

RxSV... a drawing program for Interlisp-D  
 Z[YYWzVSRxP

**Richard R. Burton**  
**Intelligent Systems Laboratory**  
**Xerox PARC**

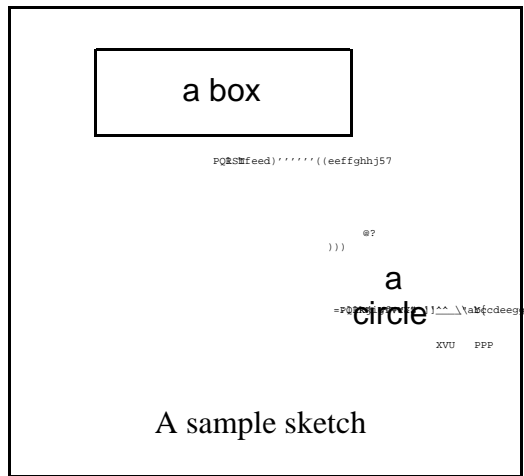
**Revision date:** January 23, 1985

(C) copyright Xerox Corporation 1984, 1985. All rights reserved.

**Introduction**

Sketch is a drawing program in which the user is able to place text and graphics to achieve desired images. The figures can be included (via copy-select) in Tedit documents to allow a mixture of text and graphics in the same document. This documentation was produced using Sketch.

A sketch consists of "sketch elements". Sketch elements include text, lines, curves, boxes, circles and ellipses. Each element has one or more positions (called control points) that determine its location, and a set of properties such as brush. A sketch is viewed in one or more sketch windows that provide a region and scale. Within a window, the sketch can be edited by adding or deleting elements, or by changing the locations of control points or the values of properties.



**How to load Sketch**

To get Sketch into your Interlisp-D system, load the file SKETCH.DCOM. This will in turn load several other support files (SKETCHEDIT, SKETCHOBJ, GRAPHZOOM).

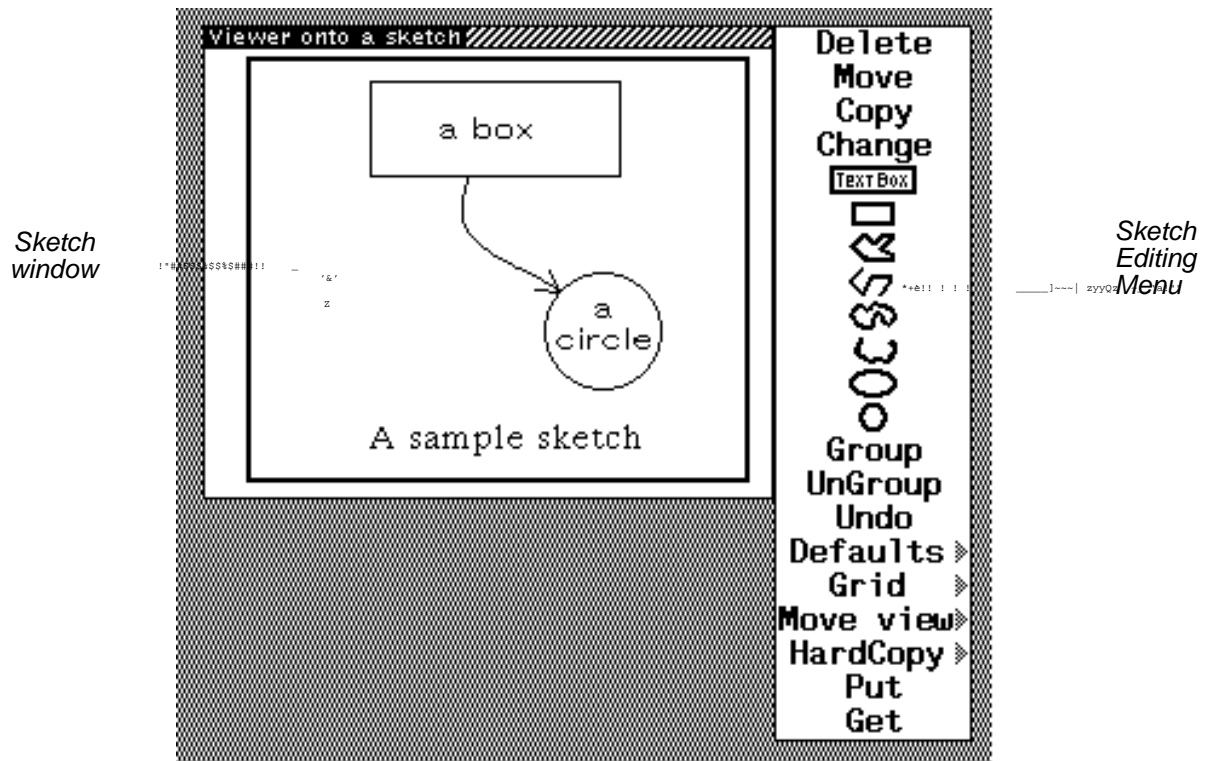
## How to start and stop Sketch

A sketch window can be opened in several ways. The most common method is by selecting *Sketch* from the background command menu. This will prompt for a region and open an empty sketch window there.

