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Sunday, 06 September 2015

How Do You Fix Aliasing in High-Res Camera Photographs?

Written by **Ctein**, TOP Technical Editor

(Author's note: Please read the already-posted responses before commenting. Thanks!)

I am mining the group-mind that is the all-knowing TOP readership.

If you're using a camera that lacks an anti-aliasing filter and if you've had to deal with aliasing in any of your photographs, how did you deal with it?

(Okay, I mean aside from deleting the photograph.)

You've got this photograph you really like. It's exhibiting annoying aliasing. How did you fix it in Photoshop or whatever?

This question comes out of a conversation I had with Richard Anderson a few days ago. I was explaining to him why I was leery of any of the new non-anti-aliased cameras because I'd already had enough problems with aliasing in my photographs from working with them in the past. (If you've never had such problems, I'm happy for you, but that's not relevant to me.)

He thought there were Photoshop techniques for fixing this. I didn't know of any, and we couldn't find them with Google or Adobe Help searches (unfortunately "aliasing" has a strong attractor having to do with rendering type and vector drawings).

I turn to you. Are there post-capture techniques for fixing this? If so, it could change my mind about considering such a camera in the future.

Tips on printing

Totally different subject (well, not entirely): Pascal Jappy in France just posted a very nice interview he did with me by phone about printing. It even contains a useful tip or two that I haven't written about before that may be helpful to folks who've been unsatisfied with the quality of their digital prints. Check it out.

Ctein, TOP Technical Editor

> **UPDATE, Monday:** Well, that got resolved faster than I expected!
>
> A couple of points of note: it's hard to get the answer to a question if you don't know how to ask it. “Alias” as a search term is a big fail. “Moiré” works great. But if you (like me) think in terms of the former rather than the latter, it's a stumper.
>
> (Not the first time I've encountered that problem. I still haven't mastered writing macros in Excel because Visual Basic uses such a radically different vocabulary that I can't even figure out how to phrase some questions. Instead of being able to search for specific points that stymie me, I'm forced to read whole chapters of books in the hopes that the information I need will fall out.)
>
> Something else—the moiré adjustment brush setting isn't available before Process Version 2012. The files I was looking at with this problem predated that. They opened up with PV2010 as their default in ACR. No moiré adjustment! It's a good argument for converting to PV2012 on raw files that haven't been massaged into their final form. There'll be tools you didn't even know existed. (Important note: don't do this if you've got a raw conversion in pretty much final form, because there are no exact equivalencies between a lot of the functions in PV2010 and PV2012. The latter is superior, but it's different.)
>
> As for the moiré tool itself, I'm lukewarm. In the real world (as opposed to studio) subjects where I see the problem, it's in areas where there's lots of fine detail of high contrast. When the tool is applied to those areas, it fixes the aliasing, but it also wipes out saturation and flattens out the color overall within the brush radius. Sometimes this isn't a problem; other times it's a big one. I know, I'm preternaturally sensitive to color. Well, that's who I am. For me this is a half-fix.
>
> Still, that's an improvement. It only leaves me half-leery of these cameras instead of totally leery.

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(To see all the comments, click on the "Comments" link below.)

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Posted on Sunday, 06 September 2015 at 08:43 PM in Ctein, Digital Techniques | Permalink

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I shoot with a 5D Mark II and I run into moire with reasonable frequency. If it's minor, I just ignore it. If it's moderate, I'll open it in ACR CS6 and see what the moire removal brush does. It rarely does a good job, and honestly, rarely even does a passable job. On top of that, it slows everything down incredibly.

I have corrected a couple shots by using the moire removal tool locally (along with a minus value for sharpening, saturation, and even contrast and clarity if that seems to help, plus some noise reduction to soften things up even more and try to break up the maze-like luminance patterning). After that, I go in and manually paint in color biases (white balance or maybe even color overlay) to reduce (but never neutralize) the bands of spurious color. That's generally an hour or more of work.

