PC Instructions

ArcDraw was developed as a simple way for amateurs to draw smooth shapes with a computer drawing program. It is not intended to be a stand-alone program. A patent (6,441,822) has been granted that covers the process. The intent is to license the process to companies who will then incorporate it into drawing or paint programs. This demo program, therefore, doesn't have any of the standard drawing features such as flipping, duplicating, snapping to points, snapping to a grid, saving, or printing.

Standard Windows Graphic Device Interface (GDI) routines are used, which give a resolution adequate for a screen display but which would look crude if printed, so printing is not implemented. You can always do a screen dump, perhaps Alt + Print Screen, and use Paint/Edit/Paste to put the picture into that program. By selecting Hide Dots from the ArcDraw menu, you can make the gray dots disappear so the picture looks a little better. Select Show Dots before making changes, so you know where to click.

A maximum of 20 curves can be generated, each with a maximum of 15 anchor points (we'll call them dots). There are two ways to draw a curve in this demo. The program starts in the New Curve mode, which I like best. The cursor is the standard crosshairs shape because we will just make and move points on the screen. The program will do the rest.

For each curve, a direction must be defined at one of the dots before the arcs can be drawn. Within a given curve, two arcs meeting at a dot will always blend smoothly. Any one of the dots in a curve can be used as the reference at which the direction is defined and that reference can be changed at will to another dot.

This program only uses the left mouse button, to make my programming job easier.

The first step in drawing a curve this way is to define two or more dots by clicking with the mouse. Then select Define Direction and click on one of the dots to make it the reference for the direction. The dot enlarges. Now move the mouse so the cursor is about in the direction from the reference dot where you want the curve to be heading, then press and hold down the mouse button. The direction of the curve will be indicated by a line, and the arcs of the curve will appear. Move the mouse around until the direction looks right, and then release the mouse button. The curve will be there, without the direction line. The curve can be changed by adding dots, deleting dots, dragging dots, and changing the defined direction.

One way to get started is to draw the right side of a heart shape using just three dots:

1) Click in the ArcDraw window to make it active, if it isn't.
2) Click the first dot near the center of the window.
3) About TWO inches to the right, click the second dot.
4) Click the last dot about THREE inches below the first dot.
5) In the ArcDraw menu, select Define Direction.
6) Click on the first dot to select it as the direction reference for the curve (the selected dot will enlarge).
7) Move the mouse to a location about ONE inch above the enlarged dot, and slightly to the right of it.
8) Press and HOLD the mouse button.
9) The arcs will be displayed, passing through the dots of the curve, and a line will show the direction of the curve at that dot.
10) With the mouse button down, move the mouse around a little until you're happy with the direction.
11) Release the mouse button.

If you want to change the direction, you don't have to select Define Direction again. The "Do" menu choices stay active until a different "Do" item is selected. The "Undo" menu choices are active for only a single time, then the program reverts back to the previous "Do" choice.

The dots and the direction can be adjusted to make the half-heart look best. In an actual drawing program, the other side could be defined by flipping the curve about the line between the first and the last dot. If you want to put in the other side, you have to choose New Curve and put in three new dots. A curve is always drawn from the first dot to the second dot, and so on.

In all cases the procedure is to select a menu item first, then do the action.

You can use Clear Curve to get rid of any and all curves in the window. Just select Clear Curve, then click on any dot of any existing curve. BE CAREFUL. Clear Curve can't be undone.

When the mouse button is released to define a direction, that direction is locked in until a new direction is defined for that curve or an "Undo" item is selected. The first time a direction is defined for a curve, an "Undo" item won't work because the program wouldn't know how to draw the arcs. You can just redefine the direction at the same dot or another dot on the curve.

After a direction has been defined for a curve, dots can be added, moved (dragged), or deleted. The dot used to define the direction for a curve can't be deleted since the program wouldn't know how to draw the arcs. If you want to get rid of that dot, you have to first define the direction for the curve at a different dot, then delete the offensive dot.

You can define the direction for a curve at any dot. Just pick one that makes it easiest to visualize the shape of the resulting curve. Since the direction line can be dragged all the way around the enlarged reference dot, you get to see all possible curve shapes for that set of dots.

When a dot is dragged, it DOES make a difference which dot is used as the direction reference for the curve, since only the direction at that dot will remain constant. All the other directions can change as a dot is dragged.

When any "Undo" item is selected, the program automatically reverts to the previous menu item.

A dot is selected by clicking on it, usually enlarging the dot. If two or more dots overlap, the program selects the lowest dot (the one defined earliest) of the lowest curve that is located in there. If that isn't the right one, as evidenced by the wrong direction being defined, the wrong dot being dragged, or whatever, just choose Undo Last And Find Hidden Dot and click the same area again. The program selects the next higher dot (the one defined later) that is located in that area. If you use this procedure to step up through the possible dots and you step up too far, you will get a warning that the click wasn't in a dot region. Just select the menu item again.

Whenever a "Do" item is selected from the ArcDraw menu (such as Drag Dot), instead of an "Undo" item, the program reverts to its initial behavior of selecting the lowest dot of the lowest curve in that area.

Dots of a given curve can be put on top of each other and they can be put on top of dots of other curves. If two dots of the same curve are adjacent to each other and placed one over the other, the results get pretty wild. This is the only way to get an arc to NOT blend smoothly with another arc at a dot.

If the first and last dots of a curve are put on top of each other and you try to make the arcs blend smoothly there by adjusting the defined direction, be aware that this will generally only work if there are an even number of dots. If there are an odd number of dots, the last direction will move in the same direction as the first one, so the difference won't change. However, if you do this with exactly three dots, you will get a perfect circle.

Direction changes are well behaved in the sense that a change in any direction causes an equal, but possibly opposite, change in the directions at all the other dots in that curve. This isn't true if DOTS are moved in order to change a direction at a dot. A small change in the location of a dot may cause large changes in the directions of the curve at higher dots.

Since this way of drawing a curve is not familiar, we have included 7 pictures of example curves in the Make Examples Picture submenu. For each curve of each picture, the dots are put on the screen connected by straight lines, one dot is selected as the direction reference, that dot enlarges, and a direction is defined (as indicated by a short line). The straight lines are erased and the arcs are drawn, smoothly connecting the dots in order. In some cases, dots are not quite put on top of an existing dot, to help you see the new dot and its new connecting line.

The second way to draw a smooth curve is the New Sketch Curve mode, which is similar to a standard freehand drawing tool. The cursor looks like a pencil. Press and hold down the mouse button while moving the mouse around. The jagged track of the mouse will show up on the screen. The program uses some of the mouse points and computes an initial direction for the curve from the initial dot. Additional dots are selected approximately every inch, up to the maximum of 15. When the mouse button is released, the program connects each of the dots, in order, with an arc of a circle. The arcs blend together smoothly at each dot, resulting in a smooth curve. As soon as one curve is drawn, the tool is ready to draw another, up to the maximum of 20. The curves can be adjusted as we indicated above. Once a curve is created, it doesn't matter which method was used.