A sketch that is in a Tedit document can be edited by pressing the *left* button in it and selecting the *Edit Sketch* item from the menu that appears. This will open a sketch window the same size as the sketch in the document.

Also, the function `SKETCHW.CREATE` (described below) can be called.

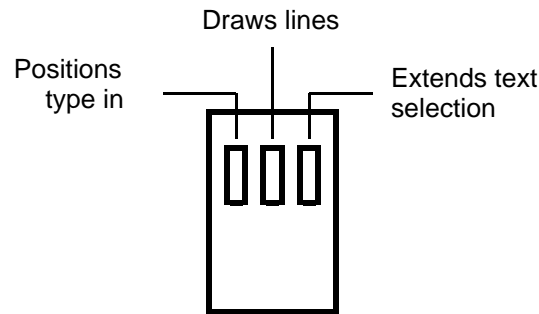
When you are finished with a sketch window, it can be closed. If you have made changes to the sketch without saving them on a file, it will ask you to confirm the closing. If the sketch window was created from a sketch in a Tedit document, you will be given a menu choice of whether or not the changes made to this window should be returned to the document.



A sketch window with its editing menu

## Sketch mouse functions editing text and adding lines

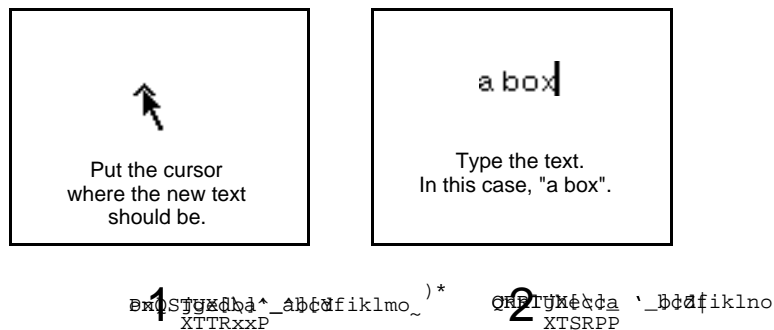
In the Sketch window, the three buttons provide quick access to text editing and line drawing.



### Mouse button functions in a sketch window

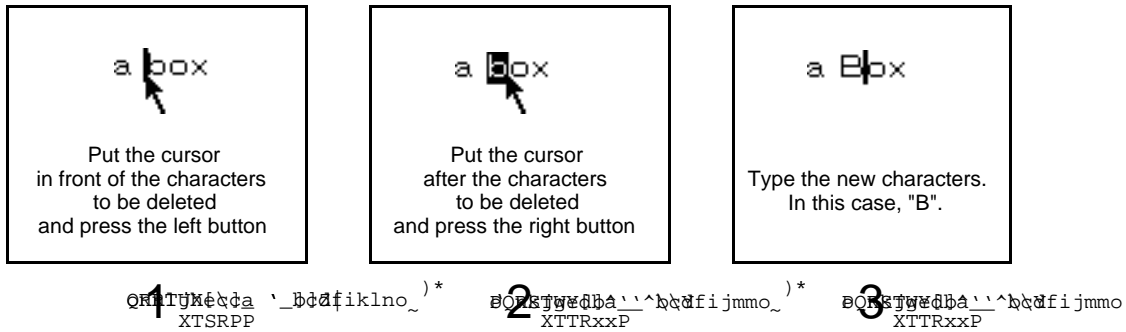
The *left* button is used to position typed characters. If this position is *not* within existing text, a caret shape (⤴) will appear and when characters are typed, a new piece of text will be centered around that position. (Note: The alignment of the text relative to this position can be changed. See the sections below on the *change* command and the *defaults* command.)


### Steps to insert new text



If the position of the cursor is in existing text when the *left* button is released, a vertical bar (|) will appear between the existing characters. The *right* button can then be used to extend the selection within the text and any text so selected will be deleted when the next character is typed.

### Steps to edit existing text



The *middle* button is used to construct straight lines. Pressing the *middle* button will cause the cursor to change to  and an  $\times$  to track the cursor (though only on grid points - described in section below on "grid"). Releasing the button marks the beginning of the line. Pressing the *middle* button again will stretch a line from the beginning point to the cursor. This line will move until the *middle* button is released again. More lines can be added by pressing the *middle* button. Each line starts where the previous one ended. To start a new series of lines, press either the *left* or the *right* mouse button. (The series of lines will be reset when you select on of the menu command discussed below.) The drawing of any line segment can be stopped by moving the mouse outside the window. This does not start a new series of lines; moving back into the window and pressing the *middle* button will pick up where the last line ended.