After that I'll pull the image into Photoshop and do some more work on it, and it still won't be great at reasonably large (~10" x 16") sizes.

It's a huge pain, a huge time sink, and it's not worth it. I've done it a couple times, each time thinking, "It can't be as bad as I remember it", and it always is. I will never do it again. If I take a shot and it has significant aliasing, it's garbage.

And as I said before, I'm shooting on a 5D Mark II, which has an AA filter, often stopped down to f11 (past the diffraction limit which is supposed to magically cure all moire-related ills), and I still run into serious moire occasionally.

Given a choice between a camera with an AA filter and a camera without one, I'd rather have the filter than deal with even more moire.

Posted by: James Sinks | Sunday, 06 September 2015 at 08:59 PM

There are several possibilities. But first, I've been using a non-AA-filter camera for nearly three years (a Fujifilm XE1) and have used the Canon 5DsR since it came out. So far I haven't encountered a problem in a photograph on either. I'm sure it will happen — as it has happened to me in the past using cameras that DO have AA filters!

Three options:

1. Use the moire filter in your post-processing application. I use the "moire reduction filter" in the FX panel of ACR, and I'm pretty sure that LR also includes it.

2. At the time of exposure, if you expect that you might have an aliasing issue with your subject and you can do so, simply stop down a bit to introduce a tiny bit of diffraction blur.

3. In the past I have selectively blurred areas of the image where I saw a moire effect.

So far I don't have a single image (from an AA-filtering or AA-filtering-free camera) that has produced an image that either had a moire problem or that couldn't be fixed.

Posted by: G Dan Mitchell | Sunday, 06 September 2015 at 09:03 PM

There was a recent post from Scott Kelby on how to remove moire with Lightroom: http://lightroomkillertips.com/removing-moire-patterns-in-lightroom/

Posted by: Tarun Bhushan | Sunday, 06 September 2015 at 09:32 PM

You can brush it away using the Moiré slider in brushes in Lightroom and ACR. In Capture One it is a slider. Most raw tools have this built in.

Posted by: Jao | Sunday, 06 September 2015 at 09:38 PM

About 15 years ago, I found a plug-in for GIMP, which did nothing but anti-alias. I don't think that it even had adjustable settings, but it worked wonderfully for cleanly smoothing edges. An example I remember using it on was a drawing made with the pencil tool, which resulted in, naturally, aliased edges. I seem to recall that this plug-in disappeared from the repository; it wasn't part of the normal GIMP installation. But it worked pretty well all those years ago!

Posted by: Daniel Binkard | Sunday, 06 September 2015 at 09:50 PM

Google "remove moiré" instead of "aliasing" and there should be many relevant results. Good luck.

Posted by: Scott L. | Sunday, 06 September 2015 at 10:01 PM

In my limited experience-I almost never had a problem with film, and only rarely with digital- the moire occurs usually in a limited area, and adding a little blur to that area will reduce or remove it. However, if this will work with high pixel count, no filter cameras, I don't know.
As for why people, especially amateurs, don't print, or have prints made, I think there are a number of factors. In addition to what you mention in the interview is cost to produce a good print (if we even can). With film, cost of equipment, chemicals, and paper, and need for a darkroom, especially to make multiple test prints until the 'good' print is produce, adds up. The cost of having a pro printer do is wasn't/isn't cheap either. Today, with digital, there are still associated costs - printer, ink, paper- but with fewer problems and quicker end products. However, for many, the problem you mention that the screen often looks better than the print may discourage many. And good professional printing still isn't cheap. And perhaps the biggest factor is that when we look at our images on screen (or negs) we figure most of our exposures aren't good enough to warrant the cost and effort of printing.

Posted by: Richard Newman | Sunday, 06 September 2015 at 10:45 PM

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Isn't jagged edge line more like feature than defect?

