



Noise Reduction

Noise Reduction

In this lesson, we're going to cover noise reduction in Lightroom, Adobe Camera Raw (ACR) and Photoshop. Before we get into the software, however, we'll talk about why we get noise in our images and what can we do to reduce noise in our captures.

What causes noise?

- Interfering electronic signals in your camera
(makes noise prominent in dark areas)
- High ISO settings
(brightens dark areas, making the noise more apparent)
- Heat from long exposures or hot climates
(the sensor misinterprets heat energy as light energy)
- Underexposure
(pushes usable image into the darker tones where the noise is more prominent)

Avoiding noise problems

- Only use high ISO settings when it's essential (ex: When the scene is really dark, or when there is really fast action that you need to freeze)
- Prevent underexposure: Shoot to the right... but not too far. When we say "shoot to the right," it means that we're trying to get the histogram as far to the right as possible without blowing out the highlights. This means that we'll be pushing the image into the brighter and brighter area of what you would capture in order to try and get it out of the dark part (where the noise is hiding). I am personally not a huge fan of "shooting to the right" because there is a high risk

that you'll blow out the highlights, making the image potentially unusable.

- Shoot with a larger sensor camera (larger light-gathering sites)
- Shoot with a lower resolution camera (larger light-gathering sites)
- Keep the camera cool when in hot climates (but not so cold that the lens fogs up when you go outside)
- Shoot HDR
- Wait to apply noise reduction until after you've brightened your image.
- Perform noise reduction before doing any masking in Photoshop
- Shoot raw instead of jpeg (jpeg files are pre-processed in-camera)

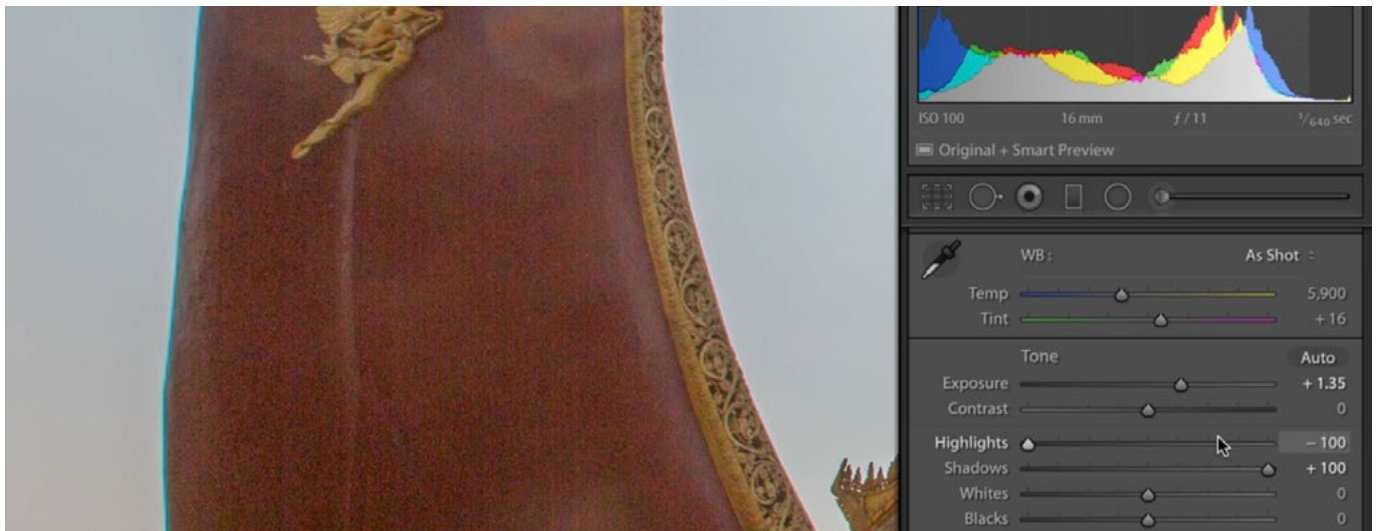
Going beyond Photoshop/Lightroom/ACR

In this lesson, we're going to cover noise reduction in Photoshop, Lightroom and Camera Raw, but there may be instances when you need to go beyond that. If this is the case, you can try the following:

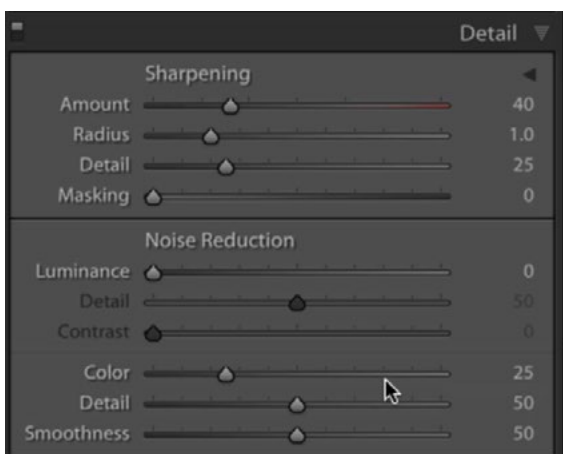
- Single function plug-ins always have more control
 - Nik DFine
 - Topaz DeNoise
 - Imagenomic Noiseware
- Automate noise reduction in Lightroom
 - Jeffrey Friedl's Bulk Develop Settings plug-in

Noise Reduction in Lightroom

Noise tends to lurk in the darker parts of your image, so you will tend to find it any time you brighten the picture. In the video example image, the dark areas were so dark they were close to black. To lighten those areas, we used the settings under the Basic tab on the right side of the Develop Module. We moved the Shadows slider all the way up and we moved the Exposure slider up as well. This made the noise in those dark areas very prominent.

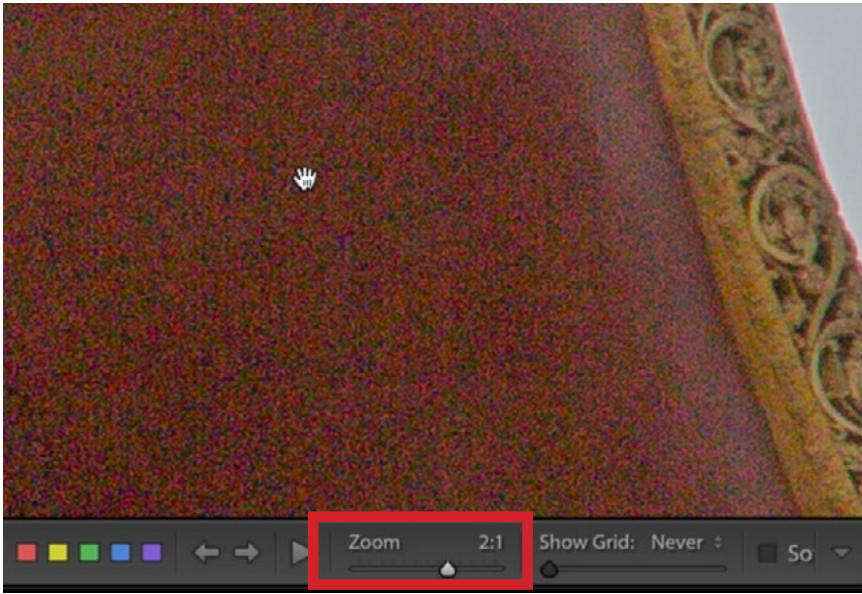


This part of the image was originally very dark (almost black). It was lightened by moving the Shadows slider all the way up and moving the Exposure slider up as well. When the shadows were brightened like this, it make all of the noise much more prominent.