### Sketch Editing Menu

The Sketch menu (shown in the second figure) provides commands to add elements other than text and lines and commands to modify existing elements. In most cases, it will be visible at the right of the sketch window. The menu can be closed by *right* buttoning in it and selecting *close* from the presented menu. After you close it, or if it wasn't visible in the first place, it can be retrieved by depressing the *middle* mouse button in the title bar. If more than one command is going to be executed, it is convenient to keep the menu visible. This is achieved by selecting *Fix Menu* from the Sketch menu (see *Fix Menu* below). Select commands with the *left* or *middle* mouse button.


The standard Interlisp-D window command menu can be retrieved by pressing the *right* button while the cursor in the title bar of the window. The *Redisplay* command is sometimes useful for cleaning up the display in the sketch window which may get "dirtied" when elements are deleted or moved. The *Shape* command is used to change the size and shape of the sketch window. The size of the sketch window determines the size a sketch occupies when it is inserted into a text document.


### Commandsto add elements to the sketch



The following commands add different elements to the sketch. After selecting one of these commands you will be prompted to specify where in the sketch window you want the new element to be.



**TEXT BOX** to add a "text box", a box within which text flows. Prompts for a region which becomes the box. Whenever the caret is inside of a text box, the characters typed become part of the text within the box. The text in a box is broken into lines that fit within the width of the box. The justification properties of the text specify the position of the text within the box. If a word in the text is wider than the box width, it spills over. If there are more lines than fit in the height of the box, they spill over also. The characters outside the box



cannot be selected for editing. The dimensions of the box are changed by using the **Move** command on either corner point of the box.


 to sketch boxes. Prompts for a region which becomes the box.

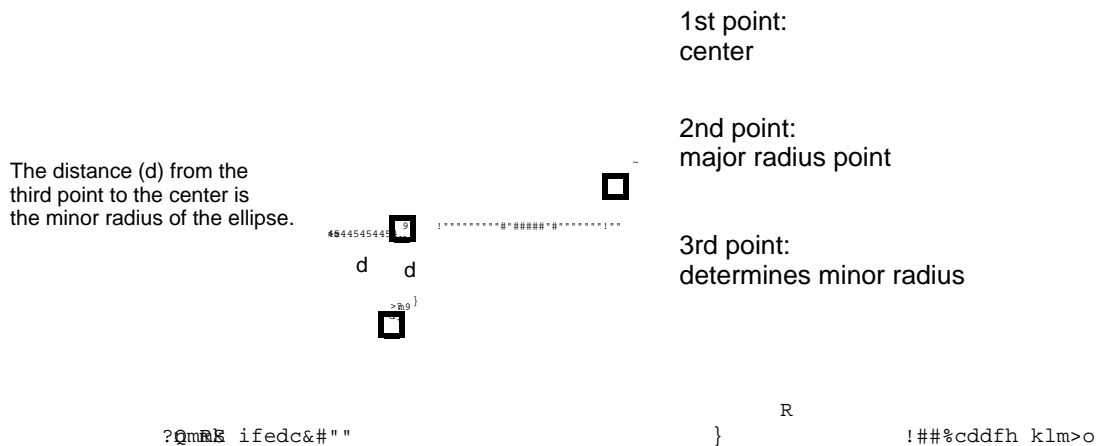
 to connect a series of points with a closed (first and last points are connected) collection of straight lines. The points that the lines go through (its control points) are placed by moving the cursor to the desired position and depressing any mouse button. The lines are drawn through the knots, when a mouse button is clicked when the cursor is outside the window. To cancel this command, click the button with the cursor outside the window before entering any knots.

 to connect a series of points with an open (first and last points are not connected) collection of straight lines. See  procedure.


 to draw a closed (first and last points are connected) curve through a collection of points. See  procedure.

 to draw a open (first and last points are not connected) curve through a collection of points. See  procedure.

 to sketch an ellipse. The figure below shows the relationships between the three control points of an ellipse. First, indicate the center of the ellipse by depressing the *left* mouse button in the window. Second, indicate the semi-major axis by depressing the *left* mouse button in the window. This second point will be an axis point on the ellipse. Finally, indicate the semi-minor axis by depressing the *left* mouse button in the window. The second radius will be determined by the distance the third point is from the center point. This command can be canceled by clicking outside the window.

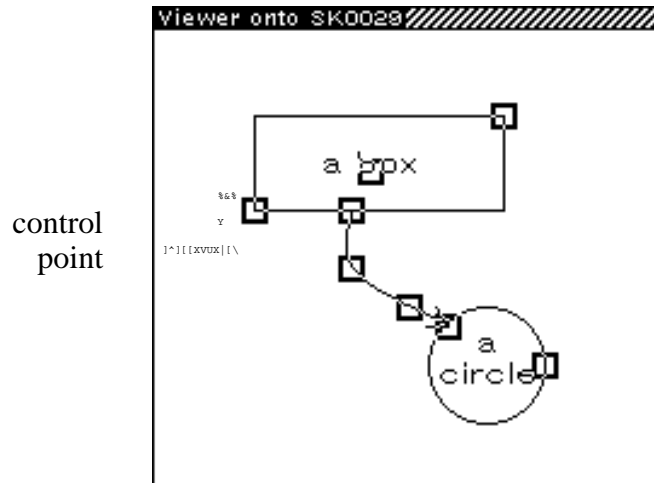


### The control points for an ellipse

 to sketch a circle. First, indicate the center of the circle by depressing the *left* mouse button in the window. Finally, indicate a point of the circumference of the circle by depressing the *left* mouse button in the window. This command can be canceled by clicking outside the window.

