



Full-frame on the Rise • Macro Workshop • Lightroom vs. Photoshop

Free DVD
inside

ct Photo

ct Digital Photography

The in-depth quarterly for the photo enthusiast

George Lepp
Workshop p. 44

Sony A7R vs. Leica M, Nikon D800

Full-frame Just Got Smaller

Stunning Image Quality
Competitive Price

Learning to See

Pack Your Photos with Emotion

Lightroom vs. Photoshop

New and Old School RAW Processing

Macro Special

George Lepp Focus Stacking Workshop • 8 Prime Lenses



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Take a look at any book or magazine and you will find that we are surrounded by incredible macro photos. Whether you choose a cookery book, a gardening periodical or a lifestyle magazine, you will be faced with apparently perfect flower blooms, cupcakes, table decorations and even perfect-looking insects captured from extreme and often unusual perspectives. With all this perfection around, why bother shooting your own macro photos?

The answer is simple – because all that perfection lacks emotion. It is all too easy for us photographers to be put off by the all-encompassing world of perfect imagery and to feel insecure about the quality of our own work. But the daily flood of images can provide inspiration too, and often provides the kick-start we need to go out and create our own wonderful pictures with their own personal message. Nothing tops the thrill of experimentation and it is the courage to invent that often produces the most interesting results.

To get you going, check out George Lepp's focus stacking workshop on page 44, Torsten Hoffmann's tips on how to see the world with fresh eyes on page 116 or Michael Jordan's take on available light photography on page 76. And, if you thought high-end close-up gear is too expensive, our macro lens test on page 60 shows that you don't have to spend a fortune to get up close and personal with all those great subjects out there.

It's time to head out into the garden!

Sophia Sieber

Sophia Sieber



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If your copy of the magazine contains no DVD, navigate to www.ct-digipho.com/dvd162014 to download the DVD content for free.

Free DVD

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Full version software: Photomizer Scan 2.0.13.704

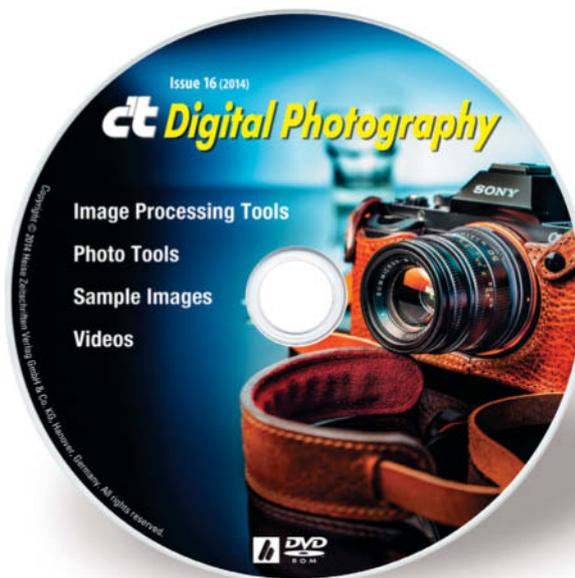
A comprehensive and easy-to-use package for processing and tweaking digitally scanned photos and negatives.

Full version software: ACDSee Pro 5.3.168

A pro-grade processing and management suite for all photographers who shoot in RAW formats.

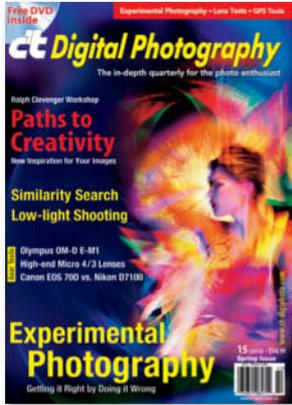
Videos

- David Burnett – Feelings and Memories
- Focus Stacking with Helicon Focus
- Josh Westrich – A Passion for Flowers
- Safe Portraits – Great Photos in No Time



Reader Forum

Canon/Nikon Duopoly



Regarding your issue #15: why do you find it necessary to limit your equipment comparisons to the Canon/Nikon duopoly? Instead of comparing just the Canon 70D and Nikon D7100, why not also include similarly priced competitors from Pentax and Sony? Is it not more journalistically ethical to compare available products from all the producers of

similarly priced products, rather than helping Canon and Nikon retain their current market power? For that matter, why not also include comparably priced mirrorless cameras? Oh yes, Canon and Nikon don't have such cameras, whereas Fuji, Olympus, Panasonic, Samsung and Sony do. Shame on you. I likely will let my subscription expire if such Canon/Nikon bias continues.

Mark Van Bergh

Thanks for your remarks and your question. Of course, we have to limit the number of devices we test – in this case to the comparison of Nikon and Canon cameras. Our aim is not to perform 'diplomatic' tests that please everybody by including all possible cameras from every

manufacturer. Why? Because the outcome of such a test would be confusing and not to the point. That's why we limit each of our camera comparison tests to only a few manufacturers. If you browse through past issues, you will discover tests that include Pentax, Sony, Panasonic and other brands too. We select our test gear independently, which the camera manufacturers don't always like but still have to live with. The major risk of this approach is that we then receive mails from readers who miss the cameras we haven't included! Please stick with us – there are plenty of great non-Canon/Nikon tests coming up.



Latitude and longitude

In Issue 15 of *c't Digital Photography*, page 90, in GPS Data Formats and Exif Tags (first column), the article states: "Latitude is measured using values between 0 and 180 degrees east or west of the Greenwich Meridian in London, and longitude is measured using values between zero and 90

degrees north and south from the equator." The Latitude and Longitude is wrongly stated. It should be the other way round. Longitude is measured using values between 0 and 180 degrees east or west of the Greenwich Meridian in London, and Latitude is measured using values between zero and 90 degrees north and south from the equator.

Thank you very much for your input. The swapped words you spotted are the result of a basic translation error that unfortunately slipped through the copy editing net. It is thanks to comments like yours that we are able to spot where we need to tighten our processes to further improve the quality of the magazine. Thanks again for your help and keep reading!

You are welcome. I always think your magazine is a great one.

Lawrence Sze-Ying Lau



Tell us what you think:

We are always happy to receive your comments and suggestions in a letter, an e-mail (editor@ct-digiphoto.com) or at www.facebook.com/ct-digiphoto. We reserve the right to abbreviate your input for publication. Our comments are printed in italics.

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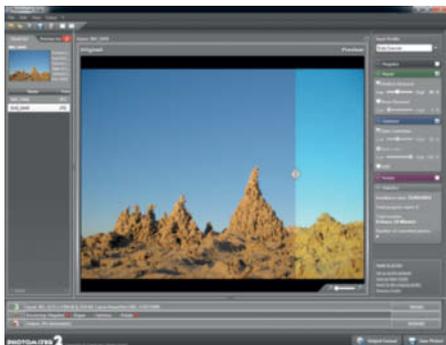
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MORE THAN A CAMERA STORE

DVD Highlights & Contents

Photomizer Scan 2

Full version software: Photomizer Scan is a highly automated application that helps to bring out the full potential of scanned negatives and prints.

Detail and color are often lacking in scans of analog photos. The *Photomizer Scan* full version software we have included here provides the functionality you need to optimize scans of negatives and photos, automatically adjusting exposure, contrast and saturation to produce great results.



The program has automatic object recognition to keep the number of edited pixels to a minimum and also includes tools for reducing image noise and removing other unwanted artifacts. All the settings are easy to apply, making the software perfect for beginners and experienced users alike. The split-screen interface, with its zoom and full-screen preview tools, gives you an instant overview of the original scan and the current state of your adjustments.

Use of the full functionality requires online registration during installation. Once registered, *c't Digital Photography* readers will receive a serial number via e-mail and a special offer that gives you US\$50 off an upgrade to the current pro version or US\$130 off the *Photoshop* plug-in version, valid until October 31, 2014. The registered full version is valid for an unlimited period. (tho)

'Safe' Portrait Workshop

Video tutorial: Pro photographer Bert Stephani explains how to produce 'safe' portraits in a minimum of time.

Bert Stephani is a pro portrait photographer who knows just how to get a shoot running smoothly. In order to ensure relaxed interaction between the photographer and the model, it is essential to produce tangible results that the subject can view right from the start of a session.

This video introduces the techniques he uses to produce quick portraits that set the scene for a productive shoot. For example, for indoor shoots, he recommends positioning female subjects in daylight near a window and shooting using a relatively warm white balance setting. Use of reflectors, changing your viewpoint and switching between portrait- and landscape-format shots are all ways to keep the look of the resulting images varied and interesting.

The main part of this video shows Stephani putting his tips and tricks into action with model Svetlana, and he rounds up by giving us some

ideas on how to produce excellent portraits of male subjects too.

These techniques are all quick and easy to apply and make it possible to produce excellent sample portraits in the space of just five minutes. (sea)



ACDSee Pro 5.3.168

Full version software: A pro-grade processing and management suite for all photographers who shoot in RAW formats.



This versatile photo editing and management package is a great all-in-one photo workflow tool aimed at pro and advanced amateur photographers. It includes RAW conversion and non-destructive editing functionality and provides a wide range of advanced image adjustment tools.

The built-in development tools include red-eye removal, dodge and burn, and shadow and highlight adjustment as well as noise reduction, perspective correction, vignetting, anti-distortion, batch processing and patented Lighting and Contrast Enhancement (LCE), functionality. Hue, saturation and brightness can be finely tuned in the Advanced Color module and Smart Sharpening gives your images a final polish.

Alongside its editing functions, the program also offers a powerful image search and management module that works directly with your computer's directory tree and includes auto-categorization based on Exif data as well as manual tagging and rating tools. Support for online services makes it simple to share your work with others.

To activate the software, register at en.software-choice.com/acdsee5. You will then receive a serial number and further information on the activation process via e-mail. Please note, new serial numbers have to be requested by September 5th in Europe, by September 26th in the US and Canada and by November 7th in Australia and the rest of the world. Additionally, all users who have an ACDSee account can upgrade to the current pro version for just US\$59.99. (sea)

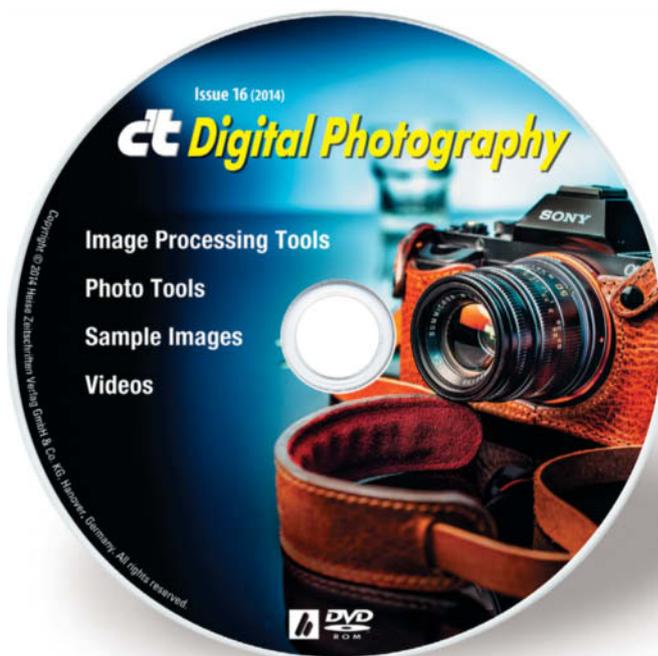


Image Processing Tools

Windows

ACDSee Pro 5.3.168
 Artweaver Free 4.5.3
 GIMP 2.8.10
 GIMP Portable 2.8.10
 GREYCs Magic Image Converter (GMIC) 1.5.8.6
 HeliosPaint 1.6
 Hugin 2013.0.0
 Liquid Rescale 0.7.1
 Liquid Rescale Portable 0.7.1
 Photomizer Scan 2.0.13.704
 PSPI 1.0.7
 StylePix 1.14.3.2
 StylePix Portable 1.14.3.2

Mac OS

GIMP 2.8.10 for Mavericks
 GREYCs Magic Image Converter (GMIC) 1.5.8.6 for Mavericks
 HeliosPaint 1.6

Linux

GREYCs Magic Image Converter (GMIC) 1.5.8.6
 HeliosPaint 1.6
 PSPI 1.0.5 for Ubuntu
 PSPI 1.0.7 for SUSE 10

Photo Tools

Windows

AmoK Exif Sorter 2.56
 ExifTool 9.59
 Helicon Photo Safe 4.10
 IrfanView 4.37
 IrfanView PlugIns 4.37
 IrfanView Portable 4.37
 PhotoRec 6.14
 Piwigo 2.6.2
 The Rasterbator 1.21
 WordPress 3.9.1
 XAMPP 1.8.3
 XAMPP Portable Light 1.8.3

Mac OS

AmoK Exif Sorter 2.56
 ExifTool 9.59
 MacPorts 2.2.1 for Mavericks
 PhotoRec 6.14
 Piwigo 2.6.2
 WordPress 3.9.1
 XAMPP 1.8.3

Linux

AmoK Exif Sorter 2.56 32-bit
 AmoK Exif Sorter 2.56 64-bit
 ExifTool 9.59
 Gallery 3.0.9
 PhotoRec 6.14 32-bit
 PhotoRec 6.14 64-bit
 Piwigo 2.6.2
 WordPress 3.9.1
 XAMPP 1.8.3 32-bit
 XAMPP 1.8.3 64-bit

Sample Images

Camera Test Sample Images
 Lens Test Sample Images

Videos

David Burnett – Feelings and Memories, Part 1
 Focus Stacking with Helicon Focus
 Josh Westrich – A Passion for Flowers
 Safe Portraits – Great Photos in No Time

Get in the Picture



c't Digital Photography gives you exclusive access to the techniques of the pros

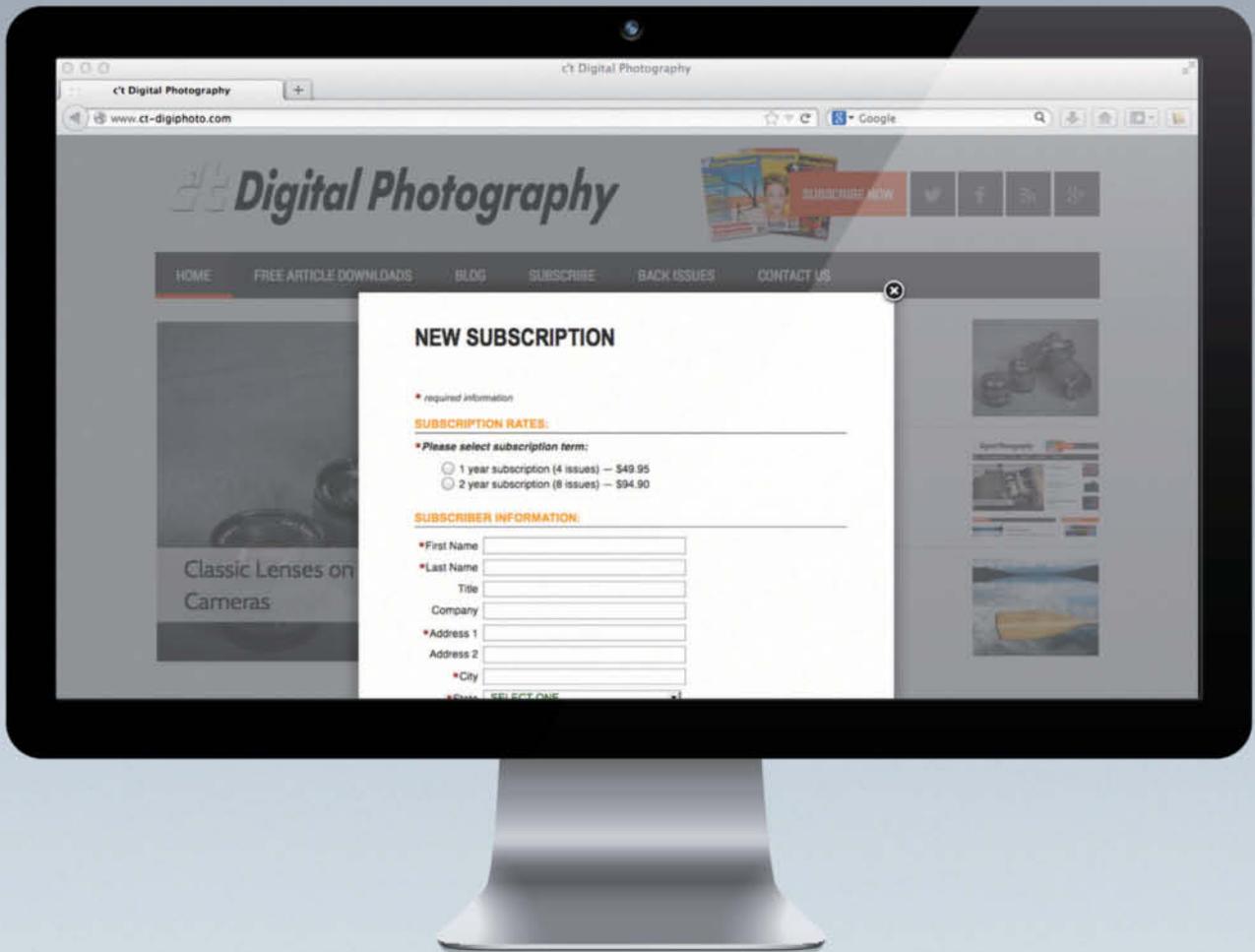
Keep on top of the latest trends and get your own regular dose of inside knowledge from our specialist authors. Every issue includes tips and tricks from experienced pro photographers as well as independent hardware and software tests.

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Portfolio

Christian Tagliavini

Models attired in paper and cardboard and portraits that look like centuries-old paintings – Swiss photographer Christian Tagliavini stage-manages stories that sometimes seem real, sometimes surreal, playfully mixing two- and three-dimensionality and using stylistic elements from a bewildering range of historical periods.

Spontaneous photos are not Christian Tagliavini's thing at all. Weeks, even months, build up to the moment when he and his team have finished their preparations and he can at last release the shutter.

After training as an architect and graphic designer, Tagliavini began taking photographs quite late in his career. Not only is he a self-taught photographer, he still performs almost every part of the creative process himself, from designing the costumes to casting the models and applying their make-up.

"What fascinates me most is that I am not just responsible for the final 'click,'" says the 42-year-old. "I don't really see myself as a photographer. I'm more like a photographic craftsman. I also really like playing the

designer and dreaming up clothing that nobody would actually wear."

Such clothing was a feature of his two latest sequences, *Carte* and *1503*, which brought him to the attention of the international photography scene. His large-format photographs are now exhibited and sold around the world at such illustrious addresses as the Paris Photo show and the CWC Gallery in Berlin (camerawork.de). They're also winning him awards – the Hasselblad Masters Award in the Fine Art category in 2012 for his *1503* series (see page 14) and the International Photography Award in 2013 for the *Carte* series shown opposite.

All Tagliavini's images, from his earliest works to his 2013 award-winners, illustrate his never-ending quest for perfection. Tagliavini

has always been dedicated to detail and his images are painstakingly put together. "Even after I've captured a photo, I'm never happy with the result and I always want to do it again," he says. "I always try to pay maximum attention to every tiny detail."

The technology he uses also has to meet his exacting standards and be fit for the purpose. Large or medium format gear is a must, and these days that also means working exclusively with digital equipment. The images for *1503* were shot using an analog Sinar large-format camera, although he has since switched to medium-format digital gear. It was a difficult decision, he says, but unavoidable because achieving the quality he wanted using analog equipment used up a disproportionate amount of time and effort.



Four playing cards from the *Carte* series, completed in 2012. Each of the cards – from Jack to Queen and Ace – has its own unique character but is also linked to the others by hidden symbols and hints. What also appealed to Tagliavini about this project was the opportunity to play with two- and three-dimensionality by dressing real people in laser-cut paper and cardboard costumes he designed himself.



Ritratto d'uomo from Christian Tagliavini's 1503 series shows a scribe portrayed the same way Renaissance artist Agnolo di Cosimo (aka 'Il Bronzino') might have painted him

The 1503 Series

With titles like Cecilia, Lucrezia and Bartolomeo, these images appear to be from another era. They look like merchants, members of the nobility and high-ranking citizens, and in some ways they are, for these portrait subjects are modeled on the art of Florentine painter Agnolo di Cosimo, also known as 'Il Bronzino'. The title of the series is the year of the painter's birth.

It took Tagliavini 13 months to put this sequence together. Like Il Bronzino, he likes to

emphasize details that are unique to the subject, such as the scribe's quill pen in the image above. Unlike in Il Bronzino's work, however, all these people appear to have extremely long necks. Tagliavini is adamant that this effect has nothing to do with *Photoshop* and that it is the product of an illusion borrowed from his other trade as an amateur magician. Like all true magicians, he didn't want to reveal how this particular trick works. (keh)

Links

CWC Gallery: www.camerawork.de
Paris Photo: www.parisphoto.fr
Agnolo Bronzino: en.wikipedia.org/wiki/Bronzino
IPA: photoawards.com
www.christiantagliavini.com





1503, Ritratto di giovane uomo
con cappello piumato



1503, Ritratto di signora in verde



1503, Bartolomeo



1503, Donna Clotilde

A detailed close-up photograph of a camera's internal sensor and mirror box. The sensor is a rectangular chip with a colorful, iridescent pattern of light reflecting off its surface. It is mounted within a circular metal frame that is secured by several screws. The surrounding camera body is black with a textured grip. Various controls and buttons are visible, including a function button labeled 'Fn' on the left and a button with a lightning bolt icon on the right. The lighting is dramatic, highlighting the metallic surfaces and the intricate details of the sensor assembly.

Sophia Sieber

Full-frame

for beginners and experienced APS-C users

With the introduction of the reasonably-priced Nikon D610, Canon EOS 6D and Sony Alpha models, full-frame digital photography has finally hit the mainstream, making it possible to shoot pro-resolution images with a camera that costs around US\$2,000. But is price the only yardstick? We take a look at the potential benefits of switching and why you might be better off sticking to what you know.

Before the 2012 Photokina show, full-frame digital cameras were the preserve of photographers on a big budget. True to the assumption that pro technology comes at a pro price, back then, you had to pay at least US\$3,500 for a full-frame camera body. And that was when the new era began, with both Nikon's D600 and the Canon EOS 6D hitting the market near the psychologically important US\$2,000 price point.

It wasn't long before the market did its usual trick and the D600 could be found for around US\$2,200 with a lens included. Its successor, the D610, now costs around the same. More recently, market leaders Nikon and Canon have encountered new competition in the shape of Sony's Alpha A7, which is already available for under US\$2,000 with a kit zoom.

What's in store in 2014

We believe that prices will sink further in 2014 and that the major manufacturers will continue to introduce new mid-range full-frame models to make the most of current consumer interest. Figures from last August confirm that more than 30 per cent of DSLR turnover in 2013 was made with full-frame models, although it has to be said that the absolute number of cameras sold was minuscule compared with the market as a whole.

Rumors that Sony is working on additional mirrorless full-frame models as small as the NEX-5 are backed up by patent filings published on the Egami blog site. Other

manufacturers are sure to follow suit: it wasn't long ago that a listing for a camera called 'NXF1' was spotted on the Samsung website and the rumor mill immediately assumed that 'F' stands for 'full-frame'. So far, Samsung has only built APS-C sensors into its mirrorless cameras.

Rumors also abound that Pentax is preparing to enter the full-frame market. 2014 certainly feels like the right time to do so. We have also heard from a reliable source that a big-name camera manufacturer known for its small-sensor cameras is planning to use full-frame sensors and possibly even develop its own.

Reasons to Switch and Reasons to Stick to Your Current System

In the current market, switching to full-frame is a tempting proposition, especially when you consider that most high-end APS-C systems cost about the same as the current crop of full-frame offerings.

But things are never as simple as they might seem, and the relatively low cost of stepping onto the full-frame ladder is quickly put into perspective by other factors. The following pages provide an overview of the benefits and potential drawbacks of making the switch.

Less Noise, More Dynamic Range

This is a clear **yes** factor. If you are not prepared to make compromises and your aim

is to achieve the best possible image quality, then full-frame is the way to go. Full-frame sensors have a greater surface area than APS-C and Micro Four Thirds models and therefore offer a much greater area per pixel for capturing incoming photons. The more photons a sensor captures, the more image data the resulting image file contains.

Larger photoreceptors also mean less image noise and greater dynamic range, making it easier to capture great-looking images in tricky situations such as low light and backlight.

But: No buts in this respect! Lower noise and better contrast are always a bonus.

Creative Scope

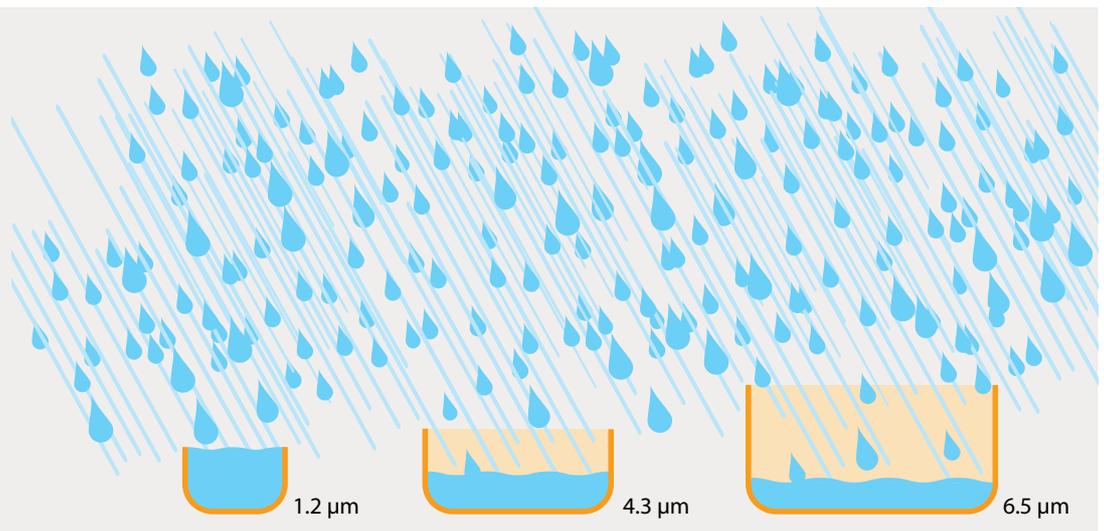
Another resounding **yes**. Full-frame photographers have much more freedom when it comes to composing and framing their photos. They also benefit creatively from the comparatively shallow depth of field available at comparable focal lengths, which makes it easier to use differences in focus as a stylistic device. See our article *Getting it Right by Doing it Wrong* in Issue 15 of *c't Digital Photography* for some ideas on using depth of field effects creatively.

Compared with small-sensor cameras, full-frame models have a larger angle of view at shorter focal lengths. This difference is expressed in terms of the 'crop factor' – a number that uses the 24×36mm full-frame format as its reference point. In other words, a full-frame sensor has a crop factor of 1, while APS-C cameras come in at approximately 1.5

Collecting Photons

Each pixel in the Canon EOS 6D's 20-megapixel full-frame sensor has a nominal width of 6.5 μm . The APS-C Sony A3000 has a 20-megapixel sensor too, but with photoreceptors that measure only 4.3 μm . In comparison, the pixels in the sensor built into the Casio EX-ZS30 measure 1.2 μm .

Larger pixels can capture more photons and produce more image data.



The EOS 6D is Canon's current calling card in the full-frame world and, unlike the Nikon D610, has built in Wi-Fi functionality



The D610 is Nikon's second-generation entry-level full-frame model, although the differences between the new model and its predecessor are only slight

and micro Four thirds models at 2. A crop factor of 1 is of particular benefit in wide-angle situations, as it enables you to shoot with a wider angle of view using a lens with the same angle of view as an equivalent lens built for use with smaller sensors.

But: Greater creative potential also demands more careful composition, especially when it comes to shooting portraits. If the plane of focus is in the wrong

place, the image will be ruined. If you are working with a full-frame camera at wide apertures, you will definitely need a tripod and a patient subject! Photographers making the switch from a smaller-sensor camera are sure to produce quite a lot of unusable images in their first few weeks with a new full-frame camera.

If you like to shoot using telephoto lenses, you will have to use used to using much

longer focal lengths, which brings us neatly to our next point.

More and Better Lenses

Another clear **yes**. Both Nikon and Canon offer only a limited range of dedicated APS-C lenses and concentrate heavily on their full-frame offerings. Full-frame lenses are generally of better quality and have larger

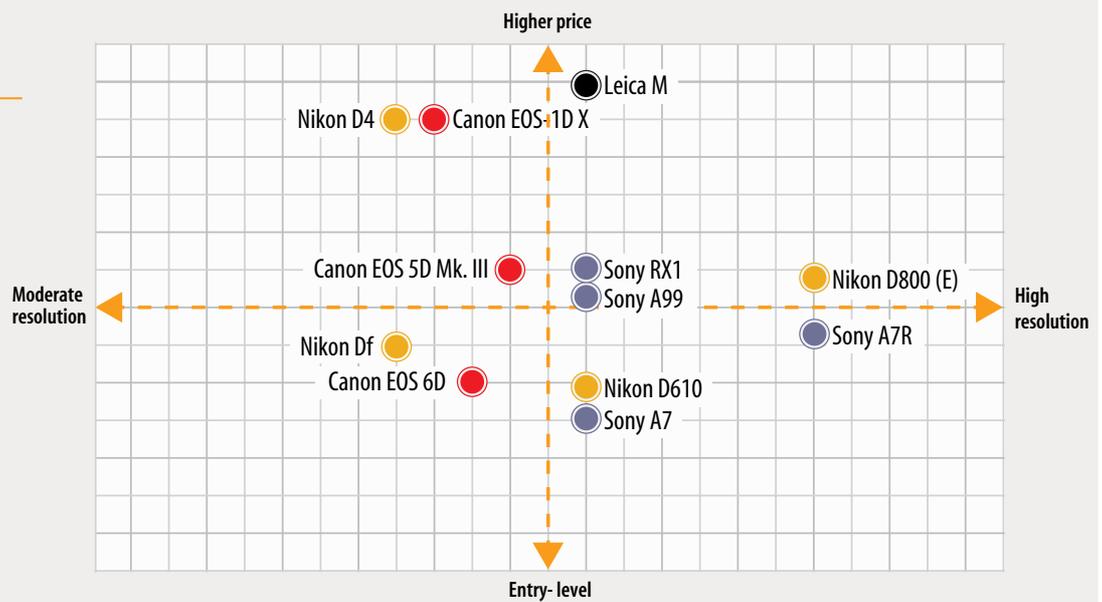
Comparing Sensor Sizes



Interchangeable-lens cameras come in a range of shapes and sizes with image sensors to match. Tiny 1/2.3" sensors are more often found in compacts than in system cameras. The undisputed king of the hill for most semi-pro and serious amateur photographers is still the 24×36 mm full-frame format. This format is also widely used in professional circles, although many pros also use cameras with medium-format sensors that measure 48×36 mm or more.

