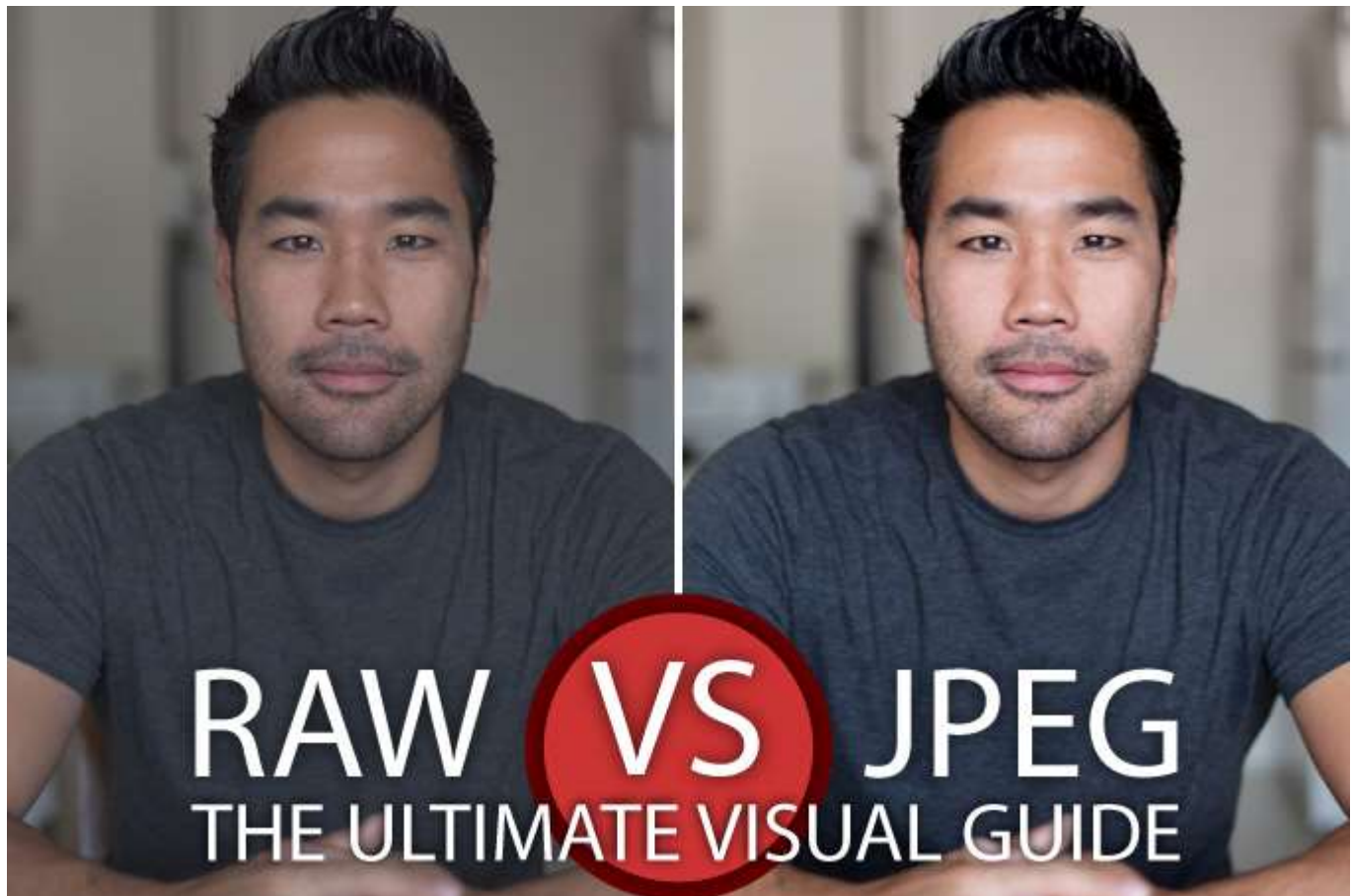

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RAW VS JPEG (JPG) – THE ULTIMATE VISUAL GUIDE

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RAW VS JPEG OVERVIEW

Shooting RAW vs JPEG is a question that every photographer faces at some point. There are many articles out there that cover the topic from the basics of size and quality, to all of the advanced technical details regarding color bits per channel, compression, firmware DCT processing, etc.

