒ void
  snip: snip% object

`after-insert` *(augmentable only)*

Called after a snip is inserted into the editor (and after the `display` is refreshed; use `on-insert` and `begin-edit-sequence` to avoid extra refreshes when `after-insert` modifies the editor).

See also `can-insert?` and `on-edit-sequence`.

No internals locks are set when this method is called.

- `(send a-pasteboard after-insert snip before x y) ⇒ void
  snip: snip% object
  before: snip% object or #f
  x: real number
  y: real number

`after-interactive-move` *(augmentable only)*

This method is called after the user stops interactively dragging snips (the ones that are selected; see `find-next-selected-snip`). The mouse event that terminated the move (usually a button-up event) is provided.

See also `can-interactive-move?` and `on-interactive-move`.

- `(send a-pasteboard after-interactive-move event) ⇒ void
  event: mouse-event% object

  Does nothing.

`after-interactive-resize` *(augmentable only)*

This method is called after the user stops interactively resizing a snip (the one that is currently selected; see `find-next-selected-snip`).

See also `can-interactive-resize?` and `on-interactive-resize`.

- `(send a-pasteboard after-interactive-resize snip) ⇒ void
  snip: snip% object

  The `snip` argument is the snip that was resized. This method does nothing.

`after-move-to` *(augmentable only)*

Called after a given snip is moved within the editor (and after the `display` is refreshed; use `on-move-to` and `begin-edit-sequence` to avoid extra refreshes when `after-move-to` modifies the editor).
See also `can-move-to?` and `on-edit-sequence`.

No internals locks are set when this method is called.

```lisp
- (send a-pasteboard after-move-to snip x y dragging?) ⇒ void
  snip: snip% object
  x: real number
  y: real number
  dragging?: boolean

  If `dragging?` is not #f, then this move was a temporary move for dragging.
```

**after-reorder** *(augmentable only)*

Called before a snip is moved in the pasteboard’s front-to-back snip order (and after the display is refreshed; use `on-reorder` and `begin-edit-sequence` to avoid extra refreshes when `after-reorder` modifies the editor).

See also `can-reorder?` and `on-edit-sequence`.

No internals locks are set when this method is called.

```lisp
- (send a-pasteboard after-reorder snip to-snip before?) ⇒ boolean
  snip: snip% object
  to-snip: snip% object
  before?: boolean

  If `before?` is #t, then `snip` was moved before `to-snip`, otherwise `snip` was moved after `to-snip`
```

**after-resize** *(augmentable only)*

Called after a given snip is resized (and after the display is refreshed; use `on-resize` and `begin-edit-sequence` to avoid extra refreshes when `after-resize` modifies the editor), or after an unsuccessful resize attempt was made.

See also `can-resize?` and `on-edit-sequence`.

No internals locks are set when this method is called.

```lisp
- (send a-pasteboard after-resize snip w h resized?) ⇒ void
  snip: snip% object
  w: non-negative real number
  h: non-negative real number
  resized?: boolean

  If `resized?` is not #f, the snip was successfully resized.
```

**after-select** *(augmentable only)*

This method is called after a snip in the pasteboard is selected or deselected. See also `on-select`. This method is not called after selected snip is deleted (and thus de-selected indirectly); see also `after-delete`.

See also `can-select?` and `on-edit-sequence`.

No internals locks are set when this method is called.
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- (send a-pasteboard after-select snip on?) ⇒ void
  snip: snip% object
  on?: boolean

If on? is #t, then snip was just selected, otherwise snip was just deselected.

can-delete? (augmentable only)

Called before a snip is deleted from the editor. If the return value is #f, then the delete will be aborted.

See also on-delete and after-delete.

The editor is internally locked for writing when this method is called (see also “Locks” (section 8.8, page 200)).

- (send a-pasteboard can-delete? snip) ⇒ boolean
  snip: snip% object

can-insert? (augmentable only)

Called before a snip is inserted from the editor. If the return value is #f, then the insert will be aborted.

See also on-insert and after-insert.

The editor is internally locked for writing when this method is called (see also “Locks” (section 8.8, page 200)).

- (send a-pasteboard can-insert? snip before x y) ⇒ boolean
  snip: snip% object
  before: snip% object or #f
  x: real number
  y: real number

can-interactive-move? (augmentable only)

This method is called when the user starts interactively dragging snips (the ones that are selected; see find-next-selected-snip). All of the selected snips will be moved. If #f is returned, the interactive move is disallowed. The mouse event that started the move (usually a button-down event) is provided.

See also on-interactive-move, after-interactive-move, and interactive-adjust-move.

- (send a-pasteboard can-interactive-move? event) ⇒ boolean
  event: mouse-event% object

Returns #t.

can-interactive-resize? (augmentable only)

This method is called when the user starts interactively resizing a snip (the one that is selected; see find-next-selected-snip). If #f is returned, the interactive resize is disallowed.

See also after-interactive-resize, after-interactive-resize, and interactive-adjust-resize.

- (send a-pasteboard can-interactive-resize? snip) ⇒ boolean
  snip: snip% object
The *snip* argument is the snip that will be resized. This method returns #t.

**can-move-to? (augmentable only)**

Called before a snip is moved in the editor. If the return value is #f, then the move will be aborted.

See also **on-move-to** and **after-move-to**.

The editor is internally locked for writing when this method is called (see also “Locks” (section 8.8, page 200)).

```scheme
- (send a-pasteboard can-move-to? snip x y dragging?) ⇒ boolean
  snip: snip% object
  x: real number
  y: real number
  dragging?: boolean

  If *dragging?* is not #f, then this move is a temporary move for dragging.
```

**can-reorder? (augmentable only)**

Called before a snip is moved in the pasteboard's front-to-back snip order. If the return value is #f, then the reordering will be aborted.

See also **on-reorder** and **after-reorder**.

The editor is internally locked for writing when this method is called (see also “Locks” (section 8.8, page 200)).

```scheme
- (send a-pasteboard can-reorder? snip to-snip before?) ⇒ boolean
  snip: snip% object
  to-snip: snip% object
  before?: boolean

  If *before?* is #t, then *snip* is to be moved before *to-snip*, otherwise *snip* is to be moved after *to-snip*
```

**can-resize? (augmentable only)**

Called before a snip is resized in the editor. If the return value is #f, then the resize will be aborted.

See also **on-resize** and **after-resize**.

The editor is internally locked for writing when this method is called (see also “Locks” (section 8.8, page 200)).

```scheme
- (send a-pasteboard can-resize? snip w h) ⇒ boolean
  snip: snip% object
  w: non-negative real number
  h: non-negative real number
```

**can-select? (augmentable only)**

This method is called before a snip in the pasteboard is selected or deselected. If #f is returned, the selection change is disallowed. This method is not called when a selected snip is to be deleted (and thus de-selected indirectly); see also **can-delete**.
See also on-select and after-select.

The editor is internally locked for writing when this method is called (see also “Locks” (section 8.8, page 200)).

```
- (send a-pasteboard can-select? snip on?) ⇒ boolean
  snip: snip% object
  on?: boolean
  If on? is #t, then snip will be selected, otherwise snip will be deselected.
```

disable-tracing

```
Changes the style for items in the editor.
```

The style within an editor can be changed by the system (in response to other method calls), and such changes do not go through this method; use on-change-style in text% to monitor style changes.

```
- (send a-pasteboard change-style style snip) ⇒ void
  style: style<%> object or #f
  snip = #f: snip% object or #f
  Changes the style of style to a specific style. If snip is #f, then all currently selected snips are changed. The editor's style list must contain style, otherwise the style is not changed. See also convert in style-list%.

- (send a-pasteboard change-style delta snip) ⇒ void
  delta: style-delta% object or #f
  snip: snip% object
  Changes the style of snip by applying a style delta. If snip is #f, then all currently selected snips are changed.

- (send a-pasteboard change-style delta) ⇒ void
  delta: style-delta% object or #f
  Changes the style of the selected items by applying a style delta.
  To change a large collection of snips from one style to another style, consider providing a style<%> instance rather than a style-delta% instance. Otherwise, change-style must convert the style-delta% instance to the style<%> instance for every snip; this conversion consumes both time and (temporary) memory.

- (send a-pasteboard change-style style) ⇒ void
  style: style<%> object or #f
  Changes the style of the selected items to a specific style. The editor's style list must contain style, otherwise the style is not changed. See also convert in style-list%.
```

copy-self-to

```
Copies the properties of this editor into an existing editor.
```

```
- (send a-pasteboard copy-self-to dest) ⇒ void
  dest: text% or pasteboard% object
  Each snip in this editor is copied and inserted into dest. In addition, this editor's filename, maximum undo history setting, keymap, interactive caret threshold, and overwrite-styles-on-load settings are installed into dest.
  This editor's style list is copied and the copy is installed as the style list for dest.
  This editor's dragability, selection visibility state, and scroll step are installed into dest.
```
The content of an editor can be changed by the system in response to other method calls, and such changes do not go through this method; use on-delete to monitor content deletion changes.

- (send a-pasteboard delete) ⇒ void
  Deletes the currently selected snips from the editor.

- (send a-pasteboard delete snip) ⇒ void
  snip: snip% object
  Deletes the snip from the editor.

do-copy

Called to copy the editor’s current selection into the clipboard. This method is provided so that it can be overridden by subclasses. Do not call this method directly; instead, call copy.

- (send a-pasteboard do-copy time extend?) ⇒ void
  time: exact integer
  extend?: boolean
  Copy the current selection, extending the current clipboard contexts if extend? is true.
  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

do-paste

Called to paste the current contents of the clipboard into the editor. This method is provided so that it can be overridden by subclasses. Do not call this method directly; instead, call paste.

- (send a-pasteboard do-paste time) ⇒ void
  time: exact integer
  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

do-paste-x-selection

Called to paste the current contents of the X selection under X (or the clipboard under Windows and Mac OS X) into the editor. This method is provided so that it can be overridden by subclasses. Do not call this method directly; instead, call paste-x-selection.

- (send a-pasteboard do-paste-x-selection time) ⇒ void
  time: exact integer
  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

erase

Deletes all snips from the editor.

See also delete.
- (send a-pasteboard erase) ⇒ void

find-next-selected-snip

Returns a selected snip in the editor.

- (send a-pasteboard find-next-selected-snip start) ⇒ snip% object or #f
  start: snip% object or #f

  Returns the next selected snip in the editor, starting the search after start. (See “Basic Organization” (section 8.1, page 194) for information about snip order in pasteboards.) If start is #f, then the search starts with the first snip in the editor (and thus returns the first selected snip, if any are selected). If no more selected snips are available, or if start is not in the pasteboard, #f is returned.

find-snip

Finds the frontmost snip (after a given snip) that intersects a given location. See “Basic Organization” (section 8.1, page 194) for information about snip order in pasteboards.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)).

- (send a-pasteboard find-snip x y after) ⇒ snip% object or #f
  x: real number
  y: real number
  after = #f: snip% object or #f

  The x and y arguments are in editor coordinates. If after is not supplied, the frontmost snip at x and y is returned, otherwise the frontmost snip behind after is returned. If after is a snip that is not in the pasteboard, #f is returned.

get-center

Returns the center of the pasteboard in pasteboard coordinates.

- (send a-pasteboard get-center x y) ⇒ void
  x: boxed real number
  y: boxed real number

  The x box is filled with the x-coordinate of the center and y is filled with the y-coordinate of the center.

get-dragable

Returns whether snips in the editor can be interactively dragged by event handling in on-default-event: #t if dragging is allowed, #f otherwise. By default, dragging is allowed. See also set-dragable.

- (send a-pasteboard get-dragable) ⇒ boolean

get-scroll-step

Gets the editor location offset for each vertical scroll position. See also set-scroll-step.

- (send a-pasteboard get-scroll-step) ⇒ non-negative real number
get-selection-visible

Returns whether selection dots are drawn around the edge of selected snips in the pasteboard. By default, selection
dots are on. See also set-selection-visible.

- (send a-pasteboard get-selection-visible) ⇒ boolean

insert

Inserts data into the editor.

The content of an editor can be changed by the system in response to other method calls, and such changes do not go
through this method; use on-insert in text% or on-insert in pasteboard% to monitor content additions
changes.

- (send a-pasteboard insert snip before x y) ⇒ void
  snip: snip% object
  before: snip% object or #f
  x : real number
  y : real number

  Inserts snip at location (x, y) just in front of before. (See “Basic Organization” (section 8.1, page 194) for
  information about snip order in pasteboards.) If before is #f, then snip is inserted behind all other snips.

- (send a-pasteboard insert snip x y) ⇒ void
  snip: snip% object
  x : real number
  y : real number

  Inserts snip at location (x, y) behind all other snips. (See “Basic Organization” (section 8.1, page 194) for
  information about snip order in pasteboards.)

- (send a-pasteboard insert snip before) ⇒ void
  snip: snip% object
  before: snip% object or #f

  Inserts snip in the center of the editor (with respect to the total width and height of the editor) just in front of
  before. (See “Basic Organization” (section 8.1, page 194) for information about snip order in pasteboards.)
  If before is #f, then snip is inserted behind all other snips.

- (send a-pasteboard insert snip) ⇒ void
  snip: snip% object

  Inserts a snip into the editor. A snip cannot be inserted into multiple editors or multiple times within a single
  editor.

interactive-adjust-mouse

This method is called during interactive dragging and resizing (of the currently selected snips; see
find-next-selected-snip) to preprocess the current mouse location (in editor coordinates). The snip and
actual x and y coordinates are passed into the method (boxed); the resulting coordinates are used instead of the actual
mouse location.

See also interactive-adjust-resize.
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- (send a-pasteboard interactive-adjust-mouse x y) ⇒ void
  
  x : boxed real number
  y : boxed real number

  A negative value for either x or y is replaced with 0.

interactive-adjust-move

This method is called during an interactive move (for each selected snip) to preprocess the user-determined snip location for each selected snip. The snip and mouse-determined locations (in editor coordinates) are passed into the method (boxed); the resulting locations are used for graphical feedback to the user during moving.

The actual mouse coordinates are first sent through interactive-adjust-mouse before determining the locations passed into this method.

- (send a-pasteboard interactive-adjust-move snip x y) ⇒ void
  
  snip : snip% object
  x : boxed real number
  y : boxed real number

  Does nothing.

interactive-adjust-resize

This method is called during interactive resizing of a snip to preprocess the user-determined snip size. The snip and mouse-determined height and width are passed into the method (boxed); the resulting height and width are used for graphical feedback to the user during resizing.

The actual mouse coordinates are first sent through interactive-adjust-mouse before determining the sizes passed into this method.

- (send a-pasteboard interactive-adjust-resize snip width height) ⇒ void
  
  snip : snip% object
  width : boxed non-negative real number
  height : boxed non-negative real number

  Does nothing.

is-selected?

Returns #t if a specified snip is currently selected or #f otherwise.

- (send a-pasteboard is-selected? snip) ⇒ boolean
  
  snip : snip% object

lower

Moves the snip one level deeper (i.e., behind one more other snip) in the pasteboard’s snip order. See “Basic Organization” (section 8.1, page 194) for information about snip order in pasteboards.

See also raise, set-before, and set-after.

- (send a-pasteboard lower snip) ⇒ void
  
  snip : snip% object
move

Moves a specified snip a given number of pixels in the horizontal and vertical directions.

Snip locations in a pasteboard can be changed by the system in response to other method calls, and such changes do not go through this method; use on-move-to to monitor snip position changes.

- (send a-pasteboard move snip x y) ⇒ void
  snip: snip% object
  x: real number
  y: real number

  Moves snip right x pixels and down y pixels.

- (send a-pasteboard move x y) ⇒ void
  x: real number
  y: real number

  Moves all selected snips right x pixels and down y pixels.

move-to

Moves a specified snip to a given location in the editor.

Snip locations in a pasteboard can be changed by the system in response to other method calls, and such changes do not go through this method; use on-move-to to monitor snip position changes.

- (send a-pasteboard move-to snip x y) ⇒ void
  snip: snip% object
  x: real number
  y: real number

no-selected

Deselects all selected snips in the editor.

The selection in a pasteboard can be changed by the system in response to other method calls, and such changes do not go through this method; use on-select to monitor selection changes.

- (send a-pasteboard no-selected) ⇒ void

on-default-event

Called by on-local-event when the event is not handled by a caret-owning snip or by the keymap.

- (send a-pasteboard on-default-event event) ⇒ void
  event: mouse-event% object

  Selects, drags, and resizes snips:
  - Clicking on a snip selects the snip. Shift-clicking extends the current selection with the snip.
  - Clicking in the space between snips drags a selection box; once the mouse button is released, all snips touching the box are selected. Shift-clicking extends the current selection with the new snips.
  - Double-clicking on a snip calls on-double-click.
– Clicking on a selected snip drags the selected snip(s) to a new location.
– Clicking on a hiliting tab for a selected object resizes the object.

on-delete (augmentable only)

Called before a snip is deleted from the editor, after can-delete? is called to verify that the deletion is allowed. The after-delete method is guaranteed to be called after the delete has completed.

The editor is internally locked for writing when this method is called (see also “Locks” (section 8.8, page 200)). Use after-delete to modify the editor, if necessary.

- (send a-pasteboard on-delete snip) ⇒ void
  snip: snip% object

on-double-click

This method is called when the user double-clicks on a snip in the editor. The clicked-on snip and event records are passed to the method.

- (send a-pasteboard on-double-click snip event) ⇒ void
  snip: snip% object
  event: mouse-event% object

  If snip accepts events, it is designated as the caret owner and all snips in the editor are unselected.

on-insert (augmentable only)

Called before a snip is inserted from the editor, after can-insert? is called to verify that the insertion is allowed. The after-insert method is guaranteed to be called after the insert has completed.

The editor is internally locked for writing when this method is called (see also “Locks” (section 8.8, page 200)). Use after-insert to modify the editor, if necessary.

- (send a-pasteboard on-insert snip before x y) ⇒ void
  snip: snip% object
  before: snip% object or #f
  x: real number
  y: real number

on-interactive-move (augmentable only)

This method is called when the user starts interactively dragging snips (the ones that are selected; see find-next-selected-snip), after can-interactive-move? is called to verify that the move is allowed. The after-interactive-move method is guaranteed to be called after the move has completed. All of the selected snips will be moved. The mouse event that started the move (usually a button-down event) is provided.

See also interactive-adjust-move.

- (send a-pasteboard on-interactive-move event) ⇒ void
  event: mouse-event% object

  Returns #t.
on-interactive-resize \textit{(augmentable only)}

This method is called when the user starts interactively resizing a snip (the one that is selected; see \texttt{find-next-selected-snip}), after \texttt{can-interactive-resize?} is called to verify that the resize is allowed. The \texttt{after-interactive-resize} method is guaranteed to be called after the resize has completed.

\begin{verbatim}
- (send a-pasteboard on-interactive-resize snip) ⇒ void
  snip: snip% object

  The \textit{snip} argument is the snip that will be resized. This method returns \#t.
\end{verbatim}

on-move-to \textit{(augmentable only)}

Called before a snip is moved in the editor, after \texttt{can-move-to?} is called to verify that the move is allowed. The \texttt{after-move-to} method is guaranteed to be called after the move has completed.

The editor is internally locked for writing when this method is called (see also “Locks” (section 8.8, page 200)). Use \texttt{after-move-to} to modify the editor, if necessary. See also \texttt{on-interactive-move} and \texttt{interactive-adjust-move}.

\begin{verbatim}
- (send a-pasteboard on-move-to snip x y dragging?) ⇒ void
  snip: snip% object
  x: real number
  y: real number
  dragging?: boolean

  If \textit{dragging?} is not \#f, then this move is a temporary move for dragging.
\end{verbatim}

on-reorder \textit{(augmentable only)}

Called before a snip is moved in the pasteboard’s front-to-back snip order, after \texttt{can-reorder?} is called to verify that the reorder is allowed. The \texttt{after-reorder} method is guaranteed to be called after the reorder has completed.

The editor is internally locked for writing when this method is called (see also “Locks” (section 8.8, page 200)). Use \texttt{after-reorder} to modify the editor, if necessary.

\begin{verbatim}
- (send a-pasteboard on-reorder snip to-snip before?) ⇒ boolean
  snip: snip% object
  to-snip: snip% object
  before?: boolean

  If \textit{before?} is \#t, then \textit{snip} is to be moved before \textit{to-snip}, otherwise \textit{snip} is to be moved after \textit{to-snip}
\end{verbatim}

on-resize \textit{(augmentable only)}

Called before a snip is resized by the editor, after \texttt{can-resize?} is called to verify that the resize is allowed. The \texttt{after-resize} method is guaranteed to be called after the resize has completed.

The editor is internally locked for writing when this method is called (see also “Locks” (section 8.8, page 200)). Use \texttt{after-resize} to modify the editor, if necessary.

Note that a snip calls \texttt{resized}, not this method, to notify the pasteboard that the snip resized itself.
- (send a-pasteboard on-resize snip w h) ⇒ void
  snip: snip% object
  w: non-negative real number
  h: non-negative real number

on-select *(augmentable only)*

This method is called before a snip in the pasteboard is selected or deselected, after can-select? is called to verify that the selection is allowed. The after-select method is guaranteed to be called after the selection has completed. This method is not called when a selected snip is to be deleted (and thus de-selected indirectly); see also on-delete.