Full-frame DSLR Market Overview

The market for full-frame digital cameras is not yet overly crowded and the available devices are not as diversified as those in the APS-C world. Nevertheless, the number of sub-US\$2,000 full-frame cameras on the market has gone from zero to four within the last year.



maximum apertures than their APS-C and Micro Four Thirds counterparts, so the resulting images look more detailed and three-dimensional. Another big bonus is that you can use all those wonderful manual lenses that you collected in the course of your analog photo career, often without even having to use an adapter.

But: Although they don't have to make as many compromises, full-frame photographers have to spend more money to get the quality they want. High-quality, bright telephoto lenses for Micro Four Thirds cameras start at about US\$700, but you won't find anything similar in the full-frame camp for less than US\$1,000. Keeping a full-frame kit up and running requires careful planning, not least because the higher quality of full-frame lenses makes them larger and heavier and therefore less easy to carry.

The ability to use legacy lenses is, in principle, a real bonus, but the genuine advantages depend on which lenses you own and their suitability for use with today's technology. Many older 'bread and butter' lenses were designed with the much lower resolution of analog film in mind. Additionally, while there is nothing but air in the space between the lens and film in an analog camera, digital cameras have various glass-based filters positioned in front of the sensor that can produce unwanted diffraction blur at the edges of the frame when used with non-dedicated

lenses. Every additional layer of glass can also produce unwanted internal reflections, which can further diminish image quality.

Conclusions

Of course, owning a pro-grade camera doesn't guarantee pro-grade results. The freedom that using full-frame gear provides also demands that you work carefully and precisely at all times. The follow-on costs of expanding your lens collection are not inconsiderable and your photo bag will be much heavier than those of your colleagues who use APS-C or Micro Four Thirds systems. These considerations are especially relevant if

you like to shoot with telephoto lenses, as crop-format cameras enable you to shoot narrow angles of view with shorter, lighter lenses that are mostly cheaper too.

Consider as well that sensor technology is still developing fast, and that smaller back-illuminated sensors can now produce images with levels of noise that are comparable with those produced by larger sensors just a year or two ago. Other technologies, such as the Fujifilm 'X-Trans' sensor use unconventional microfilter designs to coax better image quality from smaller sensors. The choice is yours, so have fun shooting with whichever format you decide to use. (ssi)

Full-frame at a Glance:

Advantages:

- Better image quality
- More creative freedom
- Larger angles of view
- Greater range of high-quality lenses

Disadvantages:

- Follow-on costs
- Heavier
- Shorter telephoto range
- Steep learning curve

ct



Thomas Saur und Sophia Sieber

The New Sony Alphas

Taking Aim at the DSLR World

Seven might just be Sony's lucky number. The new Alpha 7 and Alpha 7R models combine high-performance full-frame sensors with compact mirrorless bodies and competitive prices. This article takes the newcomers for a spin and takes a guess at just how scared Nikon and Leica should be.



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With its new Alpha models, Sony is simultaneously piling on the pressure in multiple market segments. Primarily, by pricing the 24-megapixel, full-frame A7 on a level with the SLT-A77, Sony appears to be aiming directly at the high-end hobby and semi-pro sector.

However, this move also places the new cameras in direct competition with the Nikon D610 and Canon EOS 6D. The A7 not only gives conventional DSLRs a run for their money, but also takes aim at the mirrorless

system camera market currently dominated by cameras like the Olympus OM-D and the Fujifilm X-Pro1, both of which offer significantly smaller sensors and a weaker feature set for about the same price. And we all know that consumers often make price-based decisions true to the motto, "To have is better than to want".

Thanks to its high level of flexibility with regard to lens adapters (see page 34), the Sony also offers the US\$7,000 Leica M full-frame rangefinder camera some stiff

competition and, at the top end of the DSLR market, the Sony A7R, with its 36-megapixel sensor, is squaring up to pro-grade models like the Nikon D800E.

Sony's newcomers have generated a lot of interest, so we decided to give them a thorough *c't* test and compare real-world and lab performance with that of the established competition. And, in view of the small number of full-frame E-mount lenses, we tested them with a range of adapters and third-party lenses too.

Sony A7

The Sony's full-frame sensor has a relatively modest count of 24 megapixels and uses a hybrid autofocus system that comprises 117 phase-detection and 25 contrast-detection focus areas. This system has already been tried and tested in the NEX-series mirrorless cameras and is designed to make focusing

faster and more precise. Much of the mirrorless competition uses purely contrast-based autofocus systems that continually adjust the focus setting until the camera's processor decides that maximum contrast between neighboring pixels has been achieved. The A7 has a rich feature set that includes Wi-Fi and

NFC connectivity. The 3-inch, 921,600-dot TFT monitor can be tilted up and down and the OLED viewfinder has 2.36 million dots of resolution. The top plate and the sensor unit are made of magnesium alloy. The current street price for the A7 body is around US\$1,700 and is getting cheaper all the time.

Image: Orchids at the Herrenhausen Royal Gardens in Hannover



In an initial comparison under ideal conditions at ISO 100, the A7 produced really sharp images ...

ISO 100 | 55 mm | f8 | 1/3 s

Leica M240

As a rangefinder camera, the Leica M is unique among today's full-frame digital offerings. It has a 24-megapixel sensor and uses a completely manual focusing system. In contrast to the other models we tested, the Leica is anything but fast and is designed with a more philosophical approach to photography in mind. The bright

frame split-image focusing system requires a high degree of skill and concentration on the photographer's part, and focusing on a portrait subject's eye, for example, involves adjusting the focus ring on the lens until the the contours of the eye perfectly match the overlaid image in the viewfinder. Thanks to live view, you can

compose your image via the monitor too, which is simpler and, for many users, a more familiar approach. Although it is about the same size as the A7, the top and bottom plates are made of solid brass, making the M a lot heavier. The Leica's price is exotic too, with a current street price of around US\$7,000 for the body alone.

Image: Orchids at the Herrenhausen Royal Gardens in Hannover



... but the Leica still delivered a more vivid overall look

ISO 200 | 50 mm | f8 | 1/8 s

Sony A7R

Although identical in many ways, the A7R differs from its little sister in that it has a 36-megapixel sensor and no low pass filter. This approach is intended to maximize the system's potential resolution. Low pass (or 'anti-moiré') filters are designed to reduce the incidence of moiré effects in digital

image capture systems. However, such a filter reduces the sharpness of the captured light rays in order to make it possible for the camera's circuitry to interpret them, which inevitably reduces overall resolution and the sharpness of the resulting images. This model bridges the gap between

mirrorless and pro-grade cameras. In spite of its less capable 25-point contrast-detection based AF system, the A7R has more magnesium components than the A7 and is therefore more robust and slightly lighter than its sister model. Both models are dust and moisture resistant.



Image: Orchids at the Herrenhausen Royal Gardens in Hannover



The huge range of contrast captured by the high-resolution sensors in the A7R ...

ISO 100 | 55 mm | f8 | 1/3 s

Nikon D800(E)

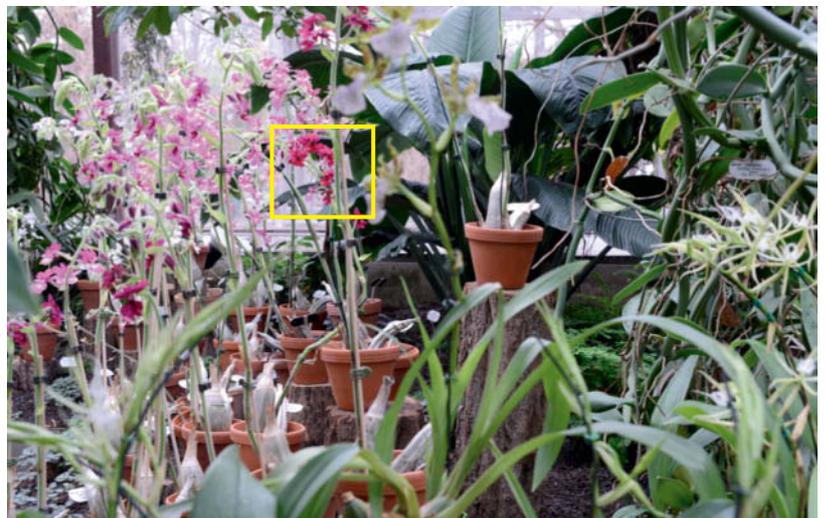
Up until the introduction of the Sony A7R, the Nikon D800 models were the undisputed leaders in the full-frame megapixel stakes. Like the Sony, both Nikons offer a 36-megapixel sensor, and the 'E' version has no low pass filter. Their enormous resolution even turns the D800E and the A7R into competitors for

some pro-grade medium-format cameras. The Nikon has a 51-point phase-detection AF system that is typical for this type of high-end DSLR. Logically, it has an optical viewfinder but can also be used in live view mode. Its 3.2-inch, 921,000-dot monitor offers 100% coverage but is not articulated. Unlike

the Sonys, the Nikon offers neither Wi-Fi nor NFC connectivity. It weighs 1,000 grams (2lb 3.30z) with the battery and a memory card installed and currently costs about US\$3,300 for the 'E' version and US\$2,900 for the standard version (both prices are for the body only).



Image: Orchids at the Herrenhausen Royal Gardens in Hannover



... and D800E produces images with an almost HDR-style look

ISO 100 | 50 mm | f8 | 1/2 s

ISO Comparison

You have to use a magnifying glass to find the differences between these images. In general, and contrary to popular opinion, sensors with fewer megapixels don't necessarily produce better results. All four of our test cameras show excellent signal-to-noise and visual noise

characteristics. Overall, the Sony results were slightly better than those of the D800, although not enough to make any real practical difference. The A7 recorded a signal-to-noise value of 97 at ISO 100, while the A7R reached an unprecedented reading of

104. A visual noise value of 0.7 for both models is on a par with the EOS 5D Mark III and the Nikon D4. Some slight artifacts were just visible at ISO 6400 for both Sonys, but had a negligible effect on our subjective perception of image quality.

Detail of the label on a wine bottle, shot in the Meyers Hof restaurant at the Hannover Adventure Zoo



ISO 100 Sony A7



Sony A7R



Leica M (ISO 200)



Nikon D800E



ISO 400 Sony A7



Sony A7R



Leica M



Nikon D800E



ISO 800 Sony A7



Sony A7R



Leica M



Nikon D800E



ISO 1600 Sony A7



Sony A7R



Leica M



Nikon D800E



ISO 3200 Sony A7



Sony A7R



Leica M



Nikon D800E



The image reproduced here is a detail of a high-ISO shot. The full image, captured using the Sony A7R, measures about 300×420 mm (12×16.5 inches).

ISO 8000 | 55mm Zeiss Otus | f1.4 | 1/8000s

Handling

Thanks to the nicely shaped rubberized grip, the new Alphas are a pleasure to hold and use and, in spite of their diminutive size, offer a shooting experience that lags only slightly – if at all – behind that of full-blooded DSLRs like the D800.

The top plate and camera back are packed full with buttons and dials but nevertheless manage not to appear too busy. The overall concept provides intuitive handling and a great deal of photographic freedom.

Alongside the obligatory mode dial, there is a dedicated exposure compensation dial and two further dials that have varying functions depending on the current shooting mode. Nearly all the dials and major buttons (including the mode dial) can be assigned custom functions.

Pressing the 'Fn' button displays all the major shooting parameters on a single screen and again, the user can customize the layout and decide which settings to display. This makes it largely unnecessary to scroll through the menus themselves, although they are clearly arranged, either as a list or in a practical tiled view that bundles sets of functions for access via dedicated icons. What this means is that functions such as ISO sensitivity, image size and self-timer are not distributed among various menus the way they are in the NEX-series cameras – in our view, this is definitely a change for the better.

Wi-Fi Control

Built-in Wi-Fi and NFC connectivity set these cameras apart from most of the direct



Card Slot

The SD card slot is practically located behind a door on the back of the grip, which makes it easy to access, even if the camera is tripod-mounted



Sensor

The latest Sonys are the first E-mount cameras with full-frame sensors. All earlier E-mount cameras have APS-C sensors.



Switches

The major functions can be assigned to many of the buttons and dials. The dedicated exposure compensation dial is a nice touch.

Menus

The list-style default menu system will be familiar to Sony users, and there is a cleaner-looking tiled view option too.



competition. The available functions include easy image sharing as well as remote camera control via your smartphone. If you have an NFC-capable smartphone with the *PlayMemories Mobile* app installed, bringing the two devices together at the touch point marked on the right-hand side of the camera body is all it takes to build a connection. We tested this using an G2 from LG, and it worked perfectly first time. If your mobile device isn't NFC-enabled, you have to enter a password generated by the camera in the app interface.

Remote control worked smoothly via Android 4.3 on our LG and on an HTC Sensation XE running Android 4.0.2, although the app did crash now and again on the older device. The remote control functionality

provided by the app is fairly basic and could do with improvement, especially with regard to manual-focus lenses (see page 30). Remotely captured images are stored as scaled versions on the smartphone, while RAW images aren't stored on the mobile device at all. Image files captured using the camera and sent to a mobile device via Wi-Fi or NFC are transferred at full JPEG resolution.

Wi-Fi functionality can also be used to download other apps from the PlayMemories Camera Apps Store, provided you register on the Sony Entertainment Network first. The *Smart Remote Control* and *Direct Upload* apps are the only ones available now, but Sony promises to add multiple exposure, lens compensation, retouching and picture effect apps soon.

Wi-Fi

Built-in Wi-Fi functionality makes it possible to control the camera remotely using a smartphone or tablet



Robust Body

The new Alphas are dust and moisture resistant. The top and front plates in the A7R are made of magnesium alloy.

LCD Monitor

The tiltable LCD screen is an unusual feature in a camera with pro-grade ambitions



Landscapes with the A7R

The high resolution and great detail rendition offered by the A7R make it an interesting option for landscape photographers who rely on their gear producing excellent results into the very corners of the frame. Like the Nikon D800E, the A7R only fulfills its real potential if used with top-notch lenses. Used carefully, the A7R almost reaches the same quality of detail rendition as the medium-format Hasselblad H4D-40 that I usually use, although the Hasselblad's 16-bit processor still offers finer color nuances. In contrast, the Alpha cameras score highly with their small size and light weight.

On the downside, Sony's remote control functionality is a disappointment and doesn't make the most of the potential of transmitting a real-time live view image to an iPad or other mobile device, and the function only works with Sony's own AF lenses. Such an option is much more important for manual focus lenses, so Sony definitely missed a trick there. Additionally, the Sony software doesn't enable pixel-level image viewing under iOS, so you have to install the (free) *Actual Pixels* app to zoom in to a 100% view. On Android, the standard photo viewer does the job admirably without the need for additional software. If Sony improves its remote control software offering, it would have another convincing selling point that would save potential buyers the US\$300 it costs to add remote control functionality to the D800E using the CamRanger wireless transmitter.

Conclusions

To really gain acceptance, Sony will have to introduce some new, small-sized lenses that make the most of its sensors' capabilities. The current third-party lens/adaptor solution wastes a lot of the camera's potential and, if you add the cost of a high-quality lens adapter to the price of the camera, there is virtually no difference between the A7R and the D800E. (Stefan Arand)



ISO 100 | 20 mm | f11 | 1/40 s | Nikon 12-24mm





The A7R in the Studio

Handling: The A7R offers fantastic functionality in a really small package. Exposure time, aperture and exposure compensation can all be set using dedicated dials, giving the camera a highly analog feel. In contrast to Sony's NEX mirrorless models that force you to scroll through apparently endless menus to adjust most key functions, the Alpha also gives you the option to assign major functions to the Fn button.

The downside of all this variety is that it is too easy to lose track of what you have set where and, for example, end up using the wrong ISO setting. I also found that the online help didn't describe the available functionality in sufficient detail and the documentation for the available apps is simply bad. An X-Sync flash socket would also help to persuade semi-pro and pro users to consider using the A7 models.

The monitor zoom function and the excellent viewfinder are great manual focusing aids. Pressing the C1 button immediately displays an enlarged detail of the viewfinder image, making manual focusing a snap.

Especially for wide-aperture portrait shots in which focus needs to be precisely located on the subject's pupil, I found focusing this way to be much more accurate than it is using an optical viewfinder or even autofocus. The quality of the monitor and the viewfinder are quite sufficient for judging focus accurately, which cannot be said for most current digital medium-format cameras.

At the time of writing, there were very few lenses available for testing autofocus speed in fast-moving fashion and people photography situations. Used with the Sony/Zeiss FE 55mm f/1.8 lens and the Sony 70-200mm f/2.8 G SSM II (with the help of the LA-EA4 adapter), the system made a very good first impression without actually breaking any speed records, although the 55mm lens quickly reached its limits when shooting a dancing model in burst mode.

The camera's tethered shooting mode, enabled using the free *Remote Camera Control* software, proved extremely useful. You only have to remember to set the camera to 'PC' mode to get it to work. The remote connection to our MacBook Pro remained stable throughout our test.

Image quality: Viewing the RAW files captured by the tiny camera on a large monitor is a real joy. Resolution, color fidelity and dynamic range are among the best offered by today's full-frame cameras. The extremely broad tonal range of the Sony's images enabled me to squeeze all sorts of effects out of my images during RAW development, using shadow and highlight detail that is simply not there in images captured by most other DSLRs.

The quality of the A7R's RAW files is directly comparable with those produced by the Nikon

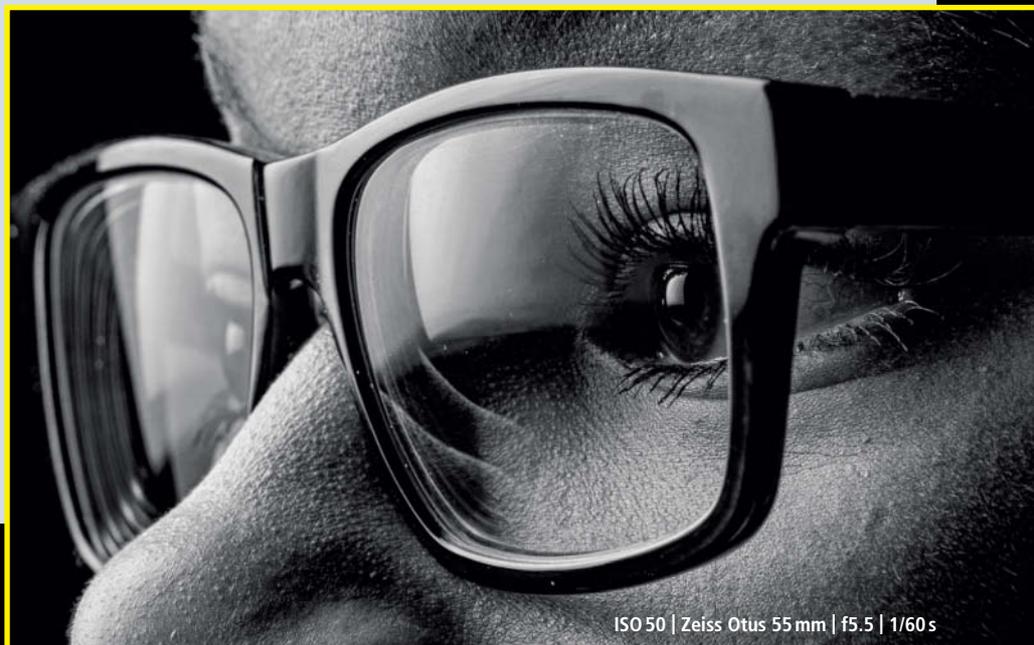
D800E, and the Sony images were slightly more detailed than the Nikon's when developed using exactly the same *Lightroom* settings. On the other hand, the Nikon seems to produce slightly cleaner signals at low sensitivity settings, which enabled us to sharpen our Nikon images more than those from the Sony without producing any unwanted artifacts. The details produced by the Sony at ISO sensitivities between 1600 and 2000 is excellent and is perfect for shooting spontaneous handheld portraits with a deliberately slightly grainy look.

Lenses: The Sony sensor's high resolution presents even the very best lenses with a serious challenge. Used with a Metabones adapter, many Canon L-series and Zeiss ZE lenses produce hitherto unseen quality, while high-end lenses like the Zeiss Otus (which we will be reviewing in the next issue of *c't Digital Photography*), transform the Sony into a real pro-grade image capture system that offers a genuine alternative to medium format.

The relatively inexpensive SEL 28-70mm lens that Sony is selling as part of the standard European A7 kit simply wastes the camera's potential, producing images that are not really sharp at the edges, even stopped down. On the other hand, the Sony/Zeiss FE 55mm f/1.8 is one of the best standard lenses around, producing lovely bokeh wide open and pin sharp images when used slightly stopped down. The FE 35mm f/2.8 is another very good prime lens that produces excellent results in everyday use. We were given two 35mm sample lenses to test, and the differing results they produced infers a relatively high degree of deviation in the manufacturing tolerances.

Conclusions

The Sony A7R is well suited to portrait photography, product photography in the studio and for fine art shots. If Sony manages to deliver more lenses at the same quality level as the FE 55mm f/1.8, they are sure to have a winner on their hands, especially among photographers who prefer using compact gear. The quality of the software and documentation are not good enough and still need improvement. (Thomas Saur)



ISO 50 | Zeiss Otus 55 mm | f5.5 | 1/60 s



Third-party Lenses and Adapters



Canon

Metabones Canon EF Adapter III (US\$400)

The Metabones adapter supports aperture and autofocus as well as the transmission of metadata (see www.metabones.com for a list of supported lenses). We had no issues using the adapter with L-series and manual focus lenses in a range from 14-135 mm, and even the wide-angle models produced images that were sharp right up to the edges. The only drawback is the slightly slower and less precise autofocus.



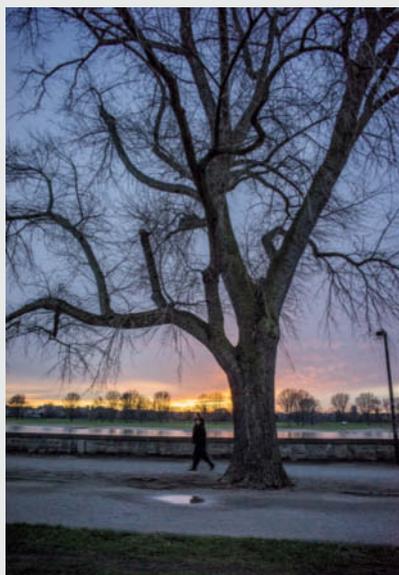
Canon 85mm f/1.2L
ISO 2000 | 85 mm | f1.2 | 1/8000 s



Leica M

Novoflex NEX/Leica M (US\$250)

Leica M-series lenses offer a compact and attractive range of additional lenses for the Sony (see this issue's cover for an example). However, care is required when using focal lengths below 50 mm, as these produce suboptimal edge and corner definition along with vignetting and color errors. To avoid these issues, you have to stop down further than you would when using a Leica camera. If you want to use the Sony camera with M-series lenses, be sure to test the combination you plan to use before shooting.



Leica 24mm f/1.4 SUMMILUX-M ASPH
ISO 2000 | 24 mm | f5.6 | 1/200 s



M42

Novoflex NEX/M42 (US\$160)

An M42 adapter transforms these hyper-modern cameras into a testbed for all sorts of legacy glass. The range of pre-owned M42-mount lenses available on eBay and elsewhere is enormous, although many of them simply don't do justice to the camera's extremely high resolution. The A7R immediately shows any lens weaknesses to their worst advantage, which is a shame – especially when it comes to using old favorite lenses. However, if you take the time to experiment, you might just as easily capture some pleasant surprises.



M42 Pentacon 135mm f/2.8
ISO 6400 | 135 mm | f2.8 | 1/250 s



Nikon

Novoflex NEX/Nikon (US\$300)

Our tests with Nikon lenses produced some very mixed results. Some were excellent, but handling with the A7R took a lot of getting used to, especially when it came to aperture control. The well-made Novoflex adapter has a built-in but unlabeled aperture ring and, because the adapter transmits neither aperture nor Exif data, we ended 'flying blind' while shooting and during processing. During our test shoot, we used a second (Nikon) camera to help us guess exactly which apertures we were using!



Sigma 35mm f/1.4 DG HSM for Nikon
ISO 2000 | 35 mm | f2.8 | 1/200 s



Sony

Sony LA-EA4 (US\$350)

We were given the Sony LA-EA4 A-mount/E-mount adapter to test just before this issue went to print. Like all the models mentioned here, the adapter's build quality is excellent. We tested it with the Sony 70-200mm f/2.8 G SSM II, which produced pin-sharp results stopped down but rather soft images wide open. Autofocus worked quickly and reliably, although it wasn't as fast as the native NEX/Alpha systems.



Sony 70-200mm f/2.8 G SSM II
ISO 100 | 200 mm | f5 | 1/800 s

Conclusions

Sony's new A7 and A7R models have caused a real stir in the market and put a new kind of pressure on Canon and Nikon, although overall mirrorless camera sales still lag behind DSLRs on a consistent but low level.

Conventional DSLRs still stand for high image quality and well-developed handling. The Sony NEX cameras have not yet been able to make inroads into this market, which is one of the reasons we might see the NEX brand disappearing from the market in the near future. Instead of attempting to create an entirely new market segment, Sony's new strategy is obviously to establish its high-end mirrorless cameras as a real alternative to traditional DSLRs.

The Alpha 7 models are the first major step along this route, combining mirrorless technology with the naming scheme of Sony's other SLR cameras – a move that is sure to break down some consumer reticence when it comes to adopting the mirrorless approach.

Alphas Top of the Heap

In general, we were very impressed with the new Alpha models, especially in view of their competitive price compared to the current Canon and Nikon full-frame offerings. Our lab-based and real-world tests produced superb results that plant both cameras firmly at the top of their respective megapixel classes. The icing on the cake for most users will be the compact size of this new pro-grade system and the extremely flexible configuration options for the user interface.

Still Some Compromises

But we at *c't Digital Photography* remain true to form and found a couple of things that we don't like too. For example, the viewfinder proximity sensor is much too sensitive and switches off the live view if you so much as wave a finger in the direction of the eyepiece while you are using the monitor to focus. Additionally, the camera's built-in Wi-Fi capabilities don't make the most of their potential and need to be further developed and refined, especially where remote manual focusing is concerned.

Another drawback is the extremely narrow range of full-frame E-mount lenses and the high prices of the available models. The Sony/Zeiss T* 55mm f/1.8 costs around US\$1,000, compared with equivalent lenses



Who hid the camera? The current lack of full-frame E-mount lenses means you are almost sure to end up using third-party lenses and adapters

The A7 looks more like an accessory when attached to an A-mount telephoto zoom

from Canon and Nikon that cost around US\$200. Right now, this would appear to make the Sony system prohibitively expensive for amateur and semi-pro photographers who are considering the switch to full-frame.

On the other hand, the range of available adapters and third-party lenses makes the system almost endlessly extendable. As this issue's cover image shows, using the A7 with

legacy lenses and selected accessories (the leather case comes from angelo-pelle.com) can give you a really attractive-looking setup that guarantees great results.

But this is where the compromises start. Most other manufacturers' lenses simply cannot do justice to the Sony sensors' enormous resolution and produce poorer results with the A7s than they do with their native camera brands. This issue is



especially obvious for lenses with shorter focal lengths.

More expensive adapters deliver better performance but, at prices of US\$400 and more, these negate the cheaper purchase price of a Sony compared to the direct competition from Canon and Nikon. In other words, switching to full-frame is still a costly undertaking however you look at it.

Actually shooting with third-party lenses requires a lot of care and attention too, as only very few support autofocus, automatic aperture control and Exif data transfer. Canon lenses offer the widest range of options and you should thoroughly test any Nikkor/adaptor combination before committing to a purchase.

We also felt that using the diminutive A7 with the rather large LA-EA4 adapter and an

A-mount telephoto zoom completely canceled out the camera's size advantage. Furthermore, we found ourselves worrying that the extra leverage involved might damage the camera's bayonet.

Sony has published an ambitious roadmap for the future of the new Alpha system and now needs to come good on its promises if it wants to see it becoming a true world-beater. (ssi)

CAMERA DATA				
Technical Data				
				
	Sony A7	Sony A7R	Leica M240	Nikon D800
Sensor resolution	6000 × 4000	7360 × 4912	5952 × 3976	7360 × 4912
Megapixels	24	36	24	36
Sensor size	35.8 mm × 23.9 mm	35.9 mm × 24 mm	36 mm × 24 mm	35.9 mm × 24 mm
Crop factor	1	1	1	1
RAW capture	Yes	Yes	Yes	Yes
Autofocus system	Hybrid	Contrast-based	–	Phase-detection
AF areas	117 phase-detection, 25 contrast-based	25	–	51
Shortest/Longest exposure time	1/8000 s / 30 s	1/8000 s / 30 s	1/4000 s / 60 s	1/8000 s / 30 s
Sensitivity	ISO 100-25600	ISO 100-25600	ISO 200-3200	ISO 100-6400
Viewfinder	OLED	OLED	Rangefinder	Optical pentaprism
Viewfinder resolution	2.36 m dots	2.36m dots	–	–
Monitor	LCD	LCD	LCD	LCD
Monitor size	3-inch	3-inch	3-inch	3.2-inch
Monitor resolution	921,600 dots	921,600 dots	920,000 dots	921,000 dots
Monitor articulation	Yes	Yes	No	No
Dimensions (W × H × D)	127 mm × 94 mm × 48 mm	127 mm × 94 mm × 48 mm	139 mm × 90 mm × 42 mm	146 × 123 × 81 mm
Weight (w/ battery and mem. card)	474 grams (16.7 oz)	465 grams (16.4 oz)	680 grams (1 lb 8 oz)	1000 grams (2 lb 3.3 oz)
Memory card types	SDHC, SDXC	SDHC, SDXC	SDHC, SDXC	SDHC, SDXC, CF
Connectors	Wi-Fi, NFC, Micro-USB, HDMI	Wi-Fi, NFC, Micro-USB, HDMI	Optional USB	USB 3.0, HDMI
Current street price (Body only)	US\$1,700	US\$2,300	US\$6,950	US\$2,800
Test Results				
	better ▶	better ▶	better ▶	better ▶
Sensor resolution (line pairs)	2000	2456	1984	2456
Center resolution (ISO 100) ¹	1767	2553	1810	2150
Center resolution (ISO 400)	1761	2359	1760	2017
Center resolution (ISO 1600)	1741	2452	1739	1879
Center resolution (ISO 6400)	1667	2206	–	1741
Dynamic range ² (ISO 100) ¹	10.2	12	10.5	10
Dynamic range (ISO 400)	10.4	10	10.4	9
Dynamic range (ISO 1600)	10.3	10	9.98	8.7
Dynamic range (ISO 6400)	10.1	9	–	7.7
	◀ better	◀ better	◀ better	◀ better
Visual Noise (ISO 100) ¹	0.7	0.7	1	0.8
Visual Noise (ISO 400)	1	0.9	1.3	1.3
Visual Noise (ISO 1600)	1.1	1.2	2.1	2
Visual Noise (ISO 6400)	1.6	1.8	–	3.1
Shutter lag at 1000 lux (in seconds)	0.28	0.44	–	0.19
¹ Leica M ISO range begins at ISO 200 – not included ² in f-stops				



Peter Nonhoff-Arps

Canon's Mega-zoom with a built-in 1.4x teleconverter

With its bright maximum aperture, built-in teleconverter, comparatively small size and excellent reproduction quality, the Canon EF 200-400mm f/4L Extender has a lot to offer. Quality has its price, and we decided to take the US\$12,000 beast for a spin.