So, here is the disclaimer, if you want the technical details regarding RAW vs JPEGs, Wikipedia and other sites have great technical primers discussing the basic

technical differences, a brief Google search will also unearth loads of additional more in depth technical resources as well.

This article is designed to teach you the differences between RAW and JPEG (JPG) from a pragmatic real world point of view. Thus, we will be using a lot of actual image examples to help show the exact concrete differences. In addition, we are going to leave out most of the technical mumbo jumbo that won't really help you beyond being exceptionally proficient at speaking "nerd."

[Reminder: Learn more about RAW vs JPEG and other critical Photography Concepts in our [Photography 101 DVD Workshop](#). We show you how to get amazing professional photography out of entry level cameras and teach you all types of photography, including Fashion, Landscape, Couples, kids, Food, and More!]

We will be using images shot from the [Canon 5D Mark II](#) with a [Canon 50mm f/1.4](#) prime lens for all of our examples. Also, let me thank Justin Lin of Lin and Jirsa Photography ahead of time for being our helpful model. Keep in mind that, while you may be shooting on a different camera, be it a DSLR or an advanced point-and-shoot with RAW capability; the principles discussed here apply to all cameras although the differences may vary slightly from model to model.

GENERAL DETAILS REGARDING RAW AND JPEG

JPEG – JPEG files are processed right within the camera. How exactly they are processed varies from model to model. While color temperature and exposure are set based on your camera settings when the image is shot, the camera will also process the image to add blacks, contrast, brightness, noise reduction, sharpening (which you can see in the example above) and then render the file to a compressed JPEG. These files are finished and can be viewed and printed immediately after shot.

Remember, because the image is compressed and saved to JPEG which is a "loss" file format, much of the initial image information and detail is discarded and cannot be recovered. You may hear the term "Dynamic Range" used a lot when discussing RAW files vs JPEG. Dynamic Range is simply the amount of tonal range detail from the darkest shadows to the brightest highlights. Dynamic Range detail in JPEG files is significantly reduced as compared to RAW.

Example 1 – The image below was shot at 1/80th shutter, f/2.0 aperture, ISO 200 and is shown as shot straight from the camera. Notice that the shot is usable directly from the camera. It has a good amount of blacks, decent contrast, and has good brightness. While we could do additional post production work to soften highlights, smooth skin, this shot is good -to-go straight from the camera.



Jpeg image

RAW – RAW files are uncompressed and unprocessed snapshots of all of the detail available to the camera sensor. Because RAW files are unprocessed, they come out looking flat and dark. RAW images need to be viewed and processed using your camera's software or in more robust commonly used software like Adobe Photoshop, Lightroom, Aperture, etc prior to being ready for display or print.

Example 2 – The image below is the RAW version of the exact shot above as it was shot in RAW+JPEG mode. Notice that the image is flat, it lacks contrast, blacks and is also much darker coming straight from the camera. While programs like [Lightroom](#) may be setup to automatically add blacks, contrast and brightness to a RAW file, this is what a “zeroed” RAW file actually looks like straight from the camera.



RAW 'image' unprocessed

When Do I Use RAW vs JPEG?

Is each format useful, yes. But, is there clearly one format that is superior? Absolutely. Don't let anyone tell you that JPEGs are just as good as RAWs because the bottom line is that they are not! **There is a vast difference in the amount of information retained in a RAW file compared to a JPEG** as you will soon come to see.

Being that RAW is a clearly superior file format, does that mean that you should always be shooting in RAW? Absolutely not. Both formats have their uses, and we use both formats frequently. So, here are some guidelines of when you would want to shoot RAW versus when you would want to shoot JPEG:

1) *Journalistic shooting (RAW)* – If you are shooting journalistically, meaning you are shooting in fast moving situations that are constantly changing in terms of lighting, scenes, backgrounds, subjects, etc then you need to be shooting RAW because **nobody has the ability to shoot the “perfect exposure” every time**. You can't stop a person from shedding a tear, smiling, laughing, just so you can dial in just the right amount of exposure compensation, or manually set your settings. **Shooting RAW allows you to quickly shoot while having enough information to fix possible exposure issues in post**. If you are a journalist, a wedding photographer, event photographer, then you need to be shooting RAW.

