
Sharpening Images

Written by Jonathan Sachs
Copyright © 1996-1999 Digital Light & Color

How Sharpening Works

Sharpening is one of the most impressive transformations you can apply to an image since it seems to bring out image detail that was not there before. What it actually does, however, is to emphasize edges in the image and make them easier for the eye to pick out -- while the visual effect is to make the image seem sharper, no new details are actually created.

Paradoxically, the first step in sharpening an image is to blur it slightly. Next, the original image and the blurred version are compared one pixel at a time. If a pixel is brighter than the blurred version it is lightened further; if a pixel is darker than the blurred version, it is darkened. The result is to increase the contrast between each pixel and its neighbors. The nature of the sharpening is influenced by the blurring radius used and the extent to which the differences between each pixel and its neighbor are exaggerated.

Sharpening Methods

Picture Window offers three sharpening techniques: Sharpen, Heavy Sharpen, and Unsharp Mask. Sharpen and Heavy Sharpen are the most straightforward methods. They are computed similarly, but Sharpen blurs the pixels in the image based on only its four closest neighbors and exaggerates the differences moderately while Heavy Sharpen blurs by using the eight nearest neighbors and exaggerates the differences more. In either case, you can moderate the effect by setting the Amount slider back from its 100% maximum value. The effects of Sharpen and Heavy Sharpen are illustrated below:



Sharpen

Heavy Sharpen

Oversharpening

If you continue to sharpen an image, several things happen:

1. Edges become unnaturally pronounced—dark objects are outlined with light halos and light objects are outlined with dark halos.
2. Normally invisible noise in the image is amplified and starts to show up as texture in areas that looked smooth in the original images. This can create an undesirable graininess in parts of photographs that should be smooth like clouds and skies.
3. Extreme sharpening causes the image to break up as each individual pixel stands out more and more from its neighbors.

Thus as you progressively sharpen a slightly blurry image, it first starts to look better, but then as you begin to oversharpen it, it starts to look worse again. Once you know what oversharpening looks like, you will be able to spot it on the screen and back off a little.



Heavy Sharpen Twice



Heavy Sharpen Three Times

Using the Sharpen transformation

The best way to set up Picture Window's Sharpen Transformation is to zoom the input image in to a magnification factor of 1:1 or even 2:1 and then zoom the Preview window in to the same magnification factor and scroll the two windows as necessary to display the same part of the image. Resize and reposition the two windows so they are next to each other across the top of the screen. This lets you see every detail at the individual pixel level in both the original image and the sharpened version. As you preview the results of various settings, you will then be able to compare the original and sharpened versions easily. If necessary, you can scroll both windows to see the effect of the transformation on other parts of the image.

For slightly blurred images, the Sharpen or Heavy Sharpen options often work well. If the effect is too strong, you can always move the Amount slider to the left to reduce the amount of sharpening. If you want to sharpen just part of an image, leaving the rest alone, you will need to create a mask that isolates the region of interest and then select this mask into the Amount control. Making and using masks is covered in the Picture Window manual and help file.

Unsharp Masking

Unsharp masking is the most powerful sharpening method Picture Window supports, however it is a little more complicated to use. When you select Unsharp Masking, the Sharpen dialog box expands to add two additional sliders for Radius and Threshold.

The Radius slider lets you control the amount of blurring. Generally you should set the radius to correspond to the degree to which the original image is blurred. The blurrier the image, the higher the radius you need to select. Choosing too large a radius creates a sort of ghosting effect around the edges of objects; if the radius is too small, the sharpening effect is minimized.

The Threshold setting lets you restrict to sharpening action to only those pixels whose difference from their neighbors exceeds a specified threshold value. The idea behind setting the threshold value is to select a value that still brings out edge detail without creating unwanted texture in smooth areas like clouds or clear blue skies. In the image detail below, you can see how Unsharp Mask with a threshold of zero sharpens the tree silhouette, but also brings out the film grain and scanning noise in the sky area. Increasing the threshold to 20 leaves the sky mostly untouched but still makes the tree stand out against its background.



Unsharp Mask -- Threshold 0

Unsharp Mask -- Threshold 20

Note: this example has been deliberately oversharpened to emphasize the effects of the threshold setting.