A super zoom as bright as this is unusual enough, with the AF-S Nikkor VR 200-400mm f/4G ED VR II and the Sigma 200-500mm f/2.8 EX DG APO IF offering the only real competition. But what really sets the new Canon mega-lens apart is its built-in teleconverter – a feature that is unrivaled anywhere. A lever on the lens barrel swings a separate lens group into the light path while you shoot, transforming this already monster lens into an unparalleled 280-560mm zoom with a constant maximum aperture of f5.6.

Professional sports and wildlife photographers often use fixed focal length lenses and either switch shooting positions or crop their images later to achieve the right framing. Other ways of changing your viewpoint also include switching lenses or mounting a teleconverter between the lens and the camera body. Zoom lenses are more flexible but usually offer reduced optical quality – and the longer the zoom range the worse things get. Teleconverters are a good compromise but reduce the effective maximum aperture you can use and cropping

only makes sense if you have enough resolution in reserve to produce sharp reformatted images. Canon's latest super-telephoto zoom attempts to bridge the gap between pro-grade creativity and everyday flexibility while retaining the maximum possible image quality. The result is a high-end, high-price, heavy-duty slab of a lens.

The lens has many more controls than a conventional zoom, some of which require a little explanation. The built-in image stabilizer has three modes: Mode 1 corrects vibrations



in all directions, while Mode 2 enables the lens to correct vertical camera shake during horizontal tracking. In both these modes, stabilization is activated as soon as you press the shutter button halfway. In Mode 3, the lens computes stabilization parameters for stationary shots and pans when the shutter button is pressed halfway, but only actually compensates for them during the exposure (i.e., once you have pressed the shutter button all the way down).

Autofocus

The autofocus system covers a range from 2 m to infinity and can also be limited to between either 2-6 m or 6 m to infinity, which means that the focusing elements don't have to move so far while they are in use, resulting in faster focusing. Alongside conventional manual and automatic focus modes, Canon has included the 'Power Focus' mode that allows you to vary focusing speed – a feature that is particularly useful when you are shooting video. Power Focus is controlled by the 'playback ring' located behind the ring that houses the AF stop buttons. If you rotate it to the right, focus adjusts toward the close end of the scale at a constant rate and the further you rotate the ring, the faster the rate of change of focus.

The Focus Preset switch is used to define a point to which the lens focuses when you press

the shutter button halfway (or when you move the focus ring in manual focus mode). Focus Preset can be used in conjunction with Power Focus to focus automatically to your predefined point at constant speed.

The ring in front of the playback ring houses four Focus Stop buttons that halt the current focus action while pressed. This is useful if, for example, an obstacle swings into view in the middle of a pan.



The built-in image stabilizer keeps images sharp even when you use long exposure times



The focusing distance range selector switch limits the focus range to reduce autofocus reaction times and speed up shooting

An Interview with Wildlife Photographer Benny Rebel

Benny Rebel is an artist who lives up to his name. He has been surprising the European and international wildlife photography scenes for more than ten years with his unique and often breathtaking wildlife photos. He now specializes in organizing photo safaris in Africa (www.Benny-Rebel.com). In this interview, he shares his thoughts on the subjects of fixed focal length lenses, teleconverters and zooms.

c't Digital Photography: Benny, what do you consider to be the most exciting wildlife subjects?

Benny Rebel: I like images that play with my emotions. Images that move or amaze me, or that make me laugh and get me thinking.

c't: Do you prefer to use fixed focal length or zoom lenses for your wildlife shots?

BR: I like to use fixed focal lengths whenever possible, as they usually deliver better image quality than zooms. On the other hand, zooms are more practical and help me to compose my images on the fly. At the end of the day, I tend to use a mixture of both zooms and primes. For example, if I am photographing a lion at rest, a fixed focal length does the job admirably, whereas if I am shooting a pride of lions on a hunt from close up, the flexibility a zoom gives me is more important than that little extra bit of image quality.

c't: How important are long focal lengths to your work as a wildlife photographer?

BR: The wildlife photos that made me famous were shot using focal lengths between 12 and 16 mm! However, this doesn't mean that I don't use long lenses too. On my safaris I use everything between 15 and 500 mm.

c't: Do you use teleconverters?

BR: I'm not a big fan of teleconverters, as they reduce image quality and therefore the number of usable images I take home from a shoot. They also reduce the maximum available aperture. A 2× converter halves the amount of light that

reaches the sensor. All the teleconverters I have used have reduced the overall quality of the lenses I used them with – some more, some less. Image sharpness and vividness especially suffer if I use a teleconverter. Some converters also amplify chromatic aberrations and vignetting effects, and I have even tested converters that cause color shifts.

Overall, I have always found 2× converters to be virtually useless for my purposes, whereas some 1.4× models are of high enough quality to consider using. On the whole, though, I prefer not to use converters at all. The latest full-frame cameras deliver excellent image quality and extremely high resolution, so it is often preferable to use a cropped image than one shot using a teleconverter.

c't: Would you consider using a high-end zoom like the Canon 200-400mm f/4.0 with its built-in extender?

BR: As you have probably noticed, I'm not keen on teleconverters, and I can't think why a built-in converter should be any better than conventional ones. Having said that, I haven't yet had a chance to test the Canon lens. For my purposes, a 200-600mm full-frame zoom with a maximum aperture of f4 or f5.6 would be a more practical option than a zoom/teleconverter combo. The only problem here is that my dream lens doesn't actually exist!

c't: What are the most important aspects of the equipment you use? Speed? Quality? Weight? Size? Robustness?

BR: I work in the wilderness in Africa, where

it is almost always hot and dusty and my gear is constantly being shaken up by bumps and ruts in the roads through the wildlife reserves that I visit. Robustness is therefore just as important to me as image quality. Additionally, the smaller and lighter my gear, the less energy I require to use it. Speed is, of course, extremely important for action scenes. In some situations, a camera can never be fast enough.

c't: Do you use tripods too? If yes, which ones?

BR: I really love high-quality, heavyweight tripods and quality heads and I always use one if I can. Shooting from a tripod always produces sharper, more vivid images and forces you to concentrate on your subject and take more time to compose your images. The result is usually better work.

c't: Have you ever found yourself having to improvise because you were out and about with the wrong gear?

BR: I plan my safaris very carefully and don't usually forget anything. However, in Africa, everyone has to improvise now and again.

If you want to earn money with wildlife photography, it is essential to learn about the behavioral patterns of the creatures you wish to photograph. If I can guess what my subject is going to do next, I usually end up in the right place at the right time and capture the best possible images.



Benny Rebel is famous for his animal portraits shot at really close distances

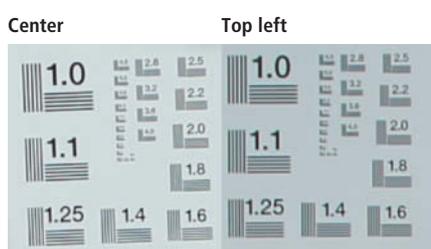
Hanuman langurs photographed at the Hanover Adventure Zoo

Canon EOS-1D X with the EF 200–400mm f/4L IS USM Extender 1.4×
set to 560 mm | ISO 200 | f8 | 1/320 s | Tripod-mounted

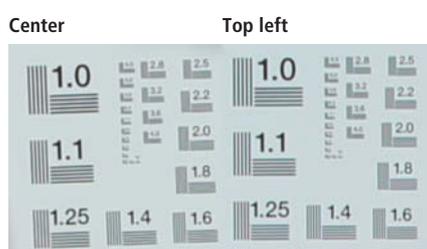




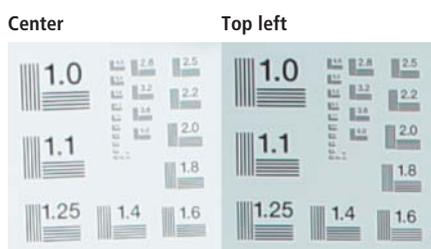
The lever at the rear of the lens barrel swings the teleconverter into the light path. The extra lens group can be activated at any time.



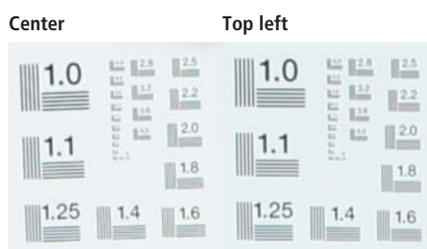
f4.0



f11



f5.6 (with 1.4x Extender)



f11 (with 1.4x Extender)

The most interesting feature is, of course, the built-in 1.4x teleconverter. The additional lens group is housed in the bulge on the rear left-hand side of the lens barrel and is moved into the light path using the built-in lever. The lens automatically transmits the modified lens data to the camera's firmware. Our test with an EOS-1D X worked faultlessly, although the user manual does include a long list of warnings about potential failures that can occur if the lens is used with particular camera bodies.

In Use in the Real World

We headed off to the local zoo to take some test shots and took the precaution of taking a robust tripod with a ball head with us to support the almost 5 kg (11 lbs) that this particular camera/lens combo weighs.

The fast autofocus and high burst shooting rates provided by the EOS 1D X make an ideal testbed for the lens, which impressed us with AF reaction times to match the camera's

capabilities and excellent image stabilization. We managed to capture a surprising number of really sharp images, even at high burst rates and using relatively long exposure times.

Contrary to the warnings printed in the user manual, we were able to move the extender in and out of the light path while shooting without causing any ill effects. The wide maximum aperture provides a bright,

clear viewfinder image for normal focusing and we were able to use the Magnify function in Live View to squeeze the very last drop of sharpness out of manual focusing situations.

The test shots we made in the lab (included on this issue's free DVD) show that sharpness is even and balanced all the way to the edges of the frame, and we only recorded very slight vignetting at maximum aperture. The lens produced maximum sharpness between f8 and f11 (with and without the extender), while performance dropped off noticeably at f16 and below. We also noticed that our EOS-1D X overexposed 'extended' images slightly in the lab, but not in our outdoor test shots.

Conclusions

The EF 200-400mm f/4L IS USM 1.4x Extender offers pro photographers a high degree of quality and convenience but Canon charges nearly US\$12,000 for the privilege. For working professionals, the costs involved in purchasing (or renting) this lens are sure to be amortized quickly by the extremely high-quality results it is capable of producing. The useful zoom range also makes multiple high-quality fixed focal length telephotos redundant and could actually reduce the overall size and weight of your camera bag. (pen)

CANON EF 200-400MM F/4L IS USM 1.4X EXTENDER

	w/o Teleconverter	w/ Teleconverter
Aperture range	f4.0- f32	f5.6- f45
Focal lengths	200-400 mm	280-560 mm
# of aperture blades	9	
Tested at ¹	Wide open / Stopped down (-2EV)	
Center resolution	1718 lp/h / 1690 lp/h	1683 lp/h / 1665 lp/h
Edge resolution	1635 lp/h / 1688 lp/h	1530 lp/h / 1614 lp/h
Vignetting	0.8% / 0.1%	0.9% / 0.1%
Chromatic aberration	0.3 pixels	0.6 pixels
Distortion	0%	1%
MRSP	US\$11,800	
¹ At medium focal length		



WE ARE NOT ONLY GEAR HEADS



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George D. Lepp and Kathryn Vincent Lepp

Focus Stacking

Expand Your Macro Depth of Field

Macro photos often have extremely shallow depth of field. The most effective way to work around this limitation is to capture multiple source images with different planes of focus and merge them into a single image with enhanced depth of field using a technique called focus stacking. In this article, renowned nature photographer George D. Lepp explains the basics of focus stacking and demonstrates how to use it to create fascinating close-up images.



Macro, or high-magnification, photography is aesthetically extremely rewarding. Whether botanical, biological, or mechanical, ordinary subjects are rendered unique when seen from a high-magnification perspective. For the photographer and the viewer of such images, the revelation of intricate details usually indiscernible to the human eye yields both new understanding of small subjects and appreciation of their compelling composition, design, and color – the essential components of a successful photograph.

Anyone who has attempted close-up or macro photography has encountered the problem of limited depth of field: the area of the image that appears acceptably sharp diminishes as the magnification increases. While the subject may be highly magnified, only a tiny portion of it is sharply detailed. At 1× (i.e., life-sized), only a 1.5mm slice of the image will be in sharp focus at f11. Increase the magnification to 5× (f5.6) and the zone of focus is reduced to a minuscule 0.095 mm. There are a number of ways to increase the range of sharpness, including stopping down the lens, using a tilt/shift lens to apply the zone of focus more efficiently and focus stacking. The latter is a product of the digital age and definitely offers the best results.

Depth of Field when Using the Canon MP-E 65mm f/2.8

In millimeters						
Magnification	f2.8	f4	f5.6	f8	f11	f16
1×	0.396	0.560	0.792	1.120	1.584	2.240
2×	0.148	0.210	0.297	0.420	0.594	0.840
3×	0.088	0.124	0.176	0.249	0.352	0.498
4×	0.062	0.088	0.124	0.175	0.247	0.350
5×	0.048	0.067	0.095	0.134	0.190	0.269

Circles of confusion measure 32 μm (0.032 mm, 32 microns)

Focus stacking is a digital editing process that combines a series of images captured at overlapping depths of field to expand the zone of focus in the resulting photograph. A variety of programs can be used for assembly, including *Zerene Stacker*, *Helicon Focus* and *Photoshop*. While the term ‘focus stacking’ generally refers to the act of compositing the images, generating the high-magnification source images is by far the most complex aspect of the technique.

The Challenges

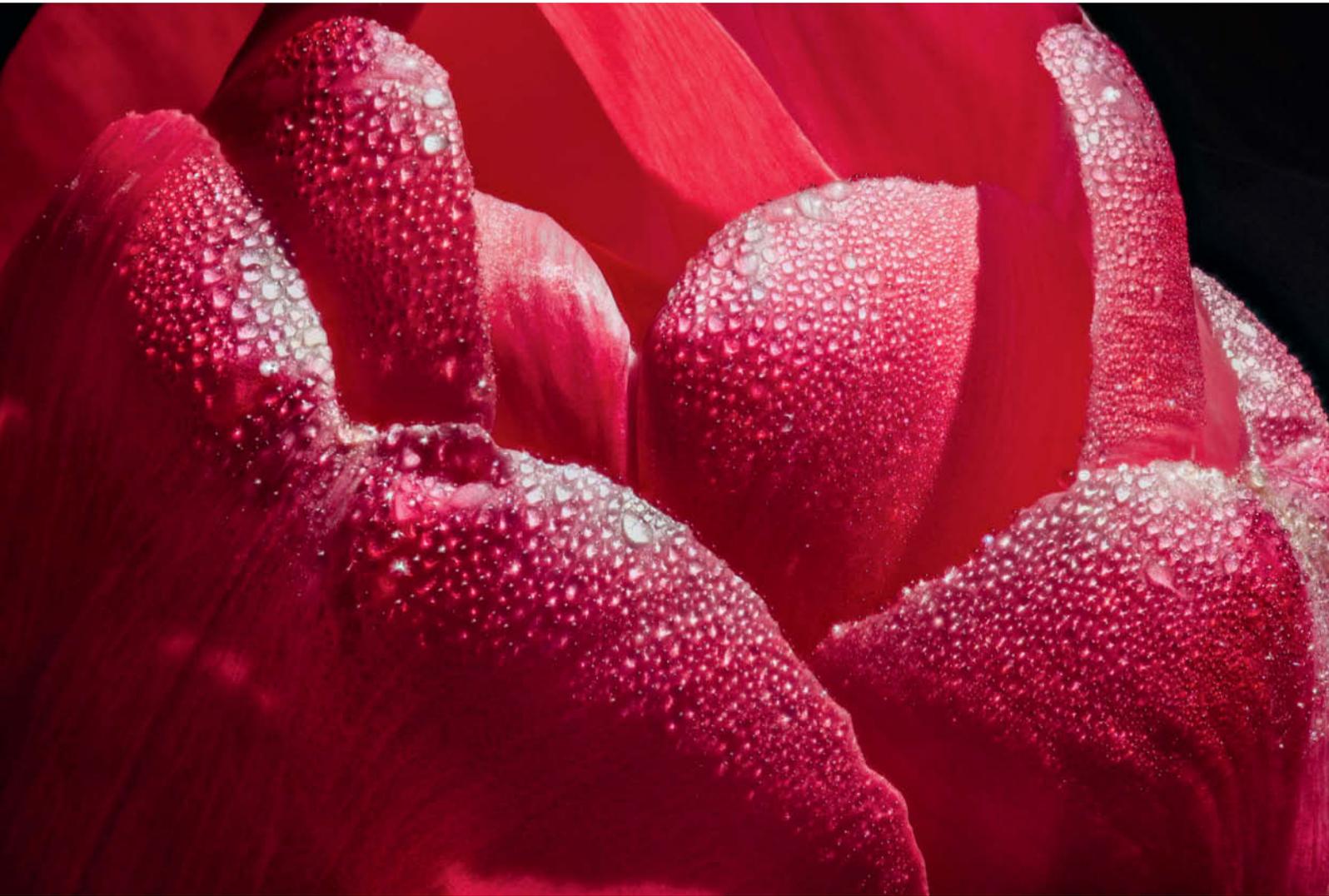
All serious photography presents challenges that have to be met if the photographer’s vision and purpose are to be successfully achieved. In the case of high-magnification photography, limited depth of field isn’t the only problem. Resolution and sharpness

depend on the quality of the camera and lenses used and on how well they are employed. It is essential to completely eliminate movement of both camera and subject so that the focus slices match properly during assembly. Getting sufficient light on the scene and controlling movement almost always requires the use of electronic flash with a very short duration. Positioning flash is complicated, too, due to the minimal working distances involved. Macro equipment requires a solid footing so that focus, the camera and the subject can each be precisely moved through the focus zones. At higher magnifications, these considerations become even more critical and require increasingly complex interventions. And, as always, composition counts. You need a strong subject, color, and/or design element with no distracting background and controlled lighting to create mood or add emphasis.



A unique perspective on a group of unusual and highly detailed U.S. coins, attained by compositing nine stacked images with overlapping depth of field captured at 1× magnification

ISO 200 | Canon MP-E 65mm macro lens | f16 | 1/250s



A brilliant red tulip, tipped with early morning mist. The image, with its easily recognizable subject, deep red color and overlapping petal design meets all the criteria of a worthy composition.

ISO 50 | 180mm macro lens | f16 | 1/45 s

George and Kathryn Lepp

George D. Lepp is one of North America's best-known contemporary outdoor and nature photographers. His passion for natural beauty, technical precision, cutting-edge technology and environmental responsibility are revealed in his beautiful and compelling photographic images. He is also recognized for his dedication to sharing his photographic and biological knowledge with other photographers through his seminars and writing. Kathryn Vincent Lepp is a writer and editor and former Assistant Dean of the College of Humanities, Arts, and Social Sciences at the University of California, Riverside. In addition to her collaboration with her husband, she often undertakes writing and editing projects for popular and scholarly publications. Kathryn Lepp shares her husband's passion for nature and the natural environment and also contributes her time to various community causes.



Basic Equipment for Focus Stacking Capture from Close-up to 10× Magnification

Camera Bodies: All of the examples and techniques presented in this article employ Digital Single Lens Reflex (DSLR) Canon cameras. To ensure maximum resolution, most of them were captured using the full-frame EOS 5D MK III. In some situations, a camera with a smaller sensor can offer the advantage of an additional 'crop factor' that yields higher magnifications. For this reason, some of the images featured here were captured with a Canon EOS 7D or 70D; their APS-C sensors have a 1.6× crop factor. Of

course, full-frame results can also be cropped to offer higher magnification in the final image if quality can be maintained. Cameras that support Live View mode (the ability to view the image on the camera's LCD as it is seen by the sensor before capture) are most efficient for capturing images that are to be stacked. Most current DSLRs will accommodate magnification from close-up to 8×, but specialty optics and accessories may be required to achieve greater magnification.

Lenses: When high-resolution results are the goal, quality optics are key. Nearly all camera brands and third-party lens manufacturers offer excellent macro lenses in various focal lengths. Because stopping down the lens to maximize depth of field compromises clarity due to diffraction of the light entering the narrow lens opening, a macro lens that operates well at wider apertures will achieve better quality. Canon's unique MP-E 65mm f/2.8 macro lens is a favorite for achieving magnifications of up to 5×, or 10× when used with a 2× tele-extender.

An inexpensive way to create a high-magnification setup is to reverse mount a normal or wide-angle lens on the front of a medium telephoto lens. A male-to-male filter thread adapter will be necessary for a clean fit, but to test out the idea, lenses can be mated using heavy-duty tape. It is best to use single focal length lenses rather than zooms for this technique. The magnification such a combination provides can be calculated by dividing the focal length of the telephoto lens attached to the camera body by the focal length of the reversed lens. For example, a reversed 50mm lens attached to a 200mm telephoto will offer a magnification of 4×, while a 28mm reversed wide-angle on a 180mm telephoto offers a magnification of approximately 6.4×. One of the lenses must be left at its widest aperture for this combination to work, so you will have to test your particular setup to determine which configuration gives the best result.

Lighting: Ambient light may be sufficient at lower magnifications, but at closer working distances and increased magnifications, significant light loss occurs. From 1× to 4×, this loss is roughly equal to (magnification +1) – i.e., you lose two stops of brightness at 1×, 3 stops at 2× and so on. For magnifications of 4× and up to 40× and more, it is most efficient to rely on TTL metering for ambient and flash lighting and to make exposure decisions depending on the reflectance of the subject and the effect you wish to achieve. Guidance is readily available in the form of the camera's LCD display, the image histogram or other

The Canon EOS 5D MK III, the Canon MP-E 65mm 1-5× macro lens and the Canon MT-24EX Twin Lite macro flash offer the ideal combination of resolution, magnification and lighting both in the field and in a studio environment





The Canon EOS 5D MK III coupled with the Canon MP-E 65mm macro lens offers high resolution and automatic aperture control for easier focusing. A Canon EF 2x tele-extender extends the reach to 10x.

1X



5X



Several examples of small LED light sources that can be used to illuminate small subjects in a studio or in the field. The Neewer CN-160 LED array pictured in the center fits on the camera's hot shoe or a stand and is powered by six AA batteries. The clamps and bendable stalks built into MightyBright LED book lights make them versatile and ideal for repurposing as photographic lights.

connected displays such as a laptop or iPad. A bright light source is needed for the subject, and a focusing lamp may also be necessary to achieve critical focus through the viewfinder. Flashes specifically designed for macro work, such as the Canon MR-14EX Ring Lite and MT-24EX Twin Lite systems, or the Nikon R1C1 Wireless Close-Up Speedlight are ideal for imaging beyond 1x magnification because they offer superb control of the direction and intensity of the light they produce.

Off-camera LED light sources offer several advantages when used for lower-magnification (close-up) captures in the studio. They don't heat up the subject, their light quality and output is consistent, the intensity can be adjusted and the effect on the subject can be viewed in real time. Such light sources also make effective focusing lamps. Flash is a better choice for work at higher magnifications because of its greater intensity and short duration,

which can mitigate camera or subject movement.

Copy Stands: Like a tripod, a copy stand keeps your gear on a solid footing and allows quick vertical repositioning of the camera/lens setup from a viewpoint above the subject. The Kaiser Corporation in Germany makes excellent copy stands. A cheaper alternative is the RS-CS1070 Heavy Duty Copy Stand from RPS Studio, which can be purchased through amazon.com for about US\$160.



While not pretty, this combination of a reversed normal lens taped to the front of a telephoto achieves a magnification equal to the focal length of the rear lens divided by the focal length of the front lens. In this case, the EOS 70D with its crop factor of 1.6, the 180mm macro and the 50mm lens offer a final magnification of 5.8x.

Capturing Source Images for Stacking

The processes available for capturing stacked images range from simple to complex, but all have two objectives in common. First, the limited depth of field in each capture must overlap the depth of field in the next image to avoid small areas of unsharpness in the final composite. Precision matters: it is possible to make too few captures, but never too many. Second, all of the captured images must align perfectly in the final composite. If the subject adjusts its position, is blown by the wind, or if the camera/lens combination moves during or between captures, the final result will be poor. While photographing handheld can be successful in some situations, a tripod or copy stand is usually necessary to control the proper register of image slices. Because the intent of

focus stacking is to achieve a highly detailed result, I suggest you use RAW format for all your captures.

Focus ring movements: This method works well using a telephoto macro lens such as a 100mm, 180mm or 200mm for close-up subjects that are not too small. Mount the camera/lens combination on a tripod to maintain alignment. For nature subjects such as wildflowers in the field, a tripod that is stable when positioned low to the ground is essential. Stop the lens down to f11 or f16 to maximize the depth of field, then frame the subject and note the range of depth of field. Without reframing, make slight movements with the focusing ring on the lens to move the area of focus through the subject from front to back.

This enables you to capture an in-focus slice at each position while ensuring that the depth of field in each image overlaps that in the prior and subsequent ones. It is not always desirable to get every element of the composition completely sharp. When working with a busy background, it is a good idea to stop making fresh captures as soon as the main subject has been covered.

Handheld movements: This one is tricky and takes some practice. Set the focus (magnification) on the lens and frame the front of the subject. Move the handheld camera toward the subject in small increments, capturing the depth of field in overlapping zones. Quickly take many images to be sure all areas of the subject are covered;



These four captures demonstrate the overlapping zones of focus used to create the tack-sharp image of the green boa opposite. Close examination reveals the movement of depth of field from the snake's nostril through the back of the head to the upper body and finally the lower body. From such a close position, a single image would not have succeeded in portraying the complex structure of the snake's head and scales.

moving both forward and backward through the subject can be helpful. Because it is impossible to maintain a perfectly consistent frame while photographing handheld, this method relies on the post-capture software to properly align the source images. This technique only works at lower magnifications but can be effective when used for stationary subjects in the field.

Focusing rail camera movements: At higher magnification and closer working distances – i.e., when depth of field is extremely small – more consistent capture methods are required. Placing the camera/lens combination on a focusing rail allows the photographer to make tiny, precise movements through the subject. The

best focus rails employ a geared system. It is essential to use a tripod or copy stand when you are working with a focus rail, which often requires you to make a great many captures. Live View mode allows focus monitoring enlarged by up to 10× on the camera's LCD and guides each movement and capture. For a larger preview, a live view can be extended through a USB connection to a laptop computer running a manufacturer's utility program designed to view the monitor image and control the camera remotely.

CamRanger internal focus movements: The CamRanger system wirelessly transmits the camera's Live View information via an ad hoc wi-fi connection to a tablet or smart phone from which the photographer can

control a broad range of camera functions (see www.camranger.com). The device aids focus stacking by programming the camera to execute a series of captures at small, medium, or large incremental changes in focus. It is necessary to test your setup before shooting to ensure that you select the best settings for the lens, aperture and magnification. The lens must have autofocus to work with this system; the Canon MP-E 65mm macro lens doesn't have autofocus and does not work with the CamRanger, but the Canon 100mm and 180mm macro lenses work well. The enlarged image on a high-resolution tablet screen is very helpful in monitoring the focus movements to ensure that the captures overlap properly.



This boa's environment didn't allow the use of a tripod, so the source images for this stack were captured handheld. Four overlapped images were captured by physically moving the camera/lens combination through the range of focus.

ISO 200 | 100mm macro lens | f11 | 1/90 s



Although it is just three inches in diameter, this focus-stacked composite of a Beallara orchid blossom seems enormous compared to the detail shown on the right. The image was created using the Focus Stacking setting in the CamRanger iPad app. Only six captures were necessary to cover the entire subject.

ISO 200 | 100mm macro lens | f8 | 1/8 s



At high magnification, this photograph of the center of a Beallara orchid yields an image of curious design and color. The 49 source captures were captured in the studio and controlled wirelessly off-camera using the Focus Stacking setting in the CamRanger iPad app. A tele-extender was used to increase magnification to 2x.

ISO 200 | 100mm macro lens | f11 | 1.5s

Moving the subject: In some situations it is easier to move the subject than the camera/lens combination to capture a sequence of images for stacking. Macro subjects will usually be a lot smaller and lighter than the camera and lens, and can be placed on a micro stage – the base of a microscope or other moveable stage capable of very small and precise positional adjustments relative to the camera (which is locked above it on a copy stand). A micro stage is equipped with measuring gauges that allow minute, repeatable manual movements for high-magnification projects. The movements of the subject toward or away from the lens are calculated visually and applied manually based on a live view transmitted to a laptop computer via USB, or wirelessly to an iPad using the CamRanger.

StackShot micro movements: As mentioned earlier, at higher magnifications (beginning at about 5x), the image ‘slices’ are very small and are just 0.095 millimeters thick at f5.6. The best way to accomplish the appropriate microscopic movements is to use the StackShot (www.cognisys-inc.com). This system is comprised of a focusing rail capable of movements as small as 2 microns (0.002 millimeters) and a movement controller that also manages the camera’s rate of capture. The controller fires at preset intervals to allow the

camera/StackShot to settle between images. Other fine adjustments that can be made via the controller include settle time, number of

captures at each position and an auto return at the end of the stacked series, to name but a few. The basic procedure is to program the

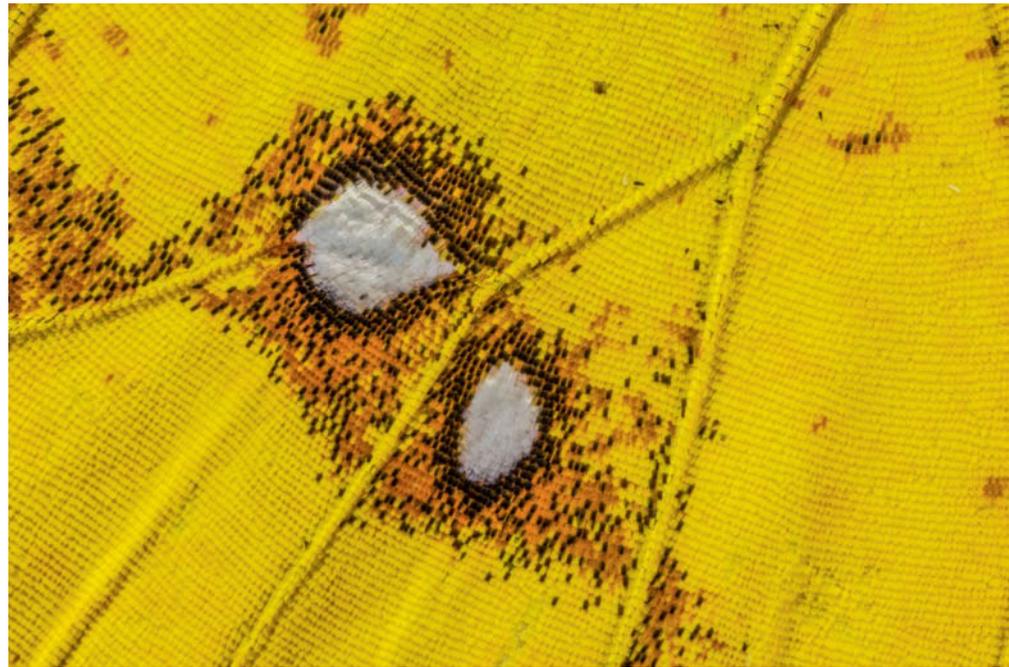


A screenshot of an iPad 3 with the CamRanger wireless off-camera app active

starting point for the image sequence, the distance the camera should move between captures and where the last image in the focusing stack should be taken. Once activated, the sequence is captured automatically – the camera is moved very precisely along the focusing rail using a step motor and worm gear. The StackShot can be attached to a copy stand for studio work or employed in the field with a tripod and an optional battery system. A longer focusing rail that allows up to 200mm of incremental movements is also available.