2) *Need additional range and tonal detail (RAW)* – If you are shooting landscapes, nature, or virtually any scene that has a high Dynamic Range, then you want to be shooting in RAW to allow you to have additional post production flexibility to darken (burn) the highlights, while raising (dodging) the shadows, and properly tone-map an image.

3) *Shooting for immediate display (JPEG or RAW+JPEG)* – If you need the images for immediate display, say you need to display a same-day slideshow for a client, or you want to have them available for immediate proofing, then you want to be shooting JPEG. If you need post production flexibility and the ability to immediately use the files, then switch to RAW+JPEG so you have both. But, make sure you have extra cards present, cause you are going to burn through those things candles on Hanukkah.

4) *Shooting for web or lower quality uses (JPEG)* – Often times when I am shooting images for the web, I don't need perfect images. I don't need to have the post production flexibility of a RAW file. After all, is a small 500 pixel image selling a car on Craig's List going to do a better job if it were a RAW file? Most likely not. Understand your audience, and if appropriate save time and shoot these types of images in JPEG format making sure that you properly set exposure and temperature while shooting.

5) *Restricted space (JPEG)* – OK, with the price of storage being so cheap, this definitely should not be a heavy factor in your reason for shooting JPEG over RAW. But, there may come a situation when say you are on a trip and you left your CF cards back at the hotel while you are out on a 8 hour travel excursion with only a 4GB card in your camera. In this situation, by all means, switch to JPEG. If you don't, you are going to run out of space just as you walk into the Sistine Chapel (which by the way wouldn't matter as they don't allow photos inside, how lame eh?).

6) *Personal use (JPEG and or RAW)* – Hey, I am a professional photographer. But, I don't need to have crazy tonal range and post production flexibility for every event in my personal life that I shoot. So, in more casual situations such as a small BBQ party, I shoot JPEG. When I am out vacationing in China or Europe shooting landscapes, cityscapes, people, etc, I shoot RAW. **The rule here is that you don't want to be spending crazy amounts of time processing images when the differences are going to be negligible and go unnoticed.** Know your audience, know your situation, know your use for the images, and select appropriately.

7) *Rapid succession burst shooting (JPEG)* – One of our readers [Benjamin D Bloom](#) brought up a great point which I totally forgot to add to this list. If you are shooting live action sports and are shooting burst sequences in rapid succession, your buffer will fill up very quickly if you are shooting RAW. This means that your camera will stop to process the buffered images, thus making you unable to continue shooting while the camera is transferring those images from the buffer to your memory card. Shooting JPEG will allow you to shoot a lot more shots prior to filling the buffer. So, in this situation it is best to switch to JPEG, dial in all of your exposure and temperature settings in camera and fire away.

Image Comparisons Between Original RAW and JPEG Images

The following sections will now show detailed visual comparisons between several different RAW and JPEG images. All shots were taken using the following camera and file settings:

Camera: Canon 5D Mark II

Lens: Canon 50mm f/1.4

File Settings: SRAW + Medium JPEG

Picture Style: Standard

All Processing Settings: Default

Brightness, Contrast & Blacks

The most obvious thing you will notice when comparing a RAW image to a JPEG image is that the **JPEG image will have a significant amount of Brightness, Contrast and Blacks added to the image during camera processing**. If you are a Lightroom user, the added amount is approximately as follows (varying slightly on camera model). The images used above, as well as this shot below illustrates this difference.

+50 Brightness, +25 Contrast, +5 Blacks

Example 3 – Both files below have been zeroed out in Lightroom prior to being exported. This means that there are no additional post production settings being applied. So, what we are seeing is both files as shot directly by the camera. Notice how the zeroed RAW file is dark and lacks contrast compared to the zeroed JPEG.