[***Ctein*** *replies: Pekka, Heh heh, depends on whether the edges really ARE jagged. In this case, though, the problem is chroma aliasing, weird color fringes and blotches showing up near fine detail that shouldn't be there.*]

Posted by: Pekka | Sunday, 06 September 2015 at 11:08 PM

This is new to me, but I recently used the Lightroom moiré brush. It was easy and effective to remove colored stripes.

http://briansmith.com/sony-a7r-removing-moire-lightroom/

Posted by: Aalok K | Sunday, 06 September 2015 at 11:14 PM

The search term you want, Ctein, is "aliase", not "alias".

Unless you are really looking for an alias. In which case, may I suggest going by the new name of Pedro Nguyen, Spanish-Vietnamese qualified CPA and noted model train enthusiast from Woy Woy, NSW.

Should be nondescript enough.

Posted by: lith | Sunday, 06 September 2015 at 11:30 PM

Moire can be significant in Oly E-5 (12MP) images. Most common with very sharp lenses and certain fabrics, but also patterns of pierced metal, fencing, etc. The Lightroom tools usually corral it to my satisfaction.

With the rollout of TruePic VII (for the E-M1, 16MP) Oly is baking moire control for µ4/3 lenses into the firmware; and this seems to work because I don't see any even with my better (sharper) lenses. But with sharp four-thirds SHG lenses like the 35-100 and 150, it will show up in E-M1 shots. Then it's back to software tools to tame it. I can't think of any important shots discarded because of moire from the E-M1.

[***Ctein*** *replies: Rick, that's curious. Definitely seems to be one of those "your mileage may differ" situations. I've never seen a case of aliasing show up in my E-M5 files, which is the same sensor, and my two favorite lenses are insanely sharp. I will consider myself fortunate.*]

Posted by: Rick D | Sunday, 06 September 2015 at 11:53 PM

Hey G, Mitchell and Ctein, my understanding is that the honeycomb pattern of the pixel array in Fuji cameras is not prone to moire precisely because the pixels do not line up like a checkerboard. And honestly, if I saw that much moire in my Pentax, I would quickly change to the Fuji. I agree and tried to remove moire and chroma aberration, not as easy some claim. There is always a compromise of some sort. And if there is camera out there that does not produce either one, let me know, please!

JR

Posted by: John R | Sunday, 06 September 2015 at 11:59 PM

Before the various moiré removal tools came out, what I did was convert the image to lab color and use the blur brush on the two color channels leaving the luminance channel untouched. If that looked like mush, then I'd try using the one of the other retouching tools in the color channels only.

Really, the moiré removal tool in Lightroom looks like it's doing exactly the same thing.

[***Ctein*** *replies: Hugh, the results I'm seeing with the adjustment brush in ACR look more heavy-handed than that–– large-scale loss of chroma differentiation and saturation. Your approach might have real promise. In particular, I'm wondering how it would work to use one of the more sophisticated noise reduction filters on the a and b channels (in a masked layer, of course, so you could paint in the effect where you wanted it). They can do a much better job of eliminating small-scale crap without messing up larger detail than blurring does.*

That won't work for the kind of aliasing that produces large blotches of color. When those happen, they're a very obvious problem, but I find those to be considerably less common than the small-scale color screw-ups.]

Posted by: hugh crawford | Monday, 07 September 2015 at 12:20 AM

I am an electronic engineer and had been working with signal processing (although 1-dimensional) since, well, forever. Mathematically speaking, once you have aliasing in a sampling operation, recovery it's simply impossible. In the sampled data, false components created by the aliasing are indistinguishable from real ones. This is the reason that in audio and signal measurement processing we use oversampling and decimation - to be able to build better antialiasing filters in digital.
So in the end the moiré removal things can't do magic - the only way to recover the thing in a photo is a) blurring (which is the same as having done an oversampling and then applying the AA-filte - this is why you lose details, or b) using the information you have on the real signal (memory) and basically painting it.

