Extending the Dynamic Range of Film

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Introduction

Limited dynamic range is a common problem, especially with today's fine-grained slide films. When photographing contrasty subjects, this can make for difficult exposure choices that trade off loss of highlight detail and saturation against loss of shadow detail.

One way to address this situation using digital imaging is to take multiple photographs of the same subject with bracketed exposure settings, register them, and then combine the correctly exposed highlights from one with the correctly exposed shadow areas from the other. Of course, this method only works with stationary subjects as the images cannot otherwise easily be combined.

Step 1 -- Open the images

Assuming you have taken the necessary photographs and scanned them, first open both images.

One stop underexposed

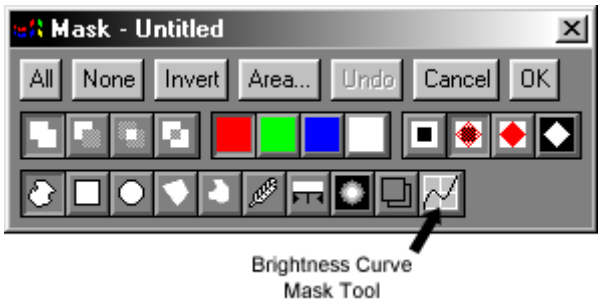
One stop overexposed

Note that the underexposed image on the left has a nicely saturated sky but no shadow detail whatsoever while the overexposed image on the right has better shadow detail but the sky is washed out and the grass is too yellow. Our goal is to create a composite image with the best parts of both images.

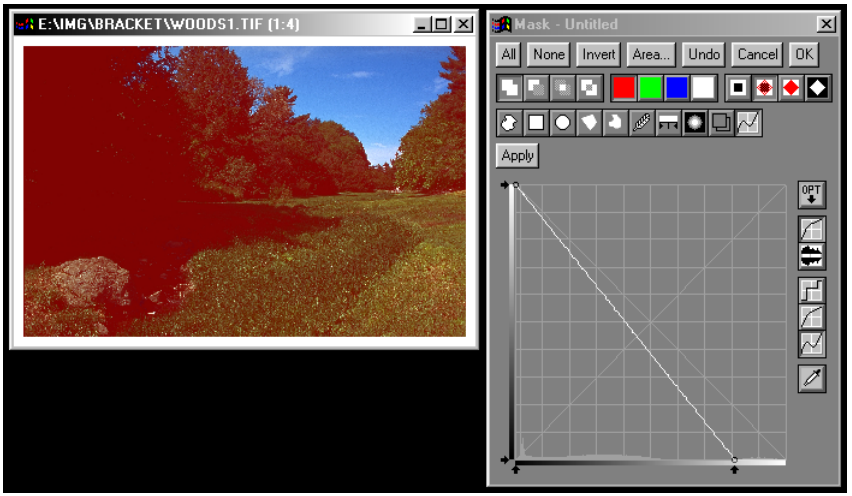
Step 2 -- Creating a Density Mask

Although we could just as easily choose the other image, let's assume that the base image will be the underexposed version and that we want to overlay the overexposed image onto the base image, but just in the shadow areas. To restrict the compositing to just the shadow areas, we will first create a mask for the base image that covers the deepest shadows completely, partially covers the midtones, and is totally transparent in the highlight areas. A mask that varies with the brightness of the underlying image is sometimes called a *density mask* and can easily be created using Picture Window's Mask tool.

First, click on the window containing the underexposed image to select it and then click on the Mask icon on the tool bar or execute the Mask/New command from the main menu. This will pop up the Mask dialog box:



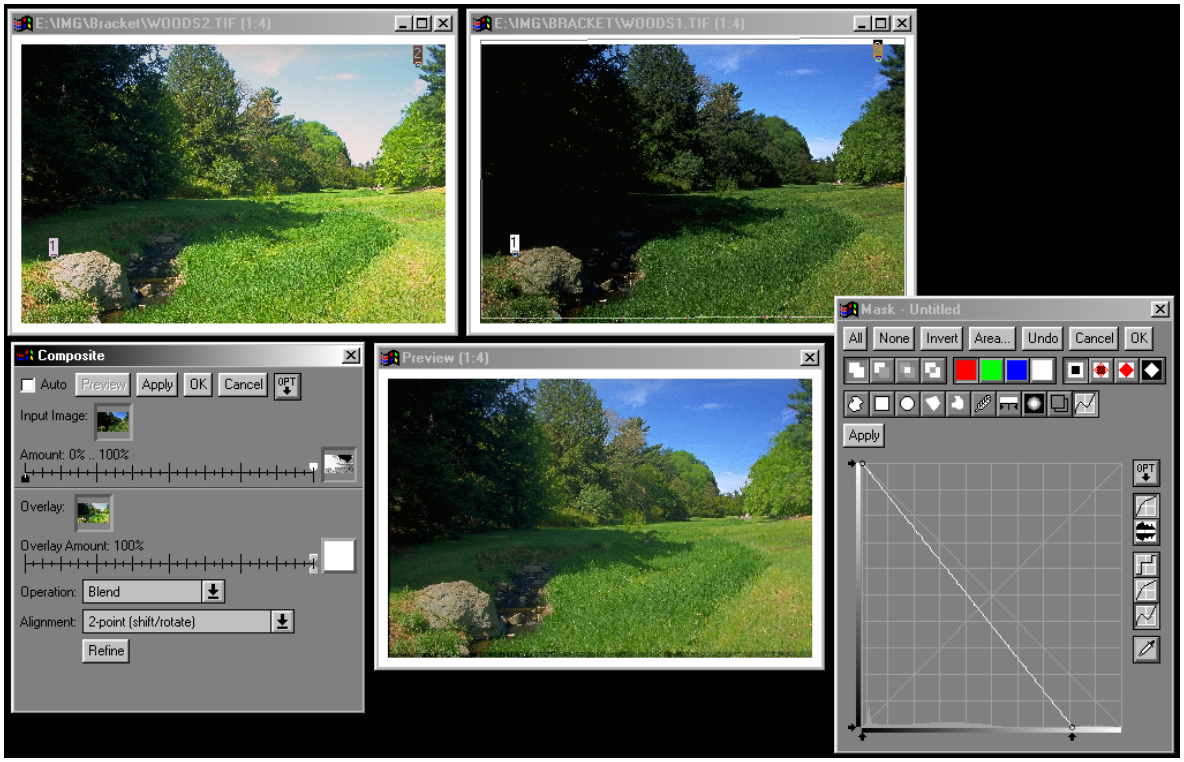
Next, click the Brightness Curve button on the mask tool bar (see above) to activate the brightness curve controls. To make a mask that is full intensity in the shadows and transparent in the highlights requires a curve like the one below:



Leave the mask in place on the underexposed image for now (i.e. don't click the OK button in the Mask dialog box), but click the Clear Mask Overlay button (the leftmost of the group of four buttons just below the OK button) to hide the mask.

Step 3 -- Creating the Composite Image

The final step is to use the Composite transformation to register and combine the two images using the mask you just created. First click on the base (underexposed) image window to select it and then select the Transformation/Composite transformation from the main menu. This brings up the Composite dialog box with the underexposed image as the Input image and, if you left the mask applied to the base image, the mask should be selected in the Amount control). Next, click on the



Overlay control and select the overlay (overexposed) image. If you click Preview at this point, the two images will be combined but, unless they were perfectly registered to begin with, they will not line up properly.

To align the images, in the Alignment control select *2-point (shift/rotate)*. This assumes that the two images were taken from exactly the same spot and all you need to do to get them to line up is shift and/or rotate the overlay image. All that is left to do now is to position the alignment points that are displayed overlayed on the

base and overlay image windows. For the most accurate registration, try to locate the same features in each image that can be marked precisely and which are as far apart as possible (e.g. in diagonally opposite corners).

The alignment points are initially displayed in the lower left and lower right corners of the base and overlay image windows. Start by dragging them to the approximate locations of distinctive features in each image. In the example above, I chose the tip of a branch and a bright spot on the grass just above the rock in the foreground. Next, zoom in on each image to at least 1:1 and refine the locations of the alignment points. As a timesaver, you can press the "1" or the "2" key to recenter each window on the corresponding alignment point. Finally, for the greatest precision, click the Refine button at the bottom of the Composite dialog box and Picture Window will jiggle the alignment points to subpixel accuracy to obtain the best possible match between the two images.

Once the alignment points are set, click Preview to check the results. At this point you can fine tune the composite image in a several ways:

- You can vary the curve selected in the Mask dialog box. This will alter the relative weighting of the two images in the different parts of the tonal range. Remember to click the None button and then the Apply button in the Mask dialog box each time you make a change to clear out the previous mask and create a new mask based on the modified curve.
- You can adjust the white and black sliders in the Amount control. These can be used to tone down the effect in the shadow or highlight areas.
- If the two images do not line up perfectly using 2-point shift/rotate alignment, you may need to use more alignment points. Complex registration problems can arise from scanner nonlinearities, film curvature, lens distortion and so on. Many simple cases can be handled using 3- or 4-point alignment, but you can use 60 or more alignment points if necessary (multipoint alignment is in Picture Window Pro only). To check how well the two images match, change the Operation control to *Absolute Difference* and click Preview. This will display the difference between the two images. Since the two exposures are different, the difference will never go to zero (all black), but if the alignment is off in part of the image, this will show up as brighter areas with double edges. When the alignment is done, don't forget to switch the Operation control back to *Blend*.

Clicking the *Auto* check box next to the Preview button will let you see the results of each change as soon as you make it.

When you are satisfied with the result, click OK to create the final composite. As a last step, you will probably want to crop the image slightly to remove the area around the edge where the images did not overlap.

In this final image, the deep blue sky from the underexposed original image has been retained while the grass in the deep shadows above the foreground rock incorporates all the detail from the overexposed original.

If you are using a digital camera on a tripod to capture the over- and under-exposed images, you will not have to worry about registering the two images. In this case you may find it more convenient to use the Stack Images transformation (Picture Window Pro 3.5 or later only) which is simlar to Composite in that it lets you combine multiple images using density masks.