

CHAPTER 4: *Understanding Key Technical Concepts*

BLACK AND RED AND OUT OF FOCUS (WHY YOUR AUTOFOCUS LETS YOU DOWN)

This entry is an expanded version of a response to a query from a photographer made in the discussion forum of the Ohio Valley Camera Club. The shooter wanted to know why she couldn't get good results using autofocus shooting a red object on a black background.

Most of the answers had to do with distance from the object, but there's more to it than that. Part of the problem is the way autofocus works (passive autofocus, at least, which is the kind you get on good digital cameras). And part of it is the mysterious kinship between red and black.

Autofocus works by detecting an object in the frame and measuring the degree of contrast between it and something next to it. It now makes a small change and sees if the contrast has become greater. When it's at its greatest, the autofocus says "voila!" and stops adjusting. If it can't find sufficient contrast, it keeps hunting or gives up in disgust.

The more contrast, the easier it is for the autofocus to do its job. In scenes of low light, there's very little contrast. In scenes with a monotone subject, such as snow on the ground or clear blue sky, it's also hard for autofocus to find enough contrast to grab a target. Same reason; not enough contrast for the autofocus sensor to grab hold of.

You can read a basic explanation of the autofocus process in *How Stuff Works* and a better one here ([Cambridge Colour.com](http://CambridgeColour.com))

Now remember that we were talking about a red object on a black background, such as this one in Figure 4-1.

This image consists of pure red, exactly half way between full light and full dark (128 on a scale of 0-256) on a black background. That's represented by the thin red line on the histogram shown above the red square. It's very short, but you can just see it. On the left is a longer line all the way at the left edge. That represents how much of the image is dead black. No problem for autofocus, right? Well, it IS a problem, and here's why. Autofocus sensors do not see color. They only see black and white. And when you desaturate this image, you get Figure 4-2.

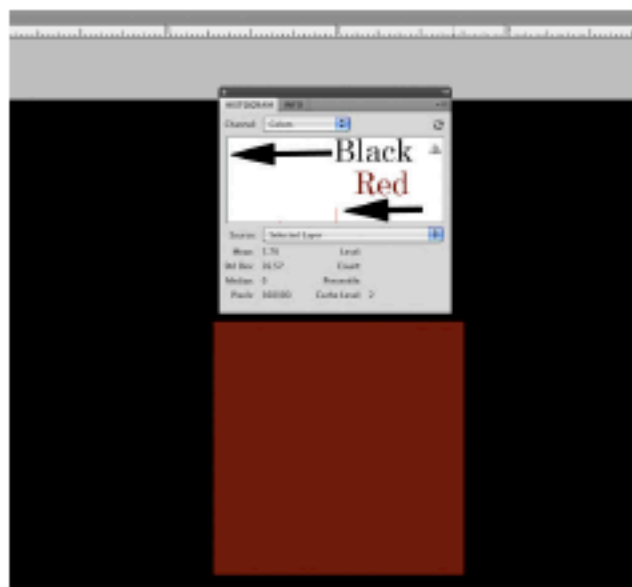


Figure 4-1. The length of the red line shows the amount of red compared to black in the whole picture. The position of the line shows where red falls between light and dark.

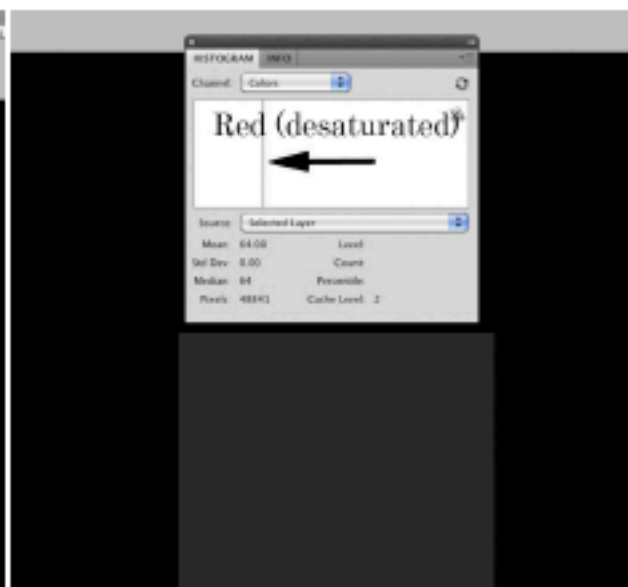


Figure 4-2. The autofocus sensor reads only black and white info. The luminance value is now much closer to pure black, leaving less contrast for the autofocus to work with.

