Part 27: Deep Illusions & DoF Geek-out

To create dynamic images we are always trying to squeeze as much depth into them as we can. When we look at our world, our eyes and mind create a 3D illusion of that scene. In reality we don't see in 3D at all, we see 2D stereo – two slightly offset two-dimensional images (our eyes are around three inches apart) that our brain converges together to create the look of three dimensions. If you don't believe me, try this test (when you are not driving or operating heavy farm equipment): stretch your left arm straight out from your body, then point your index finger (not your middle finger) up to the ceiling (as if to sign the number one with sign language). With your left arm and finger frozen in position, duplicate the same with your right arm and finger, only bend the right arm so that the right finger is half an arm length from your eyes. With both eyes open and with your head straight on to your arm/finger array, focus on the near finger, notice how the far finger is out of focus and is doubled yet the near finger is singular. Now focus on the far finger, notice how the near finger is now out of focus and doubled while the far finger is focused and singular. I can't stress how important it is to make sure you do all this with both eyes open. I just tried this little demo myself to double check that I had it right and couldn't get the unfocused finger to double, not even after four scotches! I soon realised the problem – I only had one eye open! Once you have it right, try the exercise again looking at the near finger with both eyes open and then close one eye; apart from the far finger morphing back into one finger again, notice how your perception of depth melts away – with two eyes open we have binocular vision, with just one open we have monocular vision. A camera sees like you do when you have one eye shut – it sees a single 2D image. So by working with a monocular device, we lose the illusion of depth, but we can trick the viewer of our images into thinking they are seeing depth through good lighting (dark tones recede, light tones come forward naturally creating depth) and by exaggerating the natural convergence and divergence of subject lines as well as exaggerating near and far size relationships of objects in our photo, through careful choice of viewing distance and angle.

There is one other way to enhance the illusion of depth, and that is depth of field (DoF) – if you set your camera to a wider aperture opening you will have less in focus. If you focus on the subject to make them sharp, it is possible to have the background and foreground become soft or somewhat out of focus. This creates the illusion of depth in our photos; in real life when you focus on an object with your eyes, the areas in front and behind that object are out of focus. With the aforementioned monocular/binocular finger demo you probably noticed that when you focused on the near finger, the far finger went soft and the reverse when you focused on the far finger. This occurs because our eyes work with fairly shallow DoF; whatever you focus on becomes sharp and everything else starts to go soft. DoF plays an important roll in the various illusions I use in my photography, for instance, in my recently released DVD, *Dances With One Light*, I worked with shallow depth of field to help create the illusion of model Sadie May hanging out on a sunny day outdoors in a garden or park, see Image 001. Truth be told, she was photographed indoors on the sixth floor of an office tower using my simulated sunlight technique. This image has so much depth that it almost seems like you could reach in and touch Sadie. Apart from the light sculpting her form, it is the shallow DoF provided by the f 4 aperture opening that distances the background from her. This shallow DoF not only pulls her out from the background, but hides many telltale signs in the background that would give my illusion away. To learn more about how I did this shot, check out my *Dances With One Light* DVD.

We all know that larger aperture openings render less DoF and that smaller openings render more DoF, but why is it that some images appear to have more DoF and others less, even though they were shot at the same aperture? For instance, when we photograph small things like close-ups of insects, we have very little DoF compared to when we

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photograph large things like architecture where we have lots of DoF? The answer is something most photographers are not aware of, this something is called 'reproduction size' and it profoundly affects DoF. Reproduction size refers to the amount of reduction or magnification of your subject on your imaging sensor or film. There are three main controls that govern reproduction size, they are:

- Size of subject.
- Size of the imaging sensor or film.
- Imaged size of subject on imaging sensor or film.

If you take a full length and then a headshot of a person, both at the same aperture, which one do you suppose will have the most DoF, that is to say, which will have the sharpest background? When you take a full length picture of a person on a DSLR (see Image 002 A), they are greatly reduced in size; a full-length of myself would render me down from 6ft or 183cm to about 1 inch or 2.5cm. That is a huge reduction; this reproduction of me is about 72 times smaller than my real size. A chest-up shot of me (see Image 002 B) would render my nine inches or 23 cm head down to about 1 inch or 2.5cm on a full-frame DSLR; that reproduction is about nine times smaller than my real size. Both scenarios reduce my actual size, but the full-length does so much more. When you look at the results of my full-length image (see Image 2 A) and my headshot (see Image 2 B) both shot at f 5.6 on the same camera and with the subject/background distance staying constant, notice that the DoF is greater in the full-length and less