In Lightroom, the Noise Reduction settings are found in the Detail tab.

In Lightroom, the noise reduction settings can be found under the Detail tab on the right side of the Develop Module. If you're working with a raw file, Lightroom automatically applies some color noise reduction. You can see that the Color slider is set to 25 and not 0. If you'd like to see what your camera actually captured, without any noise reduction applied, drag this slider all the way to the left.



When applying noise reduction, it's best to zoom in on the image and you can do that using the Zoom slider below the image window.

There are two kinds of noise in an image: color and luminance. Color noise is where the color is varying in a way that it shouldn't. Luminance noise deals with variations in brightness. We'll work on the color noise first. When applying noise reduction, it's best to zoom in on your image so you're getting a close-up view of one of the noisy areas. I like to zoom in to the 2:1 view.

Color Noise If you see little specks of color when viewing the zoomed-in area, you'll want to work with the Color slider located under the Noise Reduction category in the Detail tab. The higher you move this slider, the more aggressively Lightroom will try to eliminate those tiny specks of color. Move the slider to the right until you no longer see the tiny specks of color. If you only see larger blobs of color, do not continue moving the Color slider. I find that I rarely need to go above 25-30 here and because the Color slider is set to 25 by default, it's not common that I need to even move this slider.

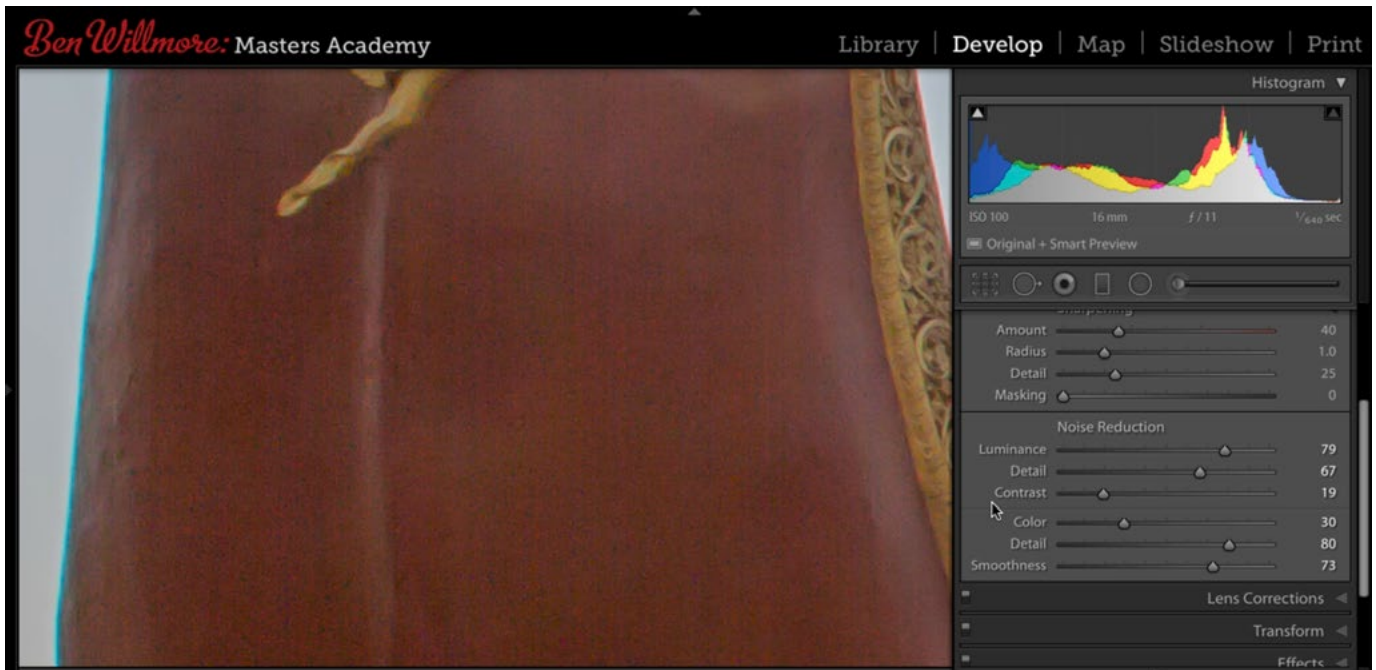
There is one instance where using an increased Color setting can mess you up a bit. This would be an image that contains an area of fine color details, like an ornate, colorful carpet or some beadwork that contains many colored beads together in a pattern or design. If you have an image that contains something like this, zoom in on that area and make sure that the colors aren't blending into each other. If they ARE blending into each other, you might need to move the Color slider down. After moving the Color slider down in order to get the detailed col-

or separation looking good, you might still have some color noise in the image. If that's the case, move the Color slider high enough to get rid of the little colored noise specks in the image. Then take to the Detail slider (directly below the Color slider) and move it as high as it goes. You'll likely see the color noise specks show up in the image again. Then start to move it down, trying to find the highest setting that is still effective in removing the noise specks. The higher this setting is, the more detail will show up in the picture.

If you look at the zoomed-in view of your image and see blobs of color (instead of tiny specks), you can use the Smoothness slider to try and eliminate or minimize them. Move the slider to the right just until they get to the point where it doesn't look objectionable.

Luminance Noise When the little specks of noise are made up of variations in brightness (instead of color), you're looking at Luminance noise. The top three sliders under the Noise Reduction section inside the Detail tab are designed to deal with this kind of noise. The Luminance slider will try to get rid of those tiny variations in brightness. The farther you move the slider to the right, the more noise reduction it will attempt to do. After moving the Luminance slider a bit, give Lightroom (or ACR) a moment to update the image. There is sometimes a lag between the slider moving and the noise reduction becoming visible in the image window, so if you quickly move the slider even more to the right (without waiting for it to update), you might end up with more noise reduction than you actually want.

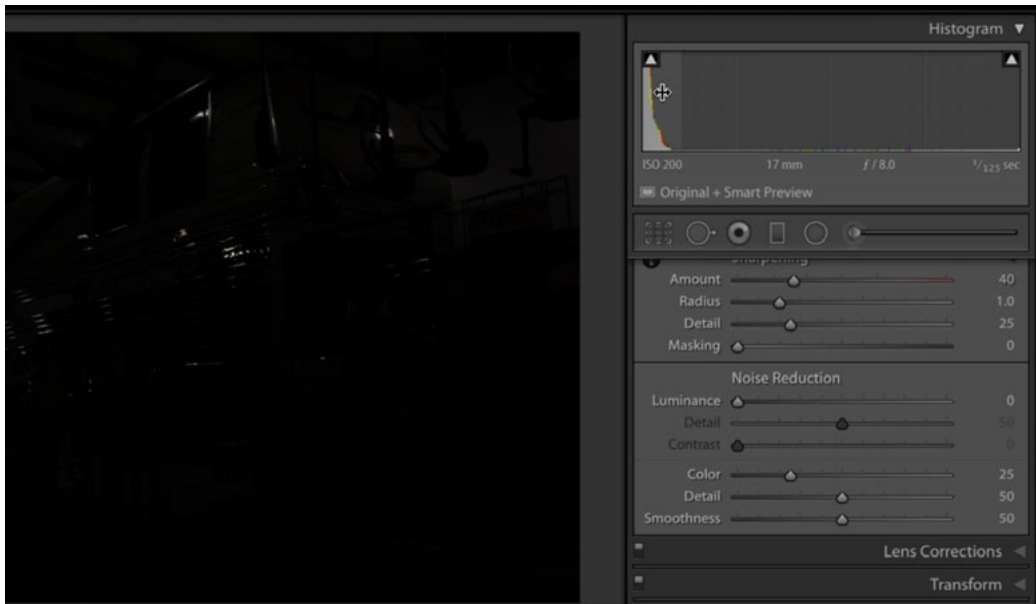
It's important to understand that the software does not know the difference between noise and fine detail, so the only way it's able to reduce noise is by softening the picture. Because of this, we only want to reduce the noise, not eliminate it. Eliminating the noise completely will also eliminate some of the fine details in the image, and personally, the fine details are more important to me than the lack of noise. I will generally use the lowest setting (on the Luminance slider) that reduces the noise enough so that it is no longer distracting.