When working with the StackShot in the studio, place the subject on the stage and set approximate focus before setting up your flash or LED lighting. Note the magnification you wish to use, check appropriate charts to see what the depth of field will be at your desired f-stop and set the controller to use increments that are smaller than the resulting depth of field. Once the system is activated, it displays the number of captures necessary to meet the movement and distance criteria and begins to photograph. A sequence can cover anything from four or five to several hundred images and can take from a few minutes to many hours to complete.

Moving the subject and the camera: Can things get more complicated? Of course! As an example, the composite panorama of a luna moth wing shown below was photographed at very high magnification and resolution. At 16x, it takes 12 images in three rows and four columns to



This beautiful composition was accomplished with 18 focus-stacked captures made in the studio. It shows a 10mm section of a Pheobus rurina wing at 3x.

ISO 200 | 65mm macro lens | f5.6 | 1/4 s

cover the entire area. To capture all the detail in the moth wing, a series of variable-depth captures was made at multiple focus points for each of the 12 positions. The final image is made up of 269 captures and can be

printed to provide stunning high-resolution detail at up to 60" wide. This kind of project requires time and concentration; an error in one of the stacks would render the entire image useless.



The 'eye' of a Luna Moth wing is presented in stunning detail when photographed at 16x and apparently unlimited depth of field. This image was assembled in Zerene Stacker software from 12 focus-stacked composites totaling 269 captures.

ISO 100 | 65mm macro lens / EF 2X MK II tele-extender | f5.6 | 1/60s

High Magnification Stacking in the Field

Successful snowflake photography requires a snow storm, but not just any snow storm. To achieve worthwhile results, the snow must be well formed into separate crystals, and not all snowfalls offer great subjects. Accomplishing high-magnification photography in the field with ambient temperatures at well below freezing presents an array of logistical challenges, from creating a portable studio and powering the StackShot to sheltering the gear and the photographer from the snow and cold.

This continuing project is based on a small copy stand modified to hold a sturdy low tripod/ballhead combo from Really Right Stuff (www.reallyrightstuff.com). The ballhead points downward and holds the StackShot with a Canon EOS 5D MK III and the Canon MP-E 65mm 1-5x macro lens. The lens has an MT-24EX macro flash attached to light the snowflakes from above. On the copy stand, the base of an LED light source works as a background light. The intensity of the light can be adjusted and its color changed by adding filters to create an interesting background. A small, clear plastic cylinder

placed on the LED base supports a glass slide which acts as the stage on which the snowflake is photographed. This positioning blurs the background and creates a space where additional colored light sources can be placed at 45-degree angles to give some definition to the clear crystal. The additional lights can be flashes with colored filters attached or small LED lights covered with colored gels.

The falling snowflakes are captured on a black card and those with promising structures are quickly moved onto the glass slide using a tiny paintbrush. With the CamRanger attached to the camera and transmitting image and camera data wirelessly to an iPad3, the snowflake can be viewed at high magnification. Nine images are usually sufficient to cover a fairly flat snowflake at magnifications of around 5x. If greater magnifications are required, adding an EF 2X extender increases the magnification to a maximum of 10x. Alternatively, using a camera body with a crop factor of 1.5 or 1.6 will achieve 7x or 8x magnification without an extender.



This snowflake, photographed at 8x on an exceptionally cold day in the Colorado Rockies, displays finely formed and delicate crystals portrayed using eight focus-stacked captures and subtle colored lighting

ISO 100 | 65mm 1-5x macro lens and 1.6 crop factor sensor | f5.6 | 1/15 s

Capturing snowflakes at magnifications of up to 5x requires a complex set of equipment that can be mobilized according to Mother Nature's whims:

1. This setup is built on a copy stand base with a Really Right Stuff TP-243 Ground-Level tripod and BH-55 ball head
2. Canon EOS 5D MK III with Canon MP-E 65mm macro (1-5x) lens
3. Canon MT-24EX TwinLite macro flash
4. StackShot rail
5. StackShot controller
6. Snowflake subject on a glass slide mounted on a clear plastic cylinder
7. LED base light array with blue acetate gel positioned beneath the subject
8. Four LED lights with colored gels positioned to illuminate the subject from below
9. CamRanger attached to the camera via USB cable
10. iPad3, encased in a Lifeproof waterproof enclosure and running the CamRanger app.



Capturing Focus Stacked Images at Extremely High Magnifications

If you want to get even closer to your subject, you can use microscope objectives and tele-extenders to achieve magnifications of up to 64×. Used with a full-frame camera, the Canon MP-E 65mm macro lens and the EF 2× tele-extender can capture magnifications of up to 10×. To photograph butterfly scales at higher magnification, you can use Nikon microscope optics called CF Infinity Corrected Objectives. To be effective, objectives need to be mounted on a host lens with a focal length of approximately 200mm. This kind of setup is called a “tube lens” in microscopy circles. The Nikon objectives screw into the front of the host lens using a special adapter.

Two examples of these lens/objective combinations are used in this article. The Nikon CFI BE Plan 10×/0.25 (approximately

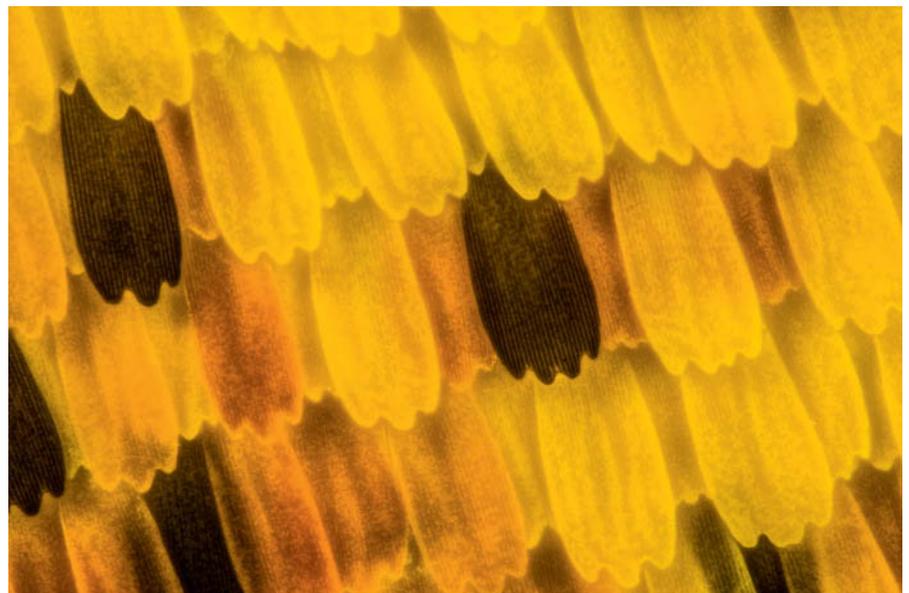


Nikon microscope objectives can be mounted on a host lens using an adaptor with an RMS thread. They enable full-frame captures of up to 40× or 64× using an APS-C camera.

US\$100 and readily available on the Internet) produces 10× magnification with the Canon 180mm macro on a full-frame camera, and can attain 20× by adding a Canon EF 2× tele-extender.

The Nikon CF Plan 20×/0.40 (available used for US\$500 or more) achieves 20× magnification with a 200mm host lens (at its widest aperture) on a full-frame camera, and

40× with an added EF 2× extender. However, to prevent vignetting, it is best to use these combinations with an APS-C camera. A smaller sensor adds to the magnification in the form of a crop factor of 1.5 for Nikon cameras and 1.6 for Canon cameras. Note that the depth of field in the resulting images will be minimal and the use of a step rail is essential for this type of work.



A tiny (< 1mm) section of the wing of a *Phoebis rurina* photographed at 64× reveals amazing texture and brilliant color. Twelve focus-stacked captures provided the necessary depth of field.

ISO 200 | 180mm macro lens, EF 2x MK II extender, Nikon CF Plan 20x/0.40 objective | f6.7 | 1/60s

Assembling a Focus Stacked Image

Successful focus stacking begins with the capture of a series of sharp images of adjoining and overlapping slices through a subject, and ends by assembling the slices to produce a single image with controlled and expanded depth of field. The compositing software works by retaining sharp elements of each capture and discarding anything that is out of focus. Several focus stacking programs exist, and we will take a look at three of the most popular here: *Adobe Photoshop*, *Helicon Focus* and *Zerene Stacker*. Each program has its own particular strengths, and all three are available for a 30-day free trial.

A little preparation and organization will improve the outcome of any focus stacking

session. A workflow is always a personal thing, but a good sample procedure is as follows:

1. Import your RAW source images into *Lightroom 5* (earlier versions also work) and check the images at the beginning and end of the sequence to determine if any can be eliminated. If the sequence begins or ends beyond the actual subject there may be several images that have no sharp areas whatsoever. These can be discarded.

2. Highlight all the images in the stack and select one that well represents the overall exposure, color and tone in the subject. Open this image in the *Develop* module, optimize it for sharpness, contrast, saturation and clarity, then click the ‘Sync’

button at the bottom right-hand corner of the program window. This duplicates the corrections you have made to the representative image for the entire set.

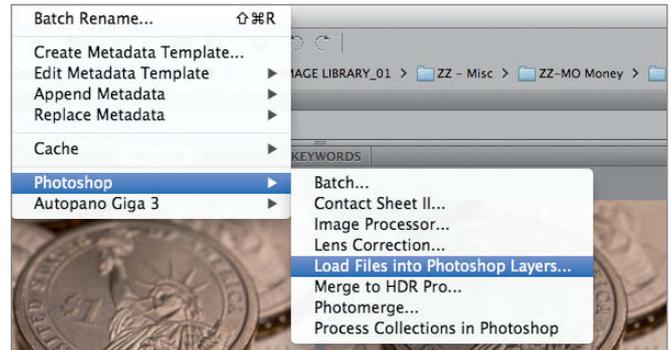
3. Some programs do not support proprietary RAW formats, so convert your images to 16-bit TIFF during export to a separate folder. As an alternative, you can also consider the *Lightroom* plug-ins available for *Helicon Focus* and *Zerene Stacker*, as these preserve changes made in *Lightroom* while converting images to TIFF format for assembly.

The source captures are now ready to be assembled into a single focus-stacked image. (sea)

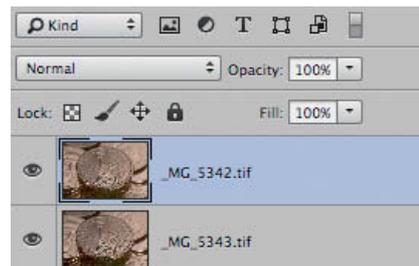
Compositing in Photoshop (CS4-CC)

If you are already familiar with *Photoshop*, it is a relatively simple matter to use the program's onboard tools to create focus-stacked images. *Photoshop* aligns and composites images in two separate actions, whereas *Helicon Focus* and *Zerene Stacker* align and assemble in a single combined process. Of the three programs mentioned here, *Photoshop* appears to be the least precise and sometimes includes small areas of unsharpness in the final rendering.

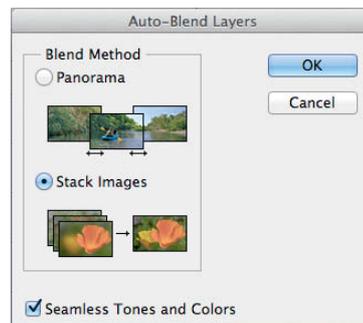
- 1 Import your source captures into *Photoshop* (CS4 or later) by highlighting them in *Bridge* and clicking on Tools > Photoshop > Load Files Into Photoshop Layers.



- 2 Highlight all the imported layers and select the Edit > Auto Align Layers command. In the dialog that then appears, leave the Projection set to *Auto* and click OK. All the layers will then be aligned.



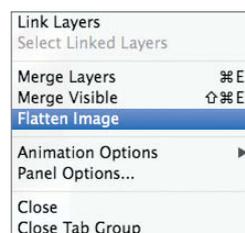
- 3 With all the layers still highlighted navigate to the Edit > Auto-Blend Layers command and select the *Stack Images* option in the dialog that follows. Check the *Seamless Tones and Colors* option and click OK. The image will now be rendered.



- 4 Crop off the out-of-focus edges to finish the image



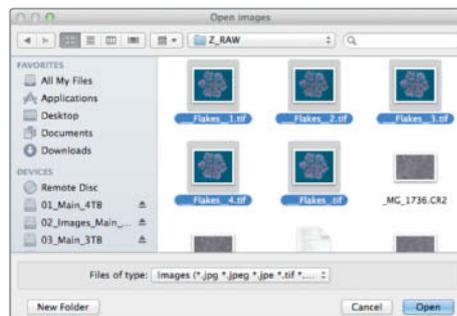
- 5 To flatten the layers and save the image, click on the pull-down menu in the top right-hand corner of the Layers panel and select the Flatten Image command. The flattened image can now be saved using the commands in the File menu.



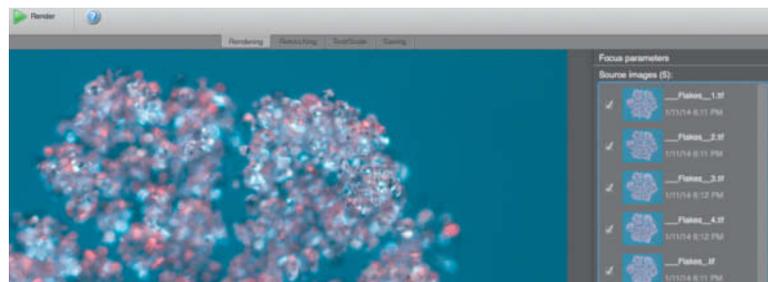
Helicon Focus

Helicon Focus was a groundbreaking pioneer in the field of focus stacking and continues to improve and incorporate new functions. Over and above the basic rendering procedure described here, the software offers many additional options that can improve stacked output. *Helicon Focus* can process RAW source files but converts them automatically to TIFF during processing. Previous edits are not preserved.

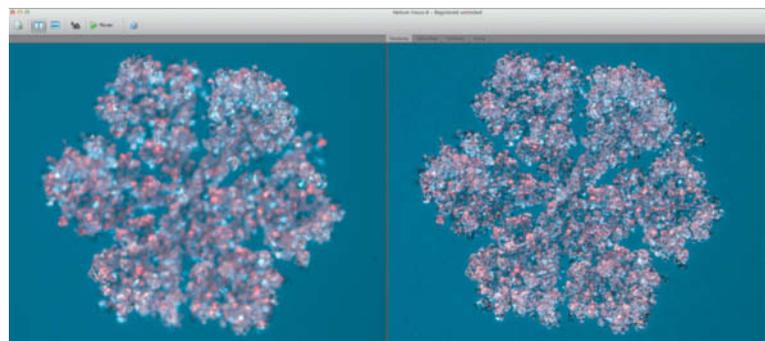
- 1 Open the program and click Add Images (at top left). Navigate to your source folder and highlight the images you wish to stack.



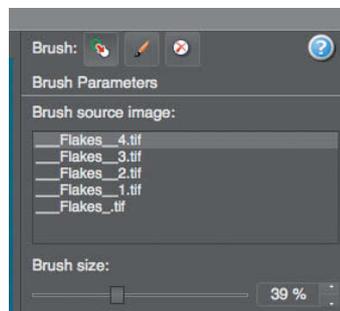
- 2 The selected images will display in a column on the right-hand side of the screen. Click the 'Focus' button, then click on the green 'Render' button.



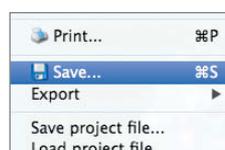
- 3 The program will then run through the image set and present a sharp composite image when it is done. Choose the View option at the top left of the screen to display each capture as it is being rendered. It is fascinating to observe the real-time growth of the area of sharp focus as it expands through the newly created image.



- 4 Use the retouching feature to correct any problem areas. If a spot on the composite is out of focus but is sharp in one of the other source captures, the sharp area can be cloned and inserted into the composited image. This powerful feature is not available as part of *Photoshop's* focus stacking tools, but *Zerene Stacker* does have similar functionality.



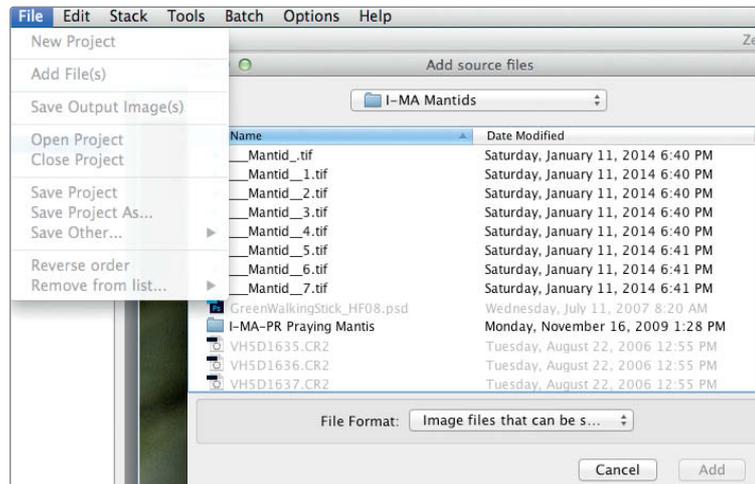
- 5 Save the finished image under File > Save



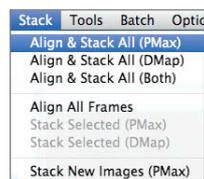
Zerene Stacker

Based on hundreds of trials, *Zerene Stacker* consistently produces the best results for complex focus-stacking tasks. The program also offers excellent built-in tutorials for the capture and assembly of focus-stacked images.

- 1 Launch the program and navigate to your source folder. Highlight the converted 16-bit TIFF files and drag them into the column on the left of the *Zerene Stacker* window.



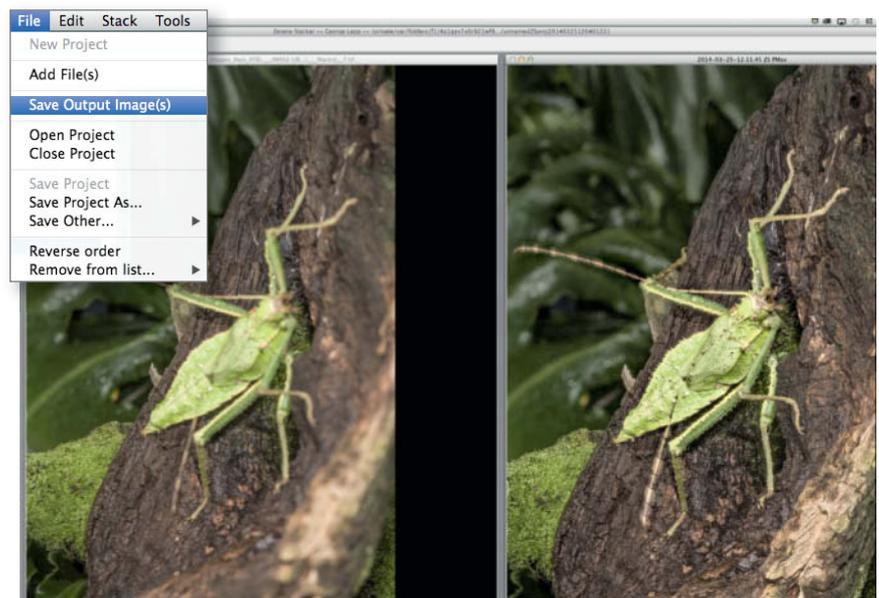
- 2 Click anywhere in the column to activate the menu at the top of the screen. Click **Stack > Align & Stack All**. The program will begin the compositing process, displaying the image currently being incorporated on the left and the composite image being created on the right. The experience is a lot like watching a black and white print appear in the developer tray.



- 3 If touch-up is needed for an area that was good in the original slice but got lost in the final compilation, go to **Edit > Start Retouching**. Clone the appropriate pixels from the individual capture on the left to the composited image on the right. Once you are done making corrections, click **Edit > Commit Retouching**.



- 4 To save the composited image go to **File > Save Output Image(s)**. Designate a save folder and click **Save**, then click **OK**. The final window confirms the destination of the saved file. Click **OK** to finish up.



Thomas Hoffmann, Sophia Sieber

Macro Lens Test

Manufacturers' Own vs. Third-party Glass

All the major DSLR manufacturers include 90mm, 100mm or 105mm macro lenses in their ranges and photographers often choose to use these own-brand optics as a matter of course. However, third-party lens manufacturers such as Sigma, Tamron and Tokina offer cheaper alternatives, while Zeiss offers its own more expensive lenses for the macro sector. We tested whether original or after-market macro lenses are the better option – read on to find out what we discovered.



Macro photography requires patience but can be extremely relaxing. If you take the time to concentrate fully on composition, camera settings and the subject itself, the resulting view into microscopically tiny worlds is highly rewarding. If you take macro photography seriously, at some point you are sure to want to purchase a purpose-built macro lens.

SLR users have a wide choice of specialized lenses with focal lengths that vary from wide-angle to medium telephoto. This test covers a selection of lenses in the popular 90-105 mm range.

All-round Lenses for Macro Beginners

General purpose macro lenses are relatively light and compact and give macro photography beginners plenty of scope for experimentation, with close focus distances of around 30 cm (12 inches). Standard-length (50-60mm) macro lenses tend to have

slightly shorter close-focus distances of around 20 cm.

A greater close-focus distance helps to maximize the light yield in macro shots and reduces the risk of the lens itself casting shadows on the subject. Greater subject-to-lens distances also give you more scope for using additional lighting. Medium telephoto macro lenses are less prone to unwanted camera shake than their telephoto counterparts and can often be used successfully handheld. As a bonus, these types of lenses also double as great portrait lenses in non-macro situations, enabling you to shoot well-defined subjects with soft background bokeh.

We took a close look at the 100/105mm lenses from Canon, Nikon and Sony and compared them with the third-party competition from Sigma, Tokina, Tamron and Zeiss. Full-frame lenses from the major manufacturers share their bayonets with their APS-C cousins, so there is nothing to stop you from using them with APS-C cameras too.

There are many more specialty macro lenses available for full-frame cameras than there are for APS-C models.

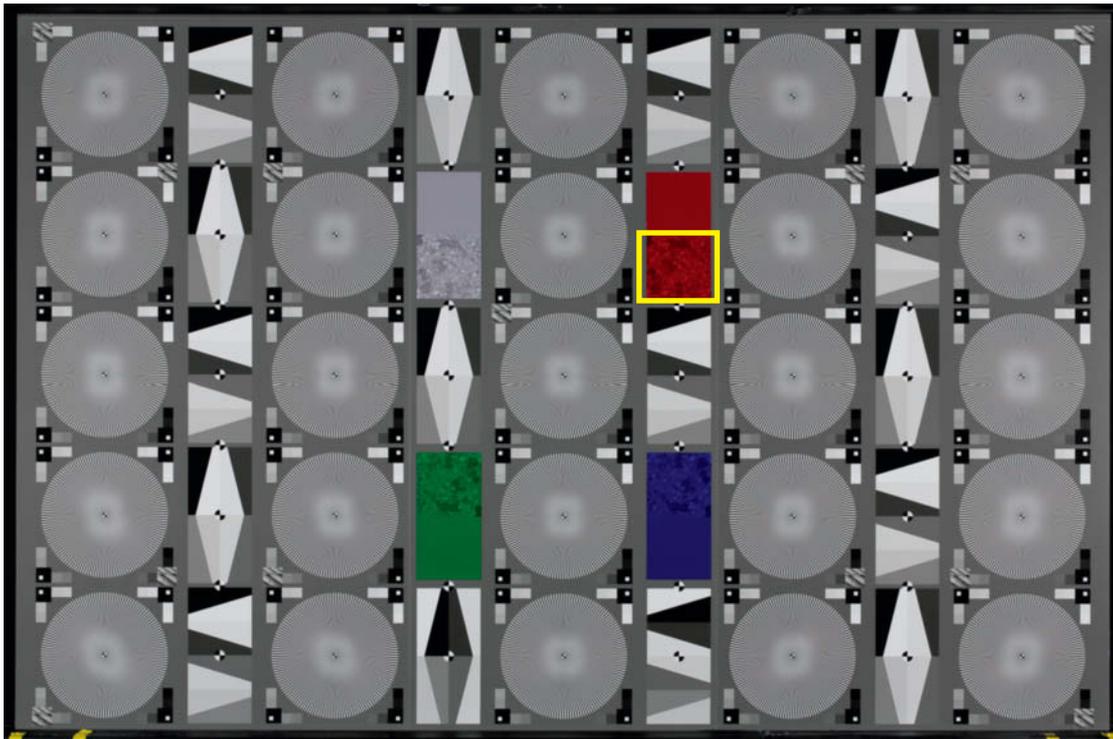
Save Money with Third-party Glass

Sigma, Tamron and Tokina all have reputations for producing great lenses at competitive prices. For example, the current street price for the Sigma 105mm f/2.8 EX DG OS HSM is around US\$670, compared with the equivalent AF-S VR Micro-Nikkor 105mm f/2.8G IF-ED for about US\$900. In the Canon camp, the EF 100mm f/2.8L Macro IS USM also costs around US\$900 new, compared with the Tokina 100mm f/2.8 AT-X Pro D that, at US\$400, costs less than half as much.

Compared to all these models, the Zeiss Makro-Planar T* 100mm f/2 (we tested the ZF version) at around US\$1850 definitely represents a serious system upgrade rather than just an additional lens purchase. The Zeiss maximum aperture of f2.0 is the widest



We visited the Berggarten orchid greenhouse in Hannover to capture our real-world test shots. In this 'group portrait', the lenses fit in well with their temporary surroundings.



The 25 Siemens stars that make up our test scene enabled us to precisely judge the quality and resolution of the test lenses right into the corners of the frame

of all our test lenses, although its reproduction ratio maxes out at 1:2.

Although we focused mainly on the DSLR world, we also took a look at the mirrorless alternatives. There are currently only two purpose-built macro lenses available for the Micro Four Thirds system, but these lightweight contenders are certainly an attractive option if you spend a lot of time on the road and want to minimize the weight of the gear you carry.

Tests in the Lab and in the Field

To provide a balanced set of results from sensors with similar (22- and 24-megapixel) resolutions, we mounted our test lenses on full-frame Canon 5D Mark III, Nikon 610D and Sony SLT-A99 bodies for our lab tests.

To test overall resolution, we shot a frame-filling aperture bracketing sequence of a test chart comprising 25 Siemens stars with sine wave-shaped brightness gradients. We focused manually for all our lab-based shots. We then analyzed the range of contrast between the brightest and darkest part of each shot using custom software, and averaged the cut-off frequency (i.e., the number of resolved line pairs) in a number of directions for each star.

We measured distortion using a special chart made up of repeated printer's register marks and determine the degree of distortion by analyzing the offset between the measured position of a specific point within the image and its theoretical position under ideal conditions.

We also shot an aperture bracketing sequence of real-world test shots in the Berggarten orchid greenhouse in Hannover.

Last but not least, we measured the degree of vignetting using an integrating sphere (see

en.wikipedia.org/wiki/Integrating_sphere for more details).

Our test subject was a dendrobium orchid that was just large enough to produce frame-filling results.

Macro photos can be just as effective when captured with smaller sensors like the Micor Four Thirds model built into the Olympus OM-D shown here. Smaller sensors also provide greater magnification (see page 74 for more details).



Canon EF 100mm f/2.8L IS USM

The Lens: This model belongs to the pro-grade 'L' series of lenses. Weighing in at 625 g (1.38 lb), it has a high-quality heft and is also dust and moisture resistant. It focuses internally, so its length doesn't change during focus adjustments. The focusing ring is grippy and well balanced, and has just the right amount of play, making manual focusing simple and precise.

Test results and image quality: The EF 100mm delivered relatively consistent results throughout the frame, although resolution drop-off at the edges measured as much as 10 percent at maximum aperture. The lens produces its best results at f5.6, recording 90 percent of the potential maximum resolution provided by the EOS 5D Mark III's sensor. At f11, there is no longer any detectable difference between center and edge resolution. Overall performance begins to fall off at f16 and below and ended up recording just 1064 line pairs of resolution at minimum aperture.

Shooting wide open, our real-world test shots show pleasant bokeh with consistent circles of confusion. We particularly liked the Canon's detail contrast, which is obvious in our test shots (see below and the archive provided on this issue's free DVD). This lens produces great definition in even the finest textures and only produces obvious vignetting at maximum aperture. Distortion was negligible across the board and we found no obvious chromatic aberrations at all.