Posted by: Romano Giannetti | Monday, 07 September 2015 at 01:09 AM

So I had this issue once. An friend of my sister's who's a very accomplished artist does (among other things) beadwork pieces consisting of thousands of 1mm colored beads in rectangular arrangements. He'd engaged a number of photographers to produce photos of these works so that he could send them to galleries which were considering exhibiting his work. The pictures were always terrible, either because the resolution wasn't high enough to show the detail of the beads, or because moire did weird things to the colors.

I did a quick back-of-the-envelope calculation and concluded that no digital camera then in existence could possibly take a good shot of these works. I think that might still be true - though if there were an X-trans sensor with three times the current maximum pixel count that might do the trick.

What I did was to haul out the Mamiya 6 and the 4x5 monorail camera and use good old-fashioned Portra film to take some shots. Film grain isn't oriented on a rectangular grid, and in larger formats it does a spectacularly better job than digital of capturing finely-spaced parallel lines or square grids.

My sister's artist friend was very happy with the pictures, and so was I. Equipment usually isn't the critical factor in getting an excellent shot - but "usually" isn't "never". This was a case where film simply had an insurmountable *geometric* advantage over digital. Fashion photography (where reproducing both the color and the texture of fabrics is one of the most important things) is another such case.

Several folks in online forums where I've discussed this particular incident have lost their minds and denounced me in the most rabid possible terms as a liar, an idiot, and a film bigot. So be careful how you discuss things like this.

Posted by: Bob Blakley | Monday, 07 September 2015 at 01:13 AM

The book by Dan Margulis - Photoshop LAB Color, the Canyon Conundrum and Other Adventures in the Most Powerful Colorspace, ISBN: 0-321-35678-0 from PeachPit Press has a method for removing moire. There is a video of Dan doing the steps but I never saved it and forgot where I saw it years ago.

P.S. While looking for the Dan Margulis video I came across this technique - http://jkwphoto.blogspot.com/2011/05/new-way-to-remove-moire.html

Posted by: Michael | Monday, 07 September 2015 at 03:48 AM

Copy the layer. Apply GaussIan blur to taste. Mask the layer and hide it. Paint back the affected areas. If further adjustments are necessary such as saturation, command click and only the painted portions will be selected. If too much, dial the corrected layer back from100%

Posted by: m3photo | Monday, 07 September 2015 at 03:49 AM

What you can do is frequency separation, and then blur the color layer. It's more or less the same as using L*a*b, but it usually solves it for me.

Posted by: Adrien Le Falher | Monday, 07 September 2015 at 04:12 AM

For shooting a matrix of one billion 1mm beads, nitty-gritty halftone photos, pen and ink drawings with tons of crosshatching, architecture with repetitive elements, the Oly EM-5 II (set to high-resolution multishot mode) is a champ among champs.

Posted by: Bob Rosinsky | Monday, 07 September 2015 at 10:13 AM

If you use a Mac, Iridient Developer does an excellent job of removing moire and color aliasing problems. Much better than Adobe. It does seem to dull color a bit.

To keep acceptable color process a file twice, one with moire correction and one without, then load both into Photoshop, black mask the corrected layer and then paint in just the moire areas.

The selective blurring of the a and b channels in Lab sounds promising. I have done similar work in the RGB channels by painting in a wee bit of blur in the offending area. It is not pleasant, but it works reasonably well and allows considerable control. With Lab you would be working on just two layers, an improvement. The idea of using noise reduction software to selectively blur the color is also intriguing. Would localized application of the despeckle filter in PS work, especially on the individual color channels?

Another way which works, is to make multiple hue/saturation layers, desaturate offending colors, and paint in the correction through masks. Again, it works reasonably well but is not a fun way to spend an hour.