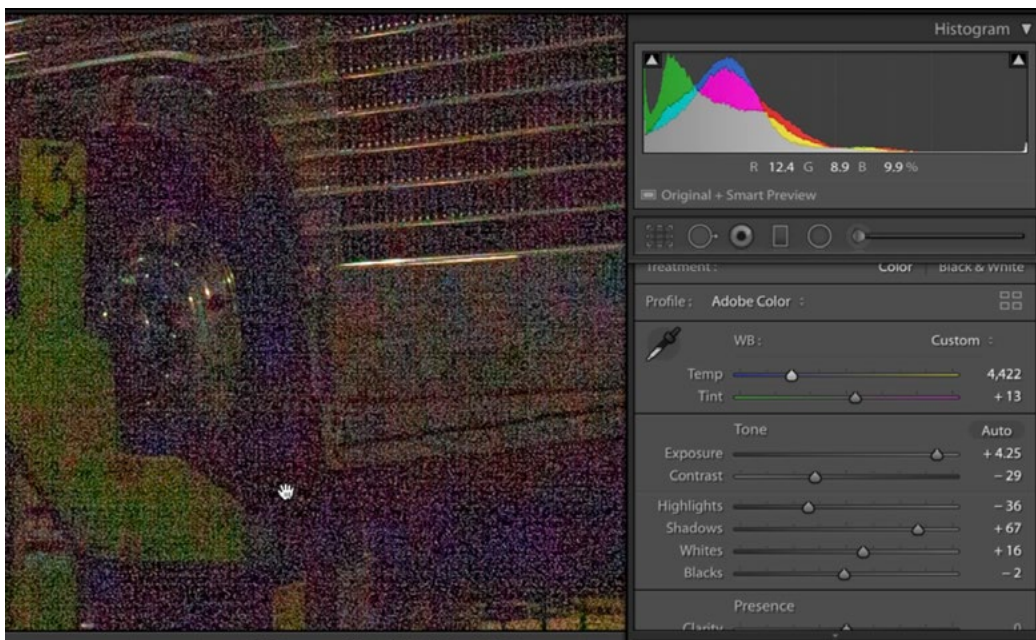
The shadows in this image were lightened significantly, exposing a large amount of noise. To reduce the noise, the Luminance slider was moved far to the right and the Detail and Contrast sliders were moved up in an attempt to recover some of the detail lost due to the softening of the image. The image also contained color noise, so the Color slider was increased as well.

The Detail and Contrast sliders will not be available unless the Luminance slider has been moved away from zero. The Detail slider will attempt to recover some of the detail lost by moving the Luminance slider, but moving it too far will end up bringing the noise back. I try to find the highest setting where the noise reduction is still helpful. The Contrast slider is for images that have undergone extreme noise reduction, to the point where some of the detailed areas have lost some tonality. Moving the slider up will attempt to recover that tonality and contrast. Again, this slider doesn't know the difference between noise and fine details, so if you bring this slider up too far, you run the risk of exaggerating the noise. If you have an image like this, try to find the highest Contrast setting that doesn't make the noise become exaggerated. Note that with some images, you won't see any change at all with this slider. It's mainly designed for images where the Luminance slider has been moved VERY far.

The histogram When looking at the Histogram for an image, know that the most noise is going to be found in the far left side of the histogram chart. With the histogram in Lightroom, you can move your cursor over the histogram and different areas will be come highlighted. These highlighted areas represent the different tonal ranges in the image. The left side of the histogram contains the shadows and the blacks, and this is where most of the noise is. In the dark video example image, most of the histogram bars are located on the far left side, which means that most of the image is dark and is going to have a lot of noise.

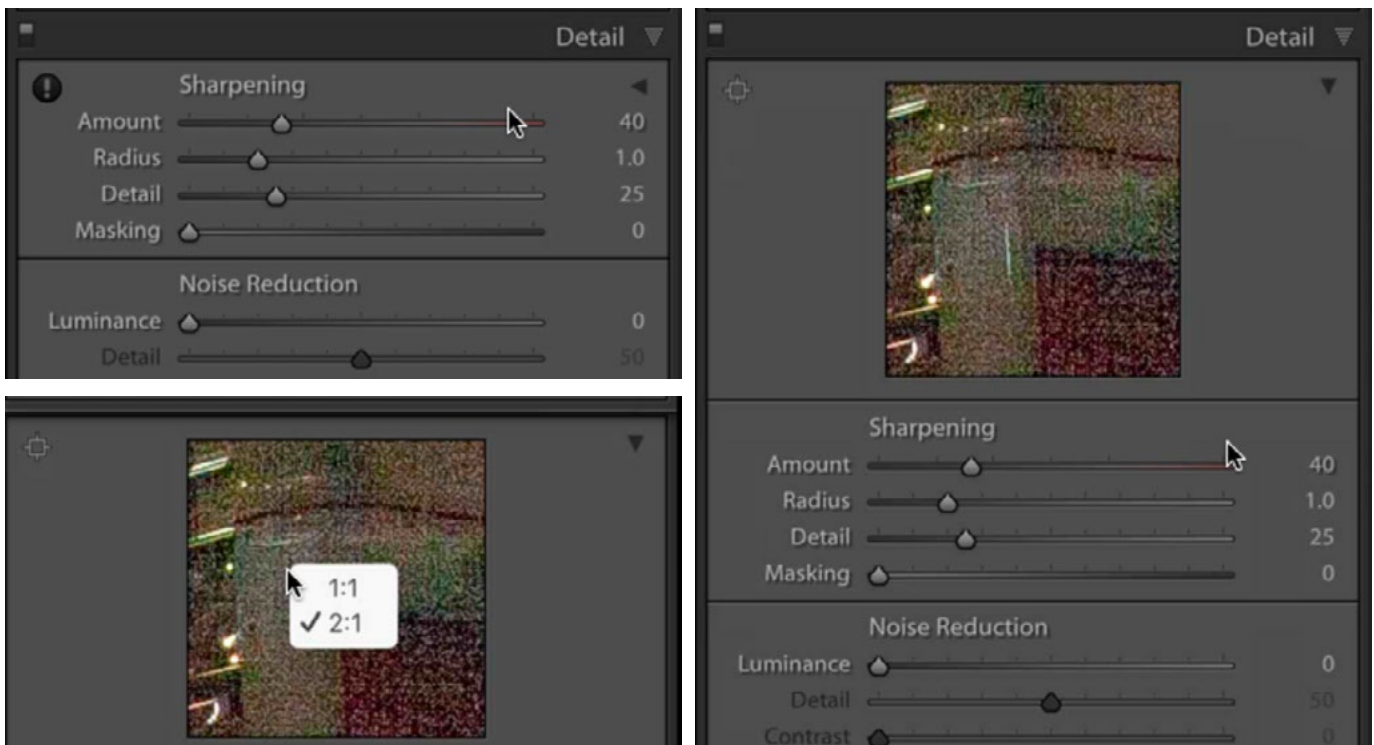


The noise in an image is mostly contained on the left side of the histogram, which is the side that represents the dark areas. This image is so dark that nearly all of the histogram bars are located on the left side. Knowing this, we can assume that brightening the image will reveal a lot of noise.