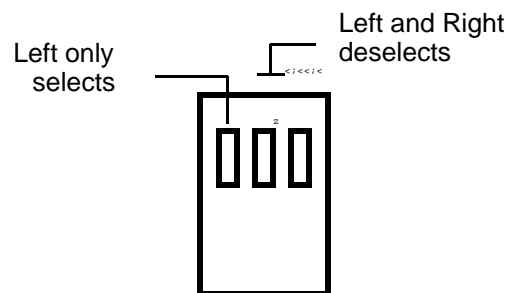
## Sketch Element Selection

The commands *delete*, *copy*, *change* and *move* apply to existing elements in the sketch. These commands are used by first selecting the command from the editing menu, then specifying the element or elements to apply the command to. When Sketch is expecting you to select elements, the control points will be highlighted with a box as shown below.



A sketch window in selection mode  
(control points visible)


While the control points are visible, elements are selected by the following protocol. The *move* command is the only command that accepts points. For the *move* command, a point can be selected by placing the cursor within the square surrounding that point and clicking the *left* button. A second immediate click (double clicking) of the left button will select the element of which the point is a part. A third click will select all visible parts of the sketch. For commands other than *move*, an element can be selected by placing the cursor within the square surrounding any of its points and clicking the *left* button. A group of elements can be selected by moving the cursor to one corner of the group, pressing the *left* button, then while holding the *left* button down, sweeping to the opposite corner. This will select all elements in the swept out area. A selected element can be deselected when the *left* button is held down by also holding down the *right* button. All visible parts of the sketch can be selected by clicking the *left* button twice in the same square. The elements selected will be marked by having their control points blackened.



Mouse button functions during selection

## Commands that modify Sketch elements


**Delete** deletes an element or group of elements. Note that delete cancels the element not just one point. All graphic objects are identified when **delete** is chosen, and the user must select the object(s) to be deleted using the protocol described above. To cancel this selection before deleting, place the cursor outside the sketch window and click a mouse button.

**Move** moves a selected control point, an element or a group of elements. If a single point is selected, the cursor will change to , a new location for that point should be selected by pressing the *left* button. To stop the move, select a point outside the sketch window.


If an element or a group of elements is selected, an image of the selected elements will be shown on the screen and will follow the cursor until the *left* button is pressed and released. When the button is released, the selected elements will be moved to the shown locations. To stop the move, press the *left* button when the entire image is out of the window. (Note: An image containing curves or ellipses may be clipped at the edges. All of the displayed elements will be moved and redrawn when you let up the button.)

**Copy** similar to **Move** except that it makes a copy of the selected elements in the new position.

Note: Copy, delete and move can also be accomplished by using copy selection, deletion selection and move selection. Copy selection is done using the following steps: First click any mouse button in the sketch window. This makes sure you are "talking" to the sketch window. (If you "talking" to someother window, the selected sketch elements will be copied into that other window.) Next, hold down the "copy key." On Alto style keyboards, this is either SHIFT key; on Dandelion keyboards, it can be either SHIFT key or the COPY key. With the "copy key" held down, press the *left* mouse button. At this point, the selection control points will appear and you can use the method described above in the section "Sketch element selection" to select the elements you wish to copy. The selected elements will have their control points shaded with gray. When you have selected the right elements, release the mouse buttons, then release the "copy key". At this point, you will be prompted with an image of the selected elements which you should move into place. If you wish to stop "copy selection", move the cursor outside of the window with either button held down or place the image completely outside the sketch window.

Deletion selection is similar. The difference is that the "delete key" is held instead of the "copy key". On Alto sytle keyboards, the "delete key" is the CTRL key; on Dandelion keyboards, it can be the PROPS key or the DELETE key. During deletion selection, the control points of selected elements are marked with .

Move selection is also similar. For "move selection", both the "delete key" and the "copy key" are held down.

During move selection, the control points of selected elements are marked with .

**Change** enables the user to change the properties of an element or collection of elements. All graphic elements are identified when **Change** is chosen, and the user must select the elements to be changed. After selecting the elements to change, you will be presented a menu of ways to change them. The particular menu varies for different elements because each has different properties. If in doubt, select the object you want to change and see what choices are offered. Selecting outside of the offered menu will not change anything. If the selection contains elements of different types, the offered change will be for the type that is first selected and the change will be made to any other selected elements to which it is applicable. For example, if the first selected element is a line and you select **LARGER**, all of the selected lines, curves and boxes will be made larger.