[***Ctein*** *replies: Steve, thanks for the recommendation. I tried it out and, unfortunately, Iridient did not do as good a job as ACR (CC 2015) at removing moire from my 32Mpx Phase One files. It was not destructive of local color and tone the way ACR was, but even at the maximum strength setting left behind considerable color artifacts. OTOH I didn't see an overall desaturation that you report.*

I suspect that this is yet another one of those cases of different RAW converters working better with different camera files. If I decided to field-test a non-anti-aliased camera with an eye towards purchase, I'd run the files through both programs and see which did better. Thanks!]

Posted by: Steve Justad | Monday, 07 September 2015 at 12:46 PM

"With the rollout of TruePic VII (for the E-M1, 16MP) Oly is baking moire control for µ4/3 lenses into the firmware..."

The difference in visible moire between the cameras is due to the difference in pixel pitch between the 12 & 16mp sensors. The smaller pixel pitch of the 16mp gives a higher spatial/sampling/Nyquest frequency so there are fewer aliasing artifacts. The universe is a physical entity and can't be updated with new firmware.

The processing power of the TruePic VII chip is used for corrections and effects when doing JPG processing.

Posted by: Bruce Rubenstein | Monday, 07 September 2015 at 01:30 PM

Bob Blakley

That sounds about right to me, including the internet yahoos.

"In theory, there is no difference between practice and theory. In practice, there is" - not Yogi Berra

If I think I am going to have an aliasing problem when I am photographing, I will ofter take three exposures one level and two rotated slightly clockwise and counterclockwise. Chances are that only one will have moire. I often have problems with air conditioners in cityscapes and this fixes that.

If I'm shooting hand held, the practice of shooting bursts of three exposures usually insures that either only one photo will have moire or that they will have moire in different spots.

Shooting raw plus jpeg will give you a jpeg file that you can take the color info from and combine it with the raw file's luminance info if all else fails.

Sony just came out with an app for their e mount cameras that will do focus bracketing that I have not tried yet but sounds promising for this sort of thing.

Posted by: hugh crawford | Monday, 07 September 2015 at 03:31 PM

Love that interview Ctein. Thanks for sharing. Killer line: "In a printer mindset, the screen is an intermediate tool. Never get invested in what you see on the screen."

[***Ctein*** *replies: Bingo!*]

Posted by: Stephen McCullough | Monday, 07 September 2015 at 04:12 PM

Since Photoshop now has the Camera Raw Filter, it's possible to select an area of your psd or tiff and use ACR's moire reduction brush more precisely than you can in ACR itself. (Make sure to zero out all the other ACR settings!) You can also adjust contrast, darken shadows, etc. with the same brush, which may help with the dulling effect of the brush. I often do this work on a duplicate layer, then merge down to the background layer when done. Not a perfect solution, but nothing is.

For subjects prone to moire, I find the best thing to be stopping down to f11 or so. The minor diffraction at that aperture not only prevents most moire, but can be effectively reversed using deconvolution sharpening.

I've recently been told by an electrical engineer that it would be possible to create very effective moire reduction software using genetic programming. I'm waiting.....

[***Ctein*** *replies: David, the CRF adjustment brush doesn't perform any differently (nor particularly better) than the ACR brush, but it has the major advantages of letting you work on previously-converted-to-PSD photos and files where you don't want to mess with the Process Version 2012 setting, along with being able to change your mind and fiddle by working in separate image layers.*

I'd deem it a superior approach to fixing this in ACR. At the least, you can fix stuff you didn't catch in ACR. A great tip!]

Posted by: david stock | Monday, 07 September 2015 at 04:44 PM

Bob Blakley, If you digitally scanned your 4x5 neg would the scanned file exhibit moire?
Digital photography is a deconstruct, reconstruct (as finely as possible) process. Film is magic.
Just curious.
bd

Posted by: Bob Dales | Monday, 07 September 2015 at 06:15 PM

Like Steve Justad I have found Iridient to be a better tool than the alternatives, but none of my cameras lack an AA filter, rather they have weak filters, so chances are it is very much camera dependent.