The editor is internally locked for writing when this method is called (see also “Locks” (section 8.8, page 200)). Use after-select to modify the editor, if necessary.

  - (send a-pasteboard on-select snip on?) ⇒ void
    snip: snip% object
    on?: boolean
    If on? is #t, then snip will be selected, otherwise snip will be deselected.

raise

Moves a snip one level shallower (i.e., in front of one more other snip) in the pasteboard’s snip order. See “Basic Organization” (section 8.1, page 194) for information about snip order in pasteboards.

See also lower, set-before, and set-after.

  - (send a-pasteboard raise snip) ⇒ void
    snip: snip% object

remove

Removes the specified snip from the editor in a non-undoable manner (so the snip is completely free of the pasteboard can can be used in other editors).

See also delete.

  - (send a-pasteboard remove snip) ⇒ void
    snip: snip% object

remove-selected

Deselects a snip without deselecting any other snips.

The selection in a pasteboard can be changed by the system in response to other method calls, and such changes do not go through this method; use on-select to monitor selection changes.

  - (send a-pasteboard remove-selected snip) ⇒ void
    snip: snip% object
    Deselects snip (if it is currently selected).
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resize
Attempts to resize a given snip. If the snip allows resizing, \#t is returned, otherwise \#f is returned. Using this method instead of calling the snip’s resize method directly will make the resize undo-able.

- (send a-pasteboard resize snip w h) ⇒ boolean
  snip: snip% object
  w: non-negative real number
  h: non-negative real number

set-after
Changes the depth of a snip. See “Basic Organization” (section 8.1, page 194) for information about snip order in pasteboards.

See also raise, lower, and set-before.

- (send a-pasteboard set-after snip after) ⇒ void
  snip: snip% object
  after: snip% object or \#f
  Changes the depth of snip moving it just behind after. If after is \#f, snip is moved to the back.

set-before
Changes the depth of a snip. See “Basic Organization” (section 8.1, page 194) for information about snip order in pasteboards.

See also raise, lower, and set-after.

- (send a-pasteboard set-before snip before) ⇒ void
  snip: snip% object
  before: snip% object or \#f
  Changes the depth of snip moving it just in front of before. If before is \#f, snip is moved to the front.

set-dragable
Sets whether snips in the editor can be interactively dragged by event handling in on-default-event: a true value allows dragging, \#f disallows dragging. See also get-dragable.

- (send a-pasteboard set-dragable allow-drag?) ⇒ void
  allow-drag?: boolean

set-scroll-step
Sets the editor location offset for each vertical scroll position. See also get-scroll-step.

- (send a-pasteboard set-scroll-step stepsize) ⇒ void
  stepsize: non-negative real number
set-selected

Selects a specified snip (deselecting all others).

The selection in a pasteboard can be changed by the system in response to other method calls, and such changes do not go through this method; use on-select to monitor selection changes.

- (send a-pasteboard set-selected snip) ⇒ void
  snip: snip% object

set-selection-visible

Sets whether selection dots are drawn around the edge of selected snips in the pasteboard. See also get-selection-visible.

- (send a-pasteboard set-selection-visible visible?) ⇒ void
  visible?: boolean

9.22 readable-snip%" exterior

A readable-snip% object is treated specially by the port generated by open-input-text-editor. When a readable-snip% object is encountered for the input stream, its read-special method is called to generate the read result for the snip.

read-special

- (send a-readable-snip read-special source line column position) ⇒ an arbitrary value
  source: value
  line: exact non-negative integer or #f
  column: exact non-negative integer or #f
  position: exact non-negative integer or #f

The arguments are the same as the arguments to a procedure returned by a custom input port’s read-proc; see Custom Ports, §11.1.7 in PLT MzScheme: Language Manual for details. The result is also the same as the result from a read-proc-produced procedure.

9.23 snip%

A direct instance of snip% is uninteresting. Useful snips are defined by instantiating derived subclasses, but this class defines the basic functionality.

In deriving a new snip class, these methods must be overridden to create a useful snip:

- get-extent
- draw
- resize if the snip can be resized by the user
- partial-offset if the snip can contain more than one item
• **split** if the snip can contain more than one item

• **size-cache-invalid** if the snip caches the result to **get-extent**

• **get-text** (not required)

• **find-scroll-step**, **get-num-scroll-steps**, and **get-scroll-step-offset** if the snip can contain more than one scroll position

• **set-unmodified** if the snip’s internal state can be modified by the user, and call **modified** in the snip’s administrator when the state changes the first time

If a snip can contain more than one item, then the snip’s **count** must be maintained as well.

To define a class of snips that can be saved or cut-and-pasted:

• Create an instance of **snip-class%**, implementing the **read** method.

• For each instance of the snip class, set the snip’s class object with **set-snipclass**.

• Override the **copy** method.

• Override the **write** method.

To define a class of snips that read specially with **open-input-text-editor**:

• Make your **snip%** class implement **readable-snip%**.

• Implement the **read-special** method.

  ```lisp
  - (make-object snip%) ⇒ snip% object
  ```

  Creates a plain snip of length 1 with the "Basic" style of the-style-list.

**adjust-cursor**

Called to determine the cursor image used when the cursor is moved over the snip in an editor. If #f is returned, a default cursor is selected by the editor. (See **adjust-cursor** in **editor%** for more information.)

  ```lisp
  - (send a-snip adjust-cursor dc x y editorx editory event) ⇒ cursor% object or #f
  dc: dc% object
  x: real number
  y: real number
  editorx: real number
  editory: real number
  event: mouse-event% object
  ```

  Returns #f.

**blink-caret**

Tells the snip to blink the selection caret. This method is called periodically when the snips’s editor’s **display** has the keyboard focus, and the snip has the editor-local focus.

The drawing context and snip’s **locations** in drawing context coordinates are provided.
- (send a-snip blink-caret dc x y) ⇒ void
  
  dc : dc<%> object
  
  x : real number
  
  y : real number

**can-do-edit-operation? (augmentable only)**

See **can-do-edit-operation?**.

Called when the snip’s editor’s method is called, recursive? is not #f, and this snip owns the caret.

- (send a-snip can-do-edit-operation? op recursive?) ⇒ boolean
  
  op : symbol in ’(undo redo clear cut copy paste kill select-all
  
  insert-text-box insert-pasteboard-box insert-image)

  recursive? = #t : boolean

  See **can-do-edit-operation?** for information about the arguments.

**copy**

Creates and returns a copy of this snip. The **copy** method is responsible for copying this snip’s style (as returned by **get-style**) to the new snip.

- (send a-snip copy) ⇒ snip% object

**do-edit-operation**

See **do-edit-operation**.

Called when the snip’s editor’s method is called, recursive? is not #f, and this snip owns the caret.

- (send a-snip do-edit-operation op recursive? time) ⇒ void
  
  op : symbol in ’(undo redo clear cut copy paste kill select-all
  
  insert-text-box insert-pasteboard-box insert-image)

  recursive? = #t : boolean

  time = 0 : exact integer

  See **do-edit-operation in editor<%>** for information about the arguments.

**draw**

Called (by an editor) to draw the snip.

Before this method is called, the correct font, text color, and pen color for the snip’s style will have been set in the drawing context already. (This is not true for **get-extent** or **partial-offset**.) The **draw** method must not make any other assumptions about the state of the drawing context, except that the clipping region is already set to something appropriate. Before **draw** returns, it must restore any drawing context settings that it changes.

See also **on-paint in editor<%>**.

The snip’s editor is usually internally locked for writing and reflowing when this method is called (see also “Locks” section 8.8, page 200)).
9. Editor Class Reference

- (send a-snip draw dc x y left top right bottom dx dy draw-caret) ⇒ void
  dc: dc% object
  x: real number
  y: real number
  left: real number
  top: real number
  right: real number
  bottom: real number
  dx: real number
  dy: real number
  draw-caret: symbol in ’(no-caret show-inactive-caret show-caret)

Draws the snip into the given drawing context with the snip’s top left corner at location (x, y) in DC coordinates. The arguments left, top, right, and bottom define a clipping region (in DC coordinates) that the snip can use to optimize drawing, but it can also ignore these arguments. The dx and dy argument provide numbers that can be subtracted from x and y to obtain the snip’s location in editor coordinates (as opposed to DC coordinates, which are used for drawing). See “Caret” (section 8.5, page 199) for information about draw-caret.

find-scroll-step

If a snip contains more than one vertical scroll step (see get-num-scroll-steps) then this method is called to find a scroll step offset for a given y-offset into the snip.

- (send a-snip find-scroll-step y) ⇒ exact non-negative integer
  y: real number

get-admin

Returns the administrator for this snip. (The administrator can be #f even if the snip is owned but not visible in the editor.)

- (send a-snip get-admin) ⇒ snip-admin% object or #f

get-count

Returns the snip’s count (i.e., number of items within the snip).

- (send a-snip get-count) ⇒ exact integer in [0, 100000]

get-extent

Calculates the snip’s width, height, descent (amount of height which is drawn below the baseline), space (amount of height which is “filler” space at the top), and horizontal spaces (amount of width which is “filler” space at the left and right).

This method is called by the snip’s administrator; it should not be called directly by others. To get the extent of a snip, use get-snip-location in editor%.

A drawing context is provided for the purpose of finding font sizes, but no drawing should occur. The get-extent and partial-offset methods must not make any assumptions about the state of the drawing context, except that
it is scaled properly. In particular, the font for the snip’s style is not automatically set in the drawing context before the method is called.\(^2\) If \texttt{get-extent} or \texttt{partial-offset} changes the drawing context’s setting, it must restore them before returning. However, the methods should not need to change the drawing context; only font settings can affect measurement results from a device context, and \texttt{get-text-extent in dc<%>} accepts a \texttt{font<%>} argument for sizing that overrides that device context’s current font.

The snip’s left and top locations are provided in editor coordinates. In a text editor, the y-coordinate is the line’s top location; the snip’s actual top location is potentially undetermined until its height is known.

If a snip caches the result size for future replies, it should invalidate its cached size when \texttt{size-cache-invalid} is called (especially if the snip’s size depends on any device context properties).

If a snip’s size changes after receiving a call to \texttt{get-extent} and before receiving a call to \texttt{size-cache-invalid}, then the snip must notify its administrator of the size change, so that the administrator can recompute its derived size information. Notify the administrator of a size change by calling its \texttt{resized} method.

The snip’s editor is usually internally locked for writing and reflowing when this method is called (see also “Locks” (section 8.8, page 200)).

\begin{verbatim}
- (send a-snip get-extent dc x y w h descent space lspace rspace) ⇒ void
  dc : dc<%> object
  x : real number
  y : real number
  w = #f : boxed non-negative real number or #f
  h = #f : boxed non-negative real number or #f
  descent = #f : boxed non-negative real number or #f
  space = #f : boxed non-negative real number or #f
  lspace = #f : boxed non-negative real number or #f
  rspace = #f : boxed non-negative real number or #f

  Fills in all boxes with 0.0.
\end{verbatim}

\texttt{get-flags}

Returns flags defining the behavior of the snip. It is a bitwise combination of these flags:

- ’is-text — this is a text snip derived from \texttt{string-snip<%>}; do not set this flag
- ’can-append — this snip can be merged with another snip of the same type
- ’invisible — the user doesn’t “see” this snip; e.g.: a carriage return
- ’hard-newline — a newline must follow the snip
- ’newline — a newline currently follows the snip; only an owning editor should set this flag
- ’handles-events — this snip can handle keyboard and mouse events
- ’width-depends-on-x — this snip’s display width depends on the snip’s x-location within the editor; e.g.: tab
- ’height-depends-on-y — this snip’s display height depends on the snip’s y-location within the editor
- ’width-depends-on-y — this snip’s display width depends on the snip’s y-location within the editor

\(^2\)Many snips cache their size information, so automatically setting the font would be wasteful.
9. Editor Class Reference

- 'height-depends-on-x — this snip’s display height depends on the snip’s x-location within the editor
- 'uses-editor-path — this snip uses its editor’s pathname and should be notified when the name changes; notification is given as a redundant call to set-admin

Additional private flags are not listed here.

- (send a-snip get-flags) ⇒ list of symbols

get-num-scroll-steps

Returns the number of horizontal scroll steps within the snip. For most snips, this is 1. Embedded editor snips use this method so that scrolling in the owning editor will step through the lines in the embedded editor.

- (send a-snip get-num-scroll-steps) ⇒ exact non-negative integer

get-scroll-step-offset

If a snip contains more than one vertical scroll step (see get-num-scroll-steps) then this method is called to find the y-offset into the snip for a given scroll offset.

- (send a-snip get-scroll-step-offset offset) ⇒ non-negative real number
  offset: exact non-negative integer

get-snipclass

Returns the snip’s class, used for file saving and cut-and-paste.

Since this method returns the snip class stored by set-snipclass, it is not meant to be overridden.

- (send a-snip get-snipclass) ⇒ snip-class% object

get-style

Returns the snip’s style. See also set-style.

- (send a-snip get-style) ⇒ style<%> object

get-text

Gets the text representation for this snip.

- (send a-snip get-text offset num flattened?) ⇒ string
  offset: exact non-negative integer
  num: exact non-negative integer
  flattened? = #f: boolean

Returns the text for this snip starting with the position offset within the snip, and continuing for a total length of num items. If offset is greater than the snip’s count, then "" is returned. If num is greater than the snip’s count minus the offset, then text from the offset to the end of the snip is returned.
If flattened? is not #f, then flattened text is returned. See “Getting Text” (section 8.4, page 199) for a discussion of flattened vs. non-flattened text.

get-text!
Like get-text in non-flattened mode, except that the characters are put into the given mutable string, instead of returned in a newly allocated string.

- (send a-snip get-text! buffer offset num buffer-offset) ⇒ void
  buffer: mutable string
  offset: exact non-negative integer
  num: exact non-negative integer
  buffer-offset: exact non-negative integer

  The default implementation calls get-text, except in the case of a string-snip%, in which case buffer
  is filled directly. In either case, the buffer string is filled starting at position buffer-offset. The buffer
  string must be at least num+buffer-offset characters long.

is-owned?
Returns #t if this snip has an owner, #f otherwise. Note that a snip may be owned by an editor if it was inserted and then deleted from the editor, if it’s still in the editor’s undo history.

- (send a-snip is-owned?) ⇒ boolean

match?
Return #t if this snip “matches” an input snip or #f otherwise.

- (send a-snip match? snip) ⇒ boolean
  snip: snip% object

  Returns #t if the snip and this snip are from the same class and have the same length.

merge-with
Merges this snip with the given snip, returning #f if the snips cannot be merged or a new merged snip otherwise. This method will only be invoked if both snips are from the same class and both have the ‘can-append flag.

If the returned snip does not have the expected count, its count is forcibly modified. If the returned snip is already owned by another administrator, a surrogate snip is created.

The snip’s editor is usually internally locked for reading when this method is called (see also “Locks” (section 8.8, page 200)).

- (send a-snip merge-with pred) ⇒ snip% object or #f
  pred: snip% object

  Returns #f.

next
Returns the next snip in the editor owning this snip, or #f if this is the last snip.
In a text editor, the next snip is the snip at the position following this snip’s (last) position. In a pasteboard, the next snip is the one immediately behind this snip. (See “Basic Organization” (section 8.1, page 194) for information about snip order in pasteboards.)

- (send a-snip next) ⇒ snip% object or #f

on-char

Called to handle keyboard events when this snip has the keyboard focus and can handle events. The drawing context is provided, as well as the snip’s location in display coordinates (the event uses display coordinates), and the snip’s location in editor coordinates.

See also ’handles-events in get-flags.

- (send a-snip on-char dc x y editorx editory event) ⇒ void
  dc: dc% object
  x: real number
  y: real number
  editorx: real number
  editory: real number
  event: key-event% object

  The x and y arguments are the snip’s location in display coordinates. The editorx and editory arguments are the snip’s location in editor coordinates. To get event’s x location in snip coordinates, subtract x from (send event get-x).

on-event

Called to handle mouse events on the snip when this snip can handle events and when the snip has the keyboard focus. See on-char for information about the arguments. See also ’handles-events in get-flags.

- (send a-snip on-event dc x y editorx editory event) ⇒ void
  dc: dc% object
  x: real number
  y: real number
  editorx: real number
  editory: real number
  event: mouse-event% object

  The x and y arguments are the snip’s location in display coordinates. The editorx and editory arguments are the snip’s location in editor coordinates. To get event’s x location in snip coordinates, subtract x from (send event get-x).

own-caret

Notifies the snip that it is or is not allowed to display the caret (indicating ownership of keyboard focus) in some display. This method is not called to request that the caret is actually shown or hidden; the draw method is called for all display requests.

- (send a-snip own-caret own-it?) ⇒ void
  own-it?: boolean

  The own-it? argument is #t if the snip owns the keyboard focus or #f otherwise.
partial-offset

Calculates a partial width for the snip, starting from the first snip item and continuing for a given number of items. The drawing context and snip’s locations in editor coordinates are provided. See also get-extent.

The snip’s editor is usually internally locked for writing and reflowing when this method is called (see also “Locks” (section 8.8, page 200)).

- (send a-snip partial-offset dc x y len) ⇒ real number
  dc : dc<> object
  x : real number
  y : real number
  len : exact non-negative integer

  Calculates a partial width for the snip, starting from the first snip item and continuing for len items.

previous

Returns the previous snip in the editor owning this snip, or #f if this is the first snip.

- (send a-snip previous) ⇒ snip% object or #f

release-from-owner

Asks the snip to try to release itself from its owner. If the snip is not owned or the release is successful, then #t is returned. Otherwise, #f is returned and the snip remains owned. See also is-owned?.

Use this method for moving a snip from one editor to another. This method notifies the snip’s owning editor that someone else really wants control of the snip. It is not necessary to use this method for "cleaning up" a snip when it is deleted from an editor.

- (send a-snip release-from-owner) ⇒ boolean
  Requests a low-level release from the snip’s owning administrator.

resize

Resizes the snip. The snip can refuse to be resized by returning #f. Otherwise, the snip will resize (it must call its administrator’s resized method) and return #t.

See also on-interactive-resize in pasteboard%.

- (send a-snip resize w h) ⇒ boolean
  w : non-negative real number
  h : non-negative real number

  Returns #f.

set-admin

Sets the snip’s administrator. Only an administrator should call this method.
The default method sets the internal state of a snip to record its administrator. It will not modify this state if the snip is already owned by an administrator and the administrator has not blessed the transition. If the administrator state of a snip is not modified as expected during a sensitive call to this method by an instance of text% or pasteboard%, the internal state may be forcibly modified (if the new administrator was #f) or a surrogate snip may be created (if the snip was expected to receive a new administrator).

The snip’s (new) editor is usually internally locked for reading when this method is called (see also “Locks” (section 8.8, page 200)).

```lisp
- (send a-snip set-admin admin) ⇒ void
  admin: snip-admin% object or #f
```

**set-count**

Sets the snip’s count (i.e., the number of items within the snip).

The snip’s count may be changed by the system (in extreme cases to maintain consistency) without calling this method.

```lisp
- (send a-snip set-count c) ⇒ void
  c: exact integer in [1, 100000]
  Sets the snip’s count (i.e., the number of items in the snip), and notifies the snip’s administrator that the snip’s size has changed.
```

**set-flags**

Sets the snip’s flags. See get-flags.

```lisp
- (send a-snip set-flags flags) ⇒ void
  flags: list of symbols
  Sets the snip flags and notifies the snip’s editor that its flags have changed.
```

**set-snipclass**

Sets the snip’s class, used for file saving and cut-and-paste.

This method stores the snip class internally; other editor objects may access the snip class directly, instead of through the get-snipclass method.

```lisp
- (send a-snip set-snipclass class) ⇒ void
  class: snip-class% object
```

**set-style**

Sets the snip’s style if it is not owned by any editor. See also get-style and is-owned?.

The snip’s style may be changed by the system without calling this method.

```lisp
- (send a-snip set-style style) ⇒ void
  style: style<%> object
```
set-unmodified

Called by the snip's administrator to notify the snip that its changed have been saved. The next time snip's internal state is modified by the user, it should call modified to report the state change (but only on the first change after this method is called, or the first change after the snip acquires a new administrator).

- (send a-snip set-unmodified) ⇒ void

size-cache-invalid

Called to notify the snip that it may need to recalculate its display arguments (width, height, etc.) when it is next asked, because the style or location of the snip has changed.

The snip's (new) editor is usually internally locked for reflowing when this method is called (see also “Locks” (section 8.8, page 200)).

- (send a-snip size-cache-invalid) ⇒ void

split

Splits the snip into two snips. This is called when a snip has more than one item and something is inserted between two items.

The arguments are a relative position integer and two boxes. The position integer specifies how many items should be given to the new first snip; the rest go to the new second snip. The two boxes must be filled with two new snips. (The old snip is no longer used, so it can be recycled as a new snip.)

If the returned snips do not have the expected counts, their counts are forcibly modified. If either returned snip is already owned by another administrator, a surrogate snip is created.

The snip's editor is usually internally locked for reading when this method is called (see also “Locks” (section 8.8, page 200)).

- (send a-snip split position first second) ⇒ void
  position: exact non-negative integer
  first: boxed snip% object
  second: boxed snip% object

write

Writes the snip to the given stream. (Snip reading is handled by the snip class.) Style information about the snip (i.e., the content of get-style) will be saved and restored automatically.