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in the headshot, the reason for this is, the smaller the reproduction size the greater the DoF or you could say, the more you reduce the subject's size in camera, the more DoF you will have. The sensor size or film size of your camera can affect this too; a DSLR sensor is much smaller than 10x8 inch film for instance and so the ability to show a subject at a larger reproduction size is greater on the 10x8. Same thing with an APC imaging sensor and a full-frame imaging sensor, only not as profound. iPhones are great for near-macro shots because they have incredible DoF – their imaging sensors are so small that you can frame tiny objects full frame and have a much greater reduction of reproduction size relative to actual size than let's say a DSLR. In my early days of digital, I had the honour of being part of the beta test team for National Semiconductor's fledgling company Foveon (Sigma now owns Foveon and uses their X3 imaging sensor). The Foveon prototype digital camera I was testing used imaging sensors (12 mm x 12 mm) that were about the size of your thumbnail. Like the iPhone, the small sensor size created huge depth of field; shooting at f 5.6 on this system was roughly equivalent, DoF-wise, to shooting at f 11.5 on a full frame DSLR.

Let's geek out even further; what happens if you crop in on a full-length shot like my full-length image (Image 2 A), and then enlarge the cropped file to match the chest-up image of me, (Image 2 B)? Will this make background appear softer since the subject is now reproduced larger? Compare the background of cropped enlarged image (see Image 2 C), with 2 A, notice how the background appears exactly the same between 2 A and 2 C, even though we enlarged 2 C's reproduction size (in Photoshop). Now compare this cropped version with the image shot chest-up 2 B; big difference, 2 B is definitely softer in the background so way less DoF. Other than aperture choice, it goes to show that changing your subject's imaged size on the sensor or film affects DoF and not cropping and resizing after capture.

Like most things in photography, it is never simple and, as you have seen DoF is no exception, and to wrap-up this geek-fest I will leave you with one final thing – does focal length affect DoF? Different lens' focal lengths will appear to affect DoF with how in focus background objects appear at a given aperture setting. Reproduction size is again the culprit. How reproduction size affects this makes sense if you understand the law of perspective. The law of perspective states: changes in perspective (distance), have a more profound effect on closer objects and less profound effect on further objects. When you view a scene up close, the apparent size difference between near and far objects is very pronounced; the far objects seem small compared to the near objects. When you

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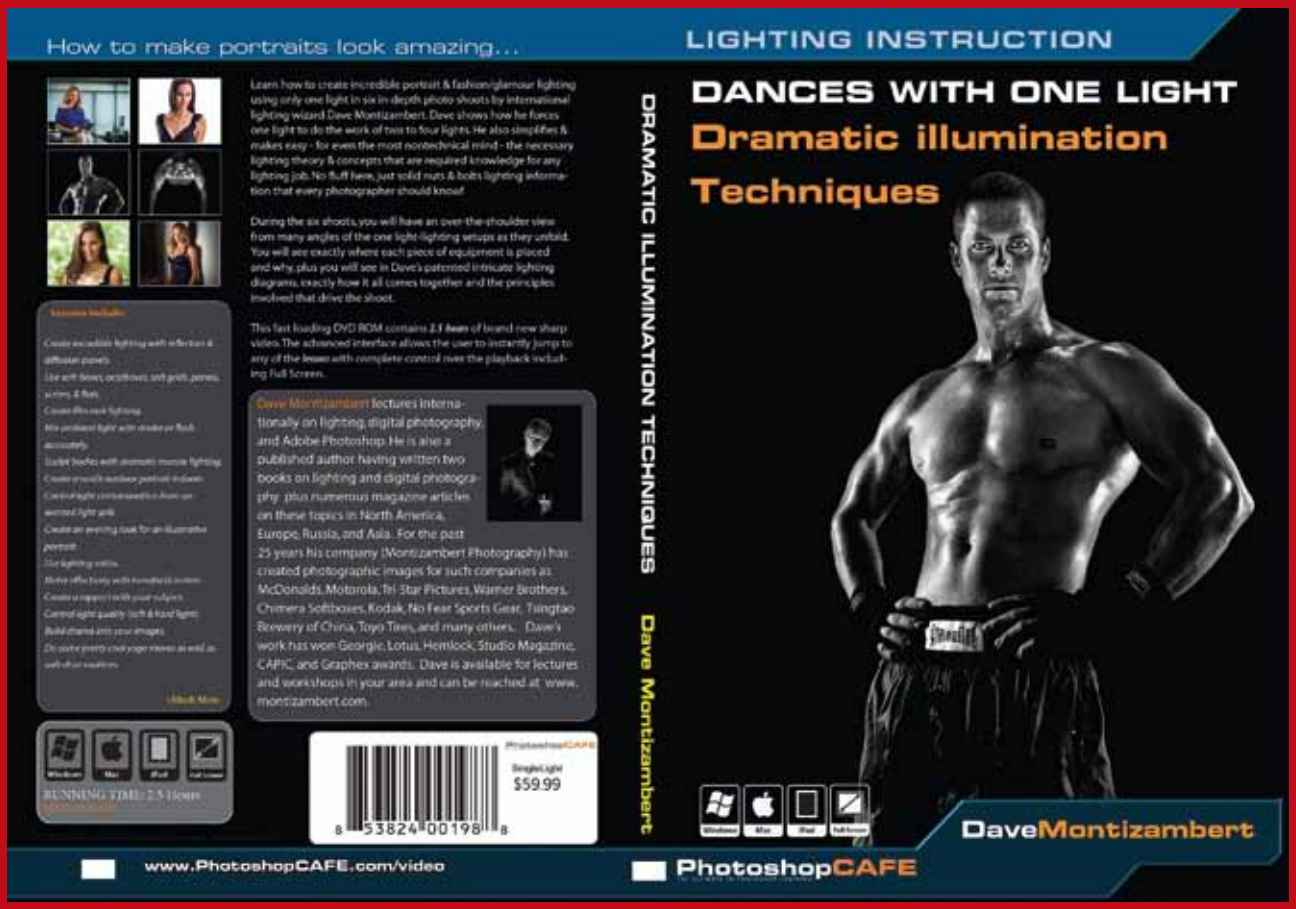
back away from the scene to a far distance, the apparent size difference between near and far objects is less pronounced; the far objects don't seem so small in comparison to the near objects. To demonstrate this I created a DoF/focal length test series of a clock photographed on the same camera twice: once in close using a 55 mm lens and then again

