Precise Gaussian Blur Transformation Notes

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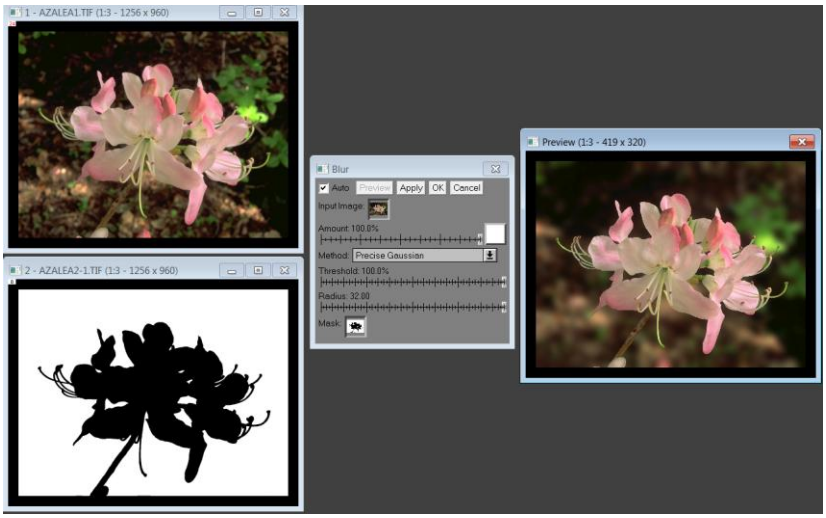
The Precise Gaussian and Precise Gaussian Blur - Chroma Only options on the Blur transformation are refinements of Gaussian blur that allow for more accuracy and control at the expense of slower performance.

The normal Gaussian blur is very fast for two reasons. First it does not perform a true Gaussian blur -- instead it computes an approximation by performing two passes of a so-called box filter. Box filters have the huge advantage that they take about the same amount of time to apply regardless of the blur radius, while most other kinds of blur take a time proportional to the square of the radius. The second reason is that blurring is done in two passes -- first each row of the image is blurred horizontally and then each column is blurred vertically. The two one-dimensional blurring passes are significantly faster than a single two-dimensional pass.

Precise Gaussian blur performs a true convolution with a two-dimensional Gaussian kernal, with the added feature that masked-out pixels and pixels that exceed the threshold setting in the input image are excluded from the blurring operation -- something that cannot be incorporated into the regular Gaussian blur. Another advantage is that fractional radius values can be used to allow fine tuning of the blurring effect. The big disadvantage of Precise Gaussian blur is that it is much slower than regular Gaussian blur -- especially when the radius gets large. Because of this, the maximum blur radius is currently restricted to 32 when Precise Gaussian or Precise Gaussian - Chroma Only are selected.

Using Precise Gaussian



Mask

When you select Precise Gaussian or Precise Gaussian - Chroma Only, an additional Mask control is displayed at the bottom of the dialog box. This is where you select what parts of the image to blur and what parts to leave alone. Note that the part you want to blur must be white and the part you want to leave alone must be black as illustrated above. This mask is used a little differently from the mask in the Amount control. The Amount mask acts as if the entire image was blurred and then selectively blends the blurred image with the input image. The difference shows up when you set the amount to somewhere between 0% and 100% in which case the output image looks like a double exposure of a blurred and a sharp image -- an effect something like a fog filter. The Precise Gaussian mask just controls the amount of blurring so values between 0% and 100% are partially blurred and there is no fog filter effect. If no Precise Gaussian mask image is selected, the entire input image is blurred uniformly at 100% -- regardless of the gray level selected for the mask color, however the Amount control can still be used to selectively blend the input image with the blurred image.

Radius

The Radius slider works exactly the same as for Gaussian blur. Larger radius values produce more blurring, although the same radius value produces less blurring with Precise Gaussian than with Gaussian.

Threshold

The Threshold slider works a little differently from Gaussian blur. When the threshold is set at 100%, everything is blurred (subject to the mask). At lower values, those pixels that differ from the pixel being blurred by more than the threshold do not contribute to the blurring process. This preserves edges and other abrupt transitions while blurring smooth areas. By contrast, the regular Gaussian blur compares the fully blurred image to the input image and based on the threshold, either the blurred or the original pixel is passed through to the output image. This means that pixels rejected by the threshold test can still bleed into the blurred image and create halos.

Precise Gaussian Examples

If you are blurring an entire image with no mask or threshold, the visual difference between blurring with Precise Gaussian and regular Gaussian is insignificant and there is no real advantage in using Precise Gaussian. There are however situations in which you can use Precise Gaussian to your advantage.

Blurring the background behind an object

One real advantage of Precise Gaussian comes into play when blurring the background behind a foreground object. This requires that you have created a mask that isolates the object from its background. The mask must be white in the background areas (the part to be blurred) and black in the foreground areas (which will remain sharp). If you blur the background using the regular Gaussian blur, colors from the foreground object bleed into the background and can create a halo around the foreground object where its color differs from the background. Using Precise Gaussian eliminates the halo giving a far more realistic look.

Precise Gaussian also allows for fractional radius values which gives you finer control over the degree of blurring, although for the same radius it blurs somewhat less than Gaussian.

Example:

Input image

Mask

Gaussian

Precise Gaussian

Reducing chroma noise

Because pixels that exceed the blur threshold (as specified by the Threshold slider) are excluded from the blurring process, the Precise Gaussian blur actually implements a bilateral blur - the same technique used in bilateral sharpening. This is a form of blurring that preserves edges and is useful for removing certain kinds of image noise.

By selecting the Precise Gaussian - Chroma Only option, you can reduce chroma noise in an image without making it significantly softer. Chroma noise is a sort of speckled color noise that most digital camera sensors produce, especially in high ISO images, in dark areas or in areas of very smoothly varying color and brightness.

Here are some examples:

Original

Precise Gaussian
Radius 8.0, Threshold 100%

Precise Gaussian
Radius 8.0, Threshold 5.9%

Precise Gaussian - Chroma Only
Radius 8.0, Threshold 5.9%

If you look closely at the area in the lower left corner of the image you can see that much of the chroma noise in the original is eliminated in the final image.