- (send a-snip write f) ⇒ void
  f: editor-stream-out% object

9.24 snip-admin%

See “Administrators” (section 8.1.1, page 195) for information about the role of administrators. The snip-admin% class is never instantiated directly. It is not even instantiated through derived classes by most programmers; each
An `text%` or `pasteboard%` object creates its own administrator. However, it may be useful to derive a new instance of this class to display snips in a new context. Also, it may be useful to call the methods of an existing administrator from an owned snip.

To create a new `snip-admin%` class, all methods described here must be overridden. They are all invoked by the administrator’s snip.

Because a `snip-admin%` object typically owns more than one snip, many methods require a `snip%` object as an argument.

```
- (make-object snip-admin%) ⇒ snip-admin% object
    Creates a (useless) editor administrator.
```

**get-dc**

Gets a drawing context suitable for determining display size information. If the snip is not displayed, `#f` is returned.

```
- (send a-snip-admin get-dc) ⇒ dc<%> object or #f
```

**get-editor**

Returns the editor that this administrator reports to (directly or indirectly)

```
- (send a-snip-admin get-editor) ⇒ text% or pasteboard% object
```

**get-view**

Gets the location and size of the visible region of a snip in snip coordinates. The result is undefined if the given snip is not managed by this administrator.

If no snip is specified, then the location and size of the snip’s editor are returned, instead, in editor coordinates.

See also **get-view in editor-admin%**.

```
- (send a-snip-admin get-view x y w h snip) ⇒ void
    x : boxed real number or #f
    y : boxed real number or #f
    w : boxed non-negative real number or #f
    h : boxed non-negative real number or #f
    snip = #f: snip% object or #f
    If snip is not #f, the current visible region of the snip is installed in the boxes x, y, w, and h. The x and y values are relative to the snip’s top-left corner. The w and h values may be larger than the snip itself.
    If snip is #f, the total visible region of the snip’s top-level display is returned in editor coordinates. Using #f for snip is analogous to using #t for full? in get-view in editor-admin%.
```

**get-view-size**

Gets the visible size of the administrator’s display region.

If the display is an editor canvas, see also **reflow-container**.
- (send a-snip-admin get-view-size h w) ⇒ void
  
  h: boxed non-negative real number or #f
  w: boxed non-negative real number or #f

modified

Called by a snip to report that its modification state has changed to either modified or unmodified.

- (send a-snip-admin modified snip modified?) ⇒ void
  
  snip: snip% object
  modified?: boolean

needs-update

Called by the snip to request that the snip’s display needs to be updated. The administrator determines when to actually update the snip; the snip’s draw method is eventually called.

No update occurs if the given snip is not managed by this administrator.

- (send a-snip-admin needs-update snip localx localy w h) ⇒ void
  
  snip: snip% object
  localx: real number
  localy: real number
  w: non-negative real number
  h: non-negative real number

  The localx, localy, w, and h arguments specify a region of the snip to be refreshed (in snip coordinates).

popup-menu

Opens a popup menu in the display for this snip’s editor. The result is #t if the popup succeeds, #f otherwise (independent of whether the user selects an item in the popup menu).

While the menu is popped up, its target is set to the top-level editor in the display for this snip’s editor. See get-popup-target for more information.

- (send a-snip-admin popup-menu menu snip x y) ⇒ boolean
  
  menu: popup-menu% object
  snip: snip% object
  x: real number
  y: real number

  The menu is placed at x and y in snip coordinates.

recounted

Called by a snip to notify the administrator that the specified snip has changed its count. The snip generally needs to be updated after changing its count, but the snip decides whether the update should occur immediately.

The method call is ignored if the given snip is not managed by this administrator.

- (send a-snip-admin recounted snip refresh?) ⇒ void
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snip: snip% object
refresh?: boolean

If refresh? is not #f, then the snip is requesting to be updated immediately. Otherwise, needs-update must eventually be called as well.

release-snip

Requests that the specified snip be released. If this administrator is not the snip’s owner or if the snip cannot be released, then #f is returned. Otherwise, #t is returned and the snip is no longer owned.

See also release-snip in editor<%>.

The result is #f if the given snip is not managed by this administrator.

- (send a-snip-admin release-snip snip) ⇒ boolean
  snip: snip% object

resized

Called by a snip to notify the administrator that the specified snip has changed its display size. The snip generally needs to be updated after a resize, but the snip decides whether the update should occur immediately.

The method call is ignored if the given snip is not managed by this administrator.

- (send a-snip-admin resized snip refresh?) ⇒ void
  snip: snip% object
  refresh?: boolean

  If refresh? is not #f, then the snip is requesting to be updated immediately, as if calling needs-update. Otherwise, needs-update must eventually be called as well.

scroll-to

Called by the snip to request scrolling so that the given region is visible. The snip generally needs to be updated after a scroll, but the snip decides whether the update should occur immediately.

The result is #t if the editor is scrolled, #f otherwise.

The method call is ignored (and the result is #f) if the given snip is not managed by this administrator.

- (send a-snip-admin scroll-to snip localx localy w h refresh? bias) ⇒ boolean
  snip: snip% object
  localx: real number
  localy: real number
  w: non-negative real number
  h: non-negative real number
  refresh?: boolean
  bias = ‘none’ symbol in ‘(start end none)

The localx, localy, w, and h arguments specify a region of the snip to be made visible by the scroll (in snip coordinates).

If refresh? is not #f, then the editor is requesting to be updated immediately.

The bias argument is one of:
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- 'start — if the range doesn’t fit in the visible area, show the top-left region
- 'none — no special scrolling instructions
- 'end — if the range doesn’t fit in the visible area, show the bottom-right region

set-caret-owner

Requests that the keyboard focus is assigned to the specified snip. If the request is granted, the own-caret method of the snip is called.

The method call is ignored if the given snip is not managed by this administrator.

- (send a-snip-admin set-caret-owner snip domain) ⇒ void
  snip:snip% object
  domain:symbol in '(immediate display global)

  See set-caret-owner for information about the possible values of domain.

update-cursor

Queues an update for the cursor in the display for this snip’s editor. The actual cursor used will be determined by calling the snip’s adjust-cursor method as appropriate.

- (send a-snip-admin update-cursor) ⇒ void

9.25 snip-class%

Useful snip classes are defined by instantiating derived subclasses of snip-class%. A class derived from snip-class% serves as a kind of “meta-class” for snips; each snip is associated with an instance of snip-class% as its snip class.

In deriving a new snip-class% class, override the read method. Then, for each instance of the derived class (where each instance corresponds to a single snip class):

- Set the classname using set-classname.
- Set the version using set-version.
- Install the class into the list returned by get-the-snip-class-list using the add method. Note that if the same name is inserted into the same class list multiple times, all but the first insertion is ignored.

See also “Snip Classes” (section 8.2.1, page 197).

- (make-object snip-class%) ⇒ snip-class% object
  Creates a useless snip class.

get-classname

Returns the class’s name, a string uniquely designating this snip class. For example, the standard text snip classname is “wxtext”. Names beginning with “wx” are reserved.

A snip class name should usually have the form "(lib ... )" to enable on-demand loading of the class; see “Snip Classes” (section 8.2.1, page 197) for details.
- (send a-snip-class get-classname) ⇒ string

get-version

Returns the version of this snip class. When attempting to load a file containing a snip with the same class name but a different version, the user is warned.

- (send a-snip-class get-version) ⇒ exact integer

read

Reads a snip from a given stream, returning a newly created snip as the result or #f if there is an error.

- (send a-snip-class read f) ⇒ snip% object or #f
  f: editor-stream-in% object

read-header

Called to read header information that may be useful for every snip read in this class. This method is only called once per editor read session, and only if the stream contains header information for this class.

The return value is #f if a read error occurs or anything else otherwise.

See also write-header.

- (send a-snip-class read-header f) ⇒ boolean
  f: editor-stream-in% object

reading-version

Returns the version number specified for this snip class for snips currently being read from the given stream.

- (send a-snip-class reading-version stream) ⇒ exact integer
  stream: editor-stream-in% object

set-classname

Sets the class’s name. See also get-classname.

- (send a-snip-class set-classname name) ⇒ void
  name: string

set-version

Sets the version of this class. See get-version.

- (send a-snip-class set-version v) ⇒ void
  v: exact integer
write-header

Called to write header information that may be useful for every snip written for this class. This method is only called once per editor write session, and only if the editor contains snips in this class.

When reading the snips back in, read-header will only be called if write-header writes some data to the stream.

The return value is #f if a write error occurs or anything else otherwise.

```scheme
- (send a-snip-class write-header stream) ⇒ boolean
  stream: editor-stream-out% object
```

**9.26 snip-class-list<%>**

Each eventspace has its own instance of `snip-class-list<%>`, obtained with `(get-the-snip-class-list)`. New instances cannot be created directly. Each instance keeps a list of snip classes. This list is needed for loading snips from a file. See also “Snip Classes” (section 8.2.1, page 197).

**add**

Adds a snip class to the list. If a class with the same name already exists in the list, this one will not be added.

```scheme
- (send a-snip-class-list add snipclass) ⇒ void
  snipclass: snip-class% object
```

**find**

Finds a snip class from the list with the given name, returning #f if none is found.

```scheme
- (send a-snip-class-list find name) ⇒ snip-class% object or #f
  name: string
```

**find-position**

Returns an index into the list for the specified class.

```scheme
- (send a-snip-class-list find-position class) ⇒ exact non-negative integer
  class: snip-class% object
```

**nth**

Returns the nth class in the list, or #f if the list has n classes or less.

```scheme
- (send a-snip-class-list nth n) ⇒ snip-class% object or #f
  n: exact non-negative integer
```

**number**

Returns the number of snip classes in the list.

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- (send a-snip-class-list number) ⇒ exact non-negative integer

9.27  string-snip%

Superclass: snip%

An instance of string-snip% is created automatically when text is inserted into a text editor. See also on-new-string-snip in text%.

- (make-object string-snip% allocsize) ⇒ string-snip% object
  allocsize = 0: exact non-negative integer
  Creates an empty string snip. The allocsize argument is a hint about how much storage space for text should be initially allocated by the snip.

- (make-object string-snip% s) ⇒ string-snip% object
  s: string
  Creates a string snip with the given initial string.

insert

Inserts text into the snip. The system can insert text into a text snip without calling this method.

- (send a-string-snip insert s len pos) ⇒ void
  s: string
  len: exact non-negative integer
  pos = 0: exact non-negative integer
  Inserts s (with length len) into the snip at relative position pos within the snip.

read

Reads the snip’s data from the given stream.

- (send a-string-snip read len f) ⇒ void
  len: exact non-negative integer
  f: editor-stream-in% object
  The len argument specifies the maximum length of the text to be read. (When a text snip is written to a file, the very first field is the length of the text contained in the snip.) This method is usually invoked by the text snip class’s read method.

9.28  style<%>

A style<%> object encapsulates drawing information (font, color, alignment, etc.) in a hierarchical manner. A style<%> object always exists within the context of a style-list% object and is never created except by a style-list% object.

See also “Styles” (section 8.1.2, page 196).
get-alignment

Returns the style’s alignment: ‘top’, ‘center’, or ‘bottom’.

- (send a-style get-alignment) ⇒ symbol in ’(top center bottom)

get-background

Returns the style’s background color.

- (send a-style get-background) ⇒ color% object

get-base-style

Returns the style’s base style. See “Styles” (section 8.1.2, page 196) for more information. The return value is #f only for the basic style in the list.

- (send a-style get-base-style) ⇒ style% object or #f

get-delta

Returns the style’s delta information if the style is not a join style. See “Styles” (section 8.1.2, page 196) for more information.

- (send a-style get-delta delta) ⇒ void
  delta: style-delta% object
  Copies the style’s delta into delta.

get-face

Returns the style’s face name. See font%.

- (send a-style get-face) ⇒ string or #f

get-family

Returns the style’s font family. See font%.

- (send a-style get-family) ⇒ symbol in ’(default decorative roman script swiss modern symbol system)

get-font

Returns the style’s font information.

- (send a-style get-font) ⇒ font% object
get-foreground

Returns the style’s foreground color.

- (send a-style get-foreground) ⇒ color% object

get-name

Returns the style’s name, or #f if it is unnamed. Style names are only set through the style’s style-list% object.

- (send a-style get-name) ⇒ string or #f

get-shift-style

Returns the style’s shift style if it is a join style. Otherwise, the root style is returned. See “Styles” (section 8.1.2, page 196) for more information.

- (send a-style get-shift-style) ⇒ style% object

get-size

Returns the style’s font size.

- (send a-style get-size) ⇒ exact integer in [0, 255]

get-size-in-pixels

Returns #t if the style size is in pixels, instead of points, or #f otherwise.

- (send a-style get-size-in-pixels) ⇒ boolean

get-smoothing

Returns the style’s font smoothing. See font%.

- (send a-style get-smoothing) ⇒ symbol in ‘(default partly-smoothed smoothed unsmoothed)

get-style

Returns the style’s font style. See font%.

- (send a-style get-style) ⇒ symbol in ‘(normal italic slant)

get-text-descent

Returns the descent of text using this style in a given DC.
- (send a-style get-text-descent dc) ⇒ non-negative real number
  dc: dc object

get-text-height

Returns the height of text using this style in a given DC.

- (send a-style get-text-height dc) ⇒ non-negative real number
  dc: dc object

get-text-space

Returns the vertical spacing for text using this style in a given DC.

- (send a-style get-text-space dc) ⇒ non-negative real number
  dc: dc object

get-text-width

Returns the width of a space character using this style in a given DC.

- (send a-style get-text-width dc) ⇒ non-negative real number
  dc: dc object

get-transparent-text-backing

Returns #t if text is drawn without erasing the text background or #f otherwise.

- (send a-style get-transparent-text-backing) ⇒ boolean

get-underlined

Returns #t if the style is underlined or #f otherwise.

- (send a-style get-underlined) ⇒ boolean

get-weight

Returns the style’s font weight. See font%.

- (send a-style get-weight) ⇒ symbol in ’(normal bold light)

is-join?

Returns #t if the style is a join style or #f otherwise. See “Styles” (section 8.1.2, page 196) for more information.

- (send a-style is-join?) ⇒ boolean
set-base-style

Sets the style’s base style and recomputes the style’s font, etc. See “Styles” (section 8.1.2, page 196) for more information.

- (send a-style set-base-style base-style) ⇒ void
  base-style: style<%> object

set-delta

Sets the style’s delta (if it is not a join style) and recomputes the style’s font, etc. See “Styles” (section 8.1.2, page 196) for more information.

- (send a-style set-delta delta) ⇒ void
  delta: style-delta% object
  Copies delta into the style’s delta.

set-shift-style

Sets the style’s shift style (if it is a join style) and recomputes the style’s font, etc. See “Styles” (section 8.1.2, page 196) for more information.

- (send a-style set-shift-style style) ⇒ void
  style: style<%> object

switch-to

Sets the font, pen color, etc. of the given drawing context. If oldstyle is not #f, only differences between the given style and this one are applied to the drawing context.

- (send a-style switch-to dc old-style) ⇒ void
  dc: dc<%> object
  old-style: style<%> object or #f

9.29 style-delta%

A style-delta% object encapsulates a style change. The changes expressible by a delta include:

- changing the font family
- changing the font face
- changing the font size to a new value
- enlarging the font by an additive amount
- enlarging the font by a multiplicative amount, etc.
- changing the font style (normal, italic, or slant)
- toggling the font style
- changing the font to italic if it is currently slant, etc.
- changing the font weight, etc.
- changing the underline, etc.
- changing the vertical alignment, etc.
• changing the foreground color
• dimming or brightening the foreground color, etc.
• changing the background color, etc.
• changing text backing transparency

The set-delta method is convenient for most style delta settings; it takes a high-level delta specification and sets the internal delta information.

To take full advantage of a style delta, it is necessary to understand the internal on/off settings that can be manipulated through methods such as set-weight-on. For example, the font weight change is specified through the weight-on and weight-off internal settings. Roughly, weight-on turns on a weight setting when it is not present and weight-off turns off a weight setting when it is present. These two interact precisely in the following way:

- If both weight-on and weight-off are set to 'base, then the font weight is not changed.
- If weight-on is not 'base, then the weight is set to weight-on.
- If weight-off is not 'base, then the weight will be set back to 'normal when the base style has the weight weight-off.
- If both weight-on and weight-off are set to the same value, then the weight is toggled with respect to that value: if the base style has the weight weight-on, then weight is changed to 'normal; if the base style has a different weight, it is changed to weight-on.
- If both weight-on and weight-off are set, but to different values, then the weight is changed to weight-on only when the base style has the weight weight-off.

Font styles, smoothing, underlining, and alignment work in an analogous manner.

The possible values for alignment-on and alignment-off are:

- 'base
- 'top
- 'center
- 'bottom

The possible values for style-on and style-off are:

- 'base
- 'normal
- 'italic
- 'slant

The possible values for smoothing-on and smoothing-off are:

- 'base
- 'default
- 'partly-smoothed
• ’smoothed
• ’unsmoothed

The possible values for underlined-on and underlined-off are:

• #f (acts like ’base)
• #t

The possible values for size-in-pixels-on and size-in-pixels-off are:

• #f (acts like ’base)
• #t

The possible values for transparent-text-backing-on and transparent-text-backing-off are:

• #f (acts like ’base)
• #t

The possible values for weight-on and weight-off are:

• ’base
• ’normal
• ’bold
• ’light

The family and face settings in a style delta are interdependent:

• When a delta’s face is #f and its family is ’base, then neither the face nor family are modified by the delta.
• When a delta’s face is a string and its family is ’base, then only face is modified by the delta.
• When a delta’s family is not ’base, then both the face and family are modified by the delta. If the delta’s face is #f, then applying the delta sets a style’s face to #f, so that the family setting prevails in choosing a font.

- (make-object style-delta% change-command) ⇒ style-delta% object
- (make-object style-delta% change-command v) ⇒ style-delta% object
  change-command: symbol in ’(change-family change-style change-toggle-style change-weight change-toggle-weight change-smoothing change-toggle-smoothing change-alignment)
  v: symbol
- (make-object style-delta% change-command v) ⇒ style-delta% object
  change-command: symbol in ’(change-size change-bigger change-smaller)  
v: exact integer in [0, 255]

- (make-object style-delta% change-command v) ⇒ style-delta% object
  change-command: symbol in ’(change-underline change-size-in-pixels)  
v: boolean

The initialization arguments are passed on to set-delta.

collapse

Tries to collapse into a single delta the changes that would be made by applying this delta after a given delta. If the return value is #f, then it is impossible to perform the collapse. Otherwise, the return value is #t and this delta will contain the collapsed change specification.

  - (send a-style-delta collapse delta) ⇒ boolean
    delta: style-delta% object

copy

Copies the given style delta’s settings into this one.

  - (send a-style-delta copy delta) ⇒ void
    delta: style-delta% object

equal?

Returns #t if the given delta is equivalent to this one in all contexts or #f otherwise.

  - (send a-style-delta equal? delta) ⇒ boolean
    delta: style-delta% object

get-alignment-off

See style-delta%.

  - (send a-style-delta get-alignment-off) ⇒ symbol in ’(base top center bottom)

get-alignment-on

See style-delta%.

  - (send a-style-delta get-alignment-on) ⇒ symbol in ’(base top center bottom)

get-background-add

Gets the object additive color shift for the background (applied after the multiplicative factor). Call this add-color<%> object’s methods to change the style delta’s additive background color shift.

  - (send a-style-delta get-background-add) ⇒ add-color<%> object
get-background-mult

Gets the multiplicative color shift for the background (applied before the additive factor). Call this `mult-color` object’s methods to change the style delta’s multiplicative background color shift.

```
- (send a-style-delta get-background-mult) ⇒ mult-color object
```

get-face

Gets the delta’s font face string. If this string is `#f` and the family is `’base` when the delta is applied to a style, the style’s face and family are not changed. However, if the face string is `#f` and the family is not `’base`, then the style’s face is changed to `#f`.

See also `get-family`.

```
- (send a-style-delta get-face) ⇒ string or #f
```

get-family

Returns the delta’s font family. The possible values are

- `’base` — no change to family
- `’default`
- `’decorative`
- `’roman`
- `’script`
- `’swiss`
- `’modern` (fixed width)
- `’symbol` (Greek letters)
- `’system` (used to draw control labels)

See also `get-face`.

```
- (send a-style-delta get-family) ⇒ symbol in ’(base default decorative roman script swiss modern symbol system)
```

get-foreground-add

Gets the additive color shift for the foreground (applied after the multiplicative factor). Call this `add-color` object’s methods to change the style delta’s additive foreground color shift.

```
- (send a-style-delta get-foreground-add) ⇒ add-color object
```
get-foreground-mult

Gets the multiplicative color shift for the foreground (applied before the additive factor). Call this mult-color% object’s methods to change the style delta’s multiplicative foreground color shift.

- (send a-style-delta get-foreground-mult) ⇒ mult-color% object

get-size-add

Gets the additive font size shift (applied after the multiplicative factor).

- (send a-style-delta get-size-add) ⇒ exact integer in [0, 255]

get-size-in-pixels-off

See style-delta%.

- (send a-style-delta get-size-in-pixels-off) ⇒ boolean

get-size-in-pixels-on

See style-delta%.