Menu offered for changing text elements

**Text** enables the user to change the font, size, and face of the text as well as the alignment of the text relative to its position. The menu commands are as follows:

**Look same** enables the user to make all of a collection of text look alike. It makes all of the selected text items be the same font size, face, and alignment as the first selected item. This changes the selected text items only. It is convenient for making text that was entered at different scales look the same.

**different font** enables the user to change the type of the font. The user will be offered a menu of the previously entered font families and the item *other*. If the item *other* is selected, you will be prompted for the name of a font family. If the selected or named font is not available in the size of the first selected text element, an error message is printed and nothing is changed. If an appropriately sized font is found, any of the selected text elements that have the same size as the first selected text element will be changed to the new font. The search for fonts will encompass any directories on `DISPLAYFONTDIRECTORIES` and may take a few minutes. For `PRESS` fonts, there is no way of determining what sizes of a given font exist. Sketch will try to create sizes 8, 10 and 12 in new fonts. If it doesn't find a font that you believe exists, you can make that font the default font (both family and size) and retry the change.

**Font size control:** *Smaller font, Larger font, Set font size*

**Font face control:** *Bold, unbold, Italic, UnItalic*

The relationship between the text and its control point is determined by the horizontal and vertical alignment properties.

**Horizontal alignment:** *Center Justify, Right Justify, Left Justify*

**Vertical alignment:** *Top Justify, Middle Justify, Baseline Justify, Bottom Justify*

The following table shows the effects of the different values for horizontal and vertical alignment.



<b>Vertical Horizontal</b>	<b>Baseline justify</b>	<b>Middle justify</b>	<b>Top justify</b>	<b>Bottom justify</b>
<b>Center justify</b>	Play	Play	Play	Play
<b>Left justify</b>	Play	Play	Play	Play
<b>Right justify</b>	Play	Play	Play	Play

⊕ - control point of the text

Table showing how the alignment properties effect the position of text relative to its control point

**Closed Curves, Circles and Ellipses** changes the brush size and shape with the following sub-menus:

**Shape** choose from the following sub-menu.

*Round, Square, Vertical, Horizontal, Diagonal*

**Size** choose from the following sub-menu:

*smaller line* makes the curve one thinner.

*larger line* makes the curve one thicker.

*Set line size* prompts for a number and sets the line to that thickness.



First menu for changing open curves

**Open Curves** changes the brush size and shape or adds and changes arrowheads at either end of the curve.

You will first be asked to specify which aspect of the curve you wish to change. The aspects are Shape, Size and Arrowheads. Depending upon your choice, you will be prompted with different other menus.



### Menus for changing arrowheads

**Arrowheads** You will be given two menus. The first one specifies which end of the curve this change is to affect. The second one specifies the change to make. If a selected line or curve does not already have an arrowhead on it, any choice but **Add Arrow** from the second menu will do nothing. The choices in the first menu are:

**Left** change arrowhead at the leftmost end of the curve (topmost if ends have the same X position.)

**Right** change the arrowhead at the rightmost end of the curve (bottommost if ends have the same X position.)

**Both** change applies to the arrowheads at both ends of the curve.

**First** change applies to the arrowheads at the first control point to have been entered.

**Last** change applies to the arrowheads at the last control point to have been entered.

The choices in the second menu are:

**Add Arrow** adds an arrowhead of the default specifications at the previously specified end or ends. If that end already has an arrowhead, nothing happens.

**Delete Arrow** deletes an arrowhead at the previously specified end or ends. If that end doesn't have an arrowhead, nothing happens.

**Wider** increases the angle of the arrowhead with respect to the line.

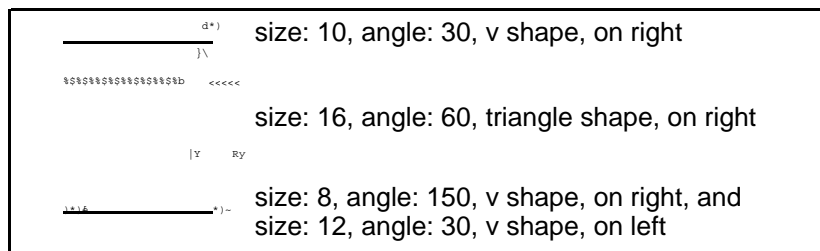
**Narrower** decreases the angle of the arrowhead with respect to the line.

**Larger** increases the length of the side of the arrowhead.

**Smaller** decreases the length of the side of the arrowhead.

**V shape** changes the shape of the arrowhead to be two sides.

**Triangle** changes the shape of the arrowhead to be two sides and a base.



Sample arrowheads

**Shape** same menus will be given as for **Curves**

**Size** same menus will be given as for **Curves**

Note: if you are entering many arrowheads, it is convenient to set the properties of the default arrowhead using the Defaults command before adding the arrows.

**Lines** change enables the user to change the arrowhead characteristics and the size in the same manner as **Open Curves**

**Boxes** change enables the user to change the line thickness in the same manner as changing the brush size of **Curves**

**Text boxes** change enables the user to change the line thickness of the box in the same manner as changing the brush size of **Curves** or the properties of the text as in **Text**.