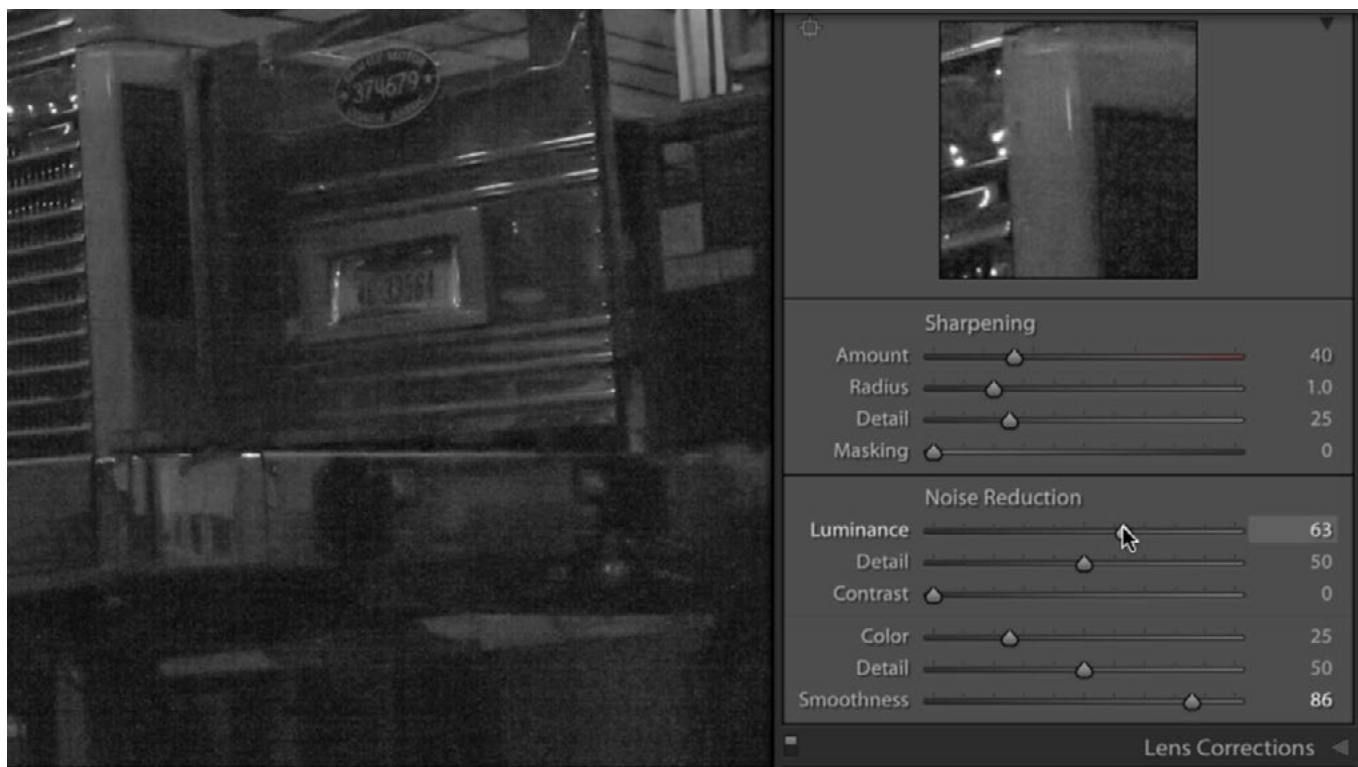
The image was lightened and you can see how much noise there was.

Detail preview As we mentioned above, it's best to apply noise reduction while looking at a zoomed-in view of the picture. However, it might not always be convenient to zoom in within the main image window. If that's the case, there's another way to get a zoomed-in view. At the top of the Detail tab, just to the right of the word "Sharpening" is a little disclosure triangle. Click on this and a small preview window will appear within the tab, showing a zoomed-in area of the image. This will allow you to inspect your image and choose which area of the image you want to be looking at while you apply the noise reduction. To choose what area the preview box should display, click the little crosshair icon to the left of the preview box and then move your cursor over the main image window. The preview will move around, reflecting the area where you're hovering. Click to specify an area to stay focused on. Clicking in the image will disable the crosshair feature so that the preview no longer keeps moving around. Right-click on the preview square and a small pop-up menu will appear, allowing you to determine what the zoom ratio should be. You can choose between a 1:1 view or a 2:1 view. I like to set the zoom ration of the main image window to 1:1 and then set the zoom ratio of the preview box to 2:1.



Click on the little disclosure triangle (circled left) to expand the preview box. Click on the crosshair icon (circled right) to specify what part of the image the preview should display. Right-click within the preview box to specify what the zoom ratio should be.

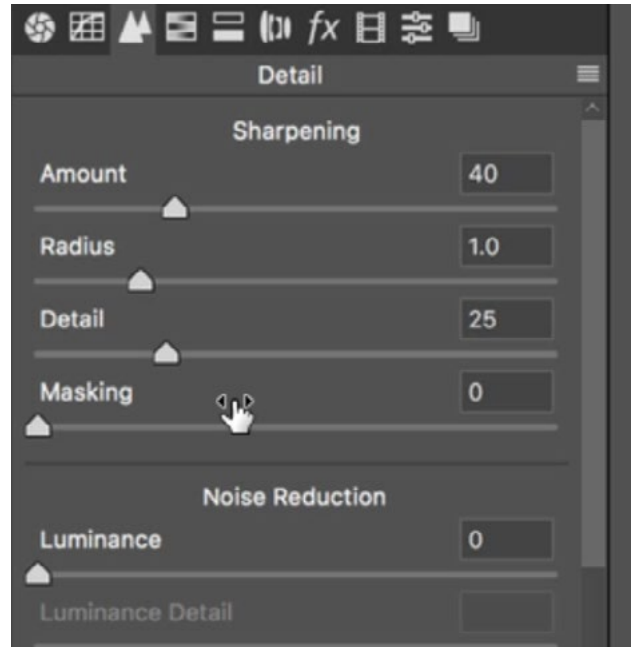
Black and white preview It can sometimes be helpful to preview the image in black and white while applying noise reduction. This can make it a little easier to see how much noise there is and how the sliders are affecting that noise. There is an easy way to get a temporary view of the image in black and white while moving the noise reduction sliders. If you hold down the Option key (Alt on Win) and then click on the Luminance slider, the image will temporarily change to black and white so you can drag the Luminance slider to apply the noise reduction while looking at this black and white view.



Hold down the Option key (Alt on Win) while dragging the Luminance slider to get a black and white view of the image. This can give you a better idea of how much noise there is.