- (send a-style-delta get-size-in-pixels-on) ⇒ boolean

get-size-mult

Gets the multiplicative font size shift (applied before the additive factor).

- (send a-style-delta get-size-mult) ⇒ real number

get-smoothing-off

See style-delta%.

- (send a-style-delta get-smoothing-off) ⇒ symbol in ’(base default partly-smoothed smoothed unsmoothed)

get-smoothing-on

See style-delta%.

- (send a-style-delta get-smoothing-on) ⇒ symbol in ’(base default partly-smoothed smoothed unsmoothed)

get-style-off

See style-delta%.
- (send a-style-delta get-style-off) ⇒ symbol in’ (base normal italic slant)

get-style-on
See style-delta%.

- (send a-style-delta get-style-on) ⇒ symbol in’ (base normal italic slant)

get-transparent-text-backing-off
See style-delta%.

- (send a-style-delta get-transparent-text-backing-off) ⇒ boolean

get-transparent-text-backing-on
See style-delta%.

- (send a-style-delta get-transparent-text-backing-on) ⇒ boolean

get-underlined-off
See style-delta%.

- (send a-style-delta get-underlined-off) ⇒ boolean

get-underlined-on
See style-delta%.

- (send a-style-delta get-underlined-on) ⇒ boolean

get-weight-off
See style-delta%.

- (send a-style-delta get-weight-off) ⇒ symbol in’ (base normal bold light)

get-weight-on
See style-delta%.

- (send a-style-delta get-weight-on) ⇒ symbol in’ (base normal bold light)

set-alignment-off
See style-delta%.
- (send a-style-delta set-alignment-off v) ⇒ void
  v: symbol in ’(base top center bottom)

set-alignment-on

See style-delta%.

- (send a-style-delta set-alignment-on v) ⇒ void
  v: symbol in ’(base top center bottom)

set-delta

Configures the delta with high-level specifications. The return value is the delta itself.

Except for ‘change-nothing and ‘change-normal, the command only changes part of the delta. Thus, applying ‘change-bold and then ‘change-italic sets the delta for both the style and weight change.

- (send a-style-delta set-delta change-command) ⇒ style-delta% object

The change-command argument specifies how the delta is changed; the possible values are:
- ‘change-nothing — reset all changes
- ‘change-normal — turn off all styles and resizings
- ‘change-toggle-underline — underline regions that are currently not underlined, and vice-versa
- ‘change-toggle-size-in-pixels — interpret sizes in pixels for regions that are currently interpreted in points, and vice-versa
- ‘change-normal-color — change the foreground and background to black and white, respectively
- ‘change-italic — change the style of the font to italic
- ‘change-bold — change the weight of the font to bold

- (send a-style-delta set-delta change-command param) ⇒ style-delta% object
  change-command: symbol in ’(change-family change-style change-toggle-style change-weight change-toggle-weight change-smoothing change-toggle-smoothing change-alignment)
  param: exact integer in [0, 255]

The change-command argument specifies how the delta is changed; the possible values are:
- ‘change-family — change the font family (param is a family; see font%); see also get-family
- ‘change-style — change the style of the font (param is a style; see font%)
- ‘change-toggle-style — toggle the style of the font (param is a style; see font%)
- ‘change-weight — change the weight of the font (param is a weight; see font%)
- ‘change-toggle-weight — toggle the weight of the font (param is a weight; see font%)
- ‘change-smoothing — change the smoothing of the font (param is a smoothing; see font%)
- ‘change-toggle-smoothing — toggle the smoothing of the font (param is a smoothing; see font%)
- ‘change-alignment — change the alignment (param is an alignment; see style-delta%)

- (send a-style-delta set-delta change-command param) ⇒ style-delta% object
  change-command: symbol in ’(change-size change-bigger change-smaller)
  param: exact integer in [0, 255]

The change-command argument specifies how the delta is changed; the possible values are:
- ‘change-size’ — change the size to an absolute value (param is a size)
- ‘change-bigger’ — make the text larger (param is an additive amount)
- ‘change-smaller’ — make the text smaller (param is an additive amount)

- (send a-style-delta set-delta change-command on?) ⇒ style-delta% object
  change-command: symbol in ’(change-underline change-size-in-pixels)
  on?: boolean

  There are two possible values for change-command:
  - ‘change-underline’ — set the underline status to either underlined or plain
  - ‘change-size-in-pixels’ — set the size interpretation to pixels or points

set-delta-background

Makes the delta encode a background color change to the absolute color given. The return value is the delta itself.

- (send a-style-delta set-delta-background name) ⇒ style-delta% object
  name: string

  The string is looked up in the-color-database. See color-database<%>.

- (send a-style-delta set-delta-background color) ⇒ style-delta% object
  color: color% object

  The color argument is copied into the delta’s background color.

set-delta-face

Like set-face, but sets the family at the same time.

The return value is the delta itself.

- (send a-style-delta set-delta-face name family) ⇒ style-delta% object
  name: string
  family = default:symbol in ’(base default decorative roman script swiss modern symbol system)

set-delta-foreground

Makes the delta encode a foreground color change to the absolute color given. The return value is the delta itself.

- (send a-style-delta set-delta-foreground name) ⇒ style-delta% object
  name: string

  The string is looked up in the-color-database. See color-database<%>.

- (send a-style-delta set-delta-foreground color) ⇒ style-delta% object
  color: color% object

  The color argument is copied into the delta’s foreground color.

set-face

See get-face. See also set-delta-face.
- (send a-style-delta set-face v) ⇒ void
  v: string or #f

set-family
Sets the delta’s font family. See get-family.

- (send a-style-delta set-family v) ⇒ void
  v: symbol in ' (base default decorative roman script swiss modern symbol system)

set-size-add
Sets the additive font size shift (applied after the multiplicative factor).

- (send a-style-delta set-size-add v) ⇒ void
  v: exact integer in [0, 255]

set-size-in-pixels-off
See style-delta%.

- (send a-style-delta set-size-in-pixels-off v) ⇒ void
  v: boolean

set-size-in-pixels-on
See style-delta%.

- (send a-style-delta set-size-in-pixels-on v) ⇒ void
  v: boolean

set-size-mult
Sets the multiplicative font size shift (applied before the additive factor).

- (send a-style-delta set-size-mult v) ⇒ void
  v: real number

set-smoothing-off
See style-delta%.

- (send a-style-delta set-smoothing-off v) ⇒ void
  v: symbol in ' (base default partly-smoothed smoothed unsmoothed)

set-smoothing-on
See style-delta%.
- (send a-style-delta set-smoothing-on v) ⇒ void
  v: symbol in ’(base default partly-smoothed smoothed unsmoothed)

set-style-off
See style-delta%.

- (send a-style-delta set-style-off v) ⇒ void
  v: symbol in ’(base normal italic slant)

set-style-on
See style-delta%.

- (send a-style-delta set-style-on v) ⇒ void
  v: symbol in ’(base normal italic slant)

set-transparent-text-backing-off
See style-delta%.

- (send a-style-delta set-transparent-text-backing-off v) ⇒ void
  v: boolean

set-transparent-text-backing-on
See style-delta%.

- (send a-style-delta set-transparent-text-backing-on v) ⇒ void
  v: boolean

set-underlined-off
See style-delta%.

- (send a-style-delta set-underlined-off v) ⇒ void
  v: boolean

set-underlined-on
See style-delta%.

- (send a-style-delta set-underlined-on v) ⇒ void
  v: boolean

set-weight-off
See style-delta%.
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- (send a-style-delta set-weight-off v) ⇒ void
  v: symbol in ’(base normal bold light)

set-weight-on

See style-delta%.

- (send a-style-delta set-weight-on v) ⇒ void
  v: symbol in ’(base normal bold light)

9.30 style-list%

A style-list% object contains a set of style<%> objects and maintains the hierarchical relationships between them. A style<%> object can only be created through the methods of a style-list% object. There is a global style list object, the-style-list, but any number of independent lists can be created for separate style hierarchies. Each editor creates its own private style list.

See “Styles” (section 8.1.2, page 196) for more information.

- (make-object style-list%) ⇒ style-list% object

The root style, named "Basic", is automatically created.

basic-style

Returns the root style. Each style list has its own root style.

See also “Preferences” (section 12, page 365) for information about the ’|MrEd:default-font-size| preference.

- (send a-style-list basic-style) ⇒ style<%> object

convert

Converts an external style to a style in this list.

- (send a-style-list convert style) ⇒ style<%> object
  style: style<%> object

Converts style, which can be from another style list, to a style in this list. If style is already in this list, then style is returned. If style is named and a style by that name is already in this list, then the existing named style is returned. Otherwise, the style is converted by converting its base style (and shift style if style is a join style) and then creating a new style in this list.

find-named-style

Finds a style by name. If no such style can be found, #f is returned.

- (send a-style-list find-named-style name) ⇒ style<%> object or #f
  name: string
find-or-create-join-style

Creates a new join style, or finds an appropriate existing one. The returned style is always unnamed. See “Styles” (section 8.1.2, page 196) for more information.

- (send a-style-list find-or-create-join-style base-style shift-style) ⇒ style<%> object
  base-style: style<%> object
  shift-style: style<%> object

  The base-style argument must be a style within this style list.

find-or-create-style

Creates a new derived style, or finds an appropriate existing one. The returned style is always unnamed. See “Styles” (section 8.1.2, page 196) for more information.

- (send a-style-list find-or-create-style base-style delta) ⇒ style<%> object
  base-style: style<%> object
  delta: style-delta% object

  The base-style argument must be a style within this style list.

forget-notification

See notify-on-change.

- (send a-style-list forget-notification key) ⇒ void
  key: value

  The key argument is the value returned by notify-on-change.

index-to-style

Returns the style associated with the given index, or #f for a bad index. See also style-to-index.

- (send a-style-list index-to-style i) ⇒ style<%> object or #f
  i: exact non-negative integer

new-named-style

Creates a new named style, unless the name is already being used.

- (send a-style-list new-named-style name like-style) ⇒ style<%> object
  name: string
  like-style: style<%> object

  If name is already being used, then like-style is ignored and the old style associated to the name is returned. Otherwise, a new style is created for name with the same characteristics (i.e., the same base style and same style delta or shift style) as like-style.

  The like-style style must be in this style list, otherwise the named style is derived from the basic style with an empty style delta.
notify-on-change

Attaches a callback to the style list. The callback is invoked whenever a style is modified.

Often, a change in one style will trigger a change in several other derived styles; to allow clients to handle all the changes in a batch, #f is passed in as the changing style after a set of styles has been processed.

The return value from notify-on-change is an opaque key to be used with forget-notification.

- (send a-style-list notify-on-change f) ⇒ value
  f: procedure of one argument: a style<%> object or #f

number

Returns the number of styles in the list.

- (send a-style-list number) ⇒ exact non-negative integer

replace-named-style

Like new-named-style, except that if the name is already mapped to a style, the existing mapping is replaced.

- (send a-style-list replace-named-style name like-style) ⇒ style<%> object
  name: string
  like-style: style<%> object

style-to-index

Returns the index for a particular style. The index for a style’s base style (and shift style, if it is a join style) is guaranteed to be lower than the style’s own index. (As a result, the root style’s index is always 0.) A style’s index can change whenever a new style is added to the list, or the base style or shift style of another style is changed.

If the given style is not in this list, #f is returned.

- (send a-style-list style-to-index style) ⇒ exact non-negative integer or #f
  style: style<%> object

9.31 tab-snip%

Superclass: string-snip%

An instance of tab-snip% is created automatically when a tab is inserted into an editor.

- (make-object tab-snip% allocsize s) ⇒ tab-snip% object
  allocsize = 0: exact non-negative integer
  s: string

  Creates a snip for a single tab, though the tab is initially empty.
  Normally, a single tab is inserted into a tab-snip% object using the insert method.
The tab’s content is not drawn, through it is used when determining the size of a single character in editors where tabbing is determined by the character width (see set-tabs); if the content is a single tab character (the normal case), then the average character width of snip’s font is used as the tab’s width.

9.32  text%

Implements: editor<%

A text% object is a standard text editor. A text editor is displayed on the screen through an editor-canvas% object or some other display.

- (new text% [(line-spacing _)] [(tab-stops _)] [(auto-wrap _)]) ⇒ text% object
  line-spacing = 1.0: non-negative real number
  tab-stops = null: list of real numbers
  auto-wrap = #f: boolean

The line-spacing argument sets the additional amount of space (in DC units) inserted between each line in the editor when the editor is displayed. This spacing is included in the reported height of each line.

See set-tabs for information about tabstops.

If auto-wrap is true, then auto-wrapping is enabled via auto-wrap.

A new keymap% object is created for the new editor. See also get-keymap and set-keymap.

A new style-list% object is created for the new editor. See also get-style-list and set-style-list.

after-change-style (augmentable only)

Called after the style is changed for a given range (and after the display is refreshed; use on-change-style and begin-edit-sequence to avoid extra refreshes when after-change-style modifies the editor).

See also can-change-style? and on-edit-sequence.

No internals locks are set when this method is called.

- (send a-text after-change-style start len) ⇒ void
  start: exact non-negative integer
  len: exact non-negative integer

after-delete (augmentable only)

Called after a given range is deleted from the editor (and after the display is refreshed; use on-delete and begin-edit-sequence to avoid extra refreshes when after-delete modifies the editor).

See also can-delete? and on-edit-sequence.

No internals locks are set when this method is called.

- (send a-text after-delete start len) ⇒ void
  start: exact non-negative integer
  len: exact non-negative integer
The `start` argument specifies the starting position of the deleted range. The `len` argument specifies number of deleted items (so `start + len` is the ending position of the deleted range).

**after-insert (augmentable only)**

Called after items are inserted into the editor (and after the display is refreshed; use `on-insert` and `begin-edit-sequence` to avoid extra refreshes when `after-insert` modifies the editor).

See also `can-insert?` and `on-edit-sequence`.

No internals locks are set when this method is called.

- `(send a-text after-insert start len) ⇒ void
  start: exact non-negative integer
  len: exact non-negative integer

  The `start` argument specifies the position of the insert. The `len` argument specifies the total length (in positions) of the inserted items.

**after-merge-snips (augmentable only)**

Called after adjacent snips in the editor are combined into one. See also `merge-with`.

- `(send a-text after-merge-snips pos) ⇒ void
  pos: exact non-negative integer

  The `pos` argument specifies the position within the editor where the snips were merged (i.e., one old snip was just before `pos`, one old was just after `pos`, and the new snip spans `pos`).

**after-set-position (augmentable only)**

Called after the start and end position have been moved (but not when the position is moved due to inserts or deletes).

See also `on-edit-sequence`.

- `(send a-text after-set-position) ⇒ void

**after-set-size-constraint (augmentable only)**

Called after the editor’s maximum or minimum height or width is changed (and after the display is refreshed; use `on-set-size-constraint` and `begin-edit-sequence` to avoid extra refreshes when `after-set-size-constraint` modifies the editor).

(This callback method is provided because setting an editor’s maximum width may cause lines to be re-flowed with soft carriage returns.)

See also `can-set-size-constraint?` and `on-edit-sequence`.

- `(send a-text after-set-size-constraint) ⇒ void
after-split-snip (*augmentable only*)

Called after a snip in the editor is split into two, either through a call to `split-snip` or during some other action, such as inserting.

- `(send a-text after-split-snip pos) ⇒ void
  pos: exact non-negative integer

  The `pos` argument specifies the position within the editor where a snip was split.

call-clickback

Simulates a user click that invokes a clickback, if the given range of positions is within a clickback’s region. See also “Clickbacks” (section 8.7, page 200).

- `(send a-text call-clickback start end) ⇒ void
  start: exact non-negative integer
  end: exact non-negative integer

can-change-style? (*augmentable only*)

Called before the style is changed in a given range of the editor. If the return value is `#f`, then the style change will be aborted.

The editor is internally locked for writing during a call to this method (see also “Locks” (section 8.8, page 200)). Use `after-change-style` to modify the editor, if necessary.

See also `on-change-style`, `after-change-style`, and `on-edit-sequence`.

- `(send a-text can-change-style? start len) ⇒ boolean
  start: exact non-negative integer
  len: exact non-negative integer

can-delete? (*augmentable only*)

Called before a range is deleted from the editor. If the return value is `#f`, then the delete will be aborted.

The editor is internally locked for writing during a call to this method (see also “Locks” (section 8.8, page 200)). Use `after-delete` to modify the editor, if necessary.

See also `on-delete`, `after-delete`, and `on-edit-sequence`.

- `(send a-text can-delete? start len) ⇒ boolean
  start: exact non-negative integer
  len: exact non-negative integer

  The `start` argument specifies the starting position of the range to delete. The `len` argument specifies number of items to delete (so `start + len` is the ending position of the range to delete).

can-insert? (*augmentable only*)

Called before items are inserted into the editor. If the return value is `#f`, then the insert will be aborted.
The editor is internally locked for writing during a call to this method (see also “Locks” (section 8.8, page 200)). Use after-insert to modify the editor, if necessary.

See also on-insert, after-insert, and on-edit-sequence.

- (send a-text can-insert? start len) ⇒ boolean
  start: exact non-negative integer
  len: exact non-negative integer
  
The start argument specifies the position of the potential insert. The len argument specifies the total length (in positions) of the items to be inserted.

can-set-size-constraint? (augmentable only)

Called before the editor’s maximum or minimum height or width is changed. If the return value is #f, then the change will be aborted.

(This callback method is provided because setting an editor’s maximum width may cause lines to be re-flowed with soft carriage returns.)

See also on-set-size-constraint, after-set-size-constraint, and on-edit-sequence.

- (send a-text can-set-size-constraint?) ⇒ boolean

caret-hidden?

Returns #t if the caret is hidden for this editor or #f otherwise.

- (send a-text caret-hidden?) ⇒ boolean
  
  See also hide-caret.

change-style

Changes the style for items in the editor.

The style within an editor can be changed by the system (in response to other method calls), and such changes do not go through this method; use on-change-style in text% to monitor style changes.

- (send a-text change-style delta start end counts-as-mod?) ⇒ void
  delta: style-delta% object or #f
  start: exact non-negative integer or ’start
  end = ’end: exact non-negative integer or ’end
  counts-as-mod? = #t: boolean
  
  Changes the style for a region in the editor by applying a style delta. If start is ’start and end is ’end, then the currently selected items are changed. Otherwise, if end is ’end, then the style is changed from start until the end of the selection. If counts-as-mod? is #f, then set-modified is not called after applying the style change.

- (send a-text change-style style start end counts-as-mod?) ⇒ void
  style: style% object or #f
  start = ’start: exact non-negative integer or ’start
end = 'end': exact non-negative integer or 'end
counts-as-mod? = #t: boolean

Changes the style for a region in the editor to a specific style. If start is 'start and end is 'end, then the
currently selected items are changed. Otherwise, if end is 'end, then the style is changed from start until
the end of the selection. If counts-as-mod? is #f, then set-modified is not called after applying
the style change. The editor’s style list must contain style, otherwise the style is not changed. See also convert
in style-list%.

- (send a-text change-style delta) => void
delta: style-delta% object or #f

Changes the style of the selected items by applying a style delta.

To change a large collection of snips from one style to another style, consider providing a style<> instance
rather than a style-delta% instance. Otherwise, change-style must convert the style-delta% in-
stance to the style<> instance for every snip; this conversion consumes both time and (temporary) memory.

- (send a-text change-style style) => void
  style: style<> object or #f

Changes the style of the selected items to a specific style. The editor’s style list must contain style, otherwise
the style is not changed. See also convert in style-list%.

copy

Copies items into the clipboard.

The system may execute a copy (in response to other method calls) without calling this method. To extend or re-
implement copying, override the do-copy in text% or do-copy in pasteboard% method of an editor.

- (send a-text copy extend? time start end) => void
  extend?: boolean
  time: exact integer
  start: exact non-negative integer or 'start
  end = 'end: exact non-negative integer or 'end

Copies specified range of text into the clipboard. If extend? is not #f, the old clipboard contents are ap-
pended. If start is 'start or end is 'end, then the current selection start/end is used.

See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the
platform-specific range of times, an exn:fail:contract exception is raised.

- (send a-text copy extend? time) => void
  extend? = #f: boolean
  time = 0: exact integer

Copies the selected items into the clipboard. If extend? is not #f, the old clipboard contents are appended.

See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the
platform-specific range of times, an exn:fail:contract exception is raised.

copy-self-to

Copies the properties of this editor into an existing editor.

- (send a-text copy-self-to dest) => void
  dest: text% or pasteboard% object
Each snip in this editor is copied and inserted into dest. In addition, this editor’s filename, maximum undo history setting, keymap, interactive caret threshold, and overwrite-styles-on-load settings are installed into dest. This editor’s style list is copied and the copy is installed as the style list for dest.

This editor’s file format, wordbreak function, wordbreak map, click-between-threshold, caret visibility state, overwrite mode state, and autowrap bitmap are installed into dest.

cut

Copies and then deletes items in the editor.

The system may execute a cut (in response to other method calls) without calling this method. To extend or re-implement the copying portion of the cut, override the do-copy in text% or do-copy in pasteboard% method of an editor. To monitor deletions in an editor, override on-delete in text% or on-delete in pasteboard%.