Sharpness

JPEG files are also slightly sharpened in camera. While this may sound like a good thing, there are many circumstances where you are going to want to have exact control over the amount of sharpening applied to an image. For Lightroom users, the approximate amount of sharpening added to an image processed in camera is

+25 Amount, +1.0 Radius, +25 Detail

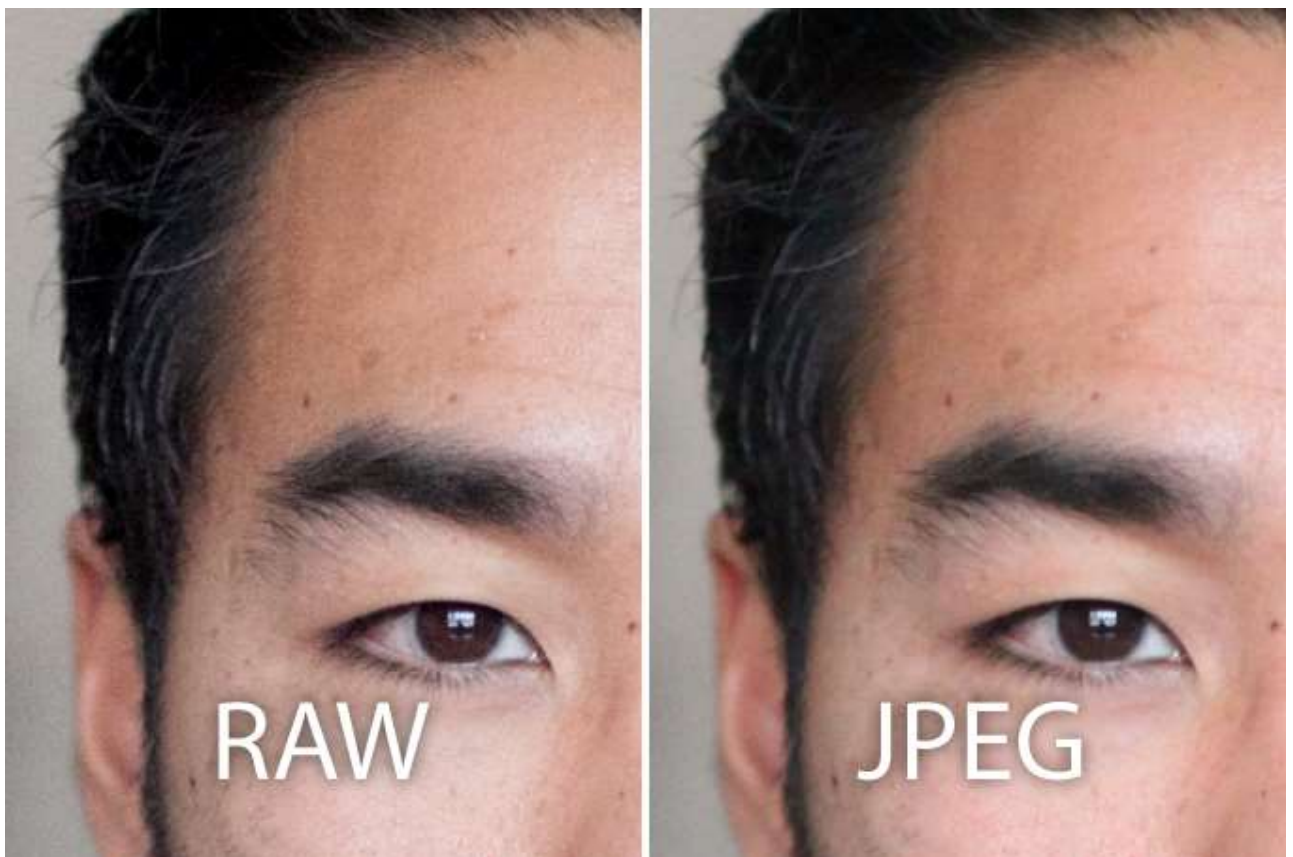
Example 4 – The RAW file below was zeroed and then had +50 Brightness, +25 Contrast and +5 Blacks added to be able to easily compare the two files without noticing differences in exposure. Notice how the JPEG image comes out just a bit sharper than the RAW. This is most noticeably visible around the eye and eyebrow area, as well as by Justin's whiskers and lips. **While this additional sharpening makes the JPEG image look better, that sharpening cannot be removed from the original file (if needed) as it is built into the JPEG after being processed in camera.**



Noise

JPEG files will have additional noise reduction applied during in camera processing. For images not intended for professional use, this is not a big deal. However, if you intend to use these images for professional use, you are doing your images a big disservice as software based noise reduction found in **Lightroom 3** or **Noiseware Professional** give you not only much more control, but also do a better job of reducing noise while maintaining sharpness and detail.