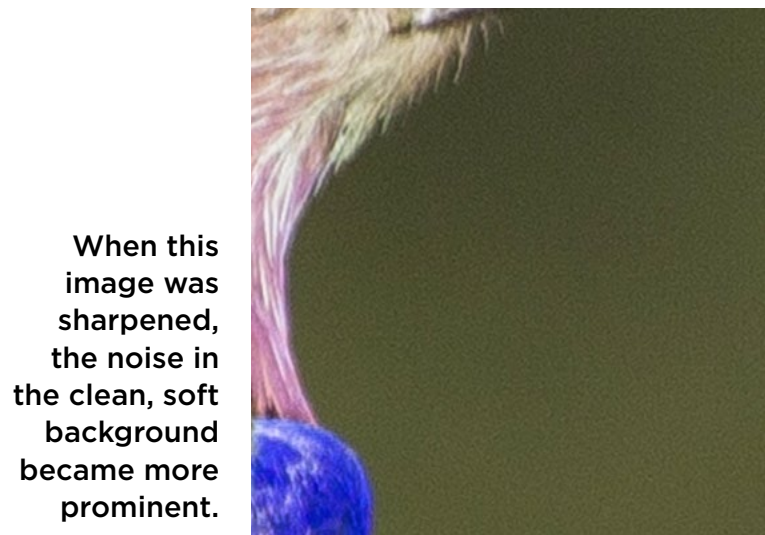
Applying noise reduction on a selective basis

You can also apply noise reduction on a selective basis, so it doesn't have to apply to the entire image. For the next video example image, we'll use Camera Raw, but know that the settings are the same between Lightroom and Camera Raw. From Bridge, we'll double-click on the raw file to open the image in Camera Raw. The tabs on the right side of Camera Raw are displayed a little differently than in Lightroom, and the individual tabs are displayed as icons beneath the histogram on the right side of the interface. The Detail tab is the icon that looks like two overlapping triangles and, once expanded, it contains the settings for sharpening and noise reduction.



In Camera Raw, the sharpening and noise reduction settings are found within the Detail tab (circled).

In the example image, we have a sharp, detailed bird set against a clean, blurry background. It's this smooth background area where the noise is going to be most prominent.

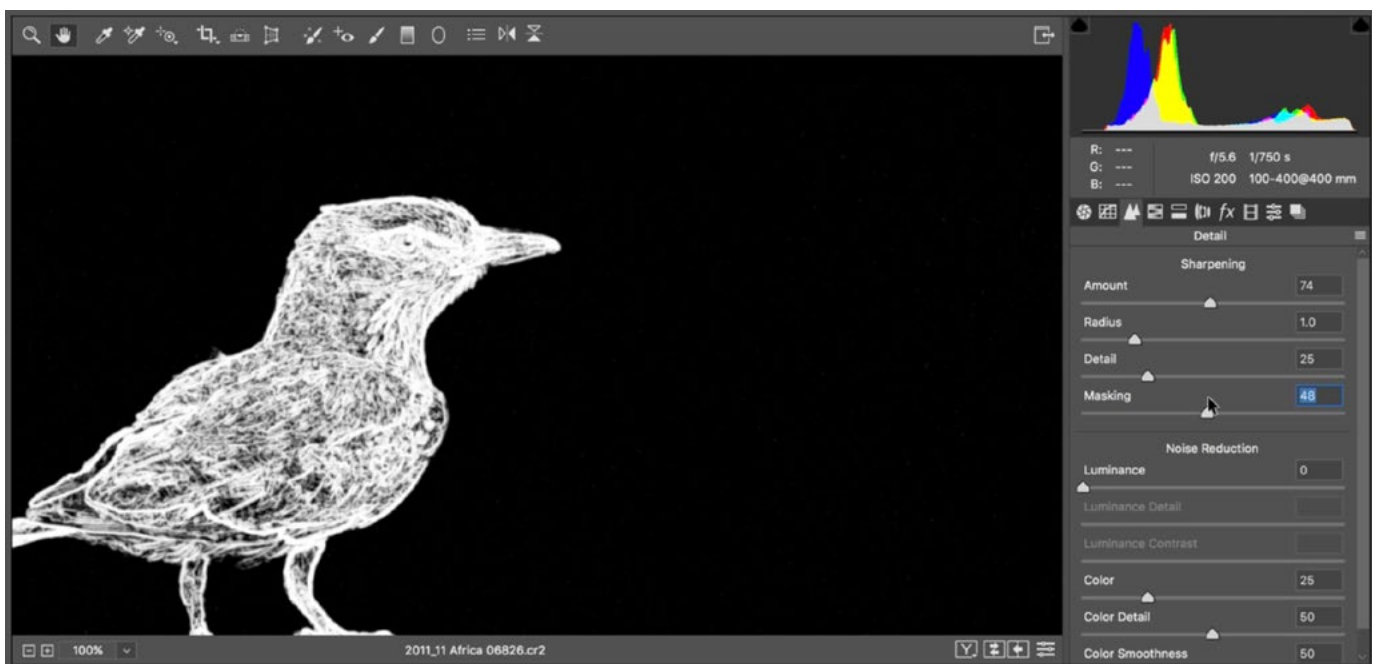


When this image was sharpened, the noise in the clean, soft background became more prominent.

It's best to apply any sharpening before moving on to noise reduction and the Amount slider can be used to increase the sharpening effect. After moving the sharpening slider to the right, the bird was sharpened, but so was the background. Because the background did not have any detail, it's the noise that became sharpened and, therefore, more prominent.

In a scenario like this, the Masking slider can be used. When Masking is set to zero (which is the default setting), sharpening is applied to the entire picture. As you increase the Masking setting, it will remove the sharpening from the areas that are less and less detailed. With the Masking slider moved far to the right, the only areas that will receive sharpening are the areas with the absolute most detail. To get a better view of this, hold down the Option key (Alt on Win) while dragging the Masking slider. This will change the view of the image where anything that's white is being sharpened and anything that's black is not being sharpened. As you move the slider to the right, more and more of the image will become black.

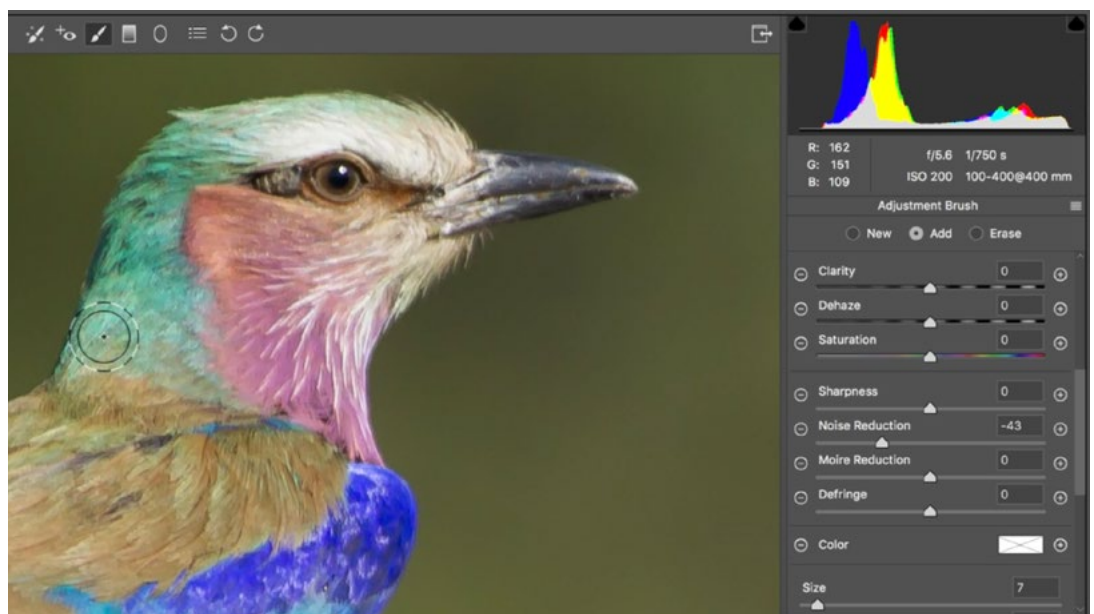
In the example image, we'll move the Masking slider up until the background is completely black and the bird is mostly white. This will remove any sharpening from the background area so the noise will no longer be exaggerated. The sharpening will remain on the fine details of the bird.