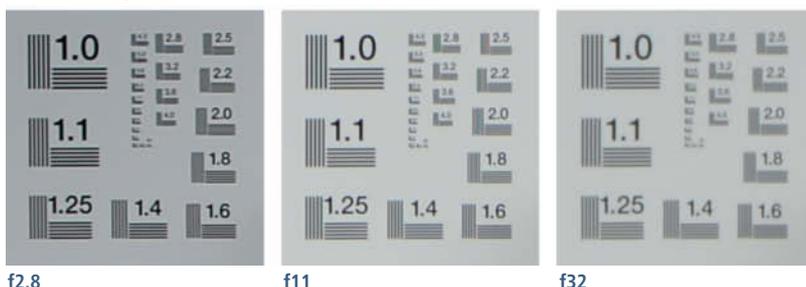


Canon EF 100mm f/2.8L IS USM	
Length	123 mm (4.84 inches)
Focal length	100 mm
Max. reproduction ratio	1:1
Aperture range / # of blades	f2.8-f32 / 9
Closest focus	30 cm (12 inches)
Current street price	US\$1,050
Test Results	Wide open / f8 / Minimum aperture
Center resolution ¹	1585/ 1671/ 1064
Edge resolution ¹	1360/ 1557/ 1035
Vignetting ²	1.4/ 0.2/ 0.2
Distortion (at f8)	0 %
¹ In line pairs	² In f-stops

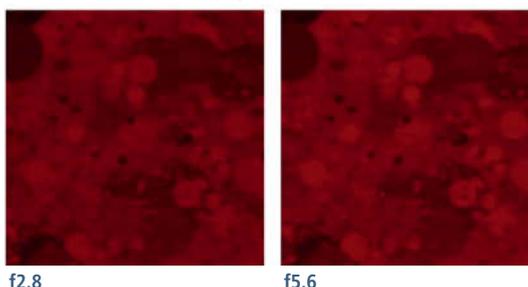


100 mm | ISO 100 | f11 | 0.6 s

Below: The top left-hand corner of the c't lab test scene at ISO 100



Below: Chart detail (see page 63)



Tokina 100mm f/2.8 AT-X M100 AF Pro D



The lens: We tested the Tokina with our Canon EOS 5D Mark III. Focused at infinity, it is quite a bit shorter than the Canon lens and also slightly lighter. The Tokina, however, does not focus internally like the Canon and is thus longer when focused on a close object. Build quality is good, although the focusing ring is slightly looser in use than the Canon's. Instead of using a dedicated switch, the Tokina design means that you have to shift the entire focusing ring backward to switch to manual focus mode, which makes it impossible to intervene in autofocus mode without producing unwanted camera shake. Overall, the Canon lens has a higher-quality look and feel.

Test results and image quality: In terms of image quality, the Tokina keeps pace well with the Canon lens. In the lab, it measured 1665 line pairs of resolution wide open – a value that is as good as or better than the direct competition. We noticed slight resolution drop-off toward the edges of the frame and recorded a value of 1712 line pairs at f5.6, which is the same as that produced by the Canon lens and represents almost 90 percent of the maximum potential resolution of the EOS 5D Mark III's sensor. Vignetting was minimal wide open and the lens produced no detectable distortion. On the downside, most of our test images contain visible chromatic aberrations.

Our real-world test images are all extremely sharp but show inconsistent, often elliptical circles of confusion.

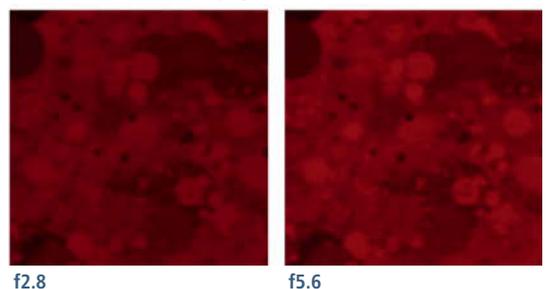
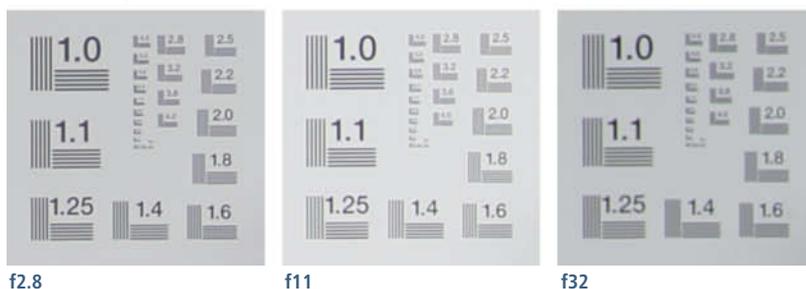
Tokina 100mm f/2.8 AT-X M100 AF Pro D	
Length: standard/extended	95/140 mm (3.74/5.51 inches)
Focal length	100 mm
Max. reproduction ratio	1:1
Aperture range / # of blades	f2.8-f32 / 9
Closest focus	30 cm (11.8 inches)
Current street price	US\$400
Test Results	Wide open / f8 / Minimum aperture
Center resolution ¹	1665/ 1693/ 999
Edge resolution ¹	1425/ 1550/ 994
Vignetting ²	0.9/ 0.2/ 0.2
Distortion (at f8)	0 %
¹ In line pairs	² In f-stops



100 mm | ISO 100 | f11 | 0.6 s

Below: The top left-hand corner of the c't lab test scene at ISO 100

Below: Chart detail (see page 63)



Zeiss Makro-Planar T* 100mm f/2

The lens: The Makro-Planar is the most expensive lens in our test and our expectations were correspondingly high. When a lens with no autofocus, no image stabilizer, no internal focusing and no moisture resistance costs from twice to more than four times as much as the competition, we simply have to assume that its image quality is unparalleled. Physically, the Zeiss delivers on all fronts. The all-metal body is pleasantly heavy, the included sunshade is lined with a soft, velvet-like material and the markings on the lens body are engraved rather than just printed like those of the competition. The focusing ring offers a pleasant degree of resistance and its 360-degree rotation range makes it possible to focus extremely precisely. The only real limitation is the relatively small maximum reproduction ratio of 1:2.

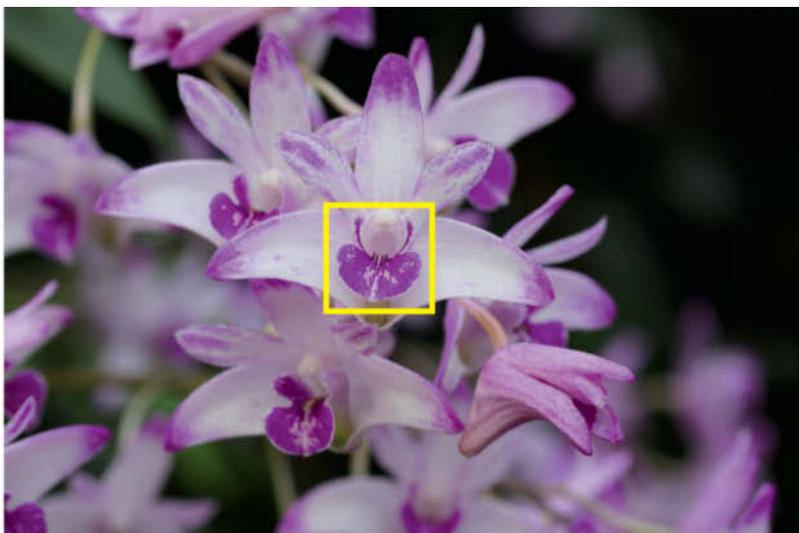
Test Results and image quality: This lens is the best option available for photographers who want to squeeze the very last drop of sharpness out of their subjects. The excellent overall image quality is accompanied by typical high-quality Zeiss detail and color rendition, and we recorded our best results between f4 and f5.6. In other words, this is a great all-round macro lens. Vignetting of only 0.7 stops at f2 (the brightest maximum aperture in our test) is perfectly acceptable and the effect disappears completely at smaller apertures for this and most of the other test lenses. Distortion and chromatic aberration are negligible or simply non-existent at all apertures.

Our real-world test images matched the expectations produced by our lab results, showing high detail contrast and vividly authentic color reproduction.



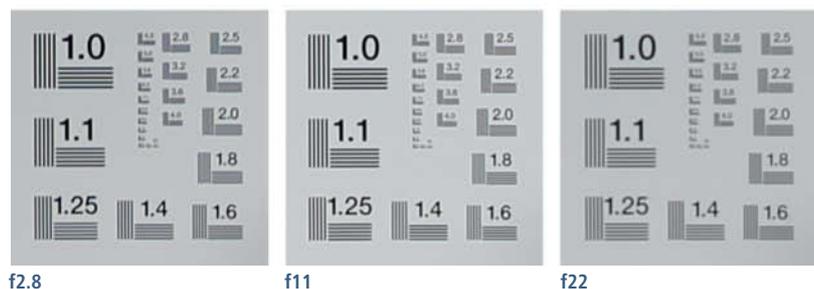
Zeiss Makro-Planar T* 100mm f/2

Length: standard/extended	113/115 mm (4.45/4.52 inches)
Focal length	100 mm
Max. reproduction ratio	1:2
Aperture range / # of blades	f2-f22 / 9
Closest focus	43 cm (16.93 inches)
Current street price	US\$1,850
Test Results	Wide open / f8 / Minimum aperture
Center resolution ¹	1663/ 1672/ 1250
Edge resolution ¹	1507/ 1643/ 1217
Vignetting ²	0.7/ 0.1/ 0.1
Distortion (at f8)	0 %
¹ In line pairs	² In f-stops

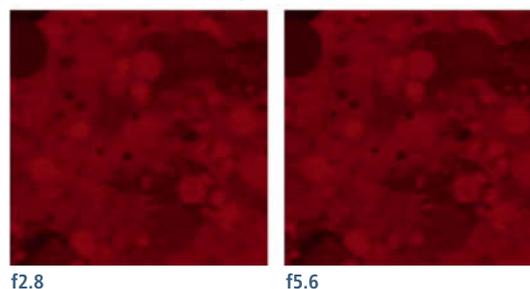


100 mm | ISO 100 | f11 | 1/4 s

Below: The top left-hand corner of the c't lab test scene at ISO 100



Below: Chart detail (see page 63)



Shot with the Canon EOS 5D Mark III and
the Zeiss Makro-Planar T* 100mm f/2
ISO 100 | f2.8 | 1/60 s



Tamron SP 90mm f/2.8 Di VC USD 1:1 Macro

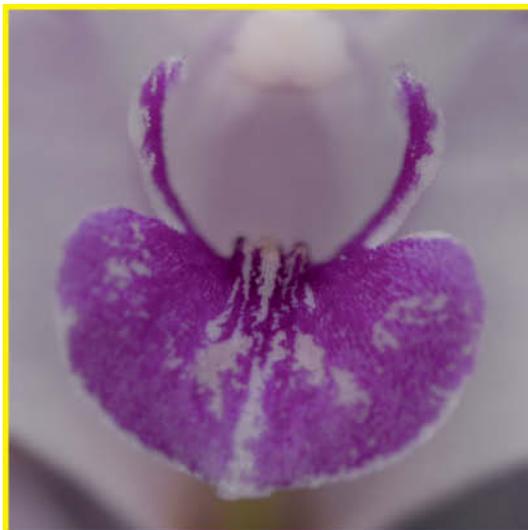
The lens: In spite of having the shortest focal length in our test field, the Tamron requires you to use only 1 cm less subject-to-lens distance than the Nikon lens in order to produce an image with a reproduction ratio of 1:1. Like the Micro-Nikkor, the Tamron focuses internally but is smaller and lighter, making it less of a burden on photo excursions. The lens is moisture resistant, making it ideal for outdoor use in poor weather. In addition, the short telephoto focal length, the built-in image stabilizer and the fast (and virtually silent) ultrasonic focus motor make this a great lens for capturing spontaneous portrait shots too. The focusing ring has virtually no play and focuses precisely. The use of plastic components give the Tamron a lower-quality feel than the Zeiss and Nikon offerings, but it is nevertheless a solid performer.

Test results and image quality: The Tamron delivered almost 1,700 line pairs of resolution between f8 and f11 and continued to perform well all the way down to f16. Quality dropped off quickly beyond f16, delivering only 70 percent of potential maximum resolution (i.e., around 1,000 line pairs at minimum aperture). Center and edge resolution are equally good throughout the aperture range, while vignetting came in at a respectable 0.6 stops wide open and 0.1 stops stopped down.

Our lab test shots confirmed these values. At f8, the lens offers finely detailed reproduction and no visible lens errors. There is some visible highlight fringing wide open and, as with the Micro-Nikkor, your choice of focus points limits the range of apertures you can select.

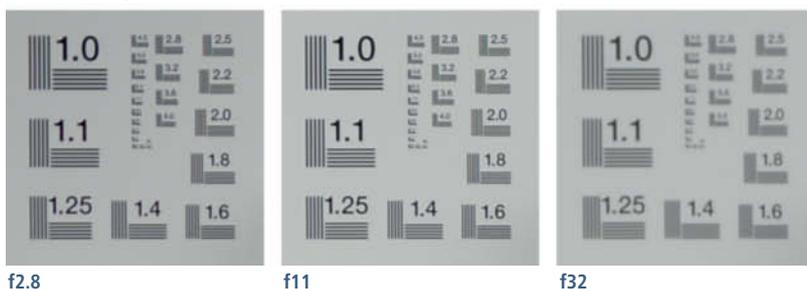


Tamron SP 90mm f/2.8 Di VC USD 1:1 Macro	
Length	115 mm (4.5 inches)
Focal length	90 mm
Max. reproduction ratio	1:1
Aperture range / # of blades	f/2.8 – f/32 / 9
Closest focus	30 cm (11.8 inches)
Current street price	US\$750
Test Results	Wide open / f8 / Minimum aperture
Center resolution ¹	1564/ 1683/ 1013
Edge resolution ¹	1508/ 1602/ 988
Vignetting ²	0.6/ 0.1/ 0.1
Distortion (at f8)	0 %
¹ In line pairs	² In f-stops

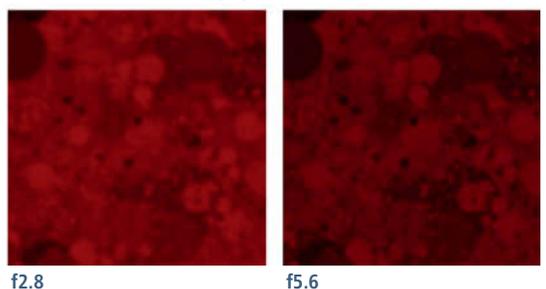


90 mm | ISO 100 | f11 | 1/10 s

Below: The top left-hand corner of the c't lab test scene at ISO 100



Below: Chart detail (see page 63)





Captured with the Nikon D610
and the Tamron SP 90mm f/2.8
ISO 100 | f16 | 1/2s

Sigma 105mm f/2.8 EX DG OS HSM

The lens: This is obviously not a value lens. Its three dedicated switches (image stabilizer, focus mode and focal distance limiter) give it a high-quality, professional look, and the lens even comes complete with two sunshades for use with full-frame and APS-C sensors. Like the Canon and Nikon models, the Sigma focuses internally using a small number of lens elements and therefore has a fixed length. Unlike the Sony lens (see page 72), the Sigma's autofocus mechanism is virtually silent.

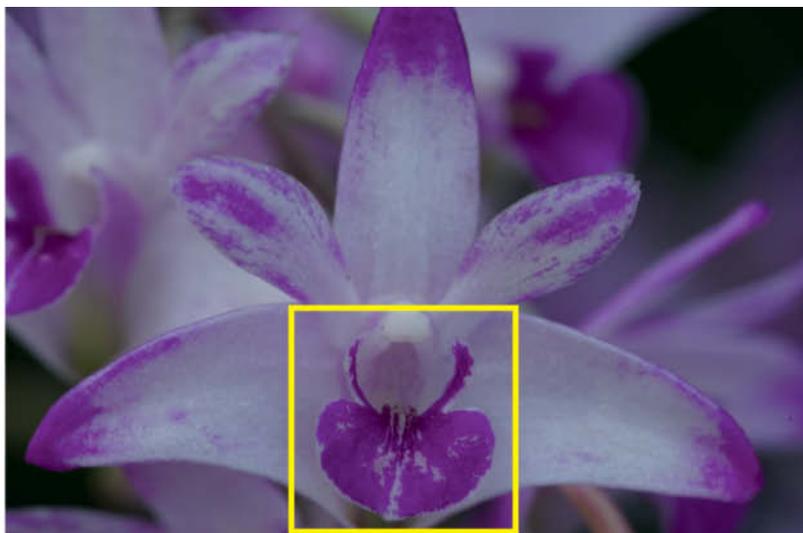
Test results and image quality: The Sigma's center resolution is not quite as good as that of the Sony at maximum aperture, recording 1,571 line pairs compared with the Sony's 1,630 (from a theoretical maximum of 2,000). However, at f8, this relationship reverses, and the 1660 and 1592 line pairs recorded by the Sigma in the center and at the edges of the frame are both better numbers than those from the Sony. After all, it is stopped down resolution that is often crucial in macro situations. As with most of the other test lenses, the Sigma produces no distortion to speak of and there was no visible chromatic aberration either. Vignetting came in at an acceptable 1.2 stops wide open and disappeared almost completely stopped down.

Our real-world test shots show good sharpness and vivid colors and a little more sharpness than the ones we captured using the Sony lens. The circles of confusion are slightly angular but the overall bokeh effect is nevertheless pleasantly balanced.



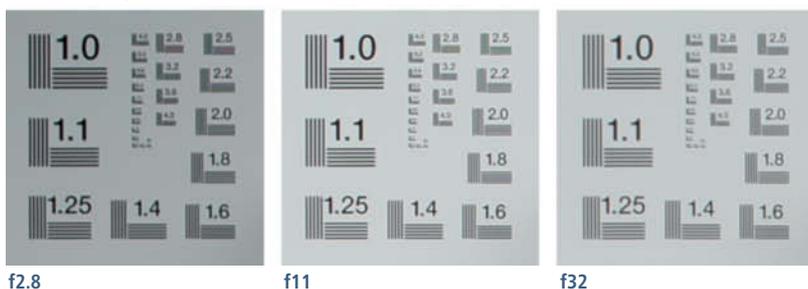
Sigma 105mm f/2.8 EX DG OS HSM

Length	126 mm (4.96 inches)
Focal length	105 mm
Max. reproduction ratio	1:1
Aperture range / # of blades	f2.8-f22 / 9
Closest focus	31 cm (12.3 inches)
Current street price	US\$670
Test Results	Wide open / f8 / Minimum aperture
Center resolution ¹	1571/ 1661/ 1415
Edge resolution ¹	1500/ 1495/ 1387
Vignetting ²	1.2/ 0.1/ 0.1
Distortion (at f8)	-0.1 %
¹ In line pairs	² In f-stops

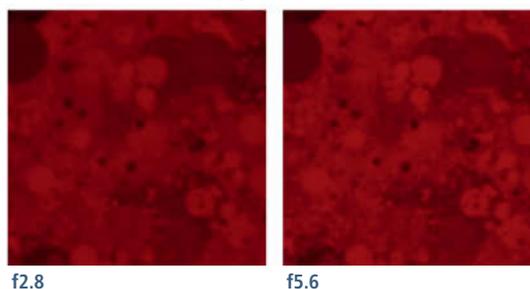


105 mm | ISO 100 | f11 | 1/2 s

Below: The top left-hand corner of the c't lab test scene at ISO 100



Below: Chart detail (see page 63)





Photographed with the Sony Alpha 99
and the Sigma 105mm f/2.8
ISO 100 | f5.6 | 1s

Sony 100mm f/2.8 Alpha A-Mount

The lens: The Sony macro is one of the lighter and less spectacular-looking lenses in our test field, but what it lacks in looks, it makes up for with its sound! Autofocus is accompanied by loud creaks and squeaks while the motor shifts the focusing elements – behavior that is less than optimal when it comes to photographing small, shy creatures from close up. This situation is compounded by the fact that you can only switch between auto and manual focus via the camera menus. On the plus side, build quality is good, although it is not up to the standard of the Zeiss or the Canon. Once you have switched to manual focus mode, the focusing ring offers a useful level of friction that enables smooth, precise focusing.

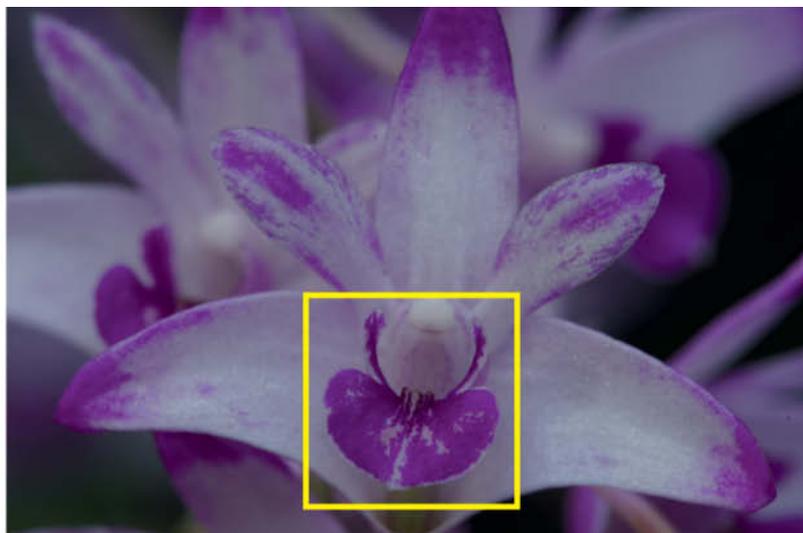
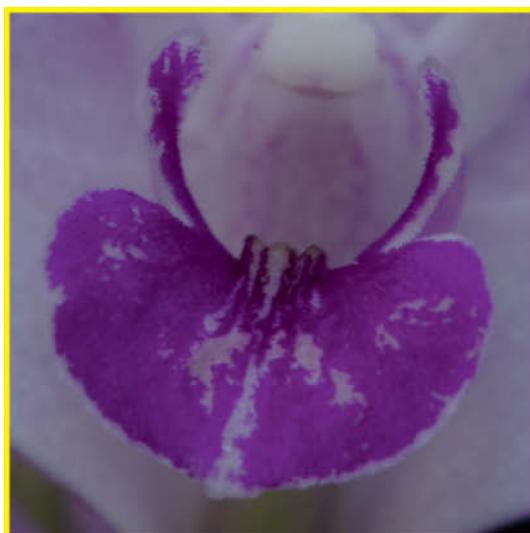
Test results and image quality: Although it didn't produce the best results in our test, the Sony lens performed consistently throughout the aperture range. Wide open, it utilized 80 per cent of the A99 sensor's potential resolution in the center of the frame and about 75 per cent at the edges – a difference that is all but undetectable under most circumstances. Edge resolution is slightly better at f8 but overall image quality drops off again at f11 and beyond, reaching a critical value of less than 1,000 line pairs stopped all the way down.

Compared for example with the Canon, the Sony lacks overall sharpness (see the chart details below and the sample images on this issue's Free DVD to compare them for yourself). As with most of the lenses tested here, the Sony produces virtually no visible chromatic aberration and distortion.



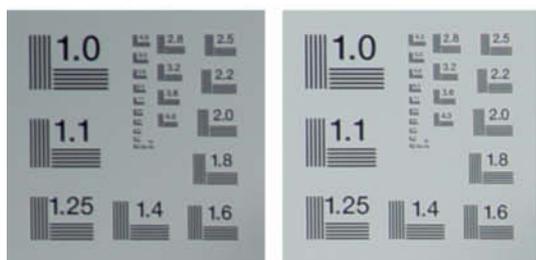
Sony 100mm f/2.8 Alpha A-Mount

Length: standard/extended	95/140 mm (3.74/5.51 inches)
Focal length	100 mm
Max. reproduction ratio	1:1
Aperture range / # of blades	f2.8-f32 / 9
Closest focus	36.6 cm (14.4 inches)
Current street price	US\$750
Test Results	Wide open / f8 / Minimum aperture
Center resolution ¹	1630/ 1627/ 987
Edge resolution ¹	1502/ 1541/ 951
Vignetting ²	0.9/ 0.1/ 0.1
Distortion (at f8)	0.1 %
¹ In line pairs	² In f-stops



100 mm | ISO 100 | f11 | 1/3 s

Below: The top left-hand corner of the c't lab test scene at ISO 100

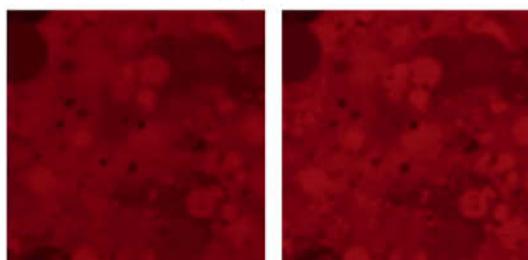


f2.8

f11

f32

Below: Chart detail (see page 63)



f2.8

f5.6

AF-S VR Micro-Nikkor 105mm f/2.8G IF-ED

The lens: The internal focusing mechanism, bright maximum aperture and moisture resistant body make this a big lens. Its all-metal construction weighs in at 750 g (26.5 oz). The ultrasonic autofocus motor is virtually silent and, thanks to the internal focus mechanism, the overall length of the lens remains the same at all times. Autofocus is fast enough for snapshots too, especially if you use the focus limit feature to exclude close-up distances from the range. The built-in image stabilizer also gives you up to three stops of extra exposure leeway and enables you to shoot handheld in low light or other tricky situations. The focusing ring has sufficient range to make manual focusing smooth and precise.

Test results and image quality: Our resolution measurements produced disappointing results, and the lens only achieved more than 70 percent resolution between f8 and f16. At these apertures, there was no detectable difference between edge and center resolution. A vignetting value of just 0.9 at f2.8 is, on the other hand, excellent and the effect disappears completely at smaller apertures. The distortion produced by the lens was measurable but nevertheless negligible in its effect.

Stopped down, the Micro-Nikkor produced highly three-dimensional images with no evidence of fringing at critical edges. The weak maximum-aperture resolution we measured in the lab is also visible in our real-world sample images, but things look much better as soon as the lens is used stopped down. Unusually, the aperture range varies according to magnification – for example, at 1:1, the maximum available aperture is f4.8.

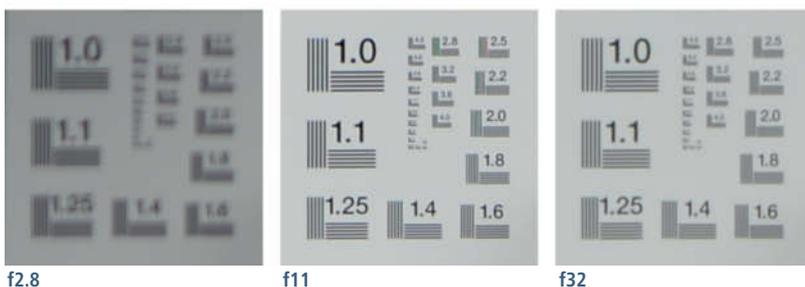


AF-S VR Micro-Nikkor 105mm f/2.8G IF-ED	
Length	116 mm (4.6 inches)
Focal length	105 mm
Max. reproduction ratio	1:1
Aperture range / # of blades	f2.8-f32 / 9
Closest focus	31 cm (12.2 inches)
Current street price	US\$900
Test Results	Wide open / f8 / Minimum aperture
Center resolution ¹	1261/ 1426/ 1062
Edge resolution ¹	1354/ 1573/ 1028
Vignetting ²	0.9/ 0.1/ 0
Distortion (at f8)	-0.1 %
¹ In line pairs	² In f-stops

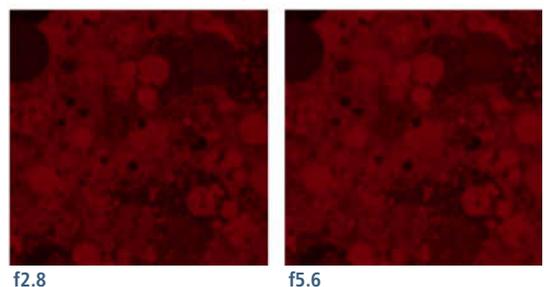


105 mm | ISO 100 | f11 | 1/13 s

Below: The top left-hand corner of the c't lab test scene at ISO 100



Below: Chart detail (see page 63)



Micro Four Thirds Macro Lenses

Mirrorless system cameras can be used in macro situations too. From the various sensor formats available today, we picked Micro Four Thirds as an example and performed a quick standalone test on a single lens. Thanks to the small sensor format and the narrow bayonet diameter, such specialist lenses turn out really compact.

Compared with its full-frame cousins, the moisture resistant M.ZUIKO ED DIGITAL 60mm f/2.8 Macro lens looks almost like a toy, although its price is still thoroughly grown-up! Overall build quality is good and a prominent switch on the lens body is used to switch between focus ranges.

Micro Four Thirds sensors have a crop factor of 2, making the angle of view of the 60mm Olympus lens equivalent to that of a 120mm full-frame lens. The 1:1 close focus distance of 19cm is about the same as that of a 60mm full-frame macro lens.

Considerations When Using a Crop-format Macro Lens

1. If, for example, you wish to use a crop-sensor camera to capture a butterfly that fills the 36x24mm full-frame sensor at a magnification of 1:1, you will have to reduce the magnification by increasing the camera-to-subject distance if you want to avoid cropping the subject.

2. The full-frame lenses described in our main test all have close focus distances of about 30 cm for 1:1 magnification. The close focus distance for the Micro Four Thirds lens is 10 cm shorter and could make it more difficult to work comfortably with small subjects.

Test Results and Image Quality

Judged by its lab results, the Olympus lens is a worthy competitor for the full-frame lenses we tested. The results are not spectacular



M.ZUIKO DIGITAL ED 60mm f/2.8 Macro

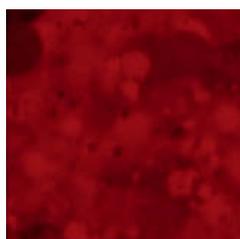
Length	82 mm (3.23 inches)
Focal length	60 mm (120 mm equivalent)
Max. reproduction ratio	1:1
Aperture range / # of blades	f2.8-f22 / 7
Closest focus	19 cm (7.4 inches)
Current street price	US\$400
Test Results	Wide open / f8 / Minimum aperture
Center resolution ¹	1602/ 1650/ 852
Edge resolution ¹	1503/ 1501/ 837
Vignetting ²	0.6/ 0.1/ 0.1
Distortion (at f8)	0 %
¹ In line pairs	² In f-stops

but are extremely consistent throughout the aperture range and across the entire frame. It produced its best center and edge resolution at f4 but only managed to record 840 line pairs when stopped all the way down. Distortion and vignetting were negligible and the mechanics allowed precise manual focusing, even if the resulting images weren't quite as detailed and contrasty as those we captured using our full-frame lenses.

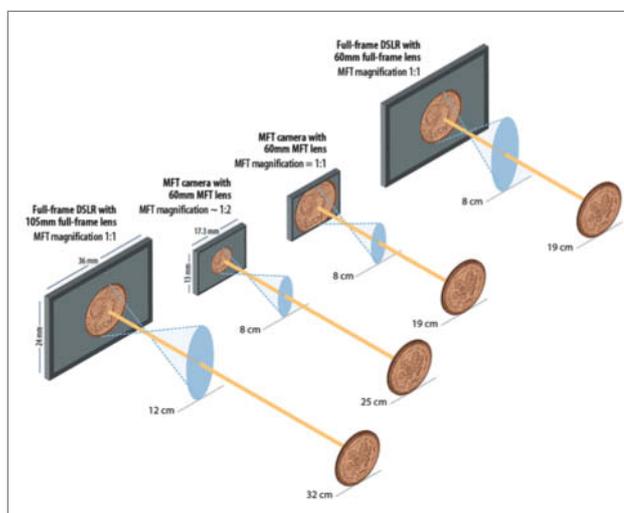


f5.6

A 1 Euro Cent coin fills more of a Micro Four Thirds sensor at 1:1 than it does with a full-frame sensor. You can achieve the same absolute proportions by reducing Micro Four Thirds magnification.



f4



Conclusions

Our test results demonstrate clearly that brand-name gear is not the only option. Models from the likes of Sigma, Tamron and Tokina save you a lot of money but still provide more than adequate build quality and feature sets. Dust and water resistance, internal focusing and image stabilizers are now standard features in many third-party lenses.