## Other Sketch commands

**Group** collects a group of elements together. After the elements are grouped, they will have a single control point which is at their center. This is sometimes convenient to reduce the number of control points in a diagram or to more easily duplicate common parts of a figure. The elements in a group are moved, copied, deleted and changed together. If you want to change just one piece of a group, you must **UnGroup** it first. Groups can be included in other groups.

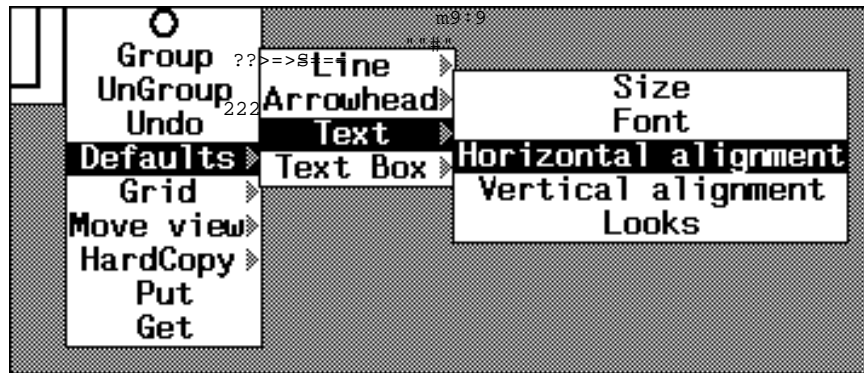
**UnGroup** restores the first selected group to its individual elements.

**Undo** to undo a previous command. Selecting this command will bring up a menu of past commands. Select the command which you wish to have undone. The most recent event is placed at the top of the menu. To cancel this command, click the button with the cursor outside the menu. In the menu, "Wire" refers to lines. If the same graphical element has been changed more than once, the changes to it must be undone in the reverse order in which they were done.

The number of changes that are remembered is determined by the variable `SKETCH.#.UNDO.ITEMS` and is initially set to 30. If you wish to save more or less changes, you can set `SKETCH.#.UNDO.ITEMS` to a larger or smaller number. To change it to 50, for example, type `(SETQ SKETCH.#.UNDO.ITEMS 50)` into the "Top level typescript window".

**Defaults** enables the user to change the default brush, text, text box and arrowhead characteristics. The default characteristics are the properties given to newly added lines, text or arrowheads. (The properties of an existing object can be changed by using the **Change** command above.)

Submenu indicators  
 Submenu is accessed  
 by holding down a button  
 and rolling out the right side  
 'ffgj18:996i11-e



Defaults Menu item showing submenus

The menu item for this command is followed by a gray triangle pointing to the right indicating a sub-menu (see figure). To retrieve the sub-menu, press down the *left* button, slide the cursor to the right through the triangle, and select the desired sub-command before releasing the button. Continue holding the button and slide through the desired sub-menu item to obtain the sub-sub-menus. When the desired item is found, release the button while over it. If you wish to choose a different item from a higher level menu, slide to the left and the submenus will be withdrawn.

**Line** enables the user to change the default line size. A pad of numbers is displayed from which the user chooses the size and clicks OK to exit. If the brush size is not to change, select OK when the size is 0 to cancel the command.

A sub-menu allows the user to change the default brush shape or size.

**Shape** enables the user to change the brush shape. The most recent change becomes the default for all new elements created. Choose from the following sub-menu:

*Round, Square, Vertical, Horizontal, Diagonal*

**Size** same as **Line** above.

**Add Arrowhead** enables the user to set whether or not newly added open lines and curves get arrowheads on either or both ends. After selecting this item, you will be given a menu of the following choices from which you can pick one or click outside, if you don't want to make any change.

*First, Last, Both, Neither, Left, Right*

**Arrowhead** enables the user to change the default arrowhead size. A pad of numbers is displayed from which the user chooses the arrowhead size and clicks OK to exit. If the arrowhead size is not to change, select OK when the size is 0 to cancel the command. The arrowhead size is given in screen points. When the arrowhead is added, the screen point size is scaled to get its real sketch size. This size is then scaled as the line or curve scales.

A sub-menu allows the user to change the default arrowhead size, angle and type.

**Size** same as *Arrowhead* above.

**Angle** enables the user to change the angle of the default arrowhead. A pad of numbers is displayed from which the user chooses the angle in degrees. If the arrowhead angle is not to change, select OK when the size is 0 to cancel the command .

**Type** enables the user to change the type of the default arrowhead. A menu of type is displayed from which the user chooses the new default. Currently there are two types: **V-shape** the arrowhead consists of two lines from the head and **Triangle** the arrowhead consists of a triangle (two lines from the head and a line connecting their endpoints.)

**Text** enables the user to change the size of new text. A menu of the known font sizes is displayed from which the user chooses the size. Note: not all fonts are available in all sizes. The sub-menu allows the user to change the size, face and alignment properties of new text.

**Size** same as *Text* above.

**Font** enables the user to change the font family property of new text. The user specifies a font family using the same method as when the font property of text is changed (described under the *change* command). If the specified font can not be found in the current default size, an error message is printed and the default is not changed.

