JacqCAD MASTER®

Gradients

Gradients are smooth transitions between two or more colors. For instance you might wish to grade smoothly between two shades of red, or between red and yellow passing through orange as in the butterfly to the above right. In a general purpose painting program such a gradient might involve hundreds of different colors (shades).

However, this general type of gradient is not useful for textile design because of the one to one correspondence between colors and weaves. A gradient which inserted hundreds of in between colors would simply produce an unweavable design. Textile designs require a different approach.

In JacqCAD a **Gradient** is a specific sequence of colors defined by the user. For example you might decide to arrange the colors 23, 92, 12, and 124 into a 4 step gradient.

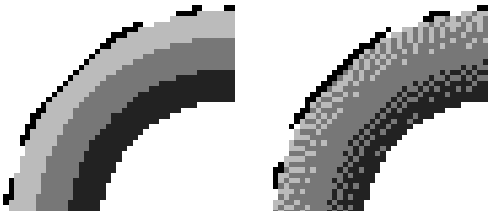
A JacqCAD gradient must contain at least 2 colors; it may contain as many as 256 colors. At any moment you can define as many as 30 different gradients.

Some important characteristics of JacqCAD gradients include:

1) applying a gradient will insert only the specific colors you included in that gradient; for example you could create a 5-step gradient to correspond to a set of 5 shading satins,

2) The gradients may be applied either as bands of solid colors, or they can blended by **dithering** - the intermingling of pixels of two colors to form a third.

   Compare the two gradients to the right, the first is shown as bands of solid color, while in the second the same bands have been blended through dithering.



3) gradients are defined in terms of ***color numbers***, hence cannot always be transported between different palettes. This is unavoidable because a gradient created for a palette that contained, say, 5 shades of red cannot be used in a palette that only contains 3 shades of red.

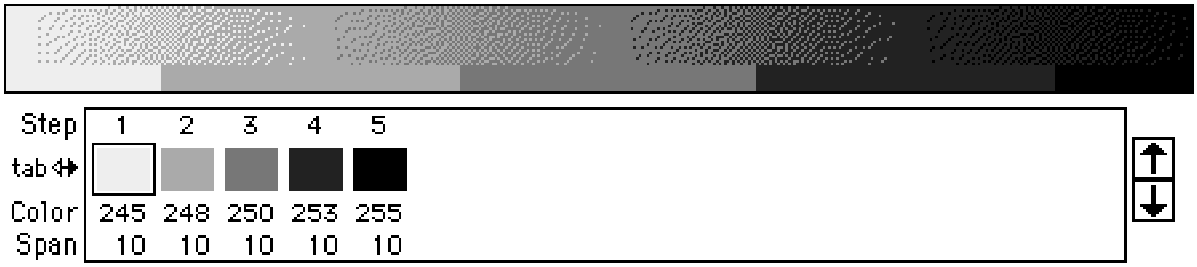
Most of the gradients used in the examples below contain only shades of gray; grays were used so you could print this note on black/white printers. Bear in mind that gradients may contain any sequence of colors.

The following figures show the gradient as it is displayed in the Edit Gradients dialog. The upper strips show the gradient - dithered in the upper 2/3 and undithered in the lower 1/3 of the strip. The lower section shows the colors you selected, their color numbers, and the span assigned to each.

Example 1: a 2-step gradient

Note that this gradient begins at the far left as solid color 246, and ends at the far right as solid color 253. Between these two endpoints intermediate shades are created by a dithering process which intermingles pixels of each of the two colors to produce the desired average value. At the mid-point the dithered gradient uses a 50/50 mix of the two colors to produce the desired mid-gray. For the technically curious, JacqCAD is using a Floyd-Steinberg dithering algorithm.

Example 2: a 5-step gradient:



This gradient is similar to Figure 1 except that it contains 5 colors. Note that the dithering always occurs between the two adjacent colors, for example the first part of the gradient begins with solid color 245, goes through a zone in which 245 and 248 are dithered, and then arrives at a zone of solid color 248. As we move further towards the right we pass through zones of 248/250 then 250/253, and finally 253/255.

Example 3: a 5-step gradient with uneven spans:

This gradient uses the same colors as in Figure 2 but the spans have been made unequal.

The Span value for each color determines the width of that color relative to the other colors in the gradient. Span values can range from 1 to 100 and it is only their relative size which matters; for example, span values of 20,2,2,20,20 would produce the same gradient as 10,1,1,10,10 or 50,5,5,50,50.

To summarize, a Gradient consists of a list of colors and span values for each color.

Up to 30 gradients can be defined at one time.

Applying Gradients:

Gradients are applied to a Selection (outline). They can be applied in three basic ways:

Basic fill gradients : these gradients are only applied within your selection, but are not otherwise affected by the selection. In other words, your selection acts only as a window through which the underlying independent gradient is made visible.

Modelling fill gradients : these gradients are affected by your selection which both shapes the gradient and defines the window in which it will be visible.

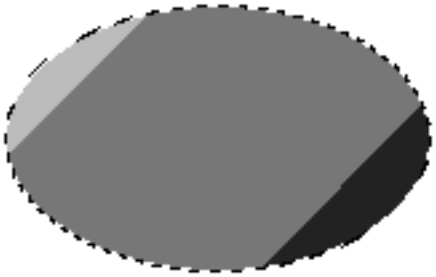
Contour gradients : special gradients which are applied by repeatedly shrinking your selection.