One of the obvious drawbacks of less expensive lenses is the quality of the materials used and the handling that results. The Sigma lens we tested was a welcome exception, but the other third-party optics don't generally have the heft or quality feel of the Nikon and Canon competition. The results nevertheless speak for themselves, with Tokina beating the Canon on most fronts and the Tamron leaving the Nikon standing in several respects.

The Canon's high-end ultrasonic motor and internal focusing functionality are nice to have but don't play a direct role in producing successful macro photos. The Sony too, has its own particular quirks, and extends to almost double its original length when used to capture subjects at 1:1. The level of noise its autofocus motor produced

gave us cause to worry about the integrity of its mechanics.

The Sigma and the Tamron were the best all-rounders in our test. In spite of their relatively long focal lengths, their ultrasonic motors and image stabilizers make them great for handheld and/or portrait shooting. Both these models also have smooth and precise manual focusing capabilities.

The Zeiss is something of an anomaly, providing only 1:2 magnification for twice the cost of the Canon and Nikon equivalents. The major plus offered by the Zeiss is, of course, its excellent reproduction quality throughout the aperture range. It also scores highly with its wide-aperture sharpness, offering image quality that others only begin to approach when used stopped down. It performs best at around f8, which is still fairly wide for many macro applications.

In spite of its lack of an image stabilizer, autofocus and internal focusing, the Zeiss also sets standards with respect to overall build quality. It is a joy to focus manually using its bright maximum aperture and wonderfully smooth focusing ring.

The major drawback common to all the lenses we tested is their full-frame geometry, which makes them quite large and heavy. An additional 800g (28 oz) of glass and metal won't make a big difference if you are concentrating on macro work using a tripod or focusing rail, but things look different if you want to use one of these lenses on a walking tour. Crop-format lenses keep your kit light and compact and also offer greater depth of field at similar magnifications. Their image quality is only poorer at high ISO settings.

We are spoiled for choice in today's market. The image quality offered by the our test lenses was surprisingly good in view of the price differentials involved and it is only the build quality that differs obviously between the manufacturers'-own and after-market models.

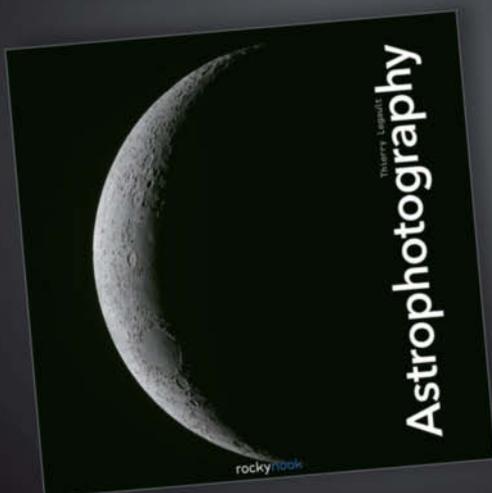
If you are looking to purchase a macro lens, we can wholeheartedly recommend taking the third-party route. However, if absolute precision and ultimate image quality in a variety of situations is your goal (and money is no object), the Zeiss solution is the only real option. (ssi, tho) **ct**

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Michael Jordan

Natural Light

Sunlight is the most widely used photographic light source. Anyone who has a feel for the way light behaves can learn to utilize its characteristics in many different ways. This article looks at how to use natural light to shoot effective photos in a variety of situations.



This image tells a story and stirs the viewer's emotions. For extreme close-ups like this, it is simpler to focus manually and fine-tune focus by moving the camera back and forth.

Full-frame DSLR | 50mm lens with extension tubes | 1/200s | f16 | ISO 200

Creating photographs is all about 'painting with light'. Light is essential to the process of photography – without it, an image cannot exist. If you look at a bunch of photos, you will quickly realize that each depicts a situation with its own unique lighting. Compare shots of the same scene – a landscape, for instance – photographed at

different times of day, in different weather or in summer instead of winter, and you will see how crucial variations in the prevailing light are to the mood of each image.

Sunlight, delivered either directly from a clear sky or indirectly through clouds or mist is the most widely used source of light in photography. This article is about what light

is and how best to use it to create great photographs.

To begin with, we will take a look at light itself – what it is made of, how it behaves and the characteristics luminance, direction, color and quality. Once you have developed a feel for light, you will soon learn to use it to give your subjects meaning and transport a

message. We will then look at specific situations and types of images and investigate how to make the most of the available light.

Like an electric lamp or a flashlight, daylight is a continuous light source that provides consistent-looking light over a period of time. Just how long it remains consistent depends on the weather and, of course, the clouds. In continuous light, a longer exposure produces a brighter image. Unlike daylight, flash lights up a scene for a very brief moment, so increasing the exposure time for a flash shot will not produce a brighter image. Imagine shooting with flash in a completely dark room, and you will see why this is the case.

Luminance

In a photographic context, the most important aspect of light is its luminance, or the 'amount' of available light. If there is enough light available, it can be used to create a photo. The three basic parameters that regulate a photographic exposure are aperture, exposure time and ISO sensitivity.

The range of available settings depends on the limits of your camera's technology – for example, its maximum ISO setting and the capabilities of your lens. The maximum aperture and the presence (or lack) of an image stabilizer will play a role in the types of image you can successfully capture. At extreme telephoto and macro focal lengths, you also run the risk of capturing unwanted camera shake.

The issue of getting exposure right is the same, whether you shoot in manual exposure mode or using one of your camera's auto, programmed or creative modes. Whichever mode you use, the built-in light meter will show the correct exposure parameters based either on the camera's own values or the settings you have made. You can then use the correct exposure parameters to capture what you see and store it as a memento or document of a particular event or object.

Usually, however, we want more than just a matter-of-fact record of our experiences. Most photographers want to produce images that touch the viewer's emotions. To do that, you need more than just an attractive subject

or an interesting viewpoint. What you need is the right light.

Using Histograms

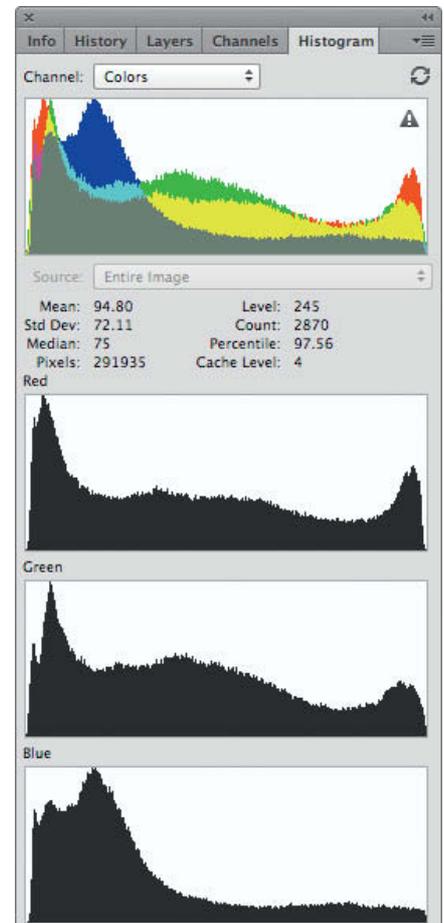
The histogram, which graphs the distribution of tonal values throughout the frame, is a really useful tool for checking the exposure of a digital image. The values depicted at the left-hand end of the scale represent the shadows (i.e., the darker tones). Tones at the far left are completely black and show no detail in the corresponding areas of the image. The values in the center of the scale represent the midtones and those on the right the highlights (i.e., the bright tones). The far right-hand end of the scale represents white – in other words, highlights that contain no discernible detail. The shape of the histogram curve is unimportant, as it simply displays the tonal values that are present in an image that has already been captured.

In order to get the most out of an image, either during processing or later, when it is published, it is preferable to have an image that contains only tones that show some



In this shot, lateral sunlight from the left produces wonderful shadows. The low viewpoint and the wide-angle perspective enhance the feeling of great depth.

Full-frame DSLR | 15 mm | 1/800 s | f7.1 | ISO 400



detail. The histogram of a 'correctly' exposed image shouldn't contain any tonal values at the extreme ends of the scale. Such extreme values are an indication that the subject contains too great a range of contrast to be captured with adequate shadow and highlight detail. One way to deal with such high-contrast subjects is to shoot a bracketing sequence and use the resulting source files to create a single HDR (high dynamic range) image.

Only image areas that contain discernible detail can be processed effectively. Altering the exposure parameters is one way to ensure that an image contains sufficient detail. Shifting the histogram curve to the right is

equivalent to increasing the overall exposure value, while shifting it to the left makes the image darker. However you decide to expose an image, areas that contain no detail are virtually impossible to rescue during processing. The only way to retrieve 'lost' detail is to copy pixels from an area that contains appropriate data using dedicated software such as Photoshop's Clone Stamp or Copy tools. This is complicated and doesn't always produce realistic-looking results. If, on the other hand, there isn't enough light available to shoot handheld without producing camera shake, all you have to do is mount your camera on a tripod.

The brightness, color, contrast and saturation in a well-exposed image can all be altered during processing to match the way you remember the situation. However, all these factors are easier to control if the image contains detail throughout the tonal range and there are no obviously under- or overexposed areas.

Direction

Another extremely important factor influencing the look of an image is the direction (relative to the camera) from which the light illuminating the subject emanates.



The light from in front in the shot on the left makes the rock look bright but rather two-dimensional. Only its shape and color distinguish it from the background.

Full-frame DSLR | 15 mm | 1/5000s | f7.1 | ISO 400

In the still life below left, the light entering the window to the left produces a three-dimensional look that emphasizes the curves in the jug and bowl. An additional reflector or accent light on the right would weaken this effect.

Compact camera (crop factor 1.3) | 35 mm | 1/20s | f8 | ISO 320

The depth created by the shadow pointing toward the viewer in the backlit shot of a tree below is further emphasized by the high overall contrast. In situations like this, you have to take care to prevent the highlights from burning out.

Compact camera (crop factor 1.3) | 21 mm | 1/125s | f8 | ISO 160





The famous 'blue hour' shortly before dusk produces the most expressive images. If this shot had been captured any earlier, the illuminations wouldn't have been switched on and the image would have been dull and two-dimensional. Any later, and the sky would have been much darker or even black.

Full-frame DSLR | 24mm tilt/shift lens | 1 s | f8 | ISO 200

Light comes basically either from the sides (lateral light), from behind the photographer or from behind the subject (backlight). Each of these situations creates a very different atmosphere. Lateral light that hits the subject virtually at right angles to the camera's optical axis 'grazes' the subject, creating unique relief effects and long shadows whereas the shadows produced by frontal light (i.e., light from behind the photographer) are not usually visible because they are cast behind the subject. The most effective shadows of all are those produced by backlight.

The vertical angle of incidence is important too. Sunlight always comes from above, although the time of year and the time of day significantly affect the angle it comes from – an aspect of composition that is particularly important in architectural shots.

Of course, we cannot influence the angle of sunlight but we can wait for the sun to move to the desired position. If this time-consuming approach isn't suitable for the shot you want to capture, the only other alternative is to alter the position of the camera. This is a particularly effective approach for people and other subjects that

can alter the direction in which they are moving to suit the camera's standpoint.

In most other situations, altering the camera position completely alters the composition and often provides the benefit of a new and more interesting view of a well-known building or landscape. Changing light nearly always throws up new perspectives and detail in familiar subjects. If the job you are doing requires a specific view, you will simply have to wait for the right light.

The Color of Light

The time of day also influences the color of light, as does the degree of cloud cover. It may seem obvious, but consider the difference in color between a cloudless blue sky and the sky on a cloudy day. The nature of these differences is described in terms of 'color temperature', which is measured in units called Kelvin (K). Low Kelvin values indicate warmer-looking colors, while higher values represent cooler colors. Daylight on a cloudy day has a color temperature of about 5500 K, whereas a cloudless sky has a Kelvin value somewhere between 8000 and 12000.

The two basic approaches to color rendition aim either to accentuate the colors to underscore the mood of a shot (at sunset, for instance) or to keep the colors as neutral and authentic as possible (for instance, in an advertising context in which the product is the center of attention). Colors that are too cool or too warm can easily reduce the recognition value of a product just as a 'neutralized' sunset will probably not touch the viewer's emotions as much as one that contains really 'warm' colors.

White Balance

The camera's white balance setting enables you to adjust the color temperature before shooting, although most contemporary cameras have very good automatic white balance functionality that rarely fails to select the right setting. If you want to select the white balance setting yourself, you can choose from a range of preset values tuned to specific light sources such as sunlight, cloud, tungsten light or flash. Most cameras also allow you to set custom Kelvin values or custom white balance by way of a reference

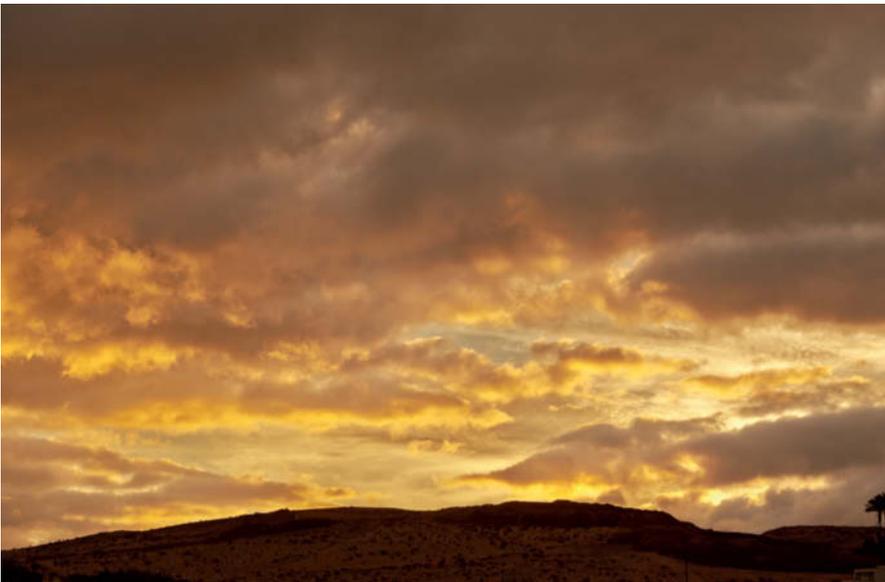


photo of a white or gray card. The downside of this approach is that white balance has to be readjusted for each new situation.

Manual adjustment is the most flexible but also the trickiest approach to setting white balance. Dedicated tools, such as gray cards and filters, help you make a reference setting. If authentic color reproduction is particularly important to you, you are better off using a reference color chart, which you will also have to recalibrate for each new situation.

The Quality of Light

The fourth important aspect of light is its 'quality', a term used to describe the relative 'hardness' or 'softness' of a light source. Midday sun in a cloudless sky produces hard-edged shadows and is thus considered 'hard', whereas the light from a cloudy sky is soft and produces only vague, indeterminate shadows. Just as light from every angle is not necessarily suitable for every subject, you also need to consider whether the available light has the right quality for the effect you wish to achieve.

If you are shooting in a particular location, it's always a good idea to check out the available light first and choose your subjects accordingly. This is definitely the best approach if you have only limited shooting time at your disposal – evenings or at the weekend, for example. On vacation, too, this

The same scene captured three times using different white balance settings, showing how radically you can influence the look of an image while you are shooting. From top to bottom: Auto, 10800 K, 3000 K.

Full-frame DSLR | 85 mm | 1/1600 s | f6.3 | ISO 400

strategy can significantly increase the number of successful images you bring home. In contrast, pro photographers who have a specific brief and are judged by the quality of their results simply have to wait until the light is right.

The Interplay of the Four Major Aspects of Light

The amount, direction, color and quality of the available light all play a role in every daylight photo, although the relative importance of each will depend on the individual circumstances and the subject. If you shoot in a RAW format you can, if necessary, alter the color temperature later during processing, but the direction and quality of the light are pretty well 'set in stone' the moment you press the shutter release. These considerations raise the question of whether there are hard and fast rules that we can observe to be sure of capturing the best possible results in any situation. Although the interplay of all four factors determines the overall quality of an image, certain aspects of the composition process require special attention, regardless of the subject. Note that many of these considerations are equally valid whether you are using flash, artificial light or natural light to illuminate your subject.

The old adage "Where there's light, there's shade" is a useful guideline when you

Manual White Balance

The various ways of setting white balance manually are all based on the same principle, which involves photographing a reference object under the same lighting conditions as the scene you wish to capture.

The reference object can be a gray card designed for use with digital cameras or a translucent, purpose-built filter that is fitted to (or simply held in front of) the lens and is designed to diffuse the light entering the lens to enable the camera to record its color temperature.

Whichever method you use to capture your reference object, the camera then compares the tones in the red, green and blue channels with neutral values recorded in its memory and calculates an

appropriate white balance value. If you then photograph your reference object with the new white balance value set, the object should be rendered with perfectly authentic colors. Take care not to overexpose your reference shot and make sure that there is visible detail in all three color channels if you want it to function correctly.

If you don't have dedicated accessories like those mentioned above, it is also possible to set white balance manually using a sheet of paper or a tissue. The important thing to watch out for is that your reference surface is a neutral white color.

You can also use this technique to produce complementary white balance settings for colored reference objects.

are composing photos. Shadows provide contrast and can be placed virtually at will depending on the direction of the incident light and the camera position. The 'harder' the light, the crisper the shadows will be and the more they will emphasize the three-dimensionality of the image. Soft,

diffuse light produces only soft, diffuse shadows. 'Hard' lateral light is often used to emphasize the contours in male portrait subjects' faces, whereas the current dictates of fashion seem to make soft, diffuse light that produces little or no shadow preferable when capturing portraits of women.



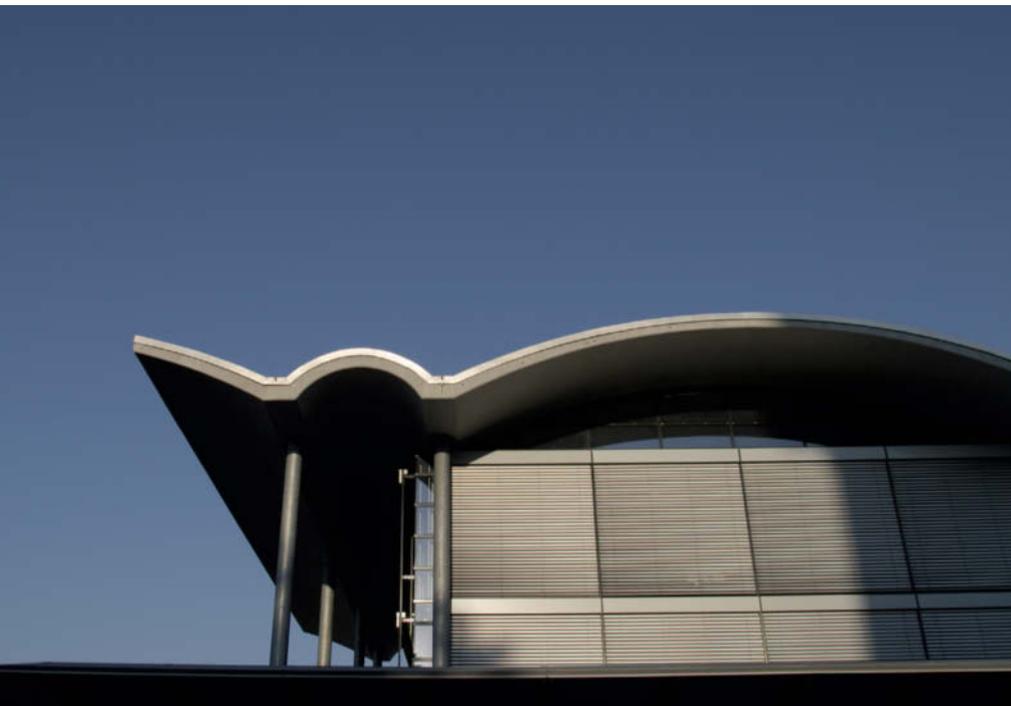
A simple example of the effects of direct and diffuse light. The warm tone of the lateral sunlight in the right-hand image emphasizes the wall behind the subject as well as the texture in the subject itself.

Above: Full-frame DSLR | 85 mm | 1/50 s
| f5.6 | ISO 250

Right: Full-frame DSLR | 85 mm | 1/640 s
| f4 | ISO 250

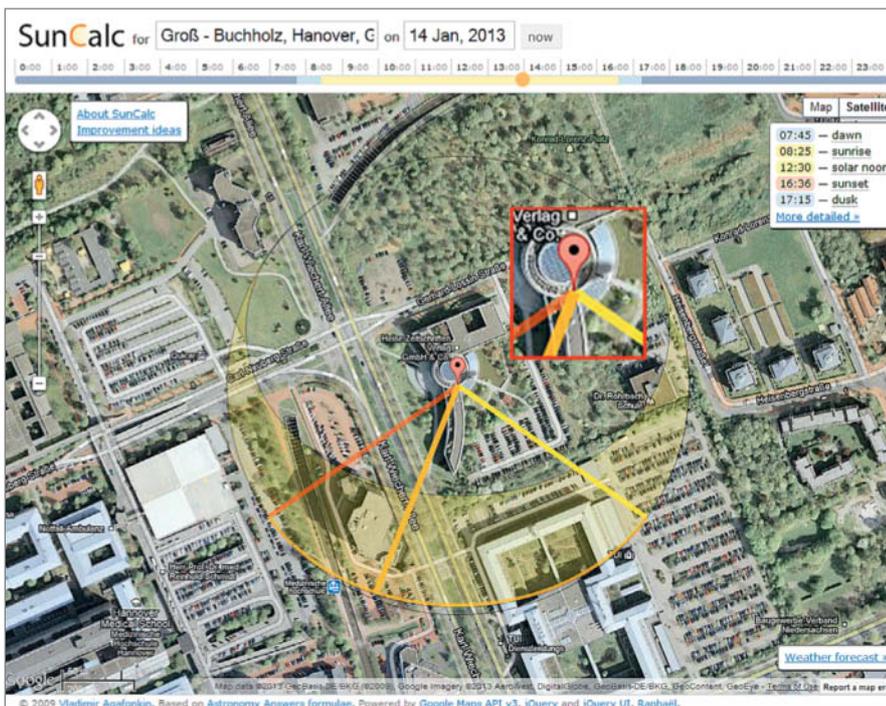


Architecture



The charm of this simple image lies in the way the brightest highlight is positioned precisely on the small curve in the roof

DSLR (crop factor 1.6) | 22 mm | 1/800 s | f6.3 | ISO 100



SunCalc is an online tool that enables you to visualize the phases of the sun and the shadows it will cast for a given location at any given time

It is always easier to assess the available light in a familiar place but, if you are planning to shoot somewhere you have never been before, it is a good idea to use a dedicated tool such as SunCalc (www.suncalc.net) to check the movements and phases of the sun at your chosen location before you get there. Of course, the weather has to play along too, but you can still make a good estimate of the time at which you need to be in position to make your shot. Using a dedicated tool to plan a shoot saves a lot of time and helps to you to concentrate on the shoot itself once you are on location .

Frontal light intensifies colors and illuminates architecture evenly, while lateral light emphasizes the three-dimensional nature of a building and underscores the textures and features in its surface. Backlight is a no-no when photographing architecture unless you are simply taking photographic notes or shooting impressionistic or artistic shots in which the shadows are as important as the building itself. If this is the approach you wish to take, the lower the sun, the longer and more impressive the shadows will be.

Generally speaking, photos taken when the sun is high in the sky are less interesting than those captured in the early morning or towards the end of the day. The warmer tones that often prevail in the late afternoon benefit most compositions, even if the overall quality of the light at these times is softer than it is in the middle of the day.

Especially for architectural shots, you will simply have to decide whether soft, warm light with a shallow angle of incidence is preferable to 'harder' light from above.

Even without refined lighting, this passageway makes a great subject, but the foreground shadow is the icing on the cake and gives the image additional depth and a feeling of space. In shots like this, it is essential to line up the edges of the frame with the vertical lines in the subject.

DSLR (crop factor 1.3) | 14 mm | 1/125 s | f16 | ISO 200

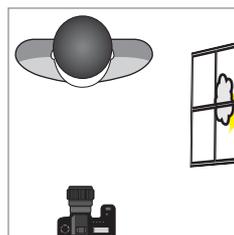


Portraits and People Shots



When shooting with long exposure times, you have to make sure that your subject is relaxed and that the head is gently supported to avoid unwanted movements. Long exposure times often produce images that radiate a special kind of calm.

Tripod-mounted full-frame DSLR | 85 mm | 0.5 s | f1.8 | ISO 800

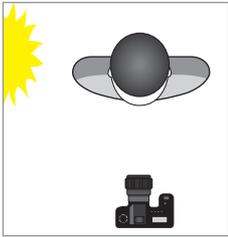
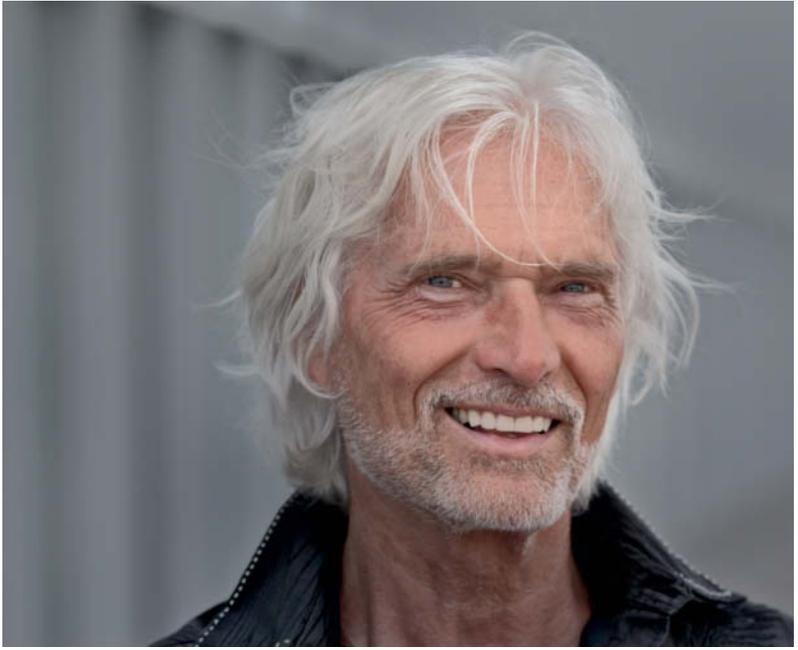


Capturing images of people in daylight requires a very different approach from the one taken in the studio, where the photographer can precisely control the color, direction and intensity of the light. Daylight people photos are more often than not the preserve of hobby photographers and are usually spontaneous, serving to preserve memories or as visual notes. If you want to take a more serious approach to daylight portraiture, you will have to analyze the surroundings and lighting conditions before you begin to shoot. As far as the ambient light is concerned, this means assessing the direction it comes from and positioning yourself and your subject accordingly. Do you want to use frontal light, or is lateral or backlight more appropriate? Does the background look right for your preferred lighting direction? These considerations may sound complex, but are relatively simple to master with a little practice. You will find that you instinctively combine the various elements of a location to form a coherent composition.

Just like with other subjects, portraits shot in backlight display few shadows, and the diffuse backlight produced by clouds is great for creating portraits with soft, flattering skin tones. Crows' feet and other slight skin blemishes are virtually invisible in soft sunlight.

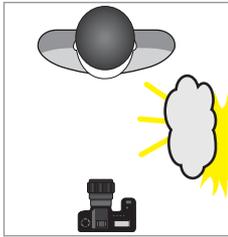
Lateral light increases definition, creates more shadows and produces striking and characterful results. Dark/light contrast can be used to make a broad face look thinner, while wrinkles in a subject's skin can be deliberately accented using light from the side. Especially in the late afternoon, backlight can create a very effective halo or 'rim light' effect that accentuates the subject against the background.

If you do shoot portraits in backlight, you will often need to use a reflector to brighten your subject's face so it doesn't disappear into the shadows. A simple sheet of Styrofoam makes a great reflector and there is a wide range of purpose-built collapsible gold or silver photo reflectors available. If you are not working with an assistant, you will also need a tripod or stand fitted with an appropriate clamp to hold your reflector in place while you shoot. A shopping bag filled with stones is a cheap and practical way to secure a light stand against the effects of wind when you are out and about. The very best option is, of course, an experienced assistant who constantly checks the angle and effect of the reflected light.



In this shot, the sunlight created extremely high contrast, so we decided to expose to retain highlight detail at the expense of some shadow detail. The dark shadows emphasize the subject's facial features and make this a very effective portrait.

Full-frame DSLR | 135 mm | 1/8000 s | f3.5 | ISO 800



This shot was captured about 30 minutes before the one on the left in the shadow cast by the building in the background. This enabled the subject to look directly into the camera with his eyes wide open.

Full-frame DSLR | 135 mm | 1/2000 s | f4.5 | ISO 800

Fill Light in Portraits

Daylight can be used to illuminate a subject directly but can be reflected and artificially manipulated too. Whichever type of reflector you use, the larger its surface, the more light it will reflect. Additionally, the closer you position a reflector to the subject, the more intense its effect will be. Smooth surfaces reflect light in a more direct, concentrated form than matte or uneven surfaces.

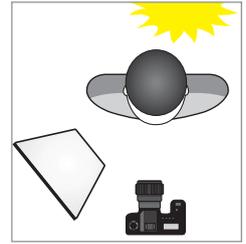
A reflector should always be at least as large as the object it illuminates. Paper is too flexible and is therefore not particularly effective, but cardboard works very well if you feel it is not worth purchasing a purpose-built reflector like the one shown on the right.

Styrofoam is stable and makes a very effective reflector, and you can paint the other side black to act as a shader or 'flag'.

Folding reflectors in various colors and sizes are popular among outdoor photographers, as are the larger aluminum-framed models manufactured by California Sunbounce, which are available with a range of coverings that includes, gold, silver, white and even zebra stripes.

Gold and silver reflectors have a more intense effect than white ones and can end up dazzling the subject if not used with care. Moderate amounts of reflected light produce images with relaxed-looking subjects and natural-looking levels of contrast.





A backlit portrait captured in late afternoon sun in fall. The gold-colored reflector used to brighten the subject's face gives the photo a sunny look with no unwanted green-tinged reflections from the surroundings.