I am of the opinion that the whole headlong rush down the "non AA filter" path is misguided, moire` really seems to be an intractable issue once you have it!

Despite reading repeatedly on forums and test sites that moire` is a rare issue, I am constantly having it crop up and will happily trade off some micro sharpness to be rid of it.

In fact I don't even think keeping the AA filter is a trade off, zoomed in to 100% view, most of the supposed clarity gains purported to arise from the missing AA filter look quite unnatural and sythetic to my eyes.

Posted by: Brad Nichol | Monday, 07 September 2015 at 06:17 PM

I agree with Brad. A properly-designed aa filter just cuts off fake resolution and artifacts above the Nyquist limit. It can slightly reduce contrast near the Nyquist limit too, but that can usually be recovered with proper sharpening.

Nevertheless, I currently find myself using an aa-less camera (Sony A7RII) because it has other things I want. And, as I discovered with a D800, even a camera with a mild aa filter will show moire sometimes. (My A7II does, too.)

It is often said that the higher the resolution of the sensor, the less chance of moire. My experience is that with a really sharp lens, high resolution sensors just shift the moire to another frequency. It may show up less in certain common situations. But if you photograph lots of urban landscape or fabric, there will still be issues.

Posted by: david stock | Monday, 07 September 2015 at 07:12 PM

I know almost nothing about the subject but wondered if a multi-shot camera (Oly M5 II, the one that takes several pics offset from one another) can help with something like this. I have this gut feel that since the pics it takes are a known offset from each other, that one should be able to use that info. I am only speculating.

Posted by: Robert Roaldi | Tuesday, 08 September 2015 at 06:25 AM

Hi Ctein,

In re your excel issue, you may have tried this already, but it has worked for me many times: whenever I'm stymied by VB nomenclature or syntax, I record a macro using menu commands or keyboard shortcuts to do whatever I need done, then open up the macro in the macro editor and see how the steps are done in VB. I generally name the macro "delete_me" or some variant so that I don't confuse myself later on (easy to do ;) YMMV, but I've found it to be a huge time-saver.

Cheers,
Dan

Posted by: Dan Gorman | Tuesday, 08 September 2015 at 01:25 PM

I have never needed to use it but this technique was recommended by a very talented professional photographer:

https://vimeo.com/23508129

Posted by: Don | Tuesday, 08 September 2015 at 01:26 PM

Try Phase One's CaptureOne Pro software (free trial available, I think): it has adjustments for Moiré. In fact, you may find that it replaces all of your other software. As a raw developer, I find that it's a toss-up between CaptureOne and DxO Optics Pro at getting the best from your files, leaving everything else lying bleeding in the gutter.

Posted by: Alun J. Carr | Tuesday, 08 September 2015 at 04:24 PM

Ctein, I was inspired by your post to experiment a bit more with overcoming moire. I may have found something to help with moire on fine straight lines (like distant air conditioners or venetian blinds).

I start by selecting the area that has moire. I then use two hue/saturation layers (of the selection) on top of each other. The one on top is used to desaturate the area, or make it all one color. The hue/saturation layer below is used to equalize luminosity as much as possible, using both hue and saturation sliders to adjust the underlying colors.

So far, this is a variant of a technique that is often suggested by others. But I find it doesn't do enough to get rid of architectural moire, especially luminosity patterns.

What I find helps a great deal is to follow up with the Emboss filter (in the Stylize drop down) on the background layer. If you get the angle, height and amount just right, the wavy and jagged patterns left over after the hue/saturation corrections can be smoothed out, at least in my tests. In my first experiments, I find that a height of around 13 and amount of around 47 works for the zones where I often get moire. Angle has varied from -20 to -44 for slightly tilted subjects. The angle seems to work about the same at 180 degrees around the circle (positive instead of negative).

I'd love to know if this works for anybody else

Posted by: david stock | Thursday, 10 September 2015 at 01:26 PM

The comments to this entry are closed.