- (send a-text cut extend? time start end) ⇒ void
  extend?: boolean
  time: exact integer
  start: exact non-negative integer or ’start
  end = ’end: exact non-negative integer or ’end

Copies and then deletes the specified range. If extend? is not #f, the old clipboard contents are appended. If start is ’start or end is ’end, then the current selection start/end is used.

See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

- (send a-text cut extend? time) ⇒ void
  extend? = #f: boolean
  time = 0: exact integer

Copies and then deletes the currently selected items. If extend? is not #f, the old clipboard contents are appended.

See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

delete

The content of an editor can be changed by the system in response to other method calls, and such changes do not go through this method; use on-delete to monitor content deletion changes.

- (send a-text delete start end scroll-ok?) ⇒ void
  start: exact non-negative integer or ’start
  end = ’back: exact non-negative integer or ’back
  scroll-ok? = #t: boolean

Deletes the specified range in the editor. If start is ’start, then the starting selection position is used; if end is ’back, then only the character preceding start is deleted. If scroll-ok? is not #f and start is the same as the current caret position, then the editor’s display may be scrolled to show the new selection position.

- (send a-text delete) ⇒ void

Deletes the currently selected text.
do-copy

Called to copy a region of the editor into the clipboard. This method is provided so that it can be overridden by subclasses. Do not call this method directly; instead, call `copy`.

```scheme
(define (send a-text do-copy start end time extend?) => void
  start: exact non-negative integer
  end: exact non-negative integer
  time: exact integer
  extend?: boolean

Copy the data from `start` to `end`, extending the current clipboard contexts if `extend?` is not #f.

See “Cut and Paste” (section 8.6, page 200) for a discussion of the `time` argument. If `time` is outside the platform-specific range of times, an exn:fail:contract exception is raised.
```

do-paste

Called to paste the current contents of the clipboard into the editor. This method is provided so that it can be overridden by subclasses. Do not call this method directly; instead, call `paste`.

```scheme
(define (send a-text do-paste start time) => void
  start: exact non-negative integer
  time: exact integer

Paste into the position `start`.

See “Cut and Paste” (section 8.6, page 200) for a discussion of the `time` argument. If `time` is outside the platform-specific range of times, an exn:fail:contract exception is raised.
```

do-paste-x-selection

Called to paste the current contents of X selection under X (or the clipboard under Windows or Mac OS X) into the editor. This method is provided so that it can be overridden by subclasses. Do not call this method directly; instead, call `paste-x-selection`.

```scheme
(define (send a-text do-paste-x-selection start time) => void
  start: exact non-negative integer
  time: exact integer

Paste into the position `start`.

See “Cut and Paste” (section 8.6, page 200) for a discussion of the `time` argument. If `time` is outside the platform-specific range of times, an exn:fail:contract exception is raised.
```

erase

Erases the contents of the editor.

See also `delete`.

```scheme
(define (send a-text erase) => void
```
find-line

Given a location in the editor, returns the line at the location. Lines are numbered starting with 0.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). Calling this method may force the recalculation of location information, even if the editor currently has delayed refreshing (see refresh-delayed?).

- (send a-text find-line y on-it?) ⇒ exact non-negative integer
  y: real number
  on-it? = #f: boxed boolean or #f

  The on-it? box is filled with #t if the line actually touches this position, or #f otherwise, unless on-it? is #f. (A large enough y will always return the last line number, but will set on-it? to #f.)

find-next-non-string-snip

Given a snip, returns the next snip in the editor (after the given one) that is not an instance of string-snip%. If #f is given as the snip, the result is the first non-string snip in the editor (if any). If no non-string snip is found after the given snip, the result is #f.

- (send a-text find-next-non-string-snip after) ⇒ snip% object or #f
  after: snip% object or #f

find-position

Given a location in the editor, returns the position at the location.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). Calling this method may force the recalculation of location information, even if the editor currently has delayed refreshing (see refresh-delayed?).

- (send a-text find-position x y at-eol? on-it? edge-close?) ⇒ exact non-negative integer
  x: real number
  y: real number
  at-eol? = #f: boxed boolean or #f
  on-it? = #f: boxed boolean or #f
  edge-close? = #f: boxed real number or #f

  See “End of Line” (section 8.3, page 199) for a discussion of the at-eol? argument. The on-it? box is filled with #t if the line actually touches this position, or #f otherwise, unless on-it? is #f.

  The edge-close? box is filled with it will be filled in with a value indicating how close the point is to the vertical edges of the item when the point falls on the item, unless edge-close? is #f. If the point is closest to the left edge of the item, the value will be negative; otherwise, the value will be positive. In either case, then absolute value of the returned result is the distance from the point to the edge of the item. The values 100 and -100 indicate infinity.

find-position-in-line

Given a location within a line of the editor, returns the position at the location. Lines are numbered starting with 0.
The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). Calling this method may force the recalculation of location information, even if the editor currently has delayed refreshing (see refresh-delayed?).

- (send a-text find-position-in-line line x at-eol? on-it? edge-close?) ⇒
  exact non-negative integer
  line: exact non-negative integer
  x: real number
  at-eol?: #f: boxed boolean or #f
  on-it?: #f: boxed boolean or #f
  edge-close?: #f: boxed real number or #f

See “End of Line” (section 8.3, page 199) for a discussion of the at-eol? argument. The on-it? box is filled with #t if the line actually touches this position, or #f otherwise, unless on-it? is #f.

See find-position for a discussion of edge-close?.

find-snip

Returns the snip at a given position, or #f if an appropriate snip cannot be found.

- (send a-text find-snip pos direction s-pos) ⇒ snip% object or #f
  pos: exact non-negative integer
  direction: symbol in ‘(before-or-none before after after-or-none)
  s-pos = #f: boxed exact non-negative integer or #f

If the position pos is between two snips, direction specifies which snip to return; direction can be any of the following:

- ‘before-or-none — returns the snip before the position, or #f if pos is 0
- ‘before — returns the snip before the position, or the first snip if pos is 0
- ‘after — returns the snip after the position, or the last snip if pos is the last position
- ‘after-or-none — returns the snip after the position, or #f if pos is the last position or larger

The s-pos box is filled with the position where the returned snip starts, unless s-pos is #f.

find-string

Finds an exact-match string in the editor and returns its position. If the string is not found, #f is returned.

- (send a-text find-string str direction start end get-start? case-sensitive?) ⇒ exact non-negative integer or #f
  str: string
  direction = ‘forward: symbol in ‘(forward backward)
  start = ‘start: exact non-negative integer or ‘start
  end = ‘eof: exact non-negative integer or ‘eof
  get-start? = #t: boolean
  case-sensitive? = #t: boolean

The direction argument can be ‘forward or ‘backward, indicating a forward search or backward search respectively. In the case of a forward search, the return value is the starting position of the string; for a backward search, the ending position is returned. However, if get-start? is #f, then the other end of the string position will be returned.

The start and end arguments set the starting and ending positions of a forward search (use start and end for a backward search). If start is ‘start, then the search starts at the start of the selection. If end is ‘eof, then the search continues to the end (for a forward search) or start (for a backward search) of the editor.
If `case-sensitive?` is `#f`, then an uppercase and lowercase of each alphabetic character are treated as equivalent.

**find-string-all**

Finds all occurrences of a string using `find-string`. If no occurrences are found, the empty list is returned.

```sente
- (send a-text find-string-all str direction start end get-start? case-sensitive) ⇒ list of exact non-negative integers
  str: string
  direction = ’forward: symbol in’ (forward backward)
  start = ’start: exact non-negative integer or ’start
  end = ’eof: exact non-negative integer or ’eof
  get-start? = #t: boolean
  case-sensitive = #t: boolean

The arguments are the same as for `find-string`.
```

**find-wordbreak**

Finds wordbreaks in the editor using the current wordbreak procedure. See also `set-wordbreak-func`.

```sente
- (send a-text find-wordbreak start end reason) ⇒ void
  start: boxed exact non-negative integer or #f
  end: boxed exact non-negative integer or #f
  reason: symbol in’ (caret line selection user1 user2)

The contents of the `start` argument specifies an position to start searching backwards to the next word start; its will be filled with the starting position of the word that is found. If `start` is `#f`, no backward search is performed.

The contents of the `end` argument specifies an position to start searching forwards to the next word end; its will be filled with the ending position of the word that is found. If `end` is `#f`, no forward search is performed.

The `reason` argument specifies more information about what the wordbreak is used for. For example, the wordbreaks used to move the caret may be different from the wordbreaks used to break lines. The possible values of `reason` are:

- ’caret — find a wordbreak suitable for moving the caret
- ’line — find a wordbreak suitable for breaking lines
- ’selection — find a wordbreak suitable for selecting the closest word
- ’user1 — for other (not built-in) uses
- ’user2 — for other (not built-in) uses

The actual handling of `reason` is controlled by the current wordbreak procedure; see `set-wordbreak-func` for details. The default handler and default wordbreak map treats alphanumeric characters the same for ’caret, ’line, and ’selection. Non-alphanumeric, non-space, non-hyphen characters do not break lines, but do break caret and selection words. For example a comma should not be counted as part of the preceding word for moving the caret past the word or double-clicking the word, but the comma should stay on the same line as the word (and thus counts in the same “line word”).
```

**flash-off**

See `flash-on`. There is no effect if this method is called when flashing is already off.
- (send a-text flash-off) => void
  
  Turns off the hiliting and shows the normal selection range again.

flash-on

Temporarily hilites a region in the editor without changing the current selection.

- (send a-text flash-on start end at-eol? scroll? timeout) => void
  
  start: exact non-negative integer
  end: exact non-negative integer
  at-eol? = #f: boolean
  scroll? = #t: boolean
  timeout = 500: exact non-negative integer

  See “End of Line” (section 8.3, page 199) for a discussion of the at-eol? argument. If scroll? is not #f, the editor’s display will be scrolled if necessary to show the hilited region. If timeout is greater than 0, then the hiliting will be automatically turned off after the given number of milliseconds.

  See also flash-off.

get-anchor

Returns #t if the selection is currently auto-extending. See also set-anchor.

- (send a-text get-anchor) => boolean

get-between-threshold

Returns an amount used to determine the meaning of a user click. If the click falls within the threshold of a position between two items, then the click registers on the space between the items rather than on either item.

See also set-between-threshold.

- (send a-text get-between-threshold) => non-negative real number

get-character

Gets a single character for the editor. The character corresponds to getting non-flattened text from the editor.

- (send a-text get-character start) => character
  
  start: exact non-negative integer

  Returns the character following the position start. If start is greater than or equal to the last position, the null character is returned.

get-end-position

Returns the ending position of the current selection. See also get-position.

- (send a-text get-end-position) => exact non-negative integer
get-file-format

Returns the format of the last file saved from or loaded into this editor. See also load-file.

- (send a-text get-file-format) ⇒ symbol in '((standard text text-force-cr)

get-line-spacing

Returns the spacing inserted by the editor between each line. This spacing is included in the reported height of each line.

- (send a-text get-line-spacing) ⇒ non-negative real number

get-overwrite-mode

Returns #t if the editor is in overwrite mode, #f otherwise. Overwrite mode only affects the way that on-default-char handles keyboard input for insertion characters. See also set-overwrite-mode.

- (send a-text get-overwrite-mode) ⇒ boolean

get-position

Returns the current selection range in positions. See also get-start-position and get-end-position.

- (send a-text get-position start end) ⇒ void
  start: boxed exact non-negative integer or #f
  end = #f: boxed exact non-negative integer or #f

  The start box is filled with the starting position of the selection, unless start is #f. The end box is filled with the ending position of the selection, unless end is #f.

get-region-data

Gets extra data associated with a given region. See “Editor Data” (section 8.2.1, page 198) for more information.

This method is not called when the whole editor is saved to a file. In such cases, the information can be stored in the header or footer; see “Global Data: Headers and Footers” (section 8.2.2, page 198).

This method is meant to be overridden; the default set-region-data method does not store information to be retrieved by this method.

- (send a-text get-region-data start end) ⇒ editor-data% object or #f
  start: exact non-negative integer
  end: exact non-negative integer

get-revision-number

Returns an inexact number that increments every time the editor is changed in one of the following ways: a snip is inserted (see after-insert), a snip is deleted (see after-delete), a snip is split (see after-split-snip), snips are merged (see after-merge-snips), or a snip changes its count (which is rare; see recounted).
- (send a-text get-revision-number) ⇒ non-negative real number

get-snip-position

Returns the starting position of a given snip or #f if the snip is not in this editor.

- (send a-text get-snip-position snip) ⇒ exact non-negative integer or #f
  snip: snip% object

get-snip-position-and-location

Gets a snip’s position and top left location in editor coordinates. The return value is #t if the snip is found, #f otherwise.

When location information is requested: The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). Calling this method may force the recalculation of location information, even if the editor currently has delayed refreshing (see refresh-delayed?).

- (send a-text get-snip-position-and-location snip pos x y) ⇒ boolean
  snip: snip% object
  pos: boxed exact non-negative integer or #f
  x = #f: boxed real number or #f
  y = #f: boxed real number or #f

  The pos box is filled with starting position of snip, unless pos is #f. The x box is filled with left location of snip in editor coordinates, unless x is #f. The y box is filled with top location of snip in editor coordinates, unless y is #f.

get-start-position

Returns the starting position of the current selection. See also get-position.

- (send a-text get-start-position) ⇒ exact non-negative integer

get-styles-sticky

In the normal mode for a text editor, style settings are sticky. With sticky styles, when a string or character is inserted into an editor, it gets the style of the snip preceding the insertion point (or the snip that includes the insertion point if text is inserted into an exiting string snip). Alternatively, if change-style is called to set the style at the caret position (when it is not a range), then the style is remembered; if the editor is not changed before text is inserted at the caret, then the text gets the remembered style.

With non-sticky styles, text inserted into an editor always gets the style in the editor’s style list named by default-style-name.

See also set-styles-sticky.

- (send a-text get-styles-sticky) ⇒ boolean

get-tabs

Returns the current tab position array as a list.
- (send a-text get-tabs length tab-width in-units) ⇒ list of real numbers
  length = #f: boxed exact non-negative integer or #f
  tab-width = #f: boxed real number or #f
  in-units = #f: boxed boolean or #f

  The length box is filled with the length of the tab array (and therefore the returned list), unless length is #f. The tab-width box is filled with the width used for tabs past the end of the tab array, unless tab-width is #f. The in-units box is filled with #t if the tabs are specified in canvas units or #f if they are specified in space-widths, unless in-units is #f.

  See also set-tabs.

get-text

Returns the contents of the editor in text form.

- (send a-text get-text start end flattened? force-cr?) ⇒ string
  start = 0: exact non-negative integer
  end = 'eof: exact non-negative integer or 'eof
  flattened? = #f: boolean
  force-cr? = #f: boolean

  Gets the text from start to end. If end is 'eof, then the contents are returned from start until the end of the editor.

  If flattened? is not #f, then flattened text is returned. See “Getting Text” (section 8.4, page 199) for a discussion of flattened vs. non-flattened text.

  If force-cr? is not #f and flattened? is not #f, then automatic carriage returns (from word-wrapping) are written into the return string as real carriage returns.

get-top-line-base

Returns the distance from the top of the editor to the alignment baseline of the top line. This method is primarily used when an editor is an item within another editor.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). For text% objects, calling this method may force the recalculation of location information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see refresh-delayed?).

- (send a-text get-top-line-base) ⇒ non-negative real number

get-visible-line-range

Returns the range of lines which are currently visible (or partially visible) to the user. Lines are numbered starting with 0.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). Calling this method may force the recalculation of location information, even if the editor currently has delayed refreshing (see refresh-delayed?).

- (send a-text get-visible-line-range start end all?) ⇒ void
  start: boxed exact non-negative integer or #f
  end: boxed exact non-negative integer or #f
  all? = #t: boolean
The start box is filled with first line visible to the user, unless start is #f. The end box is filled with last line visible to the user, unless end is #f.

If the editor is displayed by multiple canvases and all? is #t, then the computed range includes all visible lines in all displays. Otherwise, the range includes only the visible lines in the current display.

get-visible-position-range

Returns the range of positions that are currently visible (or partially visible) to the user.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). Calling this method may force the recalculation of location information, even if the editor currently has delayed refreshing (see refresh-delayed?).

- (send a-text get-visible-position-range start end all?) ⇒ void
  - start: boxed exact non-negative integer or #f
  - end: boxed exact non-negative integer or #f
  - all?: #t: boolean

  The start box is filled with first position visible to the user, unless start is #f. The end box is filled with last position visible to the user, unless end is #f.

  If the editor is displayed by multiple canvases and all? is #t, then the computed range includes all visible positions in all displays. Otherwise, the range includes only the visible positions in the current display.

get-wordbreak-map

Returns the wordbreaking map that is used by the standard wordbreaking function. See editor-wordbreak-map% for more information.

- (send a-text get-wordbreak-map) ⇒ editor-wordbreak-map% object

hide-caret

Determines whether the caret is shown when the editor has the keyboard focus.

- (send a-text hide-caret hide?) ⇒ void
  - hide?: #t: boolean

  If hide? is not #f, then the caret or selection hiliting will not be drawn for the editor. The editor can still own the keyboard focus, but no caret will be drawn to indicate the focus.

  See also caret-hidden? and lock.

insert

Inserts data into the editor.

The content of an editor can be changed by the system in response to other method calls, and such changes do not go through this method; use on-insert in text% or on-insert in pasteboard% to monitor content additions changes.

- (send a-text insert str start end scroll-ok?) ⇒ void
  - str: string
**send a-text insert n str start end scroll-ok?** ⇒ void

- **start**: exact non-negative integer
- **end** = 'same': exact non-negative integer or 'same
- **scroll-ok?** = #: boolean

Inserts the text **str** at position **start**.

If **end** is not 'same', then **str** replaces the region from **start** to **end**, and the selection is left at the end of the inserted text. Otherwise, if the insertion position is before or equal to the selection’s start/end position, then the selection’s start/end position is incremented by the length of **str**.

If **scroll-ok?** is not #f and **start** is the same as the current selection’s start position, then the editor’s display is scrolled to show the new selection position.

See also **get-styles-sticky**.

- **(send a-text insert str)** ⇒ void

- **str**: string

Inserts **str** at the current selection start position.

If the current selection covers a range of items, then **str** replaces the selected text. The selection’s starts and end positions are moved to the end of the inserted text.

The editor’s display is scrolled to show the new selection position.

See also **get-styles-sticky**.

- **(send a-text insert n str)** ⇒ void

- **n**: exact non-negative integer
- **str**: string

Inserts the first **n** characters of **str** at the current selection start position.

If the current selection covers a range of items, then the inserted text replaces the selected text. The selection’s start and end positions are moved to the end of the inserted text.

The editor’s display is scrolled to show the new selection position.

See also **get-styles-sticky**.

- **(send a-text insert snip start end scroll-ok?)** ⇒ void

- **snip**: snip% object
- **start** : exact non-negative integer
- **end** = 'same': exact non-negative integer or 'same
- **scroll-ok?** = #: boolean

Inserts **snip** into the editor at **start**. A snip cannot be inserted into multiple editors or multiple times within a single editor.
If \texttt{end} is not \texttt{same}, then \texttt{snip} replaces the region from \texttt{start} to \texttt{end}, and the selection is left at the end of the inserted snip. Otherwise, if the insertion position is before or equal to the selection’s start/end position, then the selection’s start/end position is incremented by the count of \texttt{snip}.

If \texttt{scroll-ok?} is not \texttt{#f} and \texttt{start} is the same as the current selection’s start position, then the editor’s display is scrolled to show the new selection position.

As the snip is inserted, its current style is converted to one in the editor’s style list; see also \texttt{convert}.

- (send \texttt{a-text insert snip}) \Rightarrow \texttt{void}
  \texttt{snip: snip\% object}
  Inserts \texttt{snip} into the editor at the current selection position. A snip cannot be inserted into multiple editors or multiple times within a single editor.
  If the current selection covers a range of items, then the inserted text replaces the selected text. The selection’s start and end positions are moved to the end of the inserted snip.
  The editor’s display is scrolled to show the new selection position.
  As the snip is inserted, its current style is converted to one in the editor’s style list; see also \texttt{convert}.

- (send \texttt{a-text insert char}) \Rightarrow \texttt{void}
  \texttt{char: character}
  Inserts \texttt{char} into the editor at the current selection position.
  If the current selection covers a range of items, then \texttt{char} replaces the selected text. The selection’s start and end positions are moved to the end of the inserted character.
  The editor’s display is scrolled to show the new selection position.
  See also \texttt{get-styles-sticky}.
  Multiple calls to the character-inserting method are grouped together for undo purposes, since this case of the method is typically used for handling user keystrokes. However, this undo-grouping feature interferes with the undo grouping performed by \texttt{begin-edit-sequence} and \texttt{end-edit-sequence}, so the string-inserting method should be used instead during undoable edit sequences.

- (send \texttt{a-text insert char start end}) \Rightarrow \texttt{void}
  \texttt{char: character}
  \texttt{start: exact non-negative integer}
  \texttt{end = 'same: exact non-negative integer or 'same}
  Inserts \texttt{char} into the editor at the position \texttt{start}.
  If \texttt{end} is not \texttt{same}, then \texttt{char} replaces the region from \texttt{start} to \texttt{end}, and the selection is left at the end of the inserted text. Otherwise, if the insertion position is before or equal to the selection’s start/end position, then the selection’s start/end position is incremented by 1.
  If \texttt{start} is the same as the current selection’s start position, then the editor’s display is scrolled to show the new selection position.
  See also \texttt{get-styles-sticky}.
  Multiple calls to the character-inserting method are grouped together for undo purposes, since this case of the method is typically used for handling user keystrokes. However, this undo-grouping feature interferes with the undo grouping performed by \texttt{begin-edit-sequence} and \texttt{end-edit-sequence}, so the string-inserting method should be used instead during undoable edit sequences.