After applying sharpening, the Masking slider is being used to limit what areas are being sharpened. The Option key (Alt on Win) is being held down to get this black and white view of the image. The black areas will not be sharpened and the white areas will be sharpened.

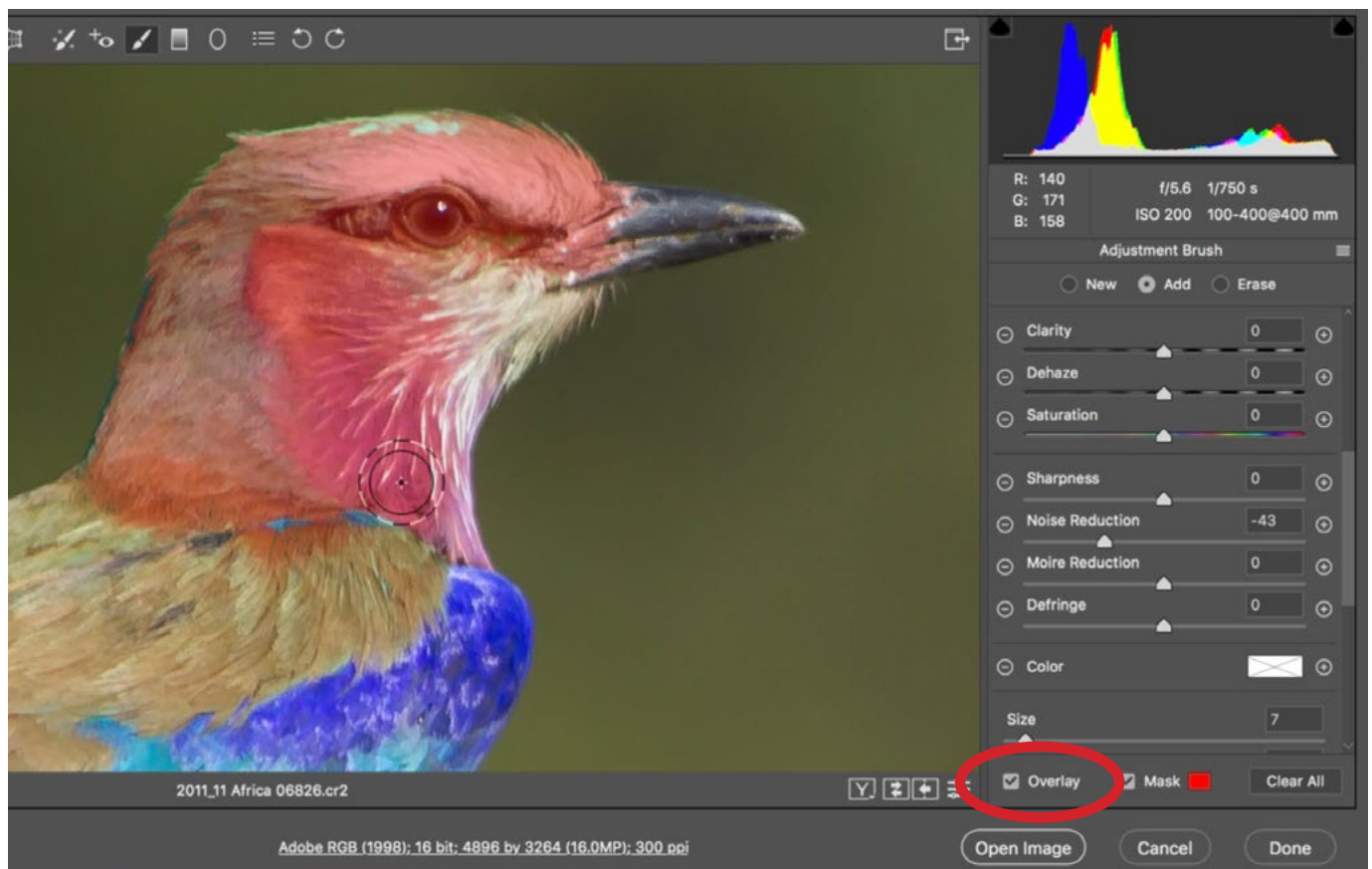
If we wanted to reduce the noise in the background even further, we'll move down to the Noise Reduction category and move the Luminance slider to the right until we can no longer make out any noise in the clean background area. We'll take note of the number to which the slider is set. This applied the noise reduction to the image as a whole, including the bird. We do not want any noise reduction applied to the bird because you couldn't see any noise in the bird to begin with. Plus, any noise reduction applied is softening the image, and we don't want the fine details of the bird to be softened. To undo any softening on the bird, we'll activate the Adjustment Brush, which can be found in the Tool Bar that runs along the top of the interface. When we activate the Adjustment Brush, the settings relating to it will appear on the right side of the interface. We want to make sure that all of the sliders are set to zero except for the Noise Reduction slider. We want to move this slider to the left by the same amount that we moved the overall Noise Reduction setting (Luminance) to the right. (This is why we wanted to take note of the number.) When we made our initial noise reduction adjustment, the slider was set to 43. Knowing this, we will move the Noise Reduction slider for the Adjustment Brush to -43. Then, we will use the brush to paint over the bird. This will apply our adjustment (the negative noise reduction) in only the areas where we paint. It's a good idea to make sure the Flow slider (located below the adjustment sliders) is set to 100. This will ensure that the brush will be used at full opacity on the first stroke.

The Adjustment Brush is being used to paint negative noise reduction onto the bird. This will counteract the noise reduction that was globally applied to the image.



When painting with the Adjustment Brush, you can turn on the Overlay check box below the Adjustment Brush sliders in order to get a red overlay in all of the areas that you have painted. This can serve as a good guide and show you areas that have been accidentally left out or areas that were painted on but shouldn't have been.

Note: In Lightroom, the Adjustment Brush can be found in the Tool Bar that is located beneath the histogram and above the Basic tab, on the right side of the Develop Module.

