

In addition, the main menu offers two simple commands:

`k n o t s` spline curves are drawn with or without their knots explicitly represented depending on the context. This command is used for displaying all the knots on all the curves (they are drawn as "x" shaped symbols).

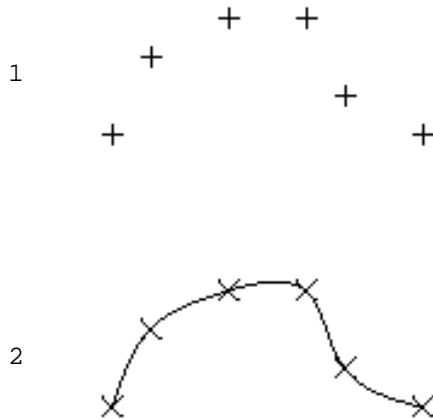
`q u i t` for returning to the Alto operating system. This command expects confirmation with a key stroke (Y or return).

Certain commands use keyboard interaction. When inputting a text string (such as filename) or a number, terminate with return or escape; edit with backspace which deletes the last character and delete for starting over. Entering only return usually aborts the command. Entering only escape may either abort or imply some default value.

### 3. Basic operations

Spline curves can be created with the command `m a k e`. They can be deleted and modified (by deleting knots, moving knots or adding new knots) with the command `r e p l a c e`. The operation `r e p l a c e` applies to a section of a curve, that is to say an ordered set of contiguous knots of the curve. Since the commands `m a k e` and `r e p l a c e` are the two most frequently used, they do not appear on the menu but are invoked by pressing switch 3 of the mouse.

#### 3.1 M a k e:



This is the operation for creating a new curve. First press switch 3. The editor goes into knot input mode (see below): a new menu appears and a small symbol "+" is now attached to the cursor. Now define the knots of a new spline curve. When all the knots of the spline have been defined, terminate knot input mode. The new spline is displayed with its knots turned on. A maximum of 40 new knots can be accepted at one time. However this restriction does not limit the number of knots for a curve since new knots can be added with a `r e p l a c e` operation.

### 3.2 Knot Input Mode

Knots are input in the display area by pressing switch 1 or 2 of the mouse. A symbol "+" is displayed at that location and the number and coordinates of the point are shown in the message area.

If switch 1 is used, a knot is placed at the exact location pointed at by the cursor.

Alternatively, if switch 2 is used, a knot is input only if the cursor is in the vicinity of either a knot on a curve or a previously input knot (i.e. a symbol "+"). The new knot will fall exactly at the location of this adjacent knot. The message "overlap" will confirm the input.

Switch 3 is used to terminate knot input, execute the operation and return to the main menu.

In addition, the following actions are available from the knot input mode menu:

```
    e r a s e:      erase the last knot input;
    a b o r t:      abort knot input; do not make a spline;
    x & y:          input a knot by its coordinates.
```

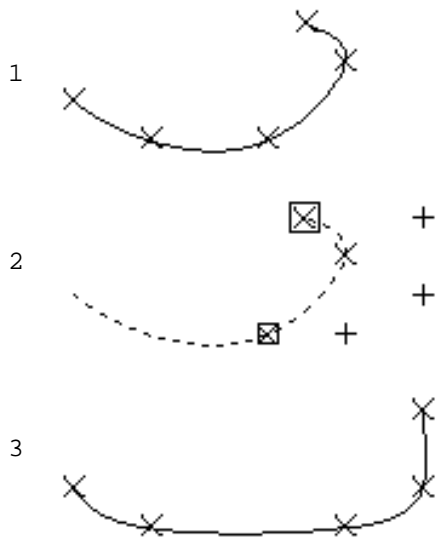
Keys delete and backspace have the same action as the command e r a s e.

The menu area also contains an 11 x 11 grid, with a black square in its center which is used for moving the last knot input. When the cursor is placed in the grid and a switch depressed, the last knot will be moved by an amount equal to the distance between the black square in the center of the grid and the square pointed at by the cursor, multiplied by the "resolution" of the grid which depends on the switch used:

```
    switch 1: 1 grid unit equals 1 screen units;
    switch 2: 1 grid unit equals 10 screen units;
    switch 3: 1 grid unit equals 100 screen units.
```

For instance, if one points at the square immediately to the right of the black square using switch 2, the last input knot will be moved by ten screen units; if one points at the top left square of the grid using switch 1, the last input knot will be moved up and left diagonally by five screen units in each direction.