\texttt{kill}

In a text editor, cuts to the end of the current line, or cuts a newline if there is only whitespace between the selection and end of line. Multiple consecutive kills are appended. In a pasteboard editor, cuts the current selection.
The content of an editor can be changed by the system in response to other method calls, and such changes do not go through this method; use `on-delete in text%` or `on-delete in pasteboard%` to monitor content deletions changes.

```
- (send a-text kill time start end) ⇒ void
  time: exact integer
  start: exact non-negative integer
  end: exact non-negative integer

Cuts the text in the given region.
```

See “Cut and Paste” (section 8.6, page 200) for a discussion of the `time` argument. If `time` is outside the platform-specific range of times, an `exn:fail:contract` exception is raised.

```
- (send a-text kill time) ⇒ void
  time = 0: exact integer

See “Cut and Paste” (section 8.6, page 200) for a discussion of the `time` argument. If `time` is outside the platform-specific range of times, an `exn:fail:contract` exception is raised.
```

### last-line

Returns the number of the last line in the editor. Lines are numbered starting with 0, so this is one less than the number of lines in the editor.

Calling this method may force the recalculation of `location` information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see `refresh-delayed?`). If the editor is not displayed and the editor has a maximum width, line breaks are calculated as for `line-start-position` (which handles specially the case of no display when the editor has a maximum width).

See also `paragraph-start-position`, which operates on paragraphs (determined by explicit newline characters) instead of lines (determined by both explicit newline characters and automatic line-wrapping).

```
- (send a-text last-line) ⇒ exact non-negative integer
```

### last-paragraph

Returns the number of the last paragraph in the editor. Paragraphs are numbered starting with 0, so this is one less than the number of paragraphs in the editor.

Calling this method may force the recalculation of `location` information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see `refresh-delayed?`).

```
- (send a-text last-paragraph) ⇒ exact non-negative integer
```

### last-position

Returns the last selection `position` in the editor. This is also the number of `items` in the editor.

```
- (send a-text last-position) ⇒ exact non-negative integer
```
line-end-position

Returns the last position of a given line. Lines are numbered starting with 0.

Calling this method may force the recalculation of location information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see refresh-delayed?). If the editor is not displayed and the editor has a maximum width, line breaks are calculated as for line-start-position (which handles specially the case of no display when the editor has a maximum width).

See also paragraph-start-position, which operates on paragraphs (determined by explicit newline characters) instead of lines (determined by both explicit newline characters and automatic line-wrapping).

- (send a-text line-end-position line visible?) ⇒ exact non-negative integer
  line: exact non-negative integer
  visible? = #t: boolean

  If there are fewer than line-1 lines, the end of the last line is returned. If line is less than 0, then the end of the first line is returned.

  If the line ends with invisible items (such as a carriage return) and visible? is not #f, the first position before the invisible items is returned.

line-length

Returns the number of items in a given line. Lines are numbered starting with 0.

Calling this method may force the recalculation of location information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see refresh-delayed?). If the editor is not displayed and the editor has a maximum width, line breaks are calculated as for line-start-position (which handles specially the case of no display when the editor has a maximum width).

- (send a-text line-length i) ⇒ exact non-negative integer
  i: exact non-negative integer

line-location

Given a line number, returns the location of the line. Lines are numbered starting with 0.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). Calling this method may force the recalculation of location information, even if the editor currently has delayed refreshing (see refresh-delayed?).

See also paragraph-start-position, which operates on paragraphs (determined by explicit newline characters) instead of lines (determined by both explicit newline characters and automatic line-wrapping).

- (send a-text line-location line top?) ⇒ real number
  line: exact non-negative integer
  top? = #t: boolean

  If top? is not #f, the location for the top of the line is returned; otherwise, the location for the bottom of the line is returned.
line-paragraph

Returns the paragraph number of the paragraph containing the line. Lines are numbered starting with 0. Paragraphs are numbered starting with 0.

Calling this method may force the recalculation of location information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see refresh-delayed?). If the editor is not displayed and the editor has a maximum width, line breaks are calculated as for line-start-position (which handles specially the case of no display when the editor has a maximum width).

- (send a-text line-paragraph start) ⇒ exact non-negative integer
  start: exact non-negative integer

line-start-position

Returns the first position of the given line. Lines are numbered starting with 0.

Calling this method may force the recalculation of location information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see refresh-delayed?).

To calculate lines, if the following are true:

- the editor is not displayed (see “Basic Organization” (section 8.1, page 194)),
- a maximum width is set for the editor, and
- the editor has never been viewed

then this method ignores the editor’s maximum width and any automatic line breaks it might imply. If the first two of the above conditions are true and the editor was formerly displayed, this method uses the line breaks from the most recent display of the editor. (Insertions or deletions since the display shift line breaks within the editor in the same way as items.)

See also paragraph-start-position, which operates on paragraphs (determined by explicit newline characters) instead of lines (determined by both explicit newline characters and automatic line-wrapping).

- (send a-text line-start-position line visible?) ⇒ exact non-negative integer
  line: exact non-negative integer
  visible? = #: boolean

  If there are fewer than line−1 lines, the start of the last line is returned. If line is less than 0, then the start of the first line is returned.

  If the line starts with invisible items and visible? is not #f, the first position past the invisible items is returned.

move-position

Move the current selection.

See also set-position.

- (send a-text move-position code extend? kind) ⇒ void
  code:symbol in ’(home end right left up down)
extend? = #f: boolean
kind = 'simple: symbol in ' (simple word page line)

The possible values for code are:
- 'home — go to start of file
- 'end — go to end of file
- 'right — move right
- 'left — move left
- 'up — move up
- 'down — move down

If extend? is not #f, the selection range is extended instead of moved. If anchoring is on (see get-anchor
and set-anchor), then extend? is effectively forced to #t.

The possible values for kind are:
- 'simple — move one item or line
- 'word — works with 'right or 'left
- 'page — works with 'up or 'down
- 'line — works with 'right or 'left; moves to the start or end of the line

on-change-style (augmentable only)

Called before the style is changed in a given range of the editor, after can-change-style? is called to verify that
the change is ok. The after-change-style method is guaranteed to be called after the change has completed.

The editor is internally locked for writing during a call to this method (see also “Locks” (section 8.8, page 200)). Use
after-change-style to modify the editor, if necessary.

See also on-edit-sequence.

- (send a-text on-change-style start len) ⇒ void
  start: exact non-negative integer
  len: exact non-negative integer

on-default-char

Called by on-local-char when the event is not handled by a caret-owning snip or by the keymap.

- (send a-text on-default-char event) ⇒ void
  event: key-event% object

Handles the following:
- Delete and Backspace — calls delete.
- The arrow keys, Page Up, Page Down, Home, and End (including shifted versions) — moves the selection
  position with move-position.
- Any other character in the range (integer->char 32) to (integer->char 255) — inserts the
  character into the editor.

Note that an editor’s editor-canvas% normally handles mouse wheel events (see also on-char).

on-default-event

Called by on-local-event when the event is not handled by a caret-owning snip or by the keymap.
on-delete (augmentable only)

Called before a range is deleted from the editor, after can-delete? is called to verify that the deletion is ok. The after-delete method is guaranteed to be called after the delete has completed.

The editor is internally locked for writing during a call to this method (see also “Locks” (section 8.8, page 200)). Use after-delete to modify the editor, if necessary.

See also on-edit-sequence.

- (send a-text on-delete start len) ⇒ void
  
  start: exact non-negative integer
  len: exact non-negative integer

  The start argument specifies the starting position of the range to delete. The len argument specifies number of items to delete (so start + len is the ending position of the range to delete).

on-insert (augmentable only)

Called before items are inserted into the editor, after can-insert? is called to verify that the insertion is ok. The after-insert method is guaranteed to be called after the insert has completed.

The editor is internally locked for writing during a call to this method (see also “Locks” (section 8.8, page 200)). Use after-insert to modify the editor, if necessary.

See also on-edit-sequence.

- (send a-text on-insert start len) ⇒ void
  
  start: exact non-negative integer
  len: exact non-negative integer

  The start argument specifies the position of the insert. The len argument specifies the total length (in positions) of the items to be inserted.

on-new-string-snip

Called by insert when a string or character is inserted into the editor, this method creates and returns a new instance of string-snip% to store inserted text. The returned string snip is empty (i.e., its count is zero).

- (send a-text on-new-string-snip) ⇒ string-snip% object
on-new-tab-snip

Creates and returns a new instance of tab-snip% to store an inserted tab. The returned tab snip is empty (i.e., its count is zero).

- (send a-text on-new-tab-snip) ⇒ tab-snip% object

on-set-size-constraint (augmentable only)

Called before the editor’s maximum or minimum height or width is changed, after can-set-size-constraint? is called to verify that the change is ok. The after-set-size-constraint method is guaranteed to be called after the change has completed.

(This callback method is provided because setting an editor’s maximum width may cause lines to be re-flowed with soft carriage returns.)

See also on-edit-sequence.

- (send a-text on-set-size-constraint) ⇒ void

paragraph-end-line

Returns the ending line of a given paragraph. Paragraphs are numbered starting with 0. Lines are numbered starting with 0.

Calling this method may force the recalculation of location information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see refresh-delayed?). If the editor is not displayed and the editor has a maximum width, line breaks are calculated as for line-start-position (which handles specially the case of no display when the editor has a maximum width).

- (send a-text paragraph-end-line paragraph) ⇒ exact non-negative integer
  paragraph: exact non-negative integer

paragraph-end-position

Returns the ending position of a given paragraph. Paragraphs are numbered starting with 0.

- (send a-text paragraph-end-position paragraph visible?) ⇒ exact non-negative integer
  paragraph: exact non-negative integer
  visible? = #f: boolean

  If there are fewer than paragraph−1 paragraphs, the end of the last paragraph is returned. If paragraph is less than 0, then the end of the first paragraph is returned.

  If the paragraph ends with invisible items (such as a carriage return) and visible? is not #f, the first position before the invisible items is returned.

paragraph-start-line

Returns the starting line of a given paragraph. Paragraphs are numbered starting with 0. Lines are numbered starting with 0.
Calling this method may force the recalculation of location information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see refresh-delayed?). If the editor is not displayed and the editor has a maximum width, line breaks are calculated as for line-start-position (which handles specially the case of no display when the editor has a maximum width).

- (send a-text paragraph-start-line paragraph) ⇒ exact non-negative integer
  paragraph: exact non-negative integer

paragraph-start-position

Returns the starting position of a given paragraph. Paragraphs are numbered starting with 0.

- (send a-text paragraph-start-position paragraph visible?) ⇒ exact non-negative integer
  paragraph: exact non-negative integer
  visible? = #f: boolean

  If there are fewer than paragraph−1 paragraphs, the start of the last paragraph is returned.
  If the paragraph starts with invisible items and visible? is not #f, the first position past the invisible items is returned.

paste

Pastes the current contents of the clipboard into the editor.

The system may execute a paste (in response to other method calls) without calling this method. To extend or re-implement copying, override the do-paste in text% or do-paste in pasteboard% method.

See also get-paste-text-only.

- (send a-text paste time start end) ⇒ void
  time: exact integer
  start: exact non-negative integer or ’end
  end = ’same: exact non-negative integer or ’same

  Pastes into the specified range. If start is ’end, then the current selection end position is used. If end is ’same, then start is used for end.

  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

- (send a-text paste time) ⇒ void
  time = 0: exact integer

  See “Cut and Paste” (section 8.6, page 200) for a discussion of the time argument. If time is outside the platform-specific range of times, an exn:fail:contract exception is raised.

paste-next

Editors collectively maintain a copy ring that holds up to 30 previous copies (and cuts) among the editors. When it is called as the next method on an editor after a paste, the paste-next method replaces the text from a previous paste with the next data in the copy ring, incrementing the ring pointer so that the next paste-next pastes in even older data.
It is a copy "ring" because the ring pointer wraps back to the most recent copied data after the oldest remembered data is pasted. Any cut, copy, or (regular) paste operation resets the copy ring pointer back to the beginning.

If the previous operation on the editor was not a paste, calling `paste-next` has no effect.

- `(send a-text paste-next) ⇒ void`

`paste-x-selection`

Like `paste`, but under X, uses the X selection instead of the X clipboard.

To extend or re-implement copying, override the `do-paste-x-selection in text%` or `do-paste-x-selection in pasteboard%` method.

- `(send a-text paste-x-selection time start end) ⇒ void
  time : exact integer
  start : exact non-negative integer or 'end
  end = 'same : exact non-negative integer or 'same

Pastes into the specified range. If `start` is 'end, then the current selection end position is used. If `end` is 'same, then `start` is used for `end`.

See “Cut and Paste” (section 8.6, page 200) for a discussion of the `time` argument. If `time` is outside the platform-specific range of times, an `exn:fail:contract` exception is raised.

- `(send a-text paste-x-selection time) ⇒ void
  time = 0 : exact integer

See “Cut and Paste” (section 8.6, page 200) for a discussion of the `time` argument. If `time` is outside the platform-specific range of times, an `exn:fail:contract` exception is raised.

`position-line`

Returns the line number of the line containing a given position. Lines are numbered starting with 0.

Calling this method may force the recalculation of location information if a maximum width is set for the editor, even if the editor currently has delayed refreshing (see `refresh-delayed?`). If the editor is not displayed and the editor has a maximum width, line breaks are calculated as for `line-start-position` (which handles specially the case of no display when the editor has a maximum width).

See also `paragraph-start-position`, which operates on paragraphs (determined by explicit newline characters) instead of lines (determined by both explicit newline characters and automatic line-wrapping).

- `(send a-text position-line start at-eol?) ⇒ exact non-negative integer
  start : exact non-negative integer
  at-eol? = #f : boolean


`position-location`

Returns the location of a given position.

The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)). Calling this method may force the recalculation of location information, even if the editor currently has delayed refreshing (see `refresh-delayed?`).
The x box is filled with the x-location of the position start in editor coordinates, unless x is #f. The y box is filled with the y-location (top or bottom; see below) of the position start in editor coordinates, unless y is #f.

See “End of Line” (section 8.3, page 199) for a discussion of at-eol?.

If top? is not #f, the top coordinate of the location is returned, otherwise the bottom coordinate of the location is returned.

The top y location may be different for different positions within a line when different-sized graphic objects are used. If whole-line? is not #f, the minimum top location or maximum bottom location for the whole line is returned in y.

position-paragraph

Returns the paragraph number of the paragraph containing a given position.

read-from-file

Reads new contents for the editor from a stream. The return value is #t if there are no errors, #f otherwise. See also “File Formats” (section 8.2, page 197).

The stream provides either new mappings for names in the editor’s style list, or it indicates that the editor should share a previously-read style list (depending on how style lists were shared when the editor was written to the stream; see also write-to-file).

- In the former case, if the overwrite-styles? argument is #f, then each style name in the loaded file that is already in the current style list keeps its current style. Otherwise, existing named styles are overwritten with specifications from the loaded file.
- In the latter case, the editor’s style list will be changed to the previously-read list.

New data is inserted at the position indicated by start, or at the current position if start is ’start.
remove-clickback

Removes clickbacks. See also “Clickbacks” (section 8.7, page 200).

- (send a-text remove-clickback start end) ⇒ void
  
  *start*: exact non-negative integer
  *end*: exact non-negative integer

  Removes all clickbacks installed for exactly the range *start* to *end*.

scroll-to-position

Scrolls the editor so that a given position is visible.

Scrolling is disallowed when the editor is internally locked for reflowing (see also “Locks” (section 8.8, page 200)).

The system may scroll the editor without calling this method.

- (send a-text scroll-to-position start at-eol? end bias) ⇒ boolean
  
  *start*: exact non-negative integer
  *at-eol?*: #f: boolean
  *end*: ‘same: exact non-negative integer or ‘same
  *bias*: ‘none: symbol in ‘(start end none)

  If *end* is ‘same or equal to *start*, then position *start* is made visible. See “End of Line” (section 8.3, page 199) for a discussion of *at-eol*?

  If *end* is not ‘same and not the same as *start*, then the range *start* to *end* is made visible and *at-eol*? is ignored.

  When the specified range cannot fit in the visible area, *bias* indicates which end of the range to display. When *bias* is ‘same, then the start of the range is displayed. When *bias* is ‘end, then the end of the range is displayed. Otherwise, *bias* must be ‘none.

  If the editor is scrolled, then the editor is redrawn and the return value is #t; otherwise, the return value is #f.

set-anchor

Turns anchoring on or off. This method can be overridden to affect or detect changes in the anchor state. See also get-anchor.

- (send a-text set-anchor on?) ⇒ void
  
  *on*?: boolean

  If *on*? is not #f, then the selection will be automatically extended when cursor keys are used (or, more generally, when move-position is used to move the selection), otherwise anchoring is turned off. Anchoring is automatically turned off if the user does anything besides cursor movements.

set-autowrap-bitmap

Sets the bitmap that is drawn at the end of a line when it is automatically line-wrapped.

The bitmap will not be modified. It may be selected into a bitmap-dc% object, but it will be selected out if this method is called again.

Setting the bitmap is disallowed when the editor is internally locked for reflowing (see also “Locks” (section 8.8, page 200)).
- (send a-text set-autowrap-bitmap bitmap) ⇒ bitmap% object or #f
  bitmap: bitmap% object or #f

  If bitmap is #f, no autowrap indicator is drawn (this is the default). The previously used bitmap (possibly #f) is returned.

set-between-threshold

Sets the graphical distance used to determine the meaning of a user click.

- (send a-text set-between-threshold threshold) ⇒ void
  threshold: non-negative real number

  If the click falls within threshold of a position between two items, then the click registers on the space between the items rather than on either item.
  See also get-between-threshold.

set-clickback

Installs a clickback for a given region. If a clickback is already installed for an overlapping region, this clickback takes precedence.

See also “Clickbacks” (section 8.7, page 200).

- (send a-text set-clickback start end f hilite-delta call-on-down?) ⇒ void
  start: exact non-negative integer
  end: exact non-negative integer
  f: procedure of three arguments: a text% object, a starting position exact non-negative integer, and an ending position exact non-negative integer
  hilite-delta = #f: style-delta% object or #f
  call-on-down? = #f: boolean

  The callback procedure f is called when the user selects the clickback. The arguments to f are this editor and the starting and ending range of the clickback.
  The hilite-delta style delta is applied to the clickback text when the user has clicked and is still holding the mouse over the clickback. If hilite-delta is #f, then the clickback region’s style is not changed when it is being selected.
  If call-on-down? is not #f, the clickback is called immediately when the user clicks the mouse button down, instead of after a mouse-up event. The hilite-delta argument is not used in this case.

set-file-format

Set the format of the file saved from this editor.

The file format of an editor can be changed by the system in response to file loading and saving method calls, and such changes do not go through this method; use on-load-file and on-save-file to monitor such file format changes.

- (send a-text set-file-format format) ⇒ void
  format: symbol in ‘(standard text text-force-cr)

  The legal formats are:
  - ’standard — a standard editor file
- `‘text` — a text file
- `‘text-force-cr` — a text file; when writing, change automatic newlines (from word-wrapping) into real carriage returns

**set-line-spacing**

Sets the spacing inserted by the editor between each line. This spacing is included in the reported height of each line.

- `(send a-text set-line-spacing space) ⇒ void`  
  `space`: non-negative real number

**set-overwrite-mode**

Enables or disables overwrite mode. See `get-overwrite-mode`. This method can be overridden to affect or detect changes in the overwrite mode.

- `(send a-text set-overwrite-mode on?) ⇒ void`  
  `on?`: boolean

**set-paragraph-alignment**

Sets a paragraph-specific horizontal alignment. The alignment is only used when the editor has a maximum width, as set with `set-max-width`. Paragraphs are numbered starting with 0.

*This method is experimental, and works reliably only when the paragraph is not merged or split. Merging or splitting a paragraph with alignment settings causes the settings to be transferred unpredictably (although other paragraphs in the editor can be safely split or merged). If the last paragraph in an editor is empty, settings assigned to it are ignored.*

- `(send a-text set-paragraph-alignment paragraph alignment) ⇒ void`  
  `paragraph`: exact non-negative integer  
  `alignment`: symbol in ‘left center right"

**set-paragraph-margins**

Sets a paragraph-specific margin. Paragraphs are numbered starting with 0.

*This method is experimental, and works reliably only when the paragraph is not merged or split. Merging or splitting a paragraph with margin settings causes the settings to be transferred unpredictably (although other paragraphs in the editor can be safely split or merged). If the last paragraph in an editor is empty, settings assigned to it are ignored.*

- `(send a-text set-paragraph-margins paragraph first-left left right) ⇒ void`  
  `paragraph`: exact non-negative integer  
  `first-left`: non-negative real number  
  `left`: non-negative real number  
  `right`: non-negative real number

The first line of the paragraph is indented by `first-left` points within the editor. If the paragraph is line-wrapped (when the editor has a maximum width), subsequent lines are indented by `left` points. If the editor has a maximum width, the paragraph’s maximum width for line-wrapping is `right` points smaller than the editor’s maximum width.
set-position

Sets the current selection in the editor.