Example 5 – The next image is the exact same composition and exposure as the previous shots, however we exposed the shot at 6400 ISO so we could have a decent amount of noise for comparing. Again we have matched all settings on the RAW to the JPEG image. The noise levels in both images are shown as shot without any additional reduction. Notice how the **RAW file displays quite a bit more noise than the JPEG, however more noise also equals more detail and sharpness as well.** The easiest place to see these differences are in the shadows, like in his eyebrows, hair, whiskers, shirt and the gray background.



Example 6 – This next image shows you the difference in sharpness and quality that can be achieved **using software based noise reduction versus in camera noise reduction applied to JPEGs**. On the left we see the same RAW file as shown in the image above shot at 6400 ISO. That shot was adjusted for brightness, contrast and blacks to match the JPEG file, then it was taken into [Adobe Photoshop](#) where we first used Noiseware Professional to reduce the noise, then a [Adobe Photoshop](#) Unsharpen mask to enhance detail. **Notice how the finished RAW file on the left not only has more detail, but is also completely free from noise**. While you can continue to smooth the JPEG image on the right, you won't be able to recover the detail lost from the in camera noise reduction which is significantly inferior to software based noise reduction solutions.



Dynamic Range – Overexposure

One of the biggest differences between a RAW and JPEG image is the amount of dynamic range and tonal detail captured. This means that you will see huge differences in quality when post processing images that are underexposed, overexposed, or images that simply have a high Dynamic Range; such as a landscape with a super bright sky against a dark ground.

Example 7 – The image below was shot at 1/40th shutter, f/2.0, ISO 400 and exposed to be 2 full stops overexposed. Below you see the zeroed RAW compared to the zeroed JPEG. Notice that because JPEG processing adds around +50 Brightness to the image, it is significantly more overexposed than the RAW image on the left. In the next example, we will show that this amount of additional brightness, plus the fact that much of the images Dynamic Range and image detail has been discarded, will make it impossible to repair the JPEG in post production.



Dynamic range comparison ('from camera')

Example 8 – For this next comparison, we have taken the exact same overexposed RAW and JPEG shots used in Example 7 and reduced the exposure by -1.50 in [Lightroom](#). Notice how the RAW image retains all of the tonal detail regardless of the image being 2 stops overexposed. **With the RAW file we have a completely usable image despite it being 2 stops overexposed when shot. On the other hand, the JPEG image clearly shows that much of the facial detail is unrecoverable leaving large blown highlight areas on the forehead, cheeks, nose and lips.**



Dynamic Range- Underexposure

RAW files are much more forgiving when it comes to brightening underexposed images. There is enough tonal detail in a RAW file to bring up the exposure by +2 or more full stops of light (so long as the image wasn't shot at a super high ISO). Conversely, there is not enough tonal range in a JPEG to do the same thing without virtually destroying the image. See the image examples below.

Example 9 – The image below was shot at 1/500th shutter, F/2.0 and ISO 400 and was shot to be 2 full stops underexposed. Once again, both files have been fully zeroed to allow us to see the unaltered files straight from the camera. At first glance, it may look like the JPEG image does a better job with underexposed shots being that it adds +50 brightness during camera processing. However, you will soon see that the additional blacks and contrast added to the JPEG image during in camera processing are going to clip the detail in the shadows. This clipping of the shadows will not be recoverable.



Underexposed comparison ('from camera')

Example 10 – This example shows the exact same underexposed images used in Example 9 above. This time, we took the images into [Lightroom](#), zeroed them out completely, then added +2.5 Exposure. Notice that the RAW file retains much more detail in the shadows where as the JPEG file begins to show where the shadows are clipped as they are fully black. Once again, the RAW file proves that it is more forgiving and allows you to retain more tonal range despite the shot being 2 full stops under exposed.



Underexposure comparison

CONCLUSION FOR OUR RAW VS. JPEG COMPARISON

By now, you should have a strong understanding of the in practice differences between RAW and JPEG file formats. Use this understanding, along with our situational advice to decide which file format best fits your needs for any particular situation. While the RAW format is a super format, that doesn't mean it is the best format for all situations.

If you have any comments or additional insight, please feel free to share below in the comments. Thanks!

All images copyright Lin and Jirsa, [Wedding Photographers in Los Angeles](#)