**Horizontal alignment** enables the user to change the horizontal alignment property of new text. The choices are:

**Center, Left, Right**

**Vertical alignment** enables the user to change the vertical alignment property of new text. A menu of alignments is displayed from which the user chooses the new default. The choices are:

**Top, Center, Baseline, Bottom**

**Looks** enables the user to change the face property of new text. A menu of faces is displayed from which the user chooses the new default. The choices are:

**regular, bold, italic, bold/italic**

**Text Box** enables the user to change the horizontal alignment of text within new text boxes. The default of text boxes is different from the default for text. Its initial setting is *Center*. The sub-menu allows the user to change the horizontal and vertical alignment properties of new text boxes.

**Horizontal alignment** enables the user to change the horizontal alignment property of text within new text boxes. The choices are:

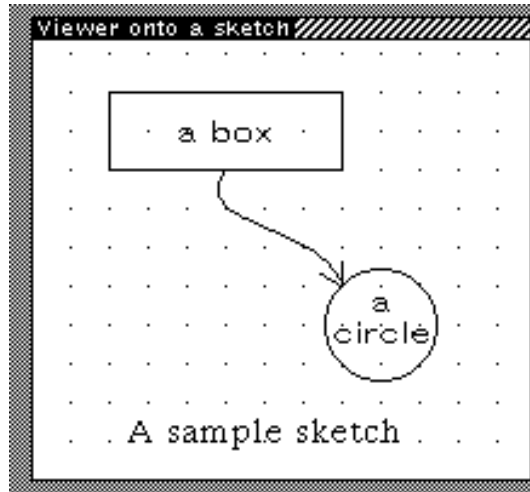
**Center, Left, Right**

**Vertical alignment** enables the user to change the vertical alignment property of text within new text boxes. A menu of alignments is displayed from which the user chooses the new default. The choices are:

**Top, Center, Baseline, Bottom**

**Grid** displays and changes the grid which determines where points can be positioned on the display. When the grid is on, only points on the corners of the grid can be specified for any sketch operations. This makes it much easier to align parts of the sketch. The default is to have a grid turned on with a default grid size of about half centimeter. If the grid is off, any point can be selected. The main menu *Grid* item flips back and

forth between using and not using the grid. Submenu items are available to display the grid and to change its size. The grid is always on a power of two in the sketch coordinate space. This means that same points are accessible on the grid as the sketch scale changes.



Sketch window with default grid displayed

A submenu of commands can be obtained by rolling out the right side of this menu item. The submenu commands are:

**Turn grid ON** while the grid is ON, any points selected are on the grid.

**Turn grid OFF** while the grid is OFF, any point can be selected.

**LARGER grid** doubles the space between the grid points

**smaller grid** halves the space between the grid points.

**Display grid** will display a point at each point on the grid. If the grid points are closer than 3 points together, they are not shown; instead, a message giving the number of screen points per grid point is displayed in the status window above the sketch window.

**Remove grid display** will remove the grid display (by redisplaying the window contents).

**Move view** changes the portion of the sketch that is visible in the window. The user specifies the new portion of the sketch that will appear in the window by depressing any mouse button at one corner and sweeping the cursor to the other corner (see next figure). The specified region will be outlined in gray. When the button is released, the portion of the sketch within the gray box will be scaled to fill the sketch window. The box will maintain the same aspect ratio as the window. The section may be smaller or larger than the current window size. This command can be cancelled by typing control-E. (Note: the sketch can be scrolled either horizontally or vertically using the standard Interlisp-D scroll bars at the left and bottom of the window.) Use the subitem **Home** to return the sketch to its original form.



**Locator** puts up a small window that displays the cursor's location in sketch coordinates whenever the cursor is inside the sketch window.

**New window** opens another window onto the same sketch. The second window can be scrolled or zoomed without affecting the view in the original window. This allows one window to act as an overview while the other can be used to blow up an intricate part of the sketch and make detailed changes. Any changes made to either of the windows are reflected in both windows.

**Hardcopy** sends the image in the window to the `DEFAULTPRINTINGHOST`. The image will be centered in the page. Hardcopy has a submenu that can change the display to hardcopy mode or makes a printer file of the current view of the sketch in either `press` or `interpress` format, and, optionally, sends it to the printer. Each of the subcommands has subitems that allow the choice of **Press** or **Interpress**. If the submenu is not used to specify the print format type, the type appropriate for the first entry on `DEFAULTPRINTINGHOST` is used. The subcommands are:

**File Only** Prompts for a file name and makes an image on it.

**Print Only** Prints the image but doesn't save the file.

**File & Print** Prompts for a file name, makes an image on it and print the image on `DEFAULTPRINTINGHOST`.

**Hardcopy Display** Displays the text in the window as close as possible to the way it will look when printed. Text fonts have significantly different widths on the display and on the `PRESS` printer.