Full-frame DSLR | 135 mm | 1/640s | f2 | ISO 320

If you prefer to keep gear to a minimum, you can always use appropriate parts of the surroundings, such as brightly painted walls or fences, as natural reflectors. You can then adjust the brightness of the reflected light by altering the distance between the reflector and your subject. The color of a reflector is important: white or light gray reflectors are the most effective, although subtle yellow or red tones can add an agreeable warm accent to a portrait shot too.

Try to keep accent lights as inconspicuous as possible for the viewer. This works best if the reflected light matches that of the surroundings and the image is composed so that there is no visible transition between the subject and the foreground. Long lenses and wide apertures are a useful combination for portrait shots.

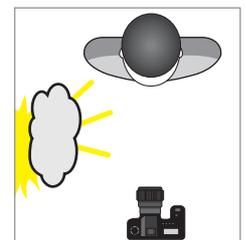
There is a definite trend toward using gold reflectors to produce obvious highlights and accents in portraits with otherwise neutral-looking backgrounds. This can produce eye-catching effects but needs to be used in moderation if you want your images to look natural.

Diffuse daylight provides even-looking light from just about every direction and gives you a lot of freedom when it comes to positioning your subject and selecting your

shooting angle. Such conditions are particularly useful for group portraits. The bright sunshine that so many people wish for at family get-togethers doesn't necessarily provide useful photographic lighting. In frontal sunlight (i.e., with the sun behind the photographer), people will be well lit but will often end up squinting into the sun or having to wear sunglasses, which doesn't make for particularly relaxed or natural-looking photos.

Even if the people you are photographing aren't keen on the idea, shooting in the shade often produces much better results. If you take this approach, it is always a good idea to set white balance manually, especially if you are shooting under trees, as they can easily give a photo a green cast. Green-tinged skin tones look strange and are difficult to correct effectively.

Another thing to look out for when shooting in the shade is that the background is shaded too – otherwise, the contrast within the frame will be too high and the background will contain burned out highlights. An alternative to shooting in the shade is to use backlight. This might mean that the photographer is the one who ends up squinting, but that doesn't affect the photos. If you use a low sun as a backlight, you might not have to brighten your subject's face at all.



Right: this scene is located under a road bridge that leads to a hill on the right, so the subject is lit evenly and exclusively by diffuse sunlight coming from the left

Full-frame DSLR | 135 mm | 1/250s | f2 | ISO 400



Landscapes

Unless you are a landscape specialist, you probably only shoot landscapes on vacation or if you are out hiking or walking. However, if you learn to incorporate the various aspects of natural light into your photos, even spontaneous opportunities can produce impressive results, especially if the sun happens to be shining.

As in most situations, the most impressive landscape colors occur when you have the sun behind you, although the resulting images are often rather two-dimensional and flat-looking. Backlit scenes provide the most depth, although shooting with a telephoto

lens from a high viewpoint also produces a more three-dimensional look, especially if distant features of the landscape, such as faraway mountains, appear in the background. The further away an object is, the lighter its colors become, so once again, the soft, warm early morning and late afternoon light provides the best landscape photo opportunities. A low sun casts interesting shadows that you can incorporate into your composition, whereas the short shadows produced when the sun is high in the sky leave you little scope for modulating the textures in an image. If you

are shooting in the early morning or late afternoon, you need to work quickly, as the light changes fast and gives you very little time to check your settings and make test shots.

Conclusions

If you take the trouble to look carefully at the light and the new opportunities it provides on every shoot, you will quickly develop an innate feel for how light behaves, and you will be rewarded with consistently exciting images. (pen)



In this shot, the soft light from the cloudy sky produced muted colors and a virtually shadow-free image. The composition is defined by the vertical tree trunks, the horizontal element provided by the boat and the frame provided by the grass and the leaves and didn't need extra shadows anyway.

DSLR (crop factor 1.6) | 50mm | 1/100s | f4 | ISO 200

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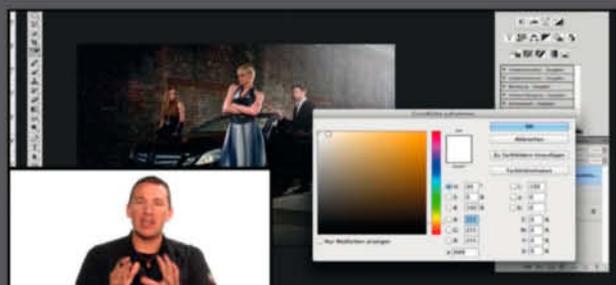


Image editing tutorials

Master Photoshop, Lightroom and other software to create stunning images.



Meet photo legends

Watch interviews with star photographers and learn how they shot their most famous photos.



Bernhard Stockmann

How to Create **Light Rays** with GIMP



Image: futureshape on flickr, Alexander Baxevanis

The Sun's rays shining through a church window – a beautiful effect created entirely in GIMP

Light rays diffused by the clouds or shining ethereally through church windows are just some of the effects you can create using GIMP's volumetric lighting tools. This workshop shows you how to apply these fantastic effects to your own images.

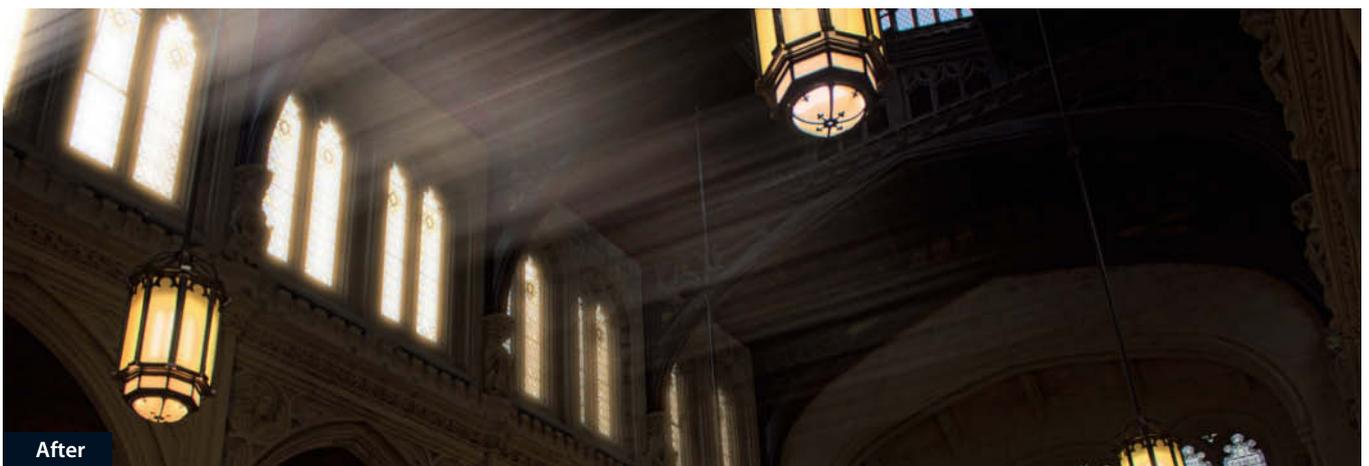
The effects produced by incident light can be diffuse, highly directional or simply random. Sometimes, when light is scattered by clouds or formed into arrow-like rays by windows, it produces effects with a unique, mystical beauty all their own.

These effects are the result of normally invisible light rays being dispersed and made

visible by fog, dust or smoke particles in the atmosphere. Recreating such effects digitally is a relatively simple matter and can be executed in the open source GIMP image editing suite using the simple steps described on the following pages. This type of edit can be used to give all manner of images additional atmosphere. (keh)

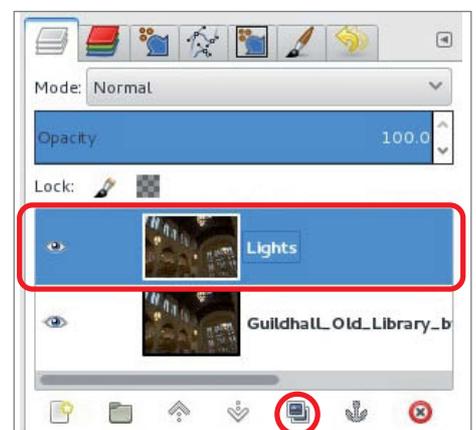
GIMP Workshop – How to Flood a Room with Volumetric Light

The basis for this workshop is a photo of the interior of the Guildhall in London. The steps described below show you how to add digital 'light rays' that appear to shine through the windows on the side of the building.



Step 1

Begin by selecting the places where the 'light rays' are to appear. To do this, you need to make a black-and-white copy of the background layer in which the 'light' areas are white and all other details black. To duplicate the background layer, use either the 'Create Duplicate Layer' button at the foot of the Layers panel or the Ctrl+Shift+D keystroke.

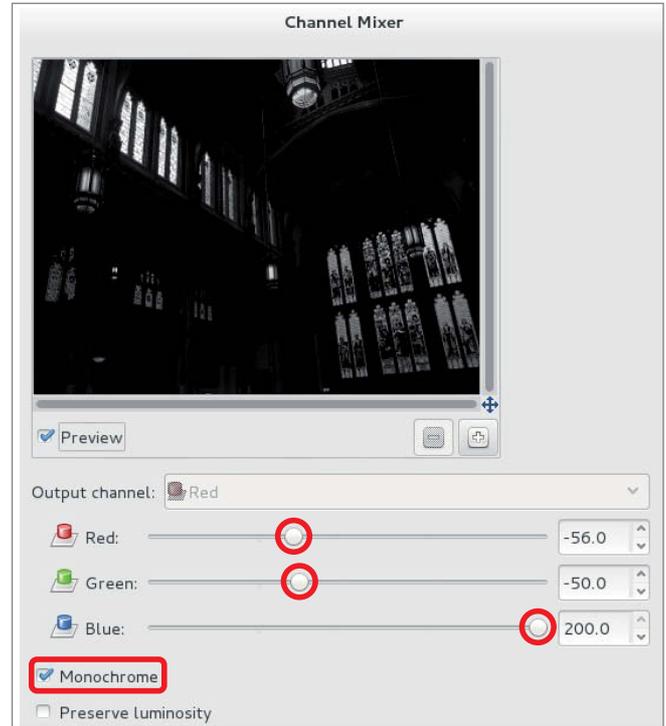


Step 2

Now select the Colors > Components > Channel Mixer command and check the *Monochrome* option. The preview image will now be displayed as a grayscale image.

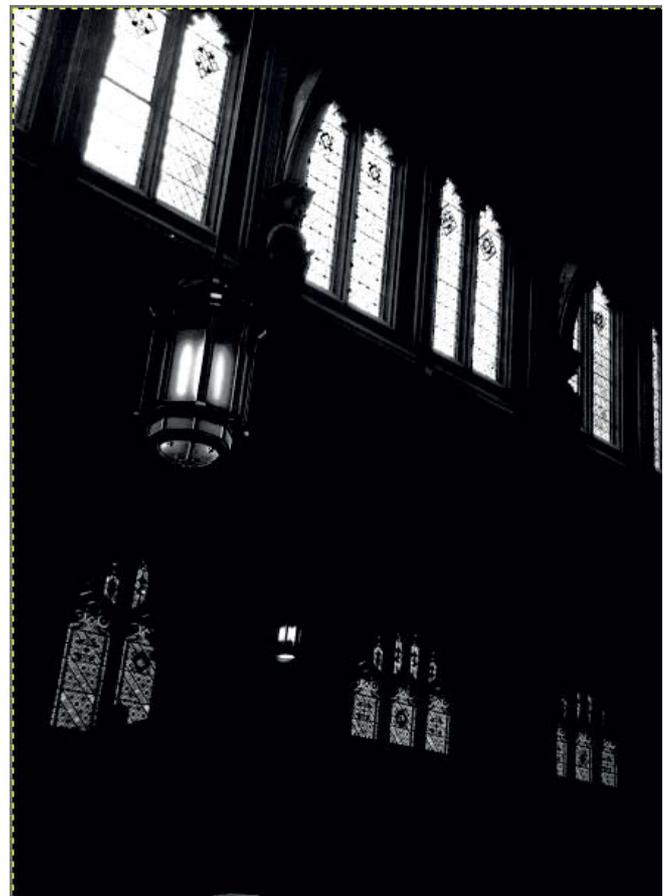
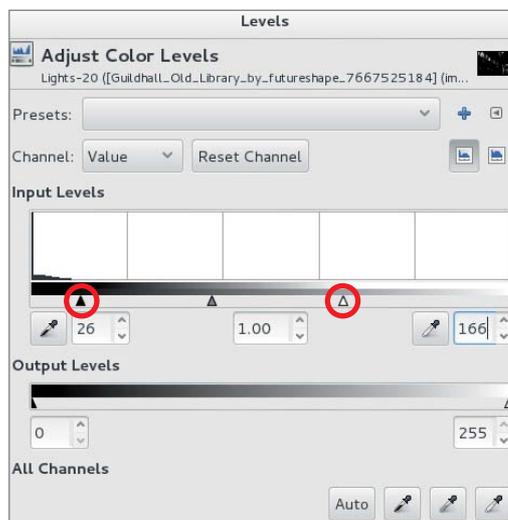
To emphasize the bright areas, shift one of the three color channel sliders all the way to the right and leave the other two set to zero. This produces a version of the grayscale image in which the tonal values are determined by the values captured in a single channel.

The brighter parts of most images are recorded in either the blue or the red channel, while highlights are rarely found in the green channel. In our example, we shifted the blue slider all the way to the right and kept the other two at low settings. The result is a high-contrast image in which the dark gray tones tend toward black, thus further emphasizing the bright windows.



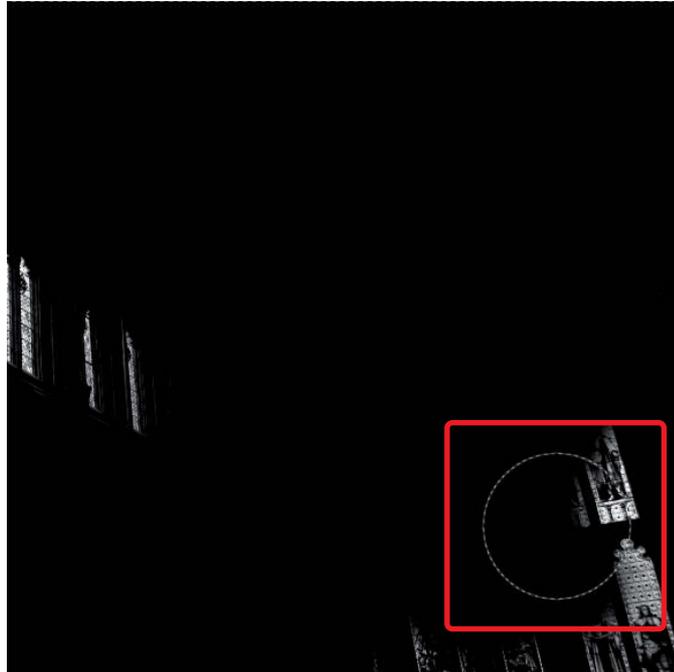
Step 3

Now use the Colors > Levels dialog to adjust the last remaining gray tones. The Input Levels histogram reveals that the image still contains quite a few dark gray tones. Move the left-hand (black point) triangular slider to the right to shift the dark gray tones to black. Similarly, moving the right-hand (white point) slider to the left brightens the remaining light gray tones so that they become pure white.



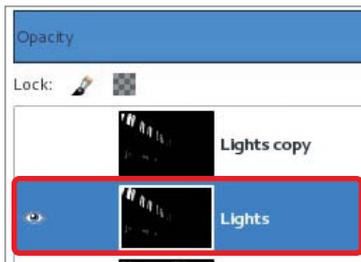
Step 4

Now use the Brush tool with a wide tip to 'paint out' any remaining highlights that you don't wish to include in your 'light ray' effect.



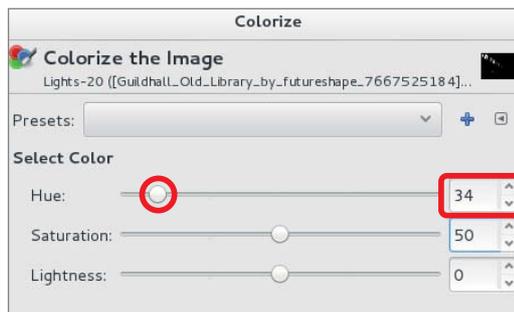
Step 5

Duplicate the edited monochrome layer and hide the duplicate (in our example, the 'Lights copy' layer) by clicking the eye icon to the left of the layer thumbnail. Now select the visible monochrome layer and apply the Filters > Blur > Gaussian Blur filter with a Radius value of 30.

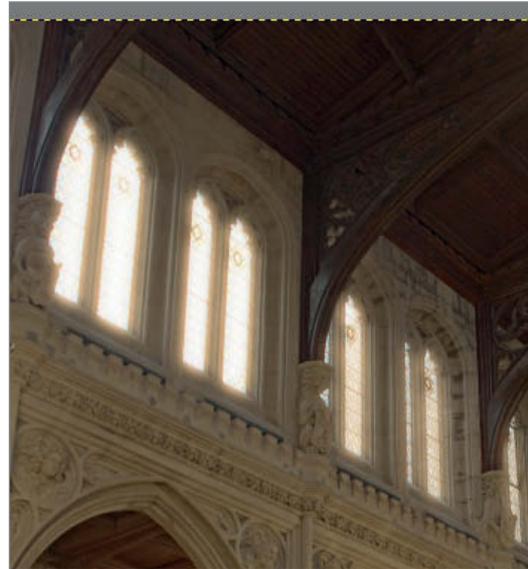
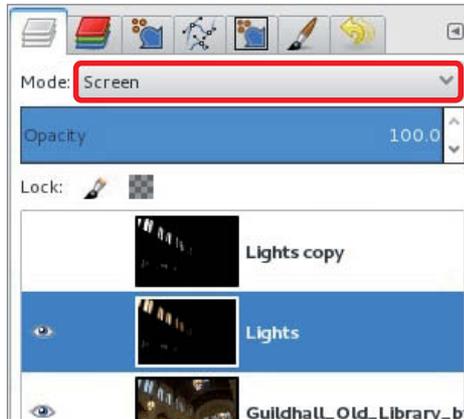


Step 6

Optionally, you can also color the 'sunlight' you have created on the blurred layer to give it a warmer yellow/orange tone. To do this, select Color > Colorize and shift the Hue slider to a value between 30 and 40.

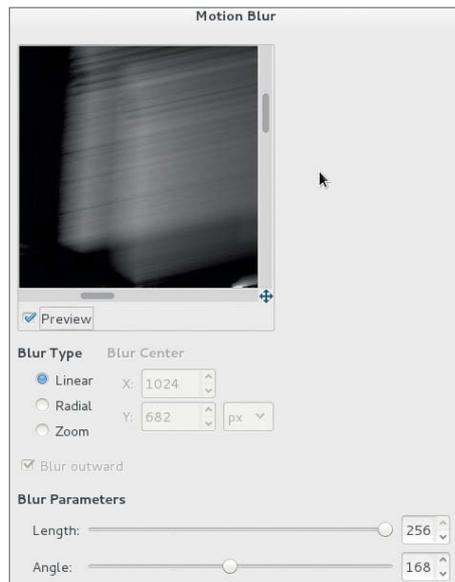
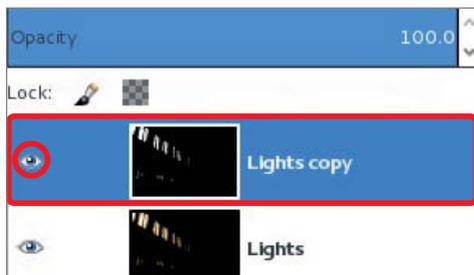


Step 7 Switch the layer mode of the edited layer to Screen. This blends the bright areas in the edited layer with those on the layer beneath to create a 'glow' effect.



Step 8 This is where we produce the all-important 'light rays'. Reactivate the topmost copy layer by clicking the eye icon on the left.

Now navigate to Filters > Blur > Motion Blur and select appropriate values. We used a Linear/Length value of 256 and an Angle of 168 degrees. Applying this effect can take some time, depending on how powerful your computer is and the values you select.



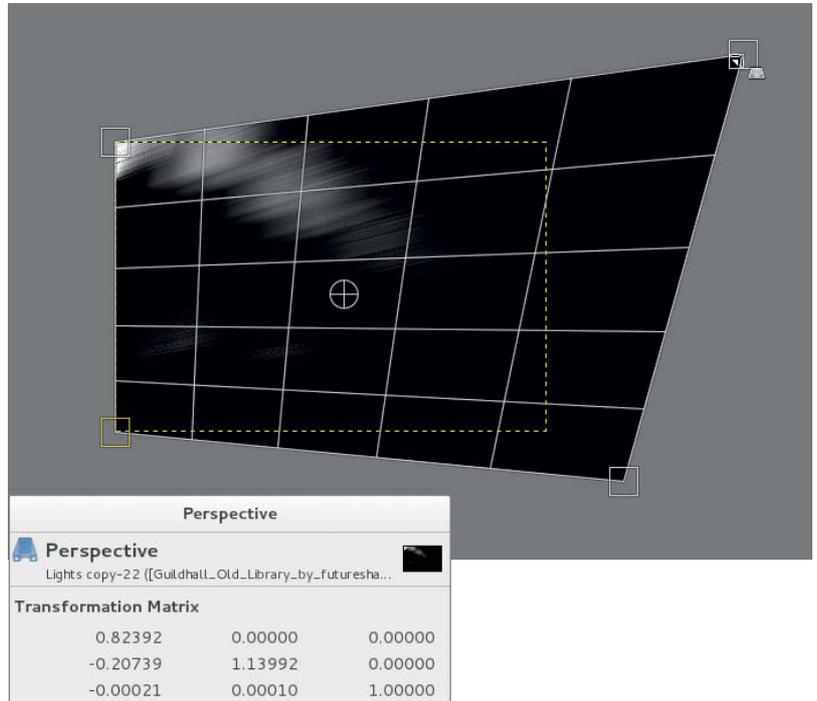
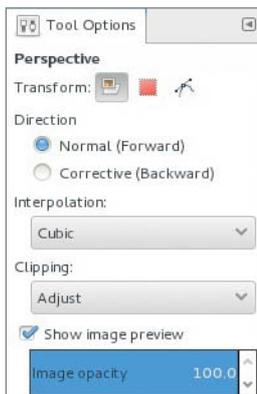
Step 9 You can further emphasize the rays using the Filters > Enhance > Unsharp Mask filter. This tool makes the image sharper by increasing the amount of contrast between the individual object edges. An Amount value of about 2.30 and a Radius of 5 make good starting points for your experiments.

You can increase the length of the 'rays' by re-applying the Motion Blur filter to the edited layer using the same settings as before. Doing this to our sample layer produced the result shown on the right.



Step 10

Altering perspective in the 'rays' layer adds vitality to the scene. Activate the Perspective tool by pressing Shift+P and zoom out a little (using the scroll wheel with the Ctrl key pressed) to give yourself a clearer view. In our example, we 'stretched' our image toward its top right corner. Press Enter to confirm your changes.



Step 11

To ensure that only the white rays remain, delete all the remaining black pixels using the Colors > Color to Alpha dialog.



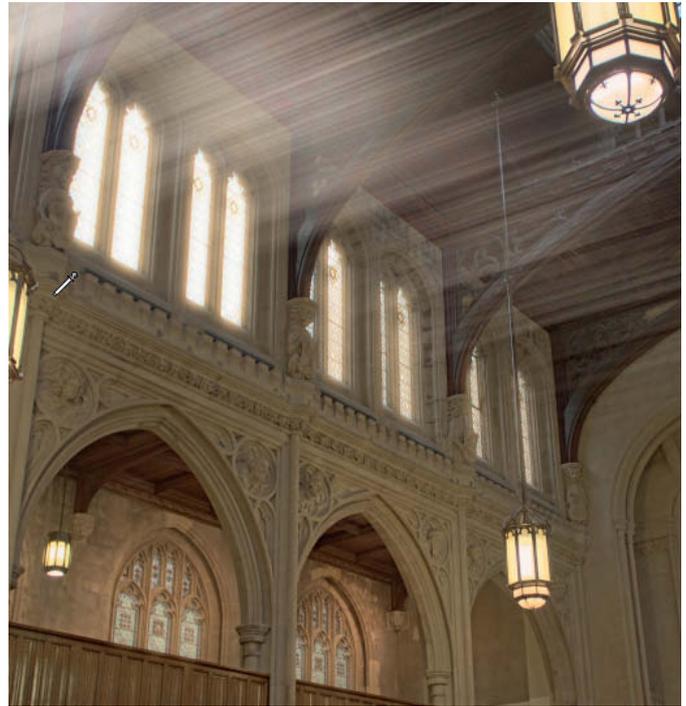
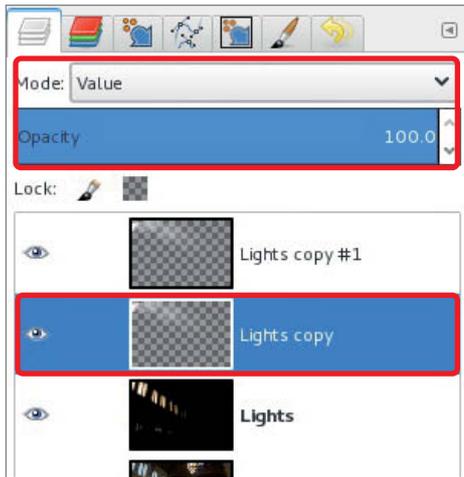
Step 12

Use the eraser to delete any stray rays that appear in the wrong places.



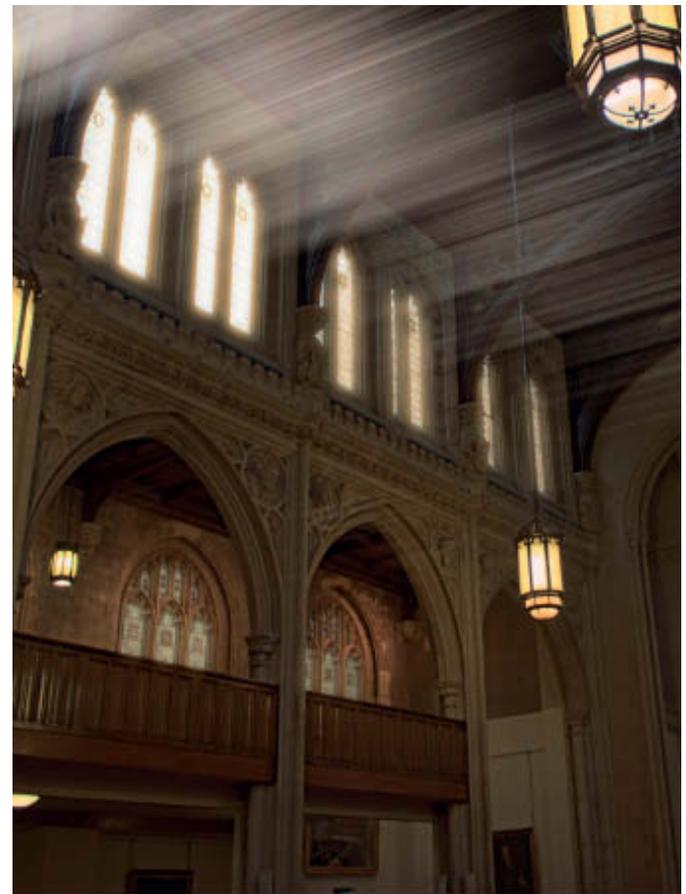
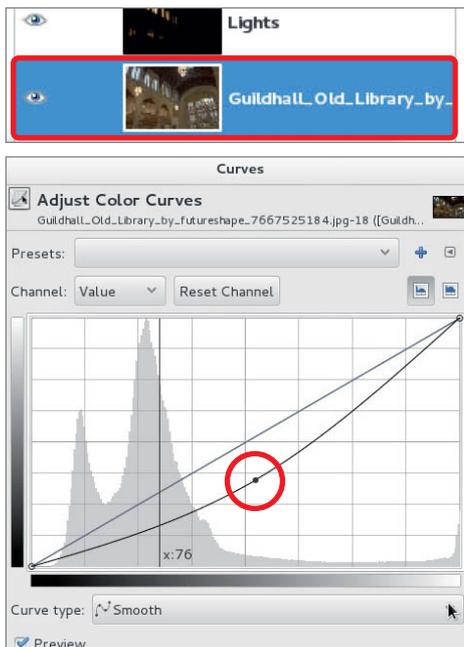
Step 13

Adapting the color of the rays to fit the scene makes them look more realistic. To do this, duplicate the 'rays' layer and switch the layer mode of the layer beneath to Value. This uses the color values from the lower layer to color the one above.



Step 14

Another way to add emphasis to the light rays is to darken the entire base image (i.e., the background layer) by dragging the image curve slightly lower in the Colors > Curves dialog. Adjust the opacity of all three layers to balance their individual effects and give the image its final polish.





Dmitri Popov

The Return of

LightZone

LightZone used to be a commercial program but is now available as part of an ongoing open source project. We checked out its strengths and weaknesses and how it compares with established favorites like Lightroom when used as part of the daily digital photo workflow.

Today's photographers are spoiled for choice when it comes to RAW processing software. From Adobe *Lightroom* and Apple's *Aperture digiKam*, there are processing and editing applications available for every need at a wide range of price points. So what does *LightZone* have to offer to entice enthusiasts and professional photographers away from their current favorite tools? The price and platform support are two obvious points that make it an appealing proposition. The application is distributed free of charge and it's available for several popular platforms. A low price alone is no guarantee of success, but *LightZone* has a few tricks up its sleeve that make it a viable alternative to the commercial competition.

