

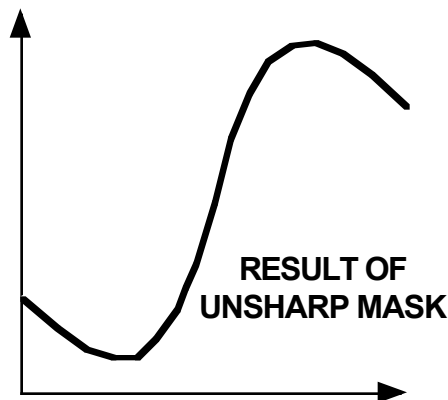
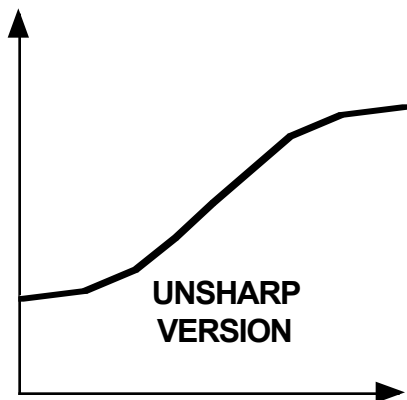
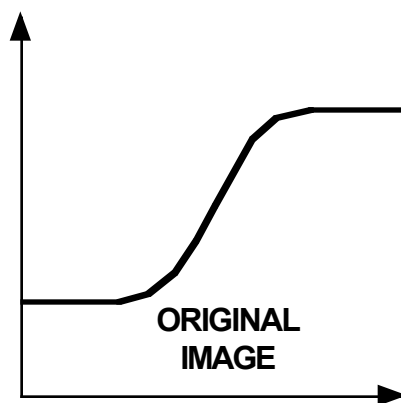
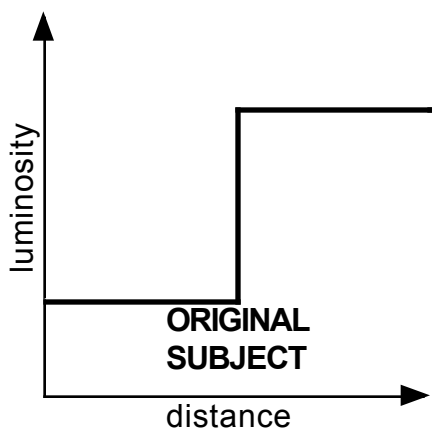
Digital Imaging Study Group July 17, 2004
Advanced Sharpening Techniques
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(see also "Notes on Sharpening" by David Warren, 5/16/02, DISG lesson 2002-8)

Review of sharpening basics

No sharpening technique can restore details that were lost when the original blurry image was captured, but they can make the details that are there much more visible, and create the illusion of sharper focus. In other words, you can't get blood out of a turnip, but sometimes you can make the turnip juice more palatable!

The workhouse tool for sharpening is Unsharp Mask, which is a digital version of an old wet darkroom trick. It works by first creating an even blurrier ("unsharp") version of your image. Then it looks at the difference between this "unsharp" version and the original. Finally it subtracts ("masks") this difference (or some multiple of this difference) from the original. The result is something like shown below. The contrast at the edge is increased, but fringe artifacts can be created on each side of the edge.



In Photoshop, there are three parameters you can control in Unsharp Mask. “Amount” ranges from 1% to 500%, and is the multiple of the difference between the “unsharp” and original versions which is to be subtracted from the image. “Radius” ranges from 0.1 to 250 pixels, and is the distance over which the “unsharp” blurring takes place. “Threshold” ranges from 0 to 255, and is the difference in light levels between nearby pixels, below which no sharpening is to be applied. Use of a threshold avoids accentuating small variations in relatively smooth portions of an image.

According to Ken Hales’ notes from the Epson Print Academy CD, they recommend the following:

- view the image at 100% magnification (key: control+alt+0)
- Set Amount to max (500%)
- For 1 - 5 MB image, set Radius=1 pixel and Threshold between 5 and 10 levels
- For >5 MB image, set Radius=2 pixels and Threshold between 10 and 15 levels
- Reduce Amount until it looks right (perhaps around 250%)

Adobe Help suggests, for “high resolution” images, Amount between 150% and 200%, Radius between 1 and 2 pixels, and Threshold between 2 and 20 levels. I have personally often used Amount between 100 and 150%, Radius between 2 and 3 pixels, and Threshold between 8 and 32 levels. I have also often found it helpful to Select and apply Unsharp Mask to only certain parts of an image.