**Normal Display** Displays the text in a way more easily read and edited on the screen.

**Put** Saves the sketch on a file. The sketch can be retrieved by the **Get** command. Sketches can also be saved by including them in Tedit documents (see below).

**Get** Retrieves a sketch from a file. Any elements in the window before the **Get** will still be there.

**Fix Menu** (appears in the pop up menu only) fixes menu to the right edge of the sketch window.

## Including image objects in a sketch

Other Interlisp-D image objects (such as bitmaps) can be placed in sketches by using the standard copy-select mechanism. For example, to include a bitmap image, hold down the "copy select" key, move the cursor into the background, press the right button and select **SNAP** from the offered menu. Select the region of the screen to be included, move the cursor back into the sketch window and place the bitmap image (which should now be following the cursor) in place. (Note: image objects do not scale.)

Image objects in sketches can be "moved", "copied" and "deleted" like an other elements. Calling "change" on an image object or pressing a button down while over its image in the sketch window will call that objects `BUTTONEVENTINFN` which is often an editor for the object.

## Putting sketches into Tedit documents

Sketches can be included in documents by copy-selection. Select the location in the document where the sketch is to go. Hold down the 'copy select' key. Move the cursor into the sketch window and select the pieces of the sketch to be inserted. The whole sketch can be selected by double clicking on a sketch element. While selecting pieces, the *right* button will remove elements from the selection. When the desired elements have been selected, release the 'copy select' key. The sketch will be inserted into the document. The sketch will be



the size of the window from which it is copied. To change its shape, reshape the sketch window. The copy selection process can be aborted by moving the cursor outside of the sketch window while a button is down.

The sketch will be adjusted so that the lower left corner of the inserted sketch is on a grid point. This is done so the when the sketch is edited, the grid remains aligned with existing points. The grid can be made smaller before the copy insertion to reduce the amount of adjustment.

Note: Current implementation limitation, TEdit will only display the sketch if the Tedit window is at least as tall as the sketch. NOTE: For now, you must have SKETCH loaded in order to edit or look at a TEdit document that has a sketch object in it. If SKETCH isn't loaded, TEDIT will break with an undefined function SKIO.GETFN. From the break window, load SKETCH and type OK into the break window.)

A sketch that is in a document can be edited by pressing the *left* button inside it and selecting the offered menu item **Edit sketch**. This will prompt for a position of a sketch window the same size as the sketch. In this window, the sketch can be edited, scrolled, zoomed, etc. A sketch so edited may contain elements that are not visible in the printed document. These elements can be exposed by zooming or scrolling. When the window is closed, you will be offered a chance to place the sketch back into the document. If accepted, the current view of the sketch will be placed into the document. The sketch window will have the menu already fixed beside it.

## Copying from one sketch to another

Parts of a sketch can be copied from one sketch to another using a protocol similar to the above. Select the target sketch. Hold down the 'copy select' key. Move into the source window and select the desired elements using the *left* and *right* button protocol described earlier. When the 'copy select' key is released, position the cursor back in the target window. You will be dragging an image of the selected elements that can be placed in the target by pressing and releasing the *left* button. For now, the scale of the transferred elements is not changed so the image in the new window may be a different size after the transfer.

## Copying the text out of a Sketch as characters

The text characters in a sketch (i.e. text and text box elements) can be copied from a sketch by using the selection procedure described above but selecting elements with the *middle* button instead of the *left* one. When the 'copy select' key is released, the characters in selected text and text box elements will be copied.

## Sketch Implementation Notes

```
SKETCHW.CREATE (SKETCH SKETCHREGION SCREENREGION TITLE INITIALSCALE BRINGUPMENUFLG INITIALGRID)
```

Opens a sketch window onto the sketch SKETCH. SKETCH can be: NIL, an empty sketch is generated and given a name; a sketch; or the name of a sketch. SKETCHREGION, if given, is a region in sketch coordinates of the part of the sketch to be initially displayed. SCREENREGION can be: a region, the screen region to be used for the sketch window; or a window to be used as the sketch window. TITLE will be used as the title of the sketch window. If TITLE is NIL, the title "Viewer onto 'SketchName'" is used. INITIALSCALE if a number will be the initial scale of the sketch; 1.0 is the default. If BRINGUPMENUFLG is non-NIL, the sketch operations menu will be brought up beside the right edge of the window. INITIALGRID indicates whether or not to use a grid. If it is a number, the grid will be set to the least power of 2 greater than INITIALGRID. If INITIALGRID is T, the grid will be set to allow approximately half a centimeter between grid points. If it is NIL, no grid will be used.

BRINGUPMENUFLG can be a menu in which case it is brought up beside the right edge of the window. The standard sketch command menu is the SKETCHPOPUPMENU property of the window.

```
EDITSLIDE (SKETCH)
```

Opens a window the size of a sheet of 8.5 by 11 piece of paper. This is useful for laying out slides or other full page images.

#### Programming Notes

If a sketch window has a non-NIL value for the property `DONTQUERYCHANGES`, the user will not be asked to confirm the close even though changes have occurred.