Setting the position is disallowed when the editor is internally locked for reflowing (see also “Locks” (section 8.8, page 200)).

The system may change the selection in an editor without calling this method (or any visible method).

```
- (send a-text set-position start end at-eol? scroll? seltype) ⇒ void
  start: exact non-negative integer
  end = ’same: exact non-negative integer or ’same
  at-eol? = #f: boolean
  scroll? = #t: boolean
  seltype = ’default: symbol in ’(default x local)
```

If end is ’same or less than or equal to start, the current start and end positions are both set to start. Otherwise the given range is selected.

See “End of Line” (section 8.3, page 199) for a discussion of at-eol?. If scroll? is not #f, then the display is scrolled to show the selection if necessary.

The seltype argument is only used when the X Window System selection mechanism is enabled. The possible values are:

- ’default — if this window has the keyboard focus and given selection is non-empty, make it the current X selection
- ’x — if the given selection is non-empty, make it the current X selection
- ’local — do not change the current X selection

See also editor-set-x-selection-mode.

set-position-bias-scroll

Like set-position, but a scrolling bias can be specified.

```
- (send a-text set-position-bias-scroll bias start end ateol? scroll? seltype) ⇒ void
  bias: symbol in ’(start-only start none end end-only)
  start: exact non-negative integer
  end = ’same: exact non-negative integer or ’same
  ateol? = #f: boolean
  scroll? = #t: boolean
  seltype = ’default: symbol in ’(default x local)
```

The possible values for bias are:

- ’start-only — only insure that the starting position is visible
- ’start — if the range doesn’t fit in the visible area, show the starting position
- ’none — no special scrolling instructions
- ’end — if the range doesn’t fit in the visible area, show the ending position
- ’end-only — only insure that the ending position is visible

See also scroll-to-position.

set-region-data

Sets extra data associated with a given region. See “Editor Data” (section 8.2.1, page 198) and get-region-data for more information.
This method is meant to be overridden in combination with `get-region-data`.

- `(send a-text set-region-data start end data) ⇒ void
  
  `start`: exact non-negative integer
  
  `end`: exact non-negative integer
  
  `data`: editor-data% object

**set-styles-sticky**

See `get-styles-sticky` for information about sticky styles.

- `(send a-text set-styles-sticky sticky?) ⇒ void
  
  `sticky?`: boolean

**set-tabs**

Sets the tabbing array for the editor.

Setting tabs is disallowed when the editor is internally locked for reflowing (see also “Locks” (section 8.8, page 200)).

- `(send a-text set-tabs tabs tab-width in-units?) ⇒ void
  
  `tabs`: list of real numbers
  
  `tab-width = 20`: real number
  
  `in-units? = #t`: boolean

  The `tabs` list determines the tabbing array. The tabbing array specifies the x-locations where each tab occurs. Tabs beyond the last specified tab are separated by a fixed amount `tab-width`. If `in-units?` is not `#f`, then tabs are specified in canvas units; otherwise, they are specified as a number of spaces. (If tabs are specified in spaces, then the graphic tab positions will change with the font used for the tab.)

**set-wordbreak-func**

Sets the word-breaking function for the editor. For information about the arguments to the word-breaking function, see `find-wordbreak`.

The standard wordbreaking function uses the editor’s `editor-wordbreak-map%` object to determine which characters break a word. See also `editor-wordbreak-map%` and `set-wordbreak-map`.

Since the wordbreak function will be called when line breaks are being determined (in an editor that has a maximum width), there is a constrained set of `text%` methods that the wordbreak function is allowed to invoke. It cannot invoke a member function that uses information about locations or lines (which are identified in this manual with “The result is only valid when the editor is displayed (see “Basic Organization” (section 8.1, page 194)).”), but it can still invoke member functions that work with snips and items.

- `(send a-text set-wordbreak-func f) ⇒ void
  
  `f`: procedure of four arguments: a `text%` object, a boxed exact non-negative integer or `#f`, another boxed exact non-negative integer or `#f`, and a symbol

**set-wordbreak-map**

Sets the wordbreaking map that is used by the standard wordbreaking function. See `editor-wordbreak-map%` for more information.
- (send a-text set-wordbreak-map map) ⇒ void
  map: editor-wordbreak-map% object or #f

  If map is #f, then then standard map (the-editor-wordbreak-map) is used.

split-snip

Given a position, splits the snip that includes the position (if any) so that the position is between two snips. The snip may refuse to split, although none of the built-in snip classes will ever refuse.

Splitting a snip is disallowed when the editor is internally locked for reflowing (see also “Locks” (section 8.8, page 200)).

- (send a-text split-snip pos) ⇒ void
  pos: exact non-negative integer

write-to-file

Writes the current editor contents to the given stream. The return value is #t if there are no errors, #f otherwise. See also “File Formats” (section 8.2, page 197).

If the editor’s style list has already been written to the stream, it is not re-written. Instead, the editor content indicates that the editor shares a previously-written style list. This sharing will be recreated when the stream is later read.

- (send a-text write-to-file stream start end) ⇒ boolean
  stream: editor-stream-out% object
  start: exact non-negative integer
  end = ‘eof: exact non-negative integer or ‘eof

  If start is 0 and end is ‘eof negative, then the entire contents are written to the stream. If end is ‘eof, then the contents are written from start until the end of the editor. Otherwise, the contents of the given range are written.

- (send a-text write-to-file stream) ⇒ boolean
  stream: editor-stream-out% object
10. Editor Procedures

10.1 Editors

add-editor-keymap-functions

Given a keymap% object, the keymap is loaded with mappable functions that apply to all editor% objects:

- “copy-clipboard”
- “copy-append-clipboard”
- “cut-clipboard”
- “cut-append-clipboard”
- “paste-clipboard”
- “paste-x-selection”
- “delete-selection”
- “clear-selection”
- “undo”
- “redo”
- “select-all”

- (add-editor-keymap-functions keymap) ⇒ void
  keymap: keymap% object

add-pasteboard-keymap-functions

Given a keymap% object, the table is loaded with mappable functions that apply to pasteboard% objects. Currently, there are no such functions.

See also add-editor-keymap-functions.

- (add-pasteboard-keymap-functions keymap) ⇒ void
  keymap: keymap% object

add-text-keymap-functions

Given a keymap% object, the table is loaded with functions that apply to all text% objects:

- “forward-character”
- “backward-character”
- “previous-line”
- “next-line”
- “previous-page”
- “next-page”
• “forward-word”
• “backward-word”
• “forward-select”
• “backward-select”
• “select-down”
• “select-up”
• “select-page-up”
• “select-page-down”
• “forward-select-word”
• “backward-select-word”
• “beginning-of-file”
• “end-of-file”
• “beginning-of-line”
• “end-of-line”
• “select-to-beginning-of-file”
• “select-to-end-of-file”
• “select-to-beginning-of-line”
• “select-to-end-of-line”
• “copy-clipboard”
• “copy-append-clipboard”
• “cut-clipboard”
• “cut-append-clipboard”
• “paste-clipboard”
• “paste-x-selection”
• “delete-selection”
• “delete-previous-character”
• “delete-next-character”
• “clear-selection”
• “delete-to-end-of-line”
• “delete-next-word”
• “delete-previous-word”
• “delete-line”
• “undo”
• “redo”

See also add-editor-keymap-functions.

- (add-text-keymap-functions keymap) ⇒ void
  keymap: keymap% object

append-editor-font-menu-items

Appends menu items to a given menu (not a popup menu) to implement a standard set of font-manipulation operations, such as changing the font face or style. The callback for each menu item uses get-edit-target-object in top-level-window% (finding the frame by following a chain of parents until a frame is reached); if the result is an editor% object, change-style in editor% is called on the editor.

- (append-editor-font-menu-items menu) ⇒ void
  menu: menu% or popup-menu% object
append-editor-operation-menu-items

Appends menu items to a given menu (not a popup menu) to implement the standard editor operations, such as cut and paste. The callback for each menu item uses \texttt{get-edit-target-object in top-level-window} (finding the frame by following a chain of parents until a frame is reached); if the result is an \texttt{editor} object, \texttt{do-edit-operation in editor} is called on the editor.

\begin{itemize}
\item \texttt{(append-editor-operation-menu-items menu text-only?) \Rightarrow void}
\begin{itemize}
\item \texttt{menu: menu\% or popup-menu\% object}
\item \texttt{text-only?= \#t: boolean}
\end{itemize}
\end{itemize}

If \texttt{text-only?} is \#f, then menu items that insert non-text snips (such as \texttt{Insert Image...}) are appended to the menu.

current-text-keymap-initializer

Parameter that specifies a keymap-initialization procedure. This procedure is called to initialize the keymap of a \texttt{text-field} object or a \texttt{text} object created by \texttt{graphical-read-eval-print-loop}.

The initializer takes a keymap object and returns nothing. The default initializer chains the given keymap to an internal keymap that implements standard text editor keyboard and mouse bindings for cut, copy, paste, undo, and select-all. The right mouse button is mapped to popup an edit menu when the button is released. Under X, start-of-line (Ctl-A) and end-of-line (Ctl-E) are also mapped.

\begin{itemize}
\item \texttt{(current-text-keymap-initializer) \Rightarrow procedure of one argument: keymap\% object}
\end{itemize}

Returns the current initializer procedure.

\begin{itemize}
\item \texttt{(current-text-keymap-initializer proc) \Rightarrow void}
\begin{itemize}
\item \texttt{proc: procedure of one argument: keymap\% object}
\end{itemize}
\end{itemize}

Sets the initializer procedure.

editor-set-x-selection-mode

\begin{itemize}
\item \texttt{(editor-set-x-selection-mode on) \Rightarrow void}
\begin{itemize}
\item \texttt{on: boolean}
\end{itemize}
\end{itemize}

Under X Windows, editor selections conform to the X Windows selection conventions instead of a clipboard-based convention. If \texttt{on} is \#f, the behavior is switched to the clipboard-based convention (where copy must be explicitly requested before a paste).

get-the-editor-data-class-list

\begin{itemize}
\item \texttt{(get-the-editor-data-class-list) \Rightarrow editor-data-class-list\% object}
\end{itemize}

Gets the editor data class list instance for the current eventspace.

get-the-snip-class-list

\begin{itemize}
\item \texttt{(get-the-snip-class-list) \Rightarrow snip-class-list\% object}
\end{itemize}

Gets the snip class list instance for the current eventspace.
open-input-graphical-file

- (open-input-graphical-file filename) ⇒ input-port
  filename : string

Opens filename (in ’binary mode) and checks whether it looks like a “graphical” file in editor format. If the file does not appear to be an editor file, the file port is returned with line counting enabled. Otherwise, the file is loaded into an editor, and the result port is created with open-input-text-editor.

open-input-text-editor

- (open-input-text-editor text-editor start-position end-position snip-filter port-name expect-to-read-all?) ⇒ input-port
  text-editor : text% object
  start-position = 0 : exact non-negative integer
  end-position = ’end : exact non-negative integer or ’end
  snip-filter = (lambda (s) s) : a procedure of one argument: a snip% object
  port-name = text-editor : value
  expect-to-read-all? = #f : boolean

Creates an input port that draws its content from text-editor. The editor content between positions start-position and end-position is the content of the port. If end-position is ’end, the content runs until the end of the editor. If a snip that is not a string-snip% object spans start-position or end-position, the entire snip contributes to the port. If a string-snip% instance spans start-position, only the part of the snip after start-position contributes, and if a string-snip% object spans end-position, only the part before end-position contributes.

An instance of string-snip% in text-editor generates a character sequence in the resulting port. All other kinds of snips are passed to snip-filter to obtain a “special” value for the port. If a snip is returned as the first result from snip-filter, and if the snip is an instance of readable-snip<%>, the snip generates a special value for the port through the read-special method. If snip-filter returns any other kind of snip, it is copied for the special result. Finally, a non-snip first result from snip-filter is used directly as the special result.

The port-name argument is used for the input port’s name. The expect-to-read-all? argument is a performance hint; use #t if the entire port’s stream will be read.

The result port must not be used if text-editor changes in any of the following ways: a snip is inserted (see after-insert), a snip is deleted (see after-delete), a snip is split (see after-split-snip), snips are merged (see after-merge-snips), or a snip changes its count (which is rare; see recounted). The get-revision-number method can be used to detect any of these changes.

open-output-text-editor

- (open-output-text-editor text-editor start-position special-filter port-name) ⇒ output-port
  text-editor : text% object
  start-position = ’end : exact non-negative integer or ’end
  special-filter = values : a procedure of one argument: a value
  port-name = text-editor : value

Creates an output port that delivers its content to text-editor. The content is written to text-editor starting at the position start-position, where ’end indicates that output should start at the text editor’s current end position.

If special-filter is provided, it is applied to any value written to the port with write-special, and the result is inserted in its place. If a special value is a snip% object, it is inserted into the editor. Otherwise, the special value is displayed into the editor.
If line counting is enabled for the resulting output port, then the port will report the line, offset from the line’s start, and position within the editor at which the port writes data.

read-editor-global-footer

- (read-editor-global-footer in) ⇒ boolean
  in: editor-stream-in% object
See read-editor-global-header. Call read-editor-global-footer even if read-editor-global-header returns #f.

read-editor-global-header

- (read-editor-global-header in) ⇒ boolean
  in: editor-stream-in% object
Reads data from in to initialize for reading editors from the stream. The return value is #t if the read succeeds, or #f otherwise.

One or more editors can be read from the stream by calling the editor’s read-from-file method. (The number of editors to be read must be known by the application beforehand.) When all editors are read, call read-editor-global-footer. Calls to read-editor-global-header and read-editor-global-footer must bracket any call to read-from-file, and only one stream at a time can be read using these methods or written using write-editor-global-header and write-editor-global-footer.

When reading from streams that span MrEd versions, use read-editor-version before this procedure.

read-editor-version

- (read-editor-version in in-base parse-format? raise-errors?) ⇒ boolean
  in: editor-stream-in% object
  in-base: editor-stream-in-base% object
  parse-format?: boolean
  raise-errors?: #t: boolean
Reads version information from in-base, where in-base is the base for in. The version information parsed from in-base is recorded in in for later version-sensitive parsing. The procedure result is true if the version information was read successfully and if the version is supported.

If parse-format? is true, then in-base is checked for an initial "WXME" format indicator. Use #f when "WXME" has been consumed already by format-dispatching code.

If raise-errors? is true, then an error in reading triggers an exception, instead of a #f result.

text-editor-load-handler

- (text-editor-load-handler filename expected-module-name) ⇒ value
  filename: path string
  expected-module-name: symbol or #f
This procedure is a load handler for use with MzScheme’s current-load; see Loading, §7.9.1.6 in PLT MzScheme: Language Manual for information about the arguments.

The handler recognizes MrEd editor-format files (see §8.2 File Format) and decodes them for loading. It is normally installed as MrEd starts (see §11 Running MrEd).

The handler recognizes editor files by the first twelve characters of the file: “WXME01nn ##”, where n is a digit between 0 and 9. Such a file is opened for loading by creating a text% object, loading the file into the object
with `insert-file`, and then converting the editor content into a port with `open-input-text-editor`. After obtaining a port in this way, the content is read in essentially the same way as by the default MzScheme load handler. (In particular, an initial `#!` line is recognized and skipped.) The difference is that the editor may contain instances of `readable-snip<%>`, which are “read” though the snips’ `read-special` method; see `open-input-text-editor` for details.

The `editor-wordbreak-map` function writes version information to `out-base` in preparation for writing editor information to the stream `out`.  

- `the-editor-wordbreak-map ⇒ editor-wordbreak-map% object`
  Initial value: basic wordbreak mapping

The `style-list` function is used to store editor style information.  

- `the-style-list ⇒ style-list% object`
  Initial value: empty style list

The `write-editor-global-footer` function writes data to `out`, initializing it for writing editors to the stream. The return value is `#t` if the write succeeds, or `#f` otherwise.

- `(write-editor-global-footer out) ⇒ boolean`
  `out`: `editor-stream-out% object`

  See `write-editor-global-header`. Call `write-editor-global-footer` even if `write-editor-global-header` returns `#f`.

The `write-editor-global-header` function writes data to `out`, initializing it for writing editors to the stream. The return value is `#t` if the write succeeds, or `#f` otherwise.

- `(write-editor-global-header out) ⇒ boolean`
  `out`: `editor-stream-out% object`

  Writes data to `out`, initializing it for writing editors to the stream. The return value is `#t` if the write succeeds, or `#f` otherwise.

One or more editors can be written to the stream by calling the editor’s `write-to-file` method. When all editors are written, call `write-editor-global-footer`. Calls to `write-editor-global-header` and `write-editor-global-footer` must bracket any call to `write-to-file`, and only one stream at a time can be written using these methods or read using `read-editor-global-header` and `read-editor-global-footer`.

To support streams that span MrEd versions, use `write-editor-version` before this procedure.

See also section 8.2.

The `write-editor-version` function writes version information to `out-base` in preparation for writing editor information to the stream `out`.  

- `(write-editor-version out out-base) ⇒ boolean`
  `out`: `editor-stream-out% object`
  `out-base`: `editor-stream-out-base% object`

  Writes version information to `out-base` in preparation for writing editor information to the stream `out`. 

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The `out` argument is currently not used, but `out-base` should be the base for `out`. In the future, `out` may record information about the version for later version-sensitive output.

The result is `#t` if the write succeeded, `#f` otherwise.
Part IV

Appendices
11. Running MrEd

MrEd accepts a number of command-line flags.

Under Mac OS X, a leading flag of the form \(-psn\) is treated specially. It indicates that Finder started the application, so the current input, output, and error output are redirected to a GUI window.

MrEd accepts the following flags (in addition to the X-specific flags described in §11.5 X Window System Flags):

- **Startup file and expression flags:**
  - \(-e \text{ expr} \) or \(--\text{eval expr}\): Evaluates expr after MrEd starts.
  - \(-f \text{ file} \) or \(--\text{load file}\): Loads file after MrEd starts.
  - \(-d \text{ file} \) or \(--\text{load-cd file}\): Uses load/cd to load file after MrEd starts.
  - \(-t \text{ file} \) or \(--\text{require file}\): Requires file after MrEd starts.
  - \(-F \) or \(--\text{Load}\): Loads each remaining argument as a file after MrEd starts.
  - \(-D \) or \(--\text{Load-cd}\): Loads each remaining argument as a file using load/cd after MrEd starts.
  - \(-T \) or \(--\text{Require}\): Requires each remaining argument as a file after MrEd starts.
  - \(-l \text{ file} \) or \(--\text{mzlib file}\): Requires the MzLib library file after MrEd starts.
  - \(-L \text{ file collect} \): Requires the library file in the collection collect after MrEd starts.
  - \(-M \text{ collect}\): Requires the library collect.ss in the collection collect after MrEd starts.
  - \(-r \text{ file} \) or \(--\text{script file}\): Use this flag for MrEd-based scripts. It mutes the startup banner printout, suppresses the graphical read-eval-print loop, and loads file after MrEd starts. No argument after file is treated as a flag. The \(-r \) or \(--\text{script}\) flag is a shorthand for \(-\text{fmv-}\).
  - \(-i \text{ file} \) or \(--\text{script-cd file}\): Same as \(-r \text{ file} \) or \(--\text{script file}\), except that the current directory is changed to file’s directory before it is loaded. The \(-i \) or \(--\text{script-cd}\) flag is a shorthand for \(-\text{dmv-}\).
  - \(-u \text{ file} \) or \(--\text{require-script file}\): Same as \(-r \text{ file} \) or \(--\text{script file}\), except that file is required instead of loaded. The \(-u \) or \(--\text{require-script}\) flag is a shorthand for \(-\text{tmv-}\).
  - \(-z \) or \(--\text{stdio}\): Calls read-eval-print loop (using the current input and output) instead of graphical-read-eval-print-loop, and also prints version information to stdout.
  - \(-Z \) or \(--\text{noGui}\): Skips the built-in require of (lib "class.ss") and (lib "mred.ss" "mred") on startup. Also skips setting current-load to text-editor-load-handler.
  - \(-K \) or \(--\text{back}\): Under Mac OS X, skips bringing the application into the foreground on startup (in case it was started through a command line).
  - \(-w \) or \(--\text{awk}\): Loads the awk.ss library after MrEd starts.
  - \(-k \text{ n m}\): Loads code embedded in the executable from file position \(n\) to \(m\) after MrEd starts. This flag is useful for creating a stand-alone binary by appending code to the normal MrEd executable. See PLT mzc: MzScheme Compiler Manual for more details.
  - \(-C \) or \(--\text{main}\): Like \(-r\), then calls the function bound to \text{main} in the top-level environment. The argument to \text{main} is a list of immutable strings; the first string is the path of the file that was loaded, and the rest of the list contains leftover command-line arguments (the ones installed in current-command-line-arguments). The \text{main} function is called only if no previous evaluations or loads resulted in an uncaught exception.