### 3.3 R e p l a c e :



This operation replaces a curve section by a set of new knots. First specify a curve section (see below). Then press switch 3. The editor goes into knot input mode (already described in section 3.2). Now input new knots. When the set of new knots has been defined, the modified spline is displayed with its knots turned on. The set of new knots may be empty (in this case, the curve section is deleted).

### 3.4 Specifying a curve section

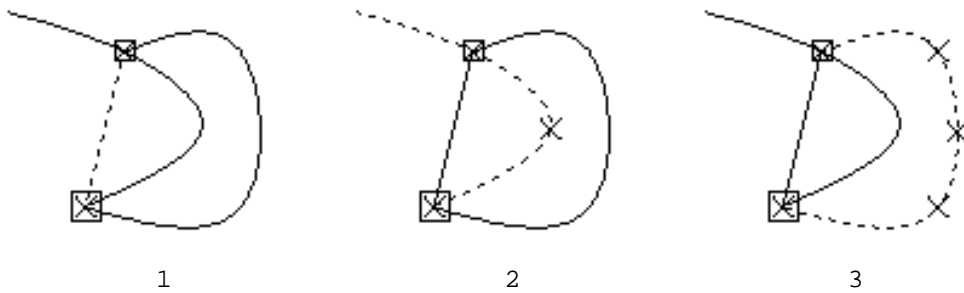
A curve section is an ordered set of contiguous knots of a curve. It is defined by its end knots. Switch 1 and switch 2 are used to specify a section. As seen above switch 3 is used for invoking the commands `m a k e` and `r e p l a c e`. If a curve section is currently selected, the operation `r e p l a c e` is invoked; otherwise the operation `m a k e` is invoked. An unwanted selected section may be suppressed with either delete or backspace.

The first knot of the section is specified by pointing at it with the cursor and pressing switch 1 of the mouse. It is displayed with a small square surrounding it. The last knot of the section is specified similarly with switch 2, and is displayed with a slightly larger square surrounding it. The first and last knot will coincide when either switch 1 or switch 2 is used, in the following two cases: no section was previously selected or the previously selected section was on a different curve from the one just pointed at.

The entire curve containing the selected section is drawn as a dotted line, with only the knots of the section turned on. The end knots of the section are surrounded by a square. In addition to the visual cues, a message is displayed indicating the spline number and the knot numbers of the selected section; that information may be helpful in some ambiguous cases.

### 3.5 Next:

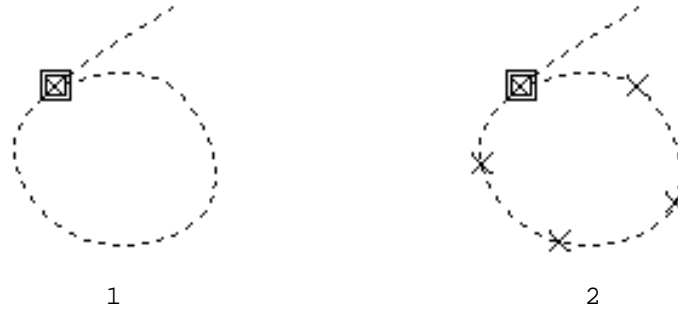
There may be ambiguity about which curve is selected by the specified section when two or more curves share end knots of the section, or when one of the end knots is a multiple knot of a single curve. The command `next` may then be used to cycle through the possible choices. In most cases, the visual cues (dotted curve and visible knots) should be sufficient to indicate which is the current choice. The following figures illustrate typical examples of the use of `next`.



Three curves having two common knots; the possible sections which may be selected by pointing at these common knots are: 1) the leftmost spline, which is a line segment since it has only two knots; 2) three knots from the four-knot spline in the middle; 3) the whole five-knot spline on the right.



A closed curve; the possible selected sections are: 1) knot 1 through 7 (i.e. the whole curve); 2) knot 1 through 2.



A closed curve; the possible selected sections are: 1) knot 2 or knot 7; 2) knot 2 through 7, or knot 7 through 2.

The sense of the selected section of the curve (observable by the relative size of the square symbols defining the beginning and end of the section) is important: the designated knots are replaced in that order. There can be ambiguity only when the section contains exactly one knot. Then the order in which the new knots are inserted into the curve is the internal order of the knots of the curve. This order may be found by observing the direction in which the curve is drawn or deleted. Alternatively the problem can be circumvented by always replacing at least two knots.

### 3.6 Summary of mouse switch use:

Top level:

switch 1	curve section (first knot)
switch 2	curve section (last knot)
switch 3	make or replace

Knot input level:

switch 1	knot input
switch 2	knot input (overlap)
switch 3	execute