For clarity most of the examples which follow use Solid Bands filling which simply switches abruptly from one color to the next. Dithered filling would blend the transitions through dithering but is otherwise identical.

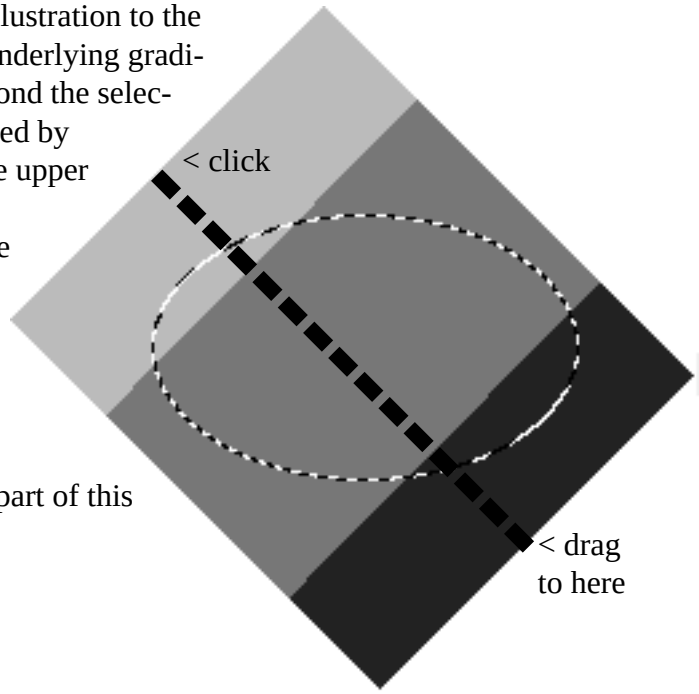
Basic fill gradients: are independent of the selection. There are 2 kinds, Linear and Radial.

Basic Linear Gradients require a Starting Point, a Direction, and a Length. These are specified by clicking on the starting point and dragging to the ending point. The linebetween the two points sets the length and direction of the gradient.

The example below on the left shows a 3 step gradient being applied as a Basic Linear Gradient at an angle of 45° into an oval selection.



The conceptual illustration to the right shows the underlying gradient extended beyond the selection. It was created by clicking along the upper left edge and draggingalong the heavy dotted line to the lower right edge of the gradient. The direction of the dragged line set the gradient's direction while the length of the dragged line sets the gradient's length.

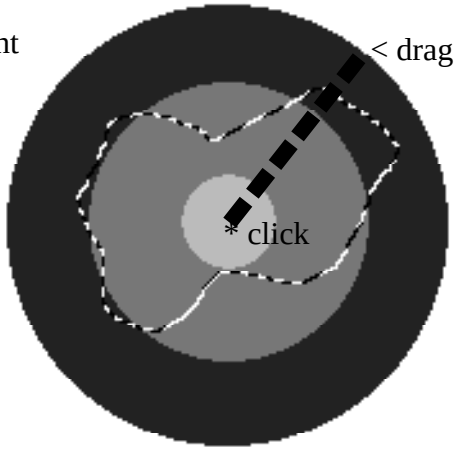


The selection's only role was to determine what part of this underlying gradient would be visible.

Basic Radial : these gradients extend radially from the starting point out to the edge in a bulls-eye pattern which is normally circular but can be set to be elliptical. They are defined by a Starting point, a Length, and a Direction.

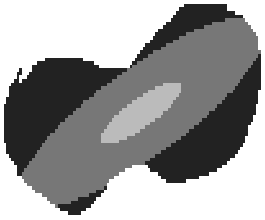
You define a radial gradient by clicking on the desired centerpoint and dragging to the desired edge.

The concept is illustrated to the right where the underlying gradient is shown extended beyond the selection.



The selection's only role is to define which part of the underlying gradient will be visible; it has no affect on the gradient itself.

The Direction matters only if the gradient is elliptical in which case it defines the ellipse's axis as shown to the right.



Modelling fill gradients: are dependent on the selection which both shapes the gradient and determines where it will be visible. There are 3 kinds: **Radial**, **Linear 1 edge**, and **Linear 2 edge**.

Modelling Radial : these gradients are characterized only by a Starting Point. They flow radially outward from a starting point towards the edges of the selection so as to reach the last color at the same time they reach the edge.

Think of the gradient as playing itself out along the spokes from the starting point to the edges. The starting point can be outside the selection; the spokes run from the starting point to the farthest away edge of the selection.

Modelling Linear 1 edge : these gradients are characterized by a Direction and a Length; the actual starting location does not matter. They begin at the first edge of the selection and flow in the chosen direction for the set length (but of course are only visible within the selection).

In the example to the left the gradient was set to fill from left towards right for a distance of about 1/2 inch; only the areas inside the selection (dotted line) that are within that distance from the first edge are affected.

Modelling Linear 2 edge : these gradients are characterized solely by a Direction; they begin at the first edge of the selection and grade so as to reach the last color at the same time it reaches the last edge.

Contour Gradients can be **Full Depth** or **Partial Depth**; they are applied to the entire selection. They fill in from the edges of the selection either until they reach the center (Full, see left) or up to some user specifed depth (Partial, see right).

The contouring is calculated by shrinking the selection step by step; as shown below this can result in the formation of 'islands'.