- **Initialization flags:**
11. Flag Conventions

- **-X dir or --collects dir**: Sets `dir` as the path to the main collection of libraries (and makes `(find-system-path 'collects-dir)` produce `dir`).
- **-S dir or --search dir**: Adds `dir` to the library collection search path (after a user-specific directory, if any, and before the main collection directory).
- **-U or --no-user-path**: Omits paths in the search for collections, C libraries, etc. More specifically, this flag initializes the `use-user-specific-search-paths` parameter to `#f`.
- **-x or --no-lib-path**: Suppresses the initialization of `current-library-collection-paths` (as described in Library Collections and MzLib, §16 in PLT MzScheme: Language Manual).
- **-N file or --name file**: sets the name of the executable as reported by `(find-system-path 'run-file)` to `file`. Also, `program` is initially defined as `file`.
- **-q or --no-init-file**: Suppresses loading the user’s initialization file, as described below.
- **-A or --no-argv**: Suppresses the definition of `argv` and `program`, as described below.
- **-j or --no-jit**: Disables the native-code just-in-time compiler, setting the `eval-jit-enabled` parameter to `#f`.

- **Language setting flags:**
  - **-g or --case-sens**: Makes the reader initially case-sensitive (the default).
  - **-G or --case-insens**: Makes the reader initially case-insensitive.
  - **-s or --set-undef**: Creates an initial namespace where `set!` will successfully mutate an undefined global variable (implicitly defining it).

- **Miscellaneous flags:**
  - **--**: No argument following this flag is used as a flag.
  - **-m or --mute-banner**: Suppresses the startup banner text produced by `-v`.
  - **-v or --version**: Suppresses the graphical read-eval-print loop and prints version information to stdout.
  - **-V or --no-yield**: Suppresses the graphical read-eval-print loop, prints version information to stdout, and suppresses the normal yield that follows command-line expression evaluation and file loading.
  - **-h or --help**: Shows information about MrEd’s command-line flags and then exits, ignoring other flags.
  - **-p or --persistent**: Catches the SIGDANGER (low page space) signal and ignores it (AIX only).
  - **-R file or --restore file**: Restores a saved image (see Images, §14.5 in PLT MzScheme: Language Manual). Extra arguments after `file` are returned as a vector of strings to the continuation of the `write-image-to-file` call that created the image.

### 11.1 Flag Conventions

Extra arguments following the last flag are available from the `current-command-line-arguments` parameter (see Images, §7.9.1.6 in PLT MzScheme: Language Manual) as an immutable vector of immutable strings. The name used to start MrEd is available from the `find-system-path` procedure (see Locating Paths, §11.3.2 in PLT MzScheme: Language Manual) using `exec-file`. In addition, unless `-A` is specified, the argument vector is put into the global variable `argv`, and the name used to start MrEd is put into the global variable `program` as a path.

Multiple single-letter flags (the ones preceded by a single dash) can be collapsed into a single flag by concatenating the letters, as long as the the first flag is not `--`. The arguments for each flag are placed after the collapsed flags (in the order of the flags). For example,

```
-vfme file expr
```

and

```
-v -f file -m -e expr
```

are equivalent. If a collapsed `--` appears before other collapsed flags, it is implicitly moved to the end of the collapsed
11. Running MrEd

11.2 Executable Name

If the MrEd executable is given a name of the form `scheme-dialect`, then the command line is effectively prefixed with

```
-qAeC `(require (lib "init.ss" "script-lang" "dialect"))`
```

The first actual command-line argument thus serves as a file to load. The file is loaded into a namespace that is initialized by the `dialect`-specific `init.ss` library. The loaded file should define `main`, which is called with command-line arguments—starting with the loaded file name—as a list of immutable strings.

11.3 Initialization

The `current-library-collection-paths` parameter is initialized (as described in Library Collections and MzLib, §16 in PLT MzScheme: Language Manual) before any expression or file is evaluated or loaded, unless the `-x` or `--no-lib-path` flag is specified.

Unless the `-q` or `--no-init-file` flag is specified, a user initialization file is loaded after `current-library-collection-paths` parameter is initialized and before any other expression or file is evaluated or loaded. The path to the user initialization file is obtained from MzScheme’s `find-system-path` procedure using `init-file`.

Expressions and files are evaluated and loaded in order that they are provided on the command line, including calls to main implied by `--main`, embeddings loaded by `-k`, and so on. If an uncaught exception occurs, the remaining expressions and files are skipped. The thread that loads the files and evaluates the expressions is the main thread. When the main thread terminates (or is killed), the MrEd process exits. The main thread is also the handler thread of the initial eventspace.

After the command-line files and expressions are loaded and evaluated, the main thread calls `graphical-read-eval-print-loop` unless the `-v`, `--version`, `-r`, `--script`, `-i`, or `--script-cd` flag is specified. The `-z` or `--stdio` flag also suppresses the call to `graphical-read-eval-print-loop`, but it calls `read-eval-print-loop`, instead. (The other flags, such as `-v`, have no effect on this call to `read-eval-print-loop`.)

Finally, after the command-line files and expressions are loaded and evaluated, and after `graphical-read-eval-print-loop` or `read-eval-print-loop` is called, the main thread evaluates `(yield 'wait)`. The `-V` or `--no-yield` flag suppresses this call to `yield`.

The exit status for the MrEd process indicates an error if an error occurs evaluating or loading a command-line expression or file and `graphical-read-eval-print-loop` is not called afterwards, or if the default exit handler is called with an exact integer between 1 and 255.

Evaluating command-line expressions with `-f` or `-v` is different from evaluating the same expressions within the window provided by `graphical-read-eval-print-loop`. The `graphical-read-eval-print-loop` window creates a new eventspace (and thus a new thread) for evaluating expressions entered into the window. One consequence of this convention is that terminating the evaluation thread (e.g., with `(kill-thread (current-thread))`) does not cause MrEd to exit, because the evaluation thread is not MrEd’s main thread.\(^1\)

In contrast, MzScheme’s `read-eval-print-loop` always evaluates expressions within the thread that calls `read-eval-print-loop`. Using the `-z` or `--stdio` flag calls `read-eval-print-loop` in the main thread.

\(^1\)However, the exit handler is not changed, so evaluating `(exit)` does exit MrEd unless the exit handler is changed before calling `graphical-read-eval-print-loop`.

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so (kill-thread (current-thread)) in that case does exit MrEd. Furthermore, the main thread is the handler thread for the initial eventspace; thus, windows created in read-eval-print-loop without changing the eventspace never receive events unless (yield) is called explicitly.

### 11.4 Initial Eventspace

MrEd creates an initial eventspace, and the handler thread for the eventspace is MrEd’s main thread; if the thread is killed, then the MrEd process exits.

### 11.5 X Window System Flags

Under Unix/X, the following standard X Window System flags are recognized (but not necessarily implemented): `-display 1 argument`, `-geometry 1 argument`, `-bg 1 argument`, `-background 1 argument`, `-fg 1 argument`, `-foreground 1 argument`, `-fn 1 argument`, `-font 1 argument`, `-iconic 0 arguments`, `-name 1 argument`, `-rv 0 argument`, `-reverse 0 arguments`, `+rv 0 arguments`, `-selectionTimeout 1 argument`, `-synchronous 0 arguments`, `-title 1 argument`, `-xnllanguage 1 argument`, and `-xrm 1 argument`.

All X flags must precede all other flags and arguments.
12. Preferences

MrEd supports a number of preferences for global configuration. The MrEd preferences are stored in the common file reported by `find-system-path` for `pref-file` (see Pathnames, §11.3.2 in PLT MzScheme: Language Manual), and preference values can be retrieved and changed through `get-preference` and `set-preference` as defined by MzLib’s file library (see file.ss, §17 in PLT MzLib: Libraries Manual). However, MrEd reads most preferences once at startup (all except the `'|MrEd:playcmd|` preference).

The following are the preference names used by MrEd. (The preference names are case-sensitive, hence the quoting vertical bars around each symbol.)

- `'|MrEd:default-font-size|` preference — sets the default font size the basic style in a style list, and thus the default font size for an editor.
- `'|MrEd:controlFontSize|` preference — sets the font size for control and menu labels (Windows, X); the font is the ‘system font, which can be configured as described in “Font Preferences” (section 13, page 367).
- `'|MrEd:defaultMenuPrefix|` preference — sets the prefix used by default for menu item shortcuts under X, one of ‘ctl’, ‘meta’, ‘alt’, or ‘ctl-m’. The default is ‘ctl. When this preference is set to ‘meta or ‘alt, underlined mnemonics (introduced by “&” in menu labels) are suppressed.
- `'|MrEd:altUpSelectsMenu|` preference — a true value makes pressing and releasing the Alt key select the first menu in the menu bar under X.
- `'|MrEd:emacsUndo|` preference — a true value makes undo in editors work as in Emacs (i.e., undo operations are themselves kept in the undo stack).
- `'|MrEd:hiliteColor|` preference — a string to sets the color for highlighting text, menus, and other GUI elements under X; the preference string should contain six hexadecimal digits, two for each component of the color. For example, set `'|MrEd:hiliteColor|` preference to "0000A0" and set `'|MrEd:hiliteMenuBorder|` preference to #t for a Bluecurve-like look.
- `'|MrEd:hiliteMenuBorder|` preference — a true value causes a menu selection to be highlighted with a border (in addition to a color) under X.
- `'|MrEd:wheelStep|` preference — sets the default mouse-wheel step size of editor-canvas% objects.
- `'|MrEd:outlineInactiveSelection|` preference — a true value causes selections in text editors to be shown with an outline of the selected region when the editor does no have the keyboard focus.
- `'|MrEd:playcmd|` preference — used to format a sound-playing command; see `play-sound` for details.
- `'|MrEd:forceFocus|` preference — a true value enables extra effort in MrEd to move the focus to a top-level window that is shown or raised.
- `'|MrEd:doubleClickTime|` preference — overrides the platform-specific default interval (in milliseconds) for double-click events.
- `'|MrEd:gamma|` preference — sets the gamma value used in gamma-correcting PNG files.
- *\texttt{[MrEd:selectionAsClipboard]}* preference — under X, a true value causes the-clipboard to be an alias to \texttt{the-x-selection-clipboard}, which means that cut and paste operations use the X selection instead of the X clipboard. See also \texttt{clipboard}. 

In addition, preference names built from font face names can provide or override default entries for the \texttt{font-name-directory}; see “Font Preferences” (section 13, page 367) for information.
# 13. Font Preferences

This chapter describes how to set up face mappings for screen and PostScript fonts via preferences (see “Preferences” (section 12, page 365)). The font-configuration system is overkill; it was designed to handle especially complex X font mappings (before fontconfig/Xft solved the problem).

An implementor for a MrEd-based program may find it easier to use the `set-screen-name` and `set-post-script-name` methods provided by `the-font-name-directory`. As a user of a MrEd-based program, preferences provide a mechanism for setting default mappings.

Whether a programmer or a user, see `font-name-directory` for an overview of the font mapping system.

To find a font name for a family, MrEd looks for a preference name by concatenating "MrEd:", a `dest` string, a `type` string, a `weight` string, and a `style` string where

- `dest` is either "Screen" or "PostScript".
- `type` is either "Default", "Decorative", "Roman", "Script", "Swiss", "Modern", "System", or "Symbol" for a mapping defining the default font for a family. Otherwise, it is a face name prefixed with "@".
- `weight` is either "Medium", "Bold", or "Light".
- `style` is either "Straight", "Italic", or "Slant".

Furthermore, any of the latter three parts can be wildcarded with ", as described below. The concatenated string is converted to a symbol (preserving case), and the associated preference value must be a string.

The value of the preference is parsed as described in `font-name-directory` for parsing face names, except that the string can contain references and other tricks described below.

## 13.1 Wildcards

Building items names by concatenating `dest`, `type`, `weight`, and `style` can create a large number of preference entries, and the `weight` and `style` parts are useful only for X screen fonts. To avoid an explosion of preferences, MrEd finds preferences via a wildcarding search.

The `type`, `weight`, and `style` parts of a preference name can be wildcarded by using ", Thus, to set the default font in X for all types, weights, and styles, use the following preference entry:

```
(MrEd:Screen| "++---medium-r-normal-++-%d-++++++"
```

Wildcarded preference entries are used only when un-wildcarded values cannot be found. If two preference names both match for some search, then the one with the “earliest” (i.e., closest to the beginning of the preference name) non-wildcarded part will prevail.
The default MrEd preferences for Windows uses wildcarding to specify the basic font mapping, as if written as:

```
(MrEd:ScreenSystem_    "MS Sans Serif")
(MrEd:ScreenRoman_     "Times New Roman")
(MrEd:ScreenDecorative_ "Modern")
```

Wildcarding in the preference name naturally leads to references, parameterizations, and wildcarding references in the preference value. These features are described in the following few sections.

### 13.2 References

Suppose we define the mapping for variants of "Default", and then we want "Roman" to use this setting, too. We could copy the preference entry, as in the following example:

```
(MrEd:ScreenDefault_    "+-*-medium-r-normal-**%d-**s-**s-**s-**s-**s-**s-""
(MrEd:ScreenRoman_     "$\{ScreenDefault\}\"
```

but the MrEd font-reading system provides a better syntax for referencing another preference entry. When a preference value contains "$\{x\}\" then the "$\{x\}\" fragment is replaced by the preference value of "x". Thus, the above can be re-written:

```
(MrEd:ScreenDefault_    "+-*-medium-r-normal-**%d-**s-**s-**s-**s-"
(MrEd:ScreenRoman_     "$\{ScreenDefault\}\"
```

A mini-language of "$\{x\}\" is used within the string (instead of an S-expression format) for historical reasons.

### 13.3 Parameterizations

Parameterization can be used with referencing to parameterize default values based on the weight and style that is needed. When a preference value contains "$[weight]\", then "$[weight]\" is replaced with a string for the desired font weight. Similarly, "$[style]\" is replaced with the desired style. Parameterizing expressions can be embedded within referencing expressions, as in the following example:

```
(MrEd:ScreenDefault_    "+-*-$\{Def[weight]\}-r-normal-**%d-**s-**s-**s-**s-"
(MrEd:DefMedium|        "medium")
(MrEd:DefBold|          "bold")
(MrEd:DefLight|         "medium")
```

Now, when the 'MrEd:ScreenDefault_' preference is used for different weights, it will return different values; the "$\{Def[weight]\}\" expression will turn into "$\{DefMedium\}\" for a medium-weight lookup, or "$\{DefBold\}\" for a bold-weight lookup. These references will in turn give either "medium" or "bold".

### 13.4 Wildcarding References

Consider the following preference configuration:

```
(MrEd:ScreenDefault_    "+-*-medium-r-normal-**%d-**s-**s-**s-**s-""
(MrEd:ScreenDefaultBold_ "+-*-bold-r-normal-**%d-**s-**s-**s-**s-"
(MrEd:ScreenRoman_     "$\{ScreenDefault\}\"
```
The effect of this statement is probably not what was intended; when a bold version of the "Roman" font is needed, the 'MrEd:ScreenDefault_' preference references the 'MrEd:ScreenDefault_' preference, which does not specify a bold font. We could try to remedy the situation as follows:

\[
(MrEd:ScreenDefault_ "+*-+medium-r-normal-**%d-**+-**+-"
(MrEd:ScreenDefaultBold_ "+*-+bold-r-normal-**%d-**+-**+-"
(MrEd:ScreenRoman_ "$\{ScreenDefault,\{weight\}\}")
\]

but this does not work either. It works fine for bold "Roman", now, but medium "Roman" will cause a reference to the 'MrEd:ScreenDefaultMedium_' preference, which doesn’t exist. The problem is that our reference does not use wildcarding like the original medium "Roman" lookup did.

Wildcarding can be specified in a reference by separating each wildcardable field with a comma. The following preference specification does what we want:

\[
(MrEd:ScreenDefault_ "+*-+medium-r-normal-**%d-**+-**+-"
(MrEd:ScreenDefaultBold_ "+*-+bold-r-normal-**%d-**+-**+-"
(MrEd:ScreenRoman_ "$\{ScreenDefault,\{weight\}\,\}")
\]

Since "\{weight\}" is between commas, it can be wildcarded if no name exactly matching "SchemeDefault\{weight\}" is found. In this case "SchemeDefault" and ",\" can also be wildcarded, but this will have no effect.

The wildcarding used in references need not reflect the wildcarding MrEd initial uses for finding fonts. In other words, a number of comma-separated selects can appear between the curly braces.

### 13.5 Internal Preferences

The initial font setup is built into MrEd through a built-in preference table. The table is shown at the end of this section. When font information is computed, it is *almost* as if this table were installed into your preferences file; the difference is that preference specifications in your file override specifications in the built-in table, even when the wildcarding of your preference provides a weaker match.

When no information is available for mapping a face name to a font, MrEd falls back to the system described in `font-name-directory<%>`.

Internal preferences for all platforms:

\[
(MrEd:PostScriptMediumStraight| ")
(MrEd:PostScriptMediumItalic| "-Oblique")
(MrEd:PostScriptMediumSlant| "-Oblique")
(MrEd:PostScriptLightStraight| "")
(MrEd:PostScriptLightItalic| "-Oblique")
(MrEd:PostScriptLightSlant| "-Oblique")
(MrEd:PostScriptBoldStraight| "-Bold")
(MrEd:PostScriptBoldItalic| "-BoldOblique")
(MrEd:PostScriptBoldSlant| "-BoldOblique")
(MrEd:PostScript__| "$\{PostScript\{family\},\{weight\},\{style\}\}\")

(MrEd:PostScriptSystem__| "$\{PostScriptTimes,\{weight\},\{style\}\}\")
(MrEd:PostScriptRoman__| "$\{PostScriptTimes,\{weight\},\{style\}\}\"
(MrEd:PostScriptDecorative__| "$\{PostScriptTimes,\{weight\},\{style\}\}\"
(MrEd:PostScriptScript__| "ZapfChancery-MediumItalic")

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13.5. Internal Preferences

Internal preferences for X with fontconfig/Xft/RENDER only:

- MrEd:PostScriptTimesMedium
- MrEd:PostScriptTimesLight
- MrEd:PostScriptTimesBold
- MrEd:PostScriptTimesMediumStraight
- MrEd:PostScriptTimesLightStraight
- MrEd:PostScriptTimesSlant
- MrEd:PostScriptTimesItalic
- MrEd:PostScriptDefault
- MrEd:PostScriptSwiss
- MrEd:PostScriptModern
- MrEd:PostScriptSymbol

Internal preferences for X only (except those overridden for fontconfig/Xft/RENDER):

- MrEd:ScreenSystem
- MrEd:ScreenDefault
- MrEd:ScreenRoman
- MrEd:ScreenDecorative
- MrEd:ScreenModern
- MrEd:ScreenSwiss
- MrEd:ScreenScript
- MrEd:ScreenSymbol

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13. Font Preferences

13.6 PostScript Fonts

To generate PostScript output, MrEd must be able to find an Adobe Font Metrics (AFM) file corresponding to the PostScript font. An AFM file typically uses the suffix `.afm`, and several AFM files are distributed with MrEd in the `afm` collection.

MrEd finds an AFM file by adding a `.afm` suffix to the PostScript name of the font, and checking all directories specified by the `current-ps-afm-file-paths` parameter. The initial value of this parameter is determined by the `PLTAFMPATHS` environment variable; the environment variable’s setting is parsed with `path-list-string->path-list` using `(list (collection-path "afm"))` as the default list (see paths in MzScheme, §11.3.2 in PLT MzScheme: Language Manual).

Depending on whether the font is CID-based (typically for the Chinese, Japanese, Korean, and Vietnamese language families, and as indicated in the AFM file), MrEd must find additional files:

- **Non-CID**: In addition to an AFM file `x.afm`, MrEd looks for a `x-glyphlist.txt` file (in the same directory as the AFM file) to map glyph names in the AFM file to Unicode character values. In addition to this font-specific file, MrEd looks for a `glyphlist.txt` file to supply a mapping for Adobe’s standard glyph names, and this mapping is used when a font-specific mapping is not supplied, or when the mapping does not cover a name found in the AFM file. MrEd looks for `glyphlist.txt` in the same place as AFM files. Since `glyphlist.txt` is large, if a `glyphshortlist.txt` file is available, it is read first, and then `glyphlist.txt` is read only if a character name must be resolved that is not in `glyphshortlist.txt`.

- **CID**: In addition to an AFM file, MrEd must find and read CMap files to convert glyph IDs for the font to Unicode characters. The character set name is used as the name of the CMap file to load, and MrEd checks all directories specified by the `current-ps-cmap-file-paths` parameter. The initial value of this parameter is determined by the `PLTCMAPPATHS` environment variable; the environment variable’s setting is parsed with `path-list-string->path-list` using `(list (collection-path "afm" "CMap"))` as the default list (see paths in MzScheme, §11.3.2 in PLT MzScheme: Language Manual). In addition to a CMap file for the font’s character set, MrEd must find a `UniCNS-UTF32-H` CMap file to complete the mapping to Unicode. MrEd automatically adds the font’s character set to the font name when producing PostScript with a CID-based font.
When drawing or measuring text using a particular PostScript font, if the font does not contain a glyph for a character (or if a relevant AFM file cannot be found for the font), then MrEd attempts to substitute another PostScript font. A substitute font is selected by checking all .afm files in the directories specified by current-ps-afm-file-paths (in order), and choosing the first discovered match.
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Version 2, June 1991

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[This is the first released version of the library GPL. It is numbered 2 because it goes with version 2 of the ordinary GPL.]

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