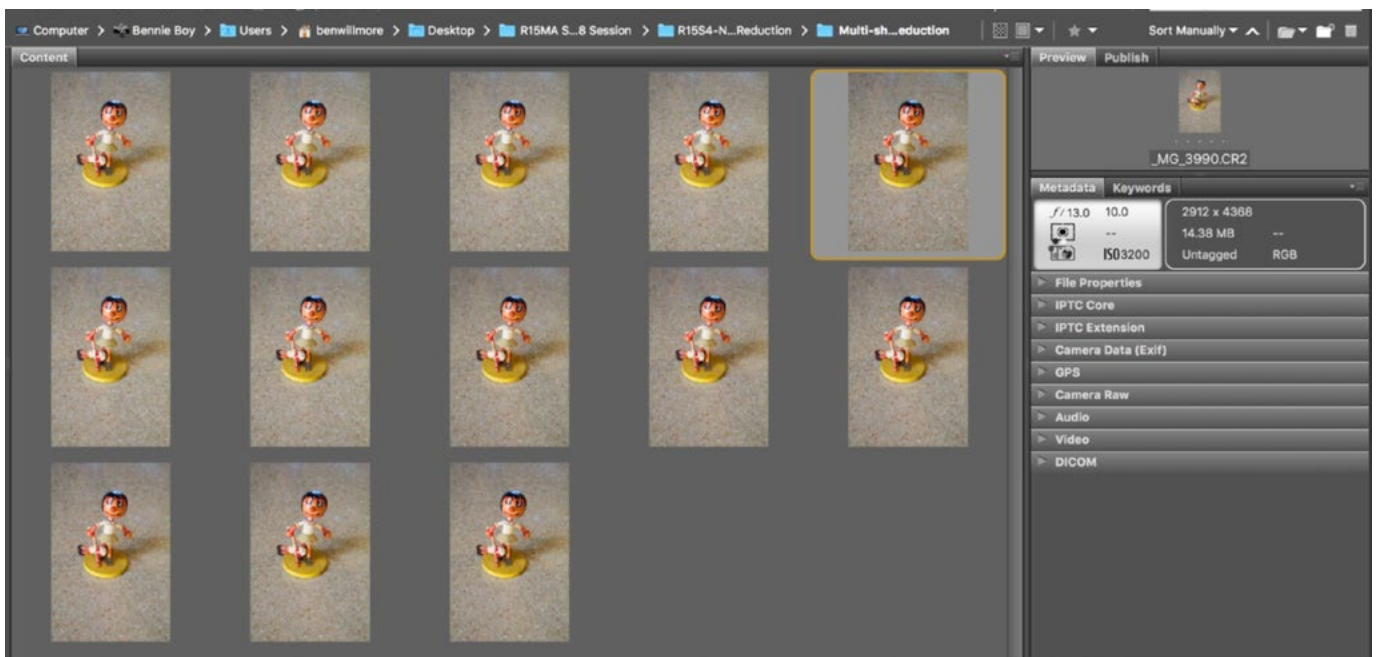


Using the Adjustment Brush, the Overlay check box is turned on, which places a red overlay on the areas of the image that have been painted on with the Adjustment Brush.

Noise reduction using more than one picture

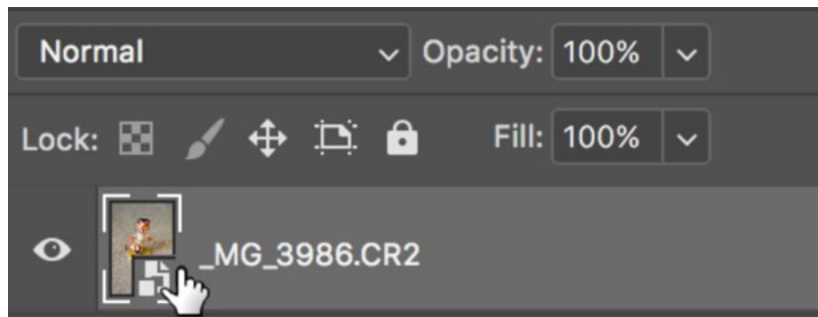
The method of noise reduction that uses more than one picture can only be accomplished in Photoshop. The noise in an image is random, but the detail in the image is not random. It's based on the scene you're photographing. We can use the random nature of the noise to take more than one image and then combine them to reduce the noise. If you know you're photographing a scene that is going to result in a lot of noise (lots of dark areas, high ISO, etc.), put the camera on a tripod and take several photos of the exact same scene and composition. The scene and details will be exactly the same between all the images, but the noise will be different. In Photoshop, there is a feature that will compare multiple images and only keep what is consistently the same across all of the exposures. It will eliminate everything else (the noise).

Select all of the images in Adobe Bridge, go to the Tools menu and choose Load Files into Photoshop Layers. Photoshop will open and all of the images will be placed as separate layers in a single document. (In Lightroom, you would select all of the layers, go to the Photo menu and choose Edit in > Load as Layers in Photoshop.)



For this image, the camera was placed on a tripod and several exposures were captured of the same scene so that we could later stack them and minimize the noise.

In Photoshop, select all of the layers and convert them into a single smart object by going to the Layer menu and choosing Smart Objects > Convert to Smart Object. When you do this, it will look as if all the layers are merged into one, but that's not the case. They are simply contained in a smart object, which is like a protective container for everything placed inside.



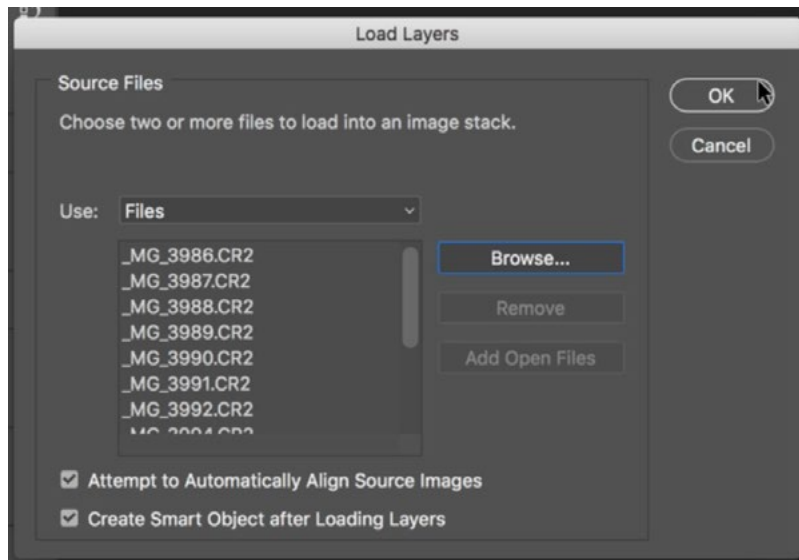
All of the images were loaded into a single Photoshop file and then converted into a single smart object. You can tell that a layer is a smart object because of the icon in the corner of the layer thumbnail.

Next, go back to the Layer menu and choose Smart Objects > Stack Mode > Median. This will cause Photoshop to compare every layer contained within the smart object and look for what's consistent between them. That's what it's going to keep. Anything that is not consistent in every layer (the noise) is going to be discarded. If one of your layers was not lined up properly when you chose the stack mode, then you might get an ugly ghosting effect. A way to prevent this would be to use the auto-align feature (Edit > Auto-Align Layers) before converting the layer stack into a smart object.