When you take the color out of red, leaving only its luminance (light-dark) value, it is nowhere near “middle gray.” In fact, as the histogram shows, it’s barely half way between pure black and middle gray. So your autofocus sensor actually has much less contrast to work with than our eyes think it should!

Now both these illustrations are for crisply defined edges. What happens if the red object was, say, a soft fuzzy pillow? Here’s the same red-on-black saturated image with the edges blurred:

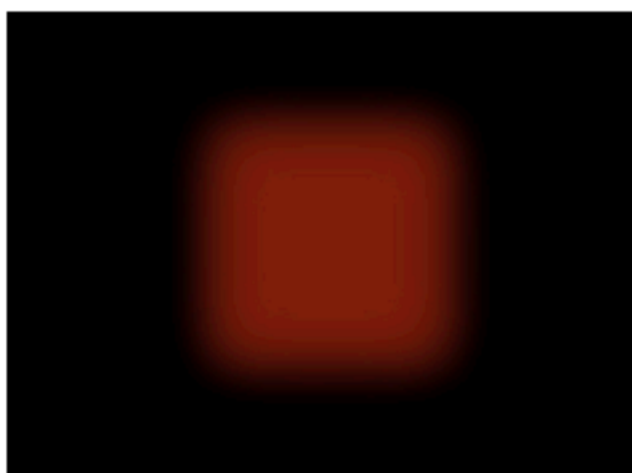


Figure 4-3. If there are no sharply defined lines in the picture, the autofocus sensor is doomed to failure; it simply hasn’t enough contrast to work with.

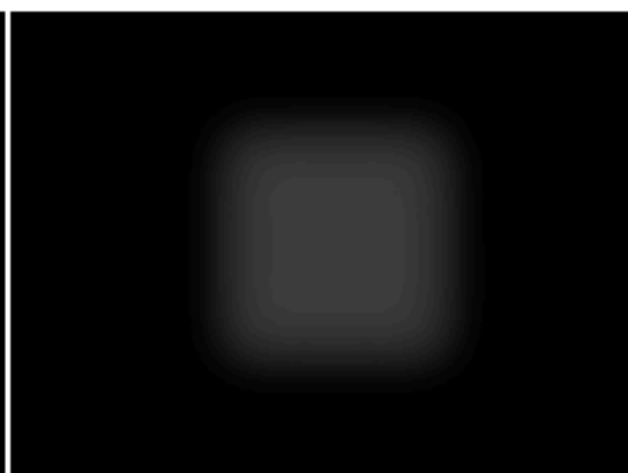


Figure 4-4. Shows luminance only; not much to work with. Your autofocus sensor is BW.

Now there's even less contrast to work with. Your autofocus would have a tough time with this image. You can tell the autofocus is in trouble when you hear it whirring and whirring and the camera tries to find an area of sharp enough contrast to focus upon.

Sometimes autofocus can't handle things because they are too close together, or because the high-contrast region picked up by the sensor blocks out the subject you DO want to have in focus. No autofocus system could handle this image of a girl behind a screen.



Figures 4-5 (full frame) and 4-6 (crop). The bamboo screen will "distract" the autofocus sensor, because it has more "contrasty" areas to work with.

At 100% crop (of a downsized jpg, so it looks lousy) you can see that the girl is actually in focus while the bamboo screen is not. This HAD to be done manually, because autofocus would grab the screen and not the model. I had to raise the screen, manually focus on the model, lower the screen, and take the shot. I had to do this for every exposure because she'd move between exposures, and I was using an open lens aperture with narrow depth of field. We were both beat when this session was over!

So, to sum up, autofocus looks for sharp edges (high contrast between one pixel and the one next to it). If it can't find them, it goes hunting or grabs the wrong part of the subject. That's why autofocus may grab a leafy branch instead of the face in front of it. Checkerboards and such are "autofocus magnets," while soft fuzzy things without much light-dark contrast are hard for it.