further away using a 180 mm lens (see Image 003); both were shot at f11 for DoF and both were focused on the clock face. The distance between the clock and the background stayed constant from one shot to the next, only the camera distance was altered in each frame; this was done to keep the size of the clock in each shot the same after swapping out lenses. When the 55 mm lens was on, the camera had to be moved closer to the clock to fill the frame appropriately. As the camera moves closer, both the clock and the background get bigger, but the clock grows larger at a faster rate than the background, and since the background objects now appear smaller relative to the clock, there is more DoF. When the 180 mm lens was used, it was necessary to place the camera further away. As the camera was backed up, both the clock and the background get smaller, but the clock grows smaller at a faster rate since it is closer to the camera than the background. In the end, the 180 mm lens magnifies the image so that the clock looks the same size as in the 55 mm shot. The background, however, doesn't look the same – the apparent larger (reproduction) size of the background objects caused by the distance change creates less DoF making all (background) objects appear larger and softer than the same in the 55 mm shot. So it is really the change in perspective (distance) from the scene that controls DoF here and not the lens choice, the lens merely takes in a wider (the 55 mm) or narrower (the 180 mm) field of view. You can put your outstretched arms back down now.

Dave Montizambert lectures internationally on lighting, digital photography, and Adobe Photoshop. He is also a published author having written two books on lighting and digital photography (www.montizambert.com) plus numerous magazine articles on these topics in North America, Europe, Russia and Asia. Dave also creates Lighting and Photoshop tutorial DVDs for www.software-cinema.com and www.photoshopcafe.com. Dave is available for lectures and workshops in your area and can be reached through www.montizambert.com.



Along with this installment on lighting I wanted to gush for a minute about my new lighting DVD (see DVD cover image) called *Dances With One Light*, I'm really excited about this one, it contains over 2½ hours of training where viewers will learn how to create dramatic lighting on subjects using only one light. It starts out with a couple of basic set-ups then moves on to more elaborate ones where that one light creates multiple light sources. The final two lessons push it to extreme 'one-light-ery'! This is not a wimpy video, tons of real information about lighting and exposure plus lots on working with people on camera and of course shot in HD with humorous bits plus elaborate lighting diagram breakdowns with technical bits about size, height and distance of gear. It is available on-line at *http://www.software-cinema.com/training/adobe-photoshop/dave-montizambert/162/dances-with-one-light-dramatic-lighting-techniques* or directly from me via email *montizambert@gmail.com* at $10 off list price.

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