Advanced Sharpening

David Warren made a list of the various sharpening methods suggested in various sources. They include:

- Plain old Unsharp Mask
- Sharpen only selected color channels (usually NOT Blue)
- Sharpen in multiple small increments (apply Unsharp Mask multiple times with small values for Amount)
 - Sharpen a duplicate layer, add a layer mask, and paint on the layer mask to reveal only those areas of the image where you want sharpening to apply.
 - The Edge Mask technique that David taught in May of 2002, along with some other options
 - A Dark/Light method which David reports gives him good results. One creates a duplicate layer, sharpens it aggressively, and sets the blending mode to Darken. Then one duplicates that layer, sets the blending mode to Lighten, and reduces the opacity until the results are acceptable. This allows sharpening to darken the image, but weakens its ability to lighten it, on the theory that dark artifacts are more acceptable than bright ones.
 - Lab mode, discussed below, along with a similar alternative using the Luminosity Blending Mode
 - High-Pass/Soft Light, discussed later
 - Special proprietary sharpening software, such as Nik Sharpener Pro (see: <http://www.outbackphoto.com/reviews/tools/20001116NikSharpenerPro.html>)

With all these choices, what is one to do? Based on limited experience and reading, I would suggest this: For a sharp original in need of only minor tweaking, almost any of the methods will do. Unsharp Mask is the simplest, but Lab Mode, Luminosity, Dark/Light, or High-Pass/Soft Light might be a little better, especially if colored or bright artifacts are a problem. For a somewhat blurry image that you are intent on trying to salvage anyway, High-Pass/Soft Light followed by Unsharp Mask of the resulting Lightness channel might be worth a try. But each of you can try them all and see for yourself! I expect there are certain images where each method shines.

Lab Mode

ref: Stephen Dow, "My Digital Darkroom" , *Exploring Digital Photography*, June 2003, www.elementkjournals.com.

Also Dan Margulis: <http://www.ledet.com/margulis/LABCorrection.pdf>

Sharpening can create unpleasant color fringing and colored "confetti" noise in an image. Adobe Help and Dow (see reference above) both suggest minimizing this problem by converting to Lab Color Mode and sharpening only the L channel. This applies the sharpening to the luminosity, but not the color, information. With this technique, most images can tolerate more sharpening (higher Amount and Radius, lower Threshold) before the artifacts become objectionable.

The specific steps are:

- Convert to Lab (Image>Mode>Lab Color)
- Select the Lightness Channel in the Channels Palette
- Apply Unsharp Mask (Filter>Sharpen>Unsharp Mask)
- Convert back to RGB if desired (Image>Mode>RGB Color)

In general, you should be cautious about converting between different color spaces, because you can lose information and limit the gamut of colors to the smallest subset of all the color spaces you go through. But you can convert from the current working space (such as Adobe RGB) to Lab and back to that same working space without loss.

You should also careful about converting multilayer images between color modes. In general, adjustment layers are lost. Semitransparent layers and layers with blending mode other than "normal" may not blend in the same way in different modes. To avoid these problems, it may be best to make a copy of only the basic image layer, convert it to Lab, sharpen, convert back, and then put it back into the multilayer image replacing the original background. The specific steps are:

- Make a copy of your image with a different name by File>Save As...
- Delete all layers except the Background
- Use the sharpening method described above (or the one below)
- Open the original image
- Use the Move Tool to drag the sharpened layer into the original image
- Choose View>Snap To>Document Bounds
- Use the Move Tool to properly align the layer you just moved
- In the Layers Palette, drag the new layer down next to the old Background
- Delete the old Background layer

If all this is too much trouble, you can achieve a similar effect in RGB mode by duplicating the layer to be sharpened, sharpening the duplicate, then setting the blending mode of the sharpened layer to Luminosity. This gives the luminosity of the sharpened layer with the color of the original.

High Pass Filter/Soft Light

Dow describes an alternative sharpening technique which can be used instead of, or in addition to, Unsharp Mask (if doing both, he recommends doing Unsharp Mask last). He says that this alternative is useful for rescuing some seriously fuzzy images which may be beyond help from Unsharp Mask alone. Based on a few experiments, it helps, but certainly doesn't make a blurry image really sharp. On a reasonably sharp original, it's not a bad alternative, especially if followed by Unsharp Mask on the resulting L channel. Even with a fairly large value for Radius, it seems to produce a more subtle effect than many of the previous alternatives.

The basic idea is to create a new semitransparent layer through which to view the original image. This new layer is a copy of the original image, with its color removed, and operated on by the High Pass Filter, which emphasizes the edges. And the new layer uses the Soft Light Blending Mode to make it semitransparent in a magical sort of way. The result is a new layer which acts on the original to sharpen it.

The specifics are:

- Convert to Lab (Image>Mode>Lab Color).
- Duplicate the Background Layer (Layer>Duplicate Layer). You will now be working on this new layer.
- Select only the Lightness Channel in the Channels Palette.
- Apply the High Pass Filter (Filter>Other>High Pass). This filter has a Radius parameter which can be set between 0.1 and 250 pixels. Dow gives an example with Radius set to 8, but one would probably want to experiment with various settings. The more blurry the original, the bigger radius you will need to fix it.
- Select the composite Lab Channel on the Channels Palette. This makes all three channels active.
- Desaturate the Layer (Image>Adjust>Desaturate) to remove all color from the new layer.
- Change the Blending Mode to Soft Light (in the Layers Palette). You can now see through the new layer to the original Background Layer, but the new layer operates to increase apparent sharpness.
- Optionally, you can now apply Unsharp Mask to the new layer, or to only its Lightness channel, for further sharpening.
- Dow doesn't mention this, but you can also adjust the Opacity of the new layer to control the degree of sharpening.
- When you are satisfied with the result, merge the layers (Layer>Merge Down) and convert back to RGB (Image>Mode>RGB Color). (You could convert back without merging, but the result will not look quite the same, since the blending will operate a little differently in RGB.)