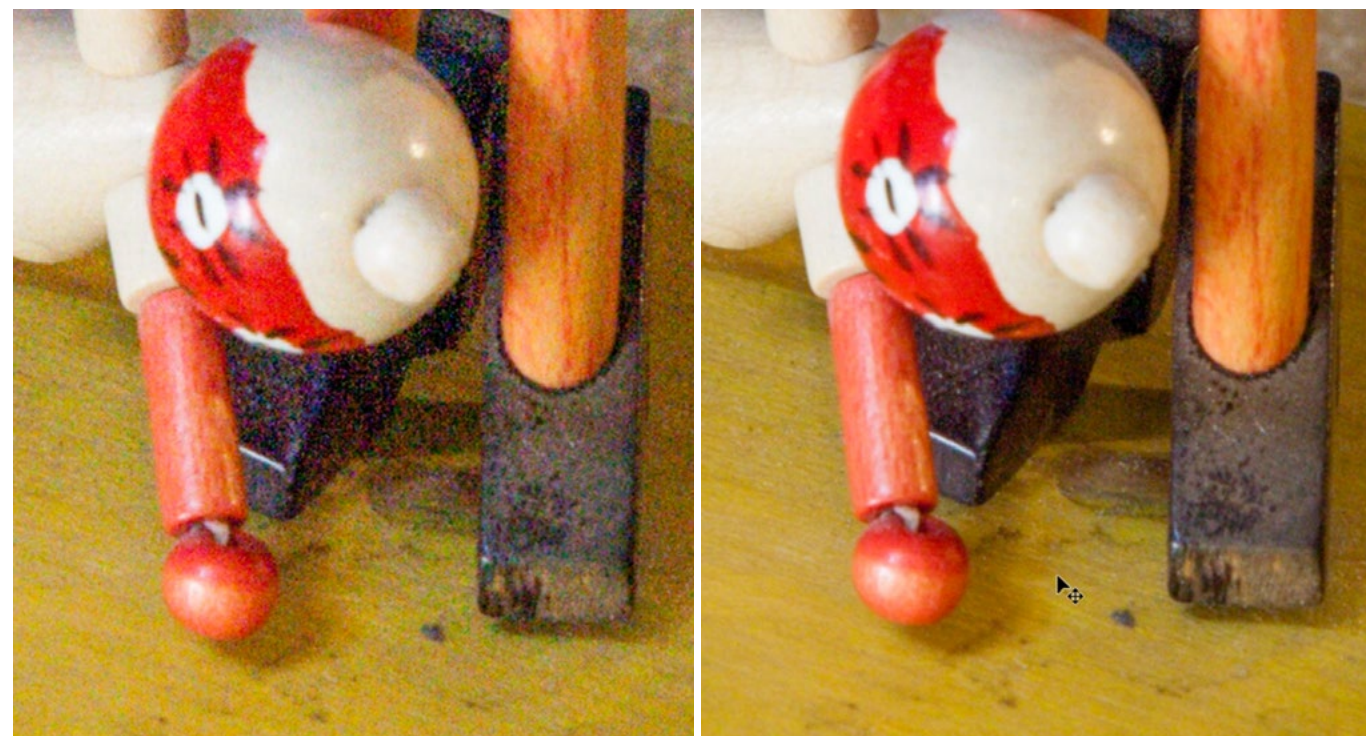
Automating noise reduction in Photoshop

Let's look at a way to automate the Photoshop noise reduction process described above. In Photoshop, go to the File menu and choose Scripts > Load Files into Stack. A Load Layers dialog box will appear where you can specify which files you want to use. If all of the images are currently open in Photoshop, you could click the "Add Open Files" button. If that's not the case, click the Browse button so you can manually direct Photoshop to the files you would like to use. Navigate

to the files on your hard drive, select all of the files that should be used in the stack and then click the Open button. This will bring you back to the Load Layers dialog and all of the selected files will be listed there. Turn on the two check boxes at the bottom of the dialog. These will tell Photoshop to align all of the layers and then convert all the layers into a smart object. Click OK and Photoshop will load all of the layers into one document, it will align them and then convert them into a single smart object. Now, you can go to the Layer menu and choose Smart Objects > Stack Mode > Median.



In the Load Layers dialog, we are choosing which files should be loaded into a single Photoshop document.

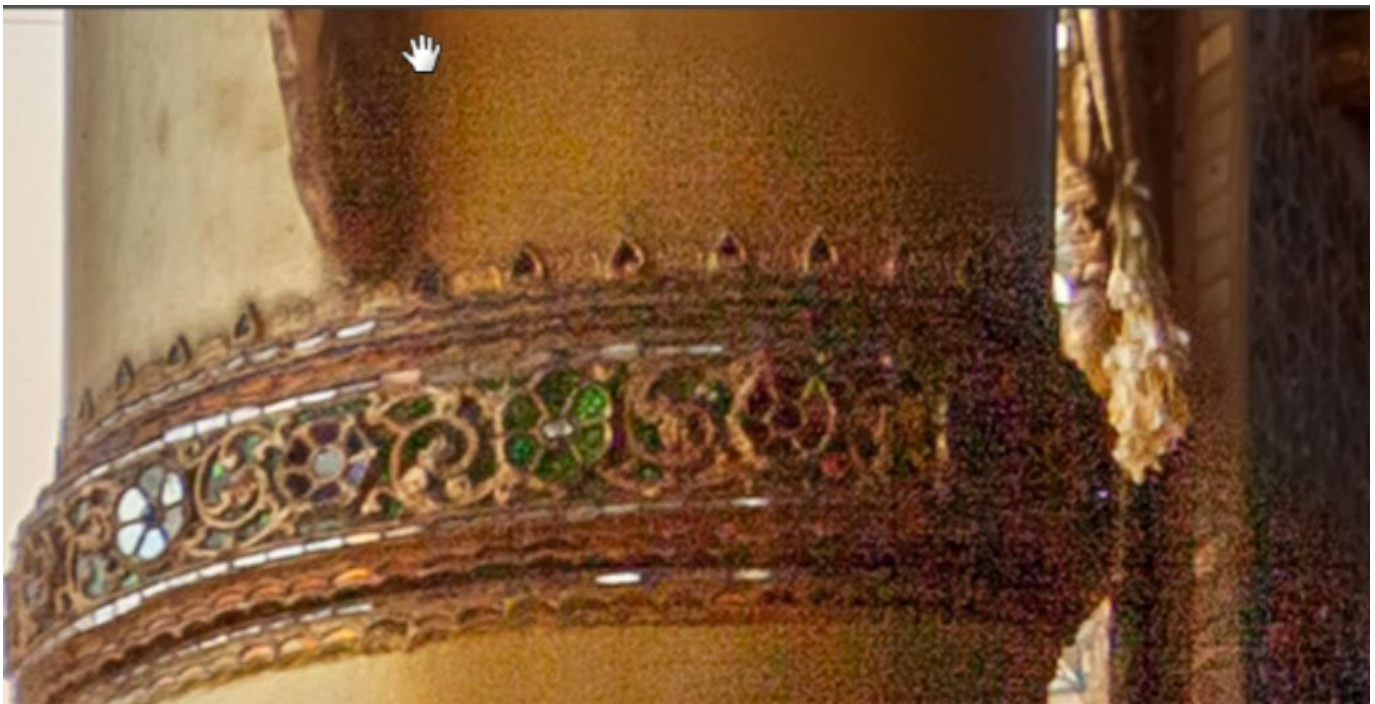


Here is the image before (left) and after (right) the layers were stacked and then set to the Median stack mode. The image on the right contains far less noise.

Noise reduction and HDR

When it comes to noise reduction, you need to be careful when working with HDR images.

When you merge images for HDR, there will be a setting for reducing ghosting. If you use this, it can potentially cause parts of your image to look noisy. That's because the setting to remove ghosting will choose a different exposure to replace the ghosted area and it might need to use one of the exposures that would be less than ideal for that area.



Here, you can see what can happen when you use the reduce ghosting setting when merging for HDR. There is an abrupt transition between a noisy area and a smooth area.