LightZone's interface follows some well established conventions, so finding your way around the main Browse and Edit modules shouldn't cause any major problems. The Browse module lets you pick a directory and perform basic operations on the photos it contains. All photos in the current directory are displayed as thumbnails in the thumbnail bar at the bottom of the window, and all you have to do to view a large preview image is select a thumbnail. You can then edit the basic info such as rating, title, location, etc. in the **Info** sidebar. In other words, the Browse

Background

The name *LightZone* may sound familiar to some photographers. This unique RAW processing application enjoyed a fair amount of popularity until the LightCrafts company who manufactured it abruptly went out of business, leaving *LightZone* users high and dry. However, the *LightZone* community didn't give up on the product and the LightZombie website quickly became a hub for those still interested in using the program. The website features updates and patches that helped to keep the original *LightZone* functional and, toward the end of 2012, the program's core developers announced that the application had been

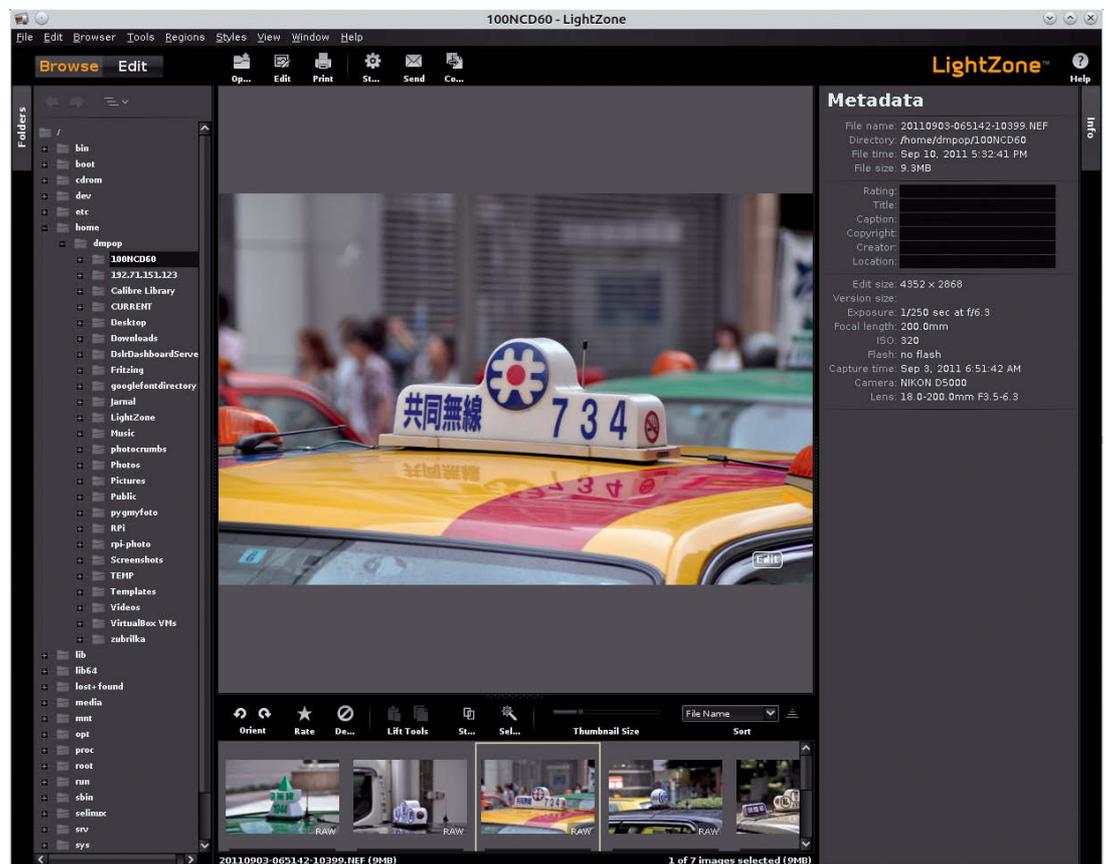
resurrected as an open source project. Now, following a few months of intensive development, the first new version has been released for Linux, Mac OS X and Windows.

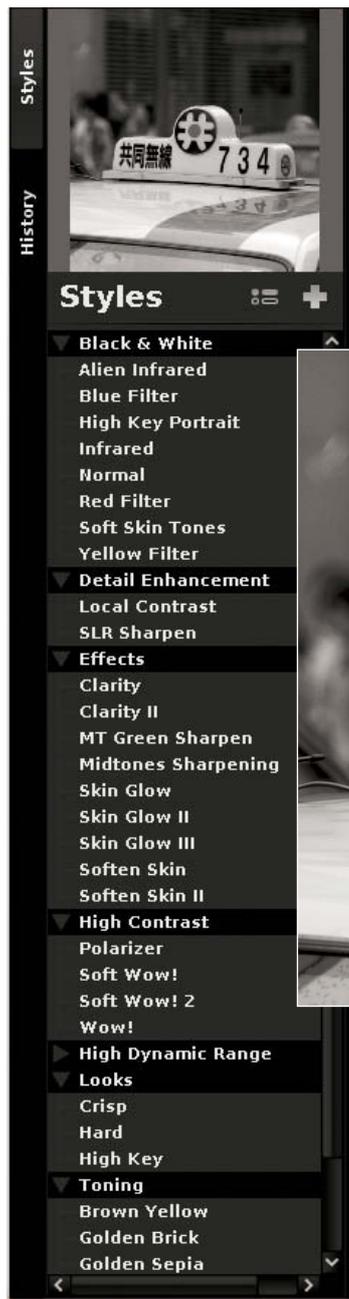
Although the new release has a different version number, it doesn't differ much from the last commercial version of the application. The main focus of this release was cleaning up and updating the existing code base. Nevertheless, a new, free, open source *LightZone* is great news for photographers looking for an alternative to existing commercial RAW processing and photo editing software.

module is a pretty standard affair. Things get more interesting when you switch to the Edit module. The first thing you will notice is the **Styles** sidebar on the left with its long list of options. A *LightZone* Style is essentially a preset that allows you to apply multiple actions in a single step. Styles are arranged

into logical groups. The **Black & White** group, for example, contains various monochrome conversion presets, while the **Detail Enhancement** group offers styles for sharpening images and improving local contrast. In addition to existing styles, *LightZone* allows you to save the operations

The Browse module is used to preview RAW files and photos and edit basic info such as ratings, titles and locations. Use the 'Send' and 'Convert' buttons in the main toolbar to copy the currently selected photo to another directory or convert it to a different format.





LightZone features a comprehensive collection of Styles with mouseover preview functionality. You can add your own custom Styles or tweak the ones supplied as standard.



LightZone offers a handful of key tools with a relatively narrow range of adjustable parameters. This makes the application easy to master, but some photographers may find the approach somewhat limiting.

you have applied to the current photo as a custom Style, making it easy to build up your own library of presets. Existing Styles can be tweaked too, and the **Preview** panel located above the **Styles** list displays mouseover previews.

The editing tools are located in the **Tools** sidebar. Instead of cramming all of its features and controls into the editing interface, *LightZone's* programmers have taken a more refined approach that distills the essence of the available editing functionality into a handful of key tools with only a few adjustable parameters. While some photographers may find this approach limiting, most users will probably find the tools on offer adequate for most editing tasks. More importantly, the simplified tools make it much easier to master the basics of the editing process.

In addition to the standard Sharpen, White Balance and Hue/Saturation tools, *LightZone* offers a couple of unique and genuinely useful tools in the form of Relight and ZoneMapper. The former is an effective tool for improving overall lighting in an image, which it does by reducing broad-scale contrast and increasing local contrast. While the resulting effect depends on the nature of the photo you are editing, in many cases simply applying the tool using its default values produces extremely impressive results. Like most of the tools on offer, Relight has only a handful of parameters for you to play with.

ZoneMapper

ZoneMapper is *LightZone's* trump card. It enables you to adjust the brightness and contrast of an entire image or selected image areas for any combination of the highlights, midtones and shadows. As the name implies, this tool is based on the Zone System developed by Ansel Adams and Fred Archer in the 1940s. The original Zone System assigns numbers from 0 through 10 to different brightness values (known as zones), with 0 representing black, 5 middle gray and 10 pure white. Each zone in this system differs by 1 EV. The *LightZone* ZoneMapper adapts the system to fit the realm of digital photography, comprising 16 zones that differ by 1/2 EV. The tool works in conjunction with the ZoneFinder, which is accessed via the Zones section of the preview pane located above the **Tools** sidebar. Once you have enabled the ZoneMapper tool, hover the mouse over a specific zone to highlight it in the preview thumbnail. This simple technique lets you quickly identify the different zones in a photo, and you can then adjust your desired zones by expanding or compressing them using the mouse. Although



you can quickly get to grips with the ZoneMapper tool simply by experimenting with different settings, knowledge of the traditional Zone System will help you to get the most out of this unique feature.

Raw Adjustments

Other useful tools include Raw Adjustments, which you can use to tweak various exposure, temperature, color noise and other image attributes. Additionally, *LightZone* automatically removes hot pixels, and the Clone tool is really handy for removing unwanted objects from your photos. The Spot tool is perfect for removing dust, scratches and other blemishes.

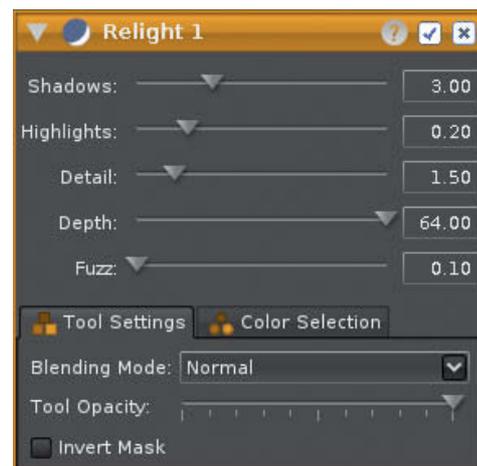
Like most serious RAW processing and photo editing applications, *LightZone* features non-destructive editing, so none of the steps you take are applied directly to the original image data. The application keeps track of all the changes you apply, and you can view and undo them in the **History** section of the left-hand sidebar. When you close an editing session, the program saves all modifications in a separate *lzn.jpg* LZN file which contains the JPEG version of the original photo along with the applied toolstack. In the Browser module, the original photo and its corresponding LZN file (or files) are displayed as a stack. You can use the 'Expand image stacks' button to view the original and its associated LZN versions. The clever part of this feature is that it allows you either to edit the original photo from scratch (thus creating a new version with a separate LZN file) or continue editing the latest LZN file. This approach allows you to simply maintain and manage multiple versions of a single image. Better still, *LightZone* allows you to pick a toolstack from an LZN file and apply it to other photos. Like most of the tools in *LightZone*, this functionality is straightforward to use – all you have to do is select the desired LZN file, click the 'Copy toolstack' button, select the target photo and click 'Paste toolstack'.

Conclusions

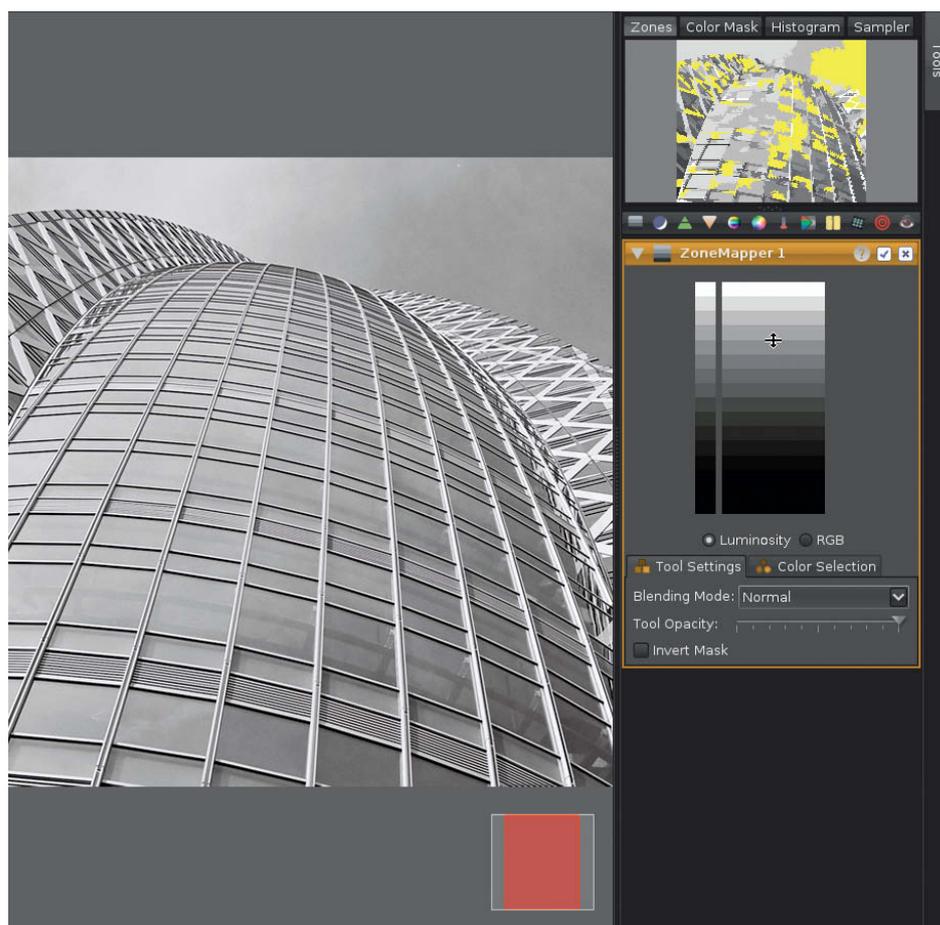
While the features we have described make *LightZone* a powerful RAW processing and photo editing application, it does have some weaknesses too. Although it remembers the most recent location, the Browser module has no bookmarking functionality, making it difficult to switch between directories that you use regularly. You can edit a file's basic metadata, but there is no way to view its full Exif data. The program allows you to sort thumbnails using different criteria (capture time, rating, aperture, ISO, etc.), but it doesn't

provide any filtering capabilities and there is no search feature either. *LightZone* also lacks lens correction and perspective adjustment tools and doesn't yet feature Curves and Levels tools. Last but not least, file export is limited to TIFF and JPEG formats, and there is no support for uploading photos to popular sharing services. In spite of its simple and powerful toolset, some photographers may find *LightZone* too simplistic and possibly even limiting.

Even though *LightZone* isn't designed to replace powerful all-around applications like *Lightroom* and *digikam*, it still makes a genuinely useful addition to any digital photographer's toolbox. The application is particularly useful for applying a few quick adjustments to a handful of RAW images. The Relight and ZoneMapper tools produce impressive results with a minimum of effort and the fact that the software is available free of charge for a variety of platforms leaves you with no excuse for not taking it for a spin! (sea)

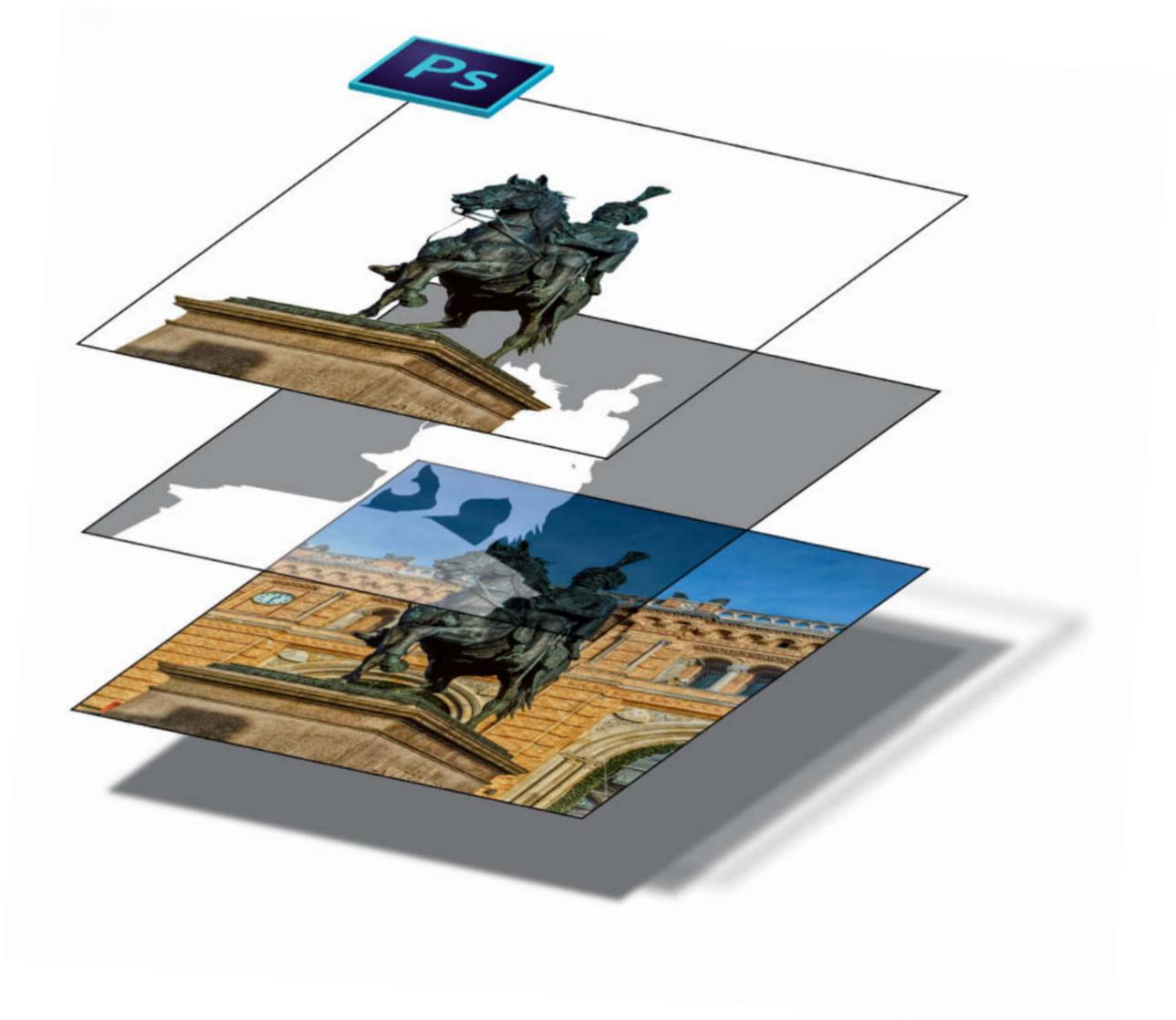


The Relight tool can dramatically improve a photo by adjusting its contrast settings, and is great for applying a quick fix to underexposed images or improving overall contrast



Based on the Zone System devised by Ansel Adams and Fred Archer, the ZoneMapper tool allows you to adjust the brightness and contrast of an entire photo or selected image areas. Like *LightZone*'s other tools, this powerful feature is really easy to use.

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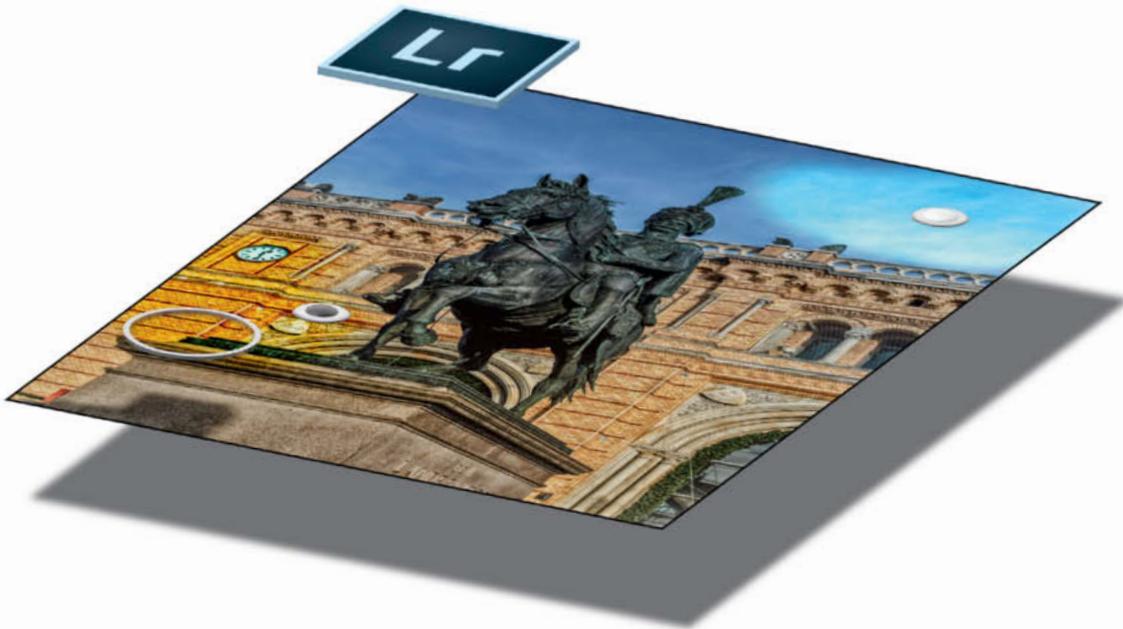


Sascha Steinhoff, Steffen Kulpe

RAW Processing

in Lightroom and Photoshop

Over the last seven years, Lightroom has evolved from a simple but effective RAW converter into a powerful all-in-one digital photo workflow tool. The latest version includes a wide range of improved processing tools and makes it easier than ever to perform your entire workflow, from import to print-ready output, within the Lightroom interface. In spite of all this progress, Lightroom hasn't caught up with Photoshop, which offers a set of standard tools that is unparalleled in its power and range. This article compares the two programs and shows you where Photoshop still has the upper hand.



Photoshop has long been considered an indispensable tool for most digital photographers. However, its status is changing, and with every new processing tool that Adobe builds into *Lightroom*, the idea of launching *Photoshop* becomes less compelling. In spite of its world-beating toolset, *Photoshop* is not particularly agile, and it is often faster and simpler to perform all your basic processing steps within *Lightroom*. From a purely creative point of view, there is still no alternative to *Photoshop*. However, most people's everyday digital photo workflow is less about the creation of artistic masterpieces than it is about eliminating the technical shortcomings of a wide range of photos, and that is exactly where *Lightroom* still needs to improve. This article looks in detail at some standard editing scenarios and points out where you are probably still better off using *Photoshop*.

New vs. Old

Designed from the ground up for RAW processing, *Lightroom* first hit the streets in 2007. Because there is no standard RAW file

format available, it is not advisable to write directly to RAW files. *Lightroom* has read-only access to original RAW files and saves all the changes made to an image in a separate metadata file that is then linked to the original image. The main advantage of this approach is that it is entirely non-destructive, and the only way to actually damage an original image is to physically delete it from your hard disk. This also means that, because alterations are stored in the form of metadata-based instructions, they can be edited or completely reversed at any time during processing, and you can revert to any previous image state (including the unprocessed original) at the click of a button. In contrast, the *Photoshop* History function allows you to step backward while you work but deletes its records of the steps you take as soon as you save a file.

Having grown organically over more than 20 years, *Photoshop* has reached a degree of complexity that matches its age. It lacks any kind of unified tool interface and you simply have to learn how to use each function separately as and when you need it. *Lightroom*, on the other hand, has a relatively simple user interface and is much more user friendly.

Photoshop also has a fragmented approach to processing and was originally designed with exclusively destructive processing functionality. Today's version includes non-destructive editing capabilities in the form of Adjustment Layers and Smart Objects. However, it is still too easy to change or overwrite an original image file unintentionally, although RAW files are protected by the separate *Adobe Camera Raw* module, which has read-only access to the original files and hands over new versions to *Photoshop* for processing.

Photomontage only in Photoshop

Unlike *Lightroom*, *Photoshop* creates a new file when processing RAW images, which makes managing your image archives more complicated. On the other hand, *Lightroom* doesn't offer functionality for combining multiple images in a single new image. In other words, you have to use *Photoshop* if you want to perform any kind of photomontage, which of course limits the range of *Lightroom's* retouching functionality.

Moving an Object in Photoshop

The task:

Move the kite surfer to the left and enhance the background with elements copied from a different image.

The solution:

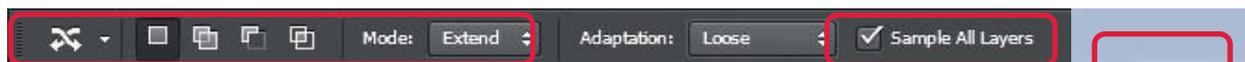
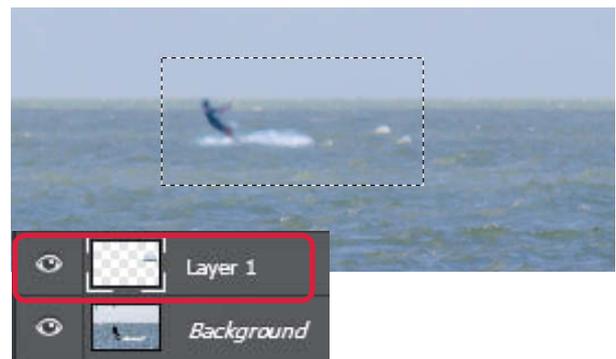
Both steps are relatively simple and require the use of Photoshop layers.

Processing steps:

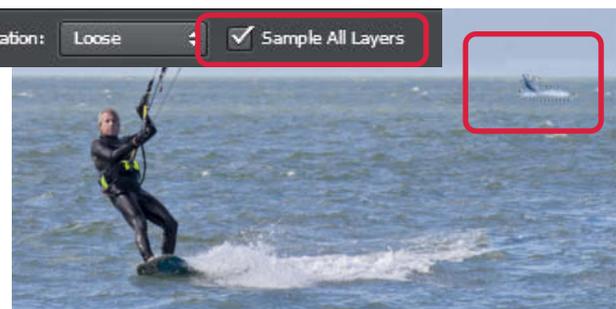
- 1 Select the Content-Aware Move tool and use it to select the object you wish to move and drag it to the desired location. This step doesn't require its own layer.



- 2 Copy the object you wish to insert from its source image, create a new layer in the target image and paste the copied object there.



- 3 If you select Extend mode and check the *Sample All Layers* option, the selected object will be automatically adjusted and inserted at the pointer location. If the source and target images don't have similar color, texture and brightness, further tweaking will be required. The Stamp tools are the best option for correcting the transitions between the old and new images areas.



The *Lightroom* interface is simple to learn and most users will quickly be able to produce attractive results. However, when it comes to performing complex processing steps, you will quickly discover the limits of its built-in functionality. The program offers just one tool for each specific task and, if the available functionality doesn't serve your desired purpose, you will have to switch to *Photoshop*. The Spot Removal tool is a good example for which *Photoshop* offers multiple options, including the Healing Brush, Patch, Content-Aware Move, Clone Stamp and Pattern Stamp tools. The downside of *Photoshop*'s powerful toolset is the complexity of each tool's handling, and only experienced users can really use its comprehensive functionality to the full. Even for the relatively simple examples shown here, we often have to summarize sets of steps to keep things clear.

No Layers in Lightroom

The lack of Layers is one of *Lightroom*'s major drawbacks. You can add layer functionality using the *PerfectLayers* plug-in from onOne Software but, as with all after-market tools, it is not smoothly integrated in the program's

interface and forces you to move the files you want to process back and forth between the plug-in and *Lightroom*.

The simple fact that *Photoshop* layers can be individually and comprehensively adjusted and manipulated means that *Photoshop* is a much the better option when it comes to making sophisticated adjustments. Layers can be grouped and individually named, making it simple to keep track of even the most complex processing steps. You can also change the order of layers at will and fine-tune your adjustments at any time. Adjustments made with *Lightroom* are restricted to the single layer offered by each image file and, because the program creates History panel entries for every step, it can quickly become unclear which steps produced which results. You can go back to each individual step, but we don't recommend that you make targeted adjustments in previous steps because *Lightroom* then switches all the following steps back to the earlier version too.

The following pages introduce the retouching tools that are part of the latest version of *Lightroom* and list their particular strengths and weaknesses. *Photoshop* users will find all of *Lightroom*'s native tools built

into the *Adobe Camera Raw* RAW processing module.

Crop Overlay

The Crop Overlay tool can be used to perform crops and straighten images. The *Constrain to Warp* option, which is unique to *Lightroom*, enables you to automatically exclude any pixel-free image areas produced by transformations from the final output file. This is particularly useful in view of the fact that *Lightroom* doesn't offer functionality for filling empty pixels and using it to perform transformations and warps inevitably causes a loss of image data.

Photoshop is much smarter in this respect and is even capable of creating brand new pixels that it generates automatically from neighboring image areas using the Content-Aware Fill tool. While it retains the original image size, this approach can create unwanted artifacts in complex textures and patterns. At the end of the day, you will usually have to perform some manual fine-tuning for pixels generated by *Photoshop*, whereas in *Lightroom* you simply have to decide whether to keep any remaining pixel-free areas or remove them by cropping the image.

Moving an Object in **Lightroom**



Lightroom doesn't have a dedicated Move tool, but you can use the Spot Removal tool in Clone mode to perform a similar function. To copy an object, you have to mask the target area rather than the source area and then cover up the 'empty' source area when you are done. Because it is so imprecise, this approach is not really suitable for use in critical situations.

Distortion Correction in Photoshop

The task:

Our source image shows strong distortion that we wish to correct while retaining all the original image data. We also want to avoid cropping the corrected image, as important details are located at the edges of the frame.



Image: Wikimedia Commons: Wladyslaw Sojka

The solution:

Tools for correcting distortion and perspective are available in *Adobe Camera Raw* and in *Photoshop* itself.

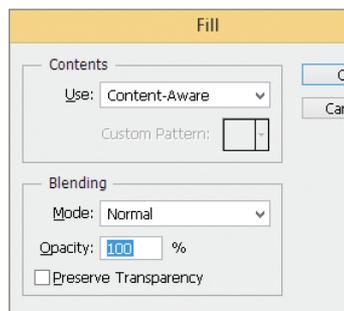
The rectangular shape of the original image is distorted by the correction process, but the pixel-free areas that result can be filled using the Content-Aware Fill tool.



Processing steps:

- 1 Correcting distortion and/or perspective creates pixel-free areas at the edges of the frame. If you don't want to crop these out, you have to select them (preferably using the Magic Wand tool) and fill them with new pixels.

Navigate to the Edit > Fill dialog and select the *Content-Aware* option.



- 2 *Photoshop* automatically generates new pixels based on the surrounding details. Any unwanted artifacts that result can be eliminated using the Clone Stamp and Patch tools.



Red Eye Correction

The Red Eye Correction tool in the current version of *Lightroom* is the same as the previous version and will be familiar to *Photoshop* users too. Once you have selected the area you want to apply it to, you can manually adjust the size of the pupil and the tone of the new fill color. This useful function is simple to apply, and the *Lightroom* version is just as good as its *Photoshop* counterpart. In the unlikely case that the tool fails, you can also use *Lightroom's* Adjustment Brush to manually correct any unwanted red areas in portrait subjects' eyes, so there is no need to switch to *Photoshop*.

Using the Graduated Filter, Radial Filter and Adjustment Brush

Lightroom's Graduated Filter, Radial Filter and Adjustment Brush buttons are located together because they all use masks to limit the effect of the adjustments they apply. Alongside standard parameters such as

Exposure and Tint, the drop-down list of tool options includes more exotic options such as *Teeth Whitening* and *Iris Enhance*. All of the listed effects are available for all three filters, although not all of the resulting permutations make sense (using the teeth whitening effect with a graduated filter, for example). The effects all use the same palette of sliders, which can be used to adjust settings and save sets of parameters as presets.

The Graduated Filter tool fills a two-dimensional space that covers either the entire breadth or the entire height of the image and is perfect for adjusting the look of the sky in a landscape photo, but the degree of user control is fairly coarse. For example, if you need to recolor a sky while leaving the mountain range beneath it untouched, you will have to switch to *Photoshop* and use a custom mask. The only fully user-defined elements of a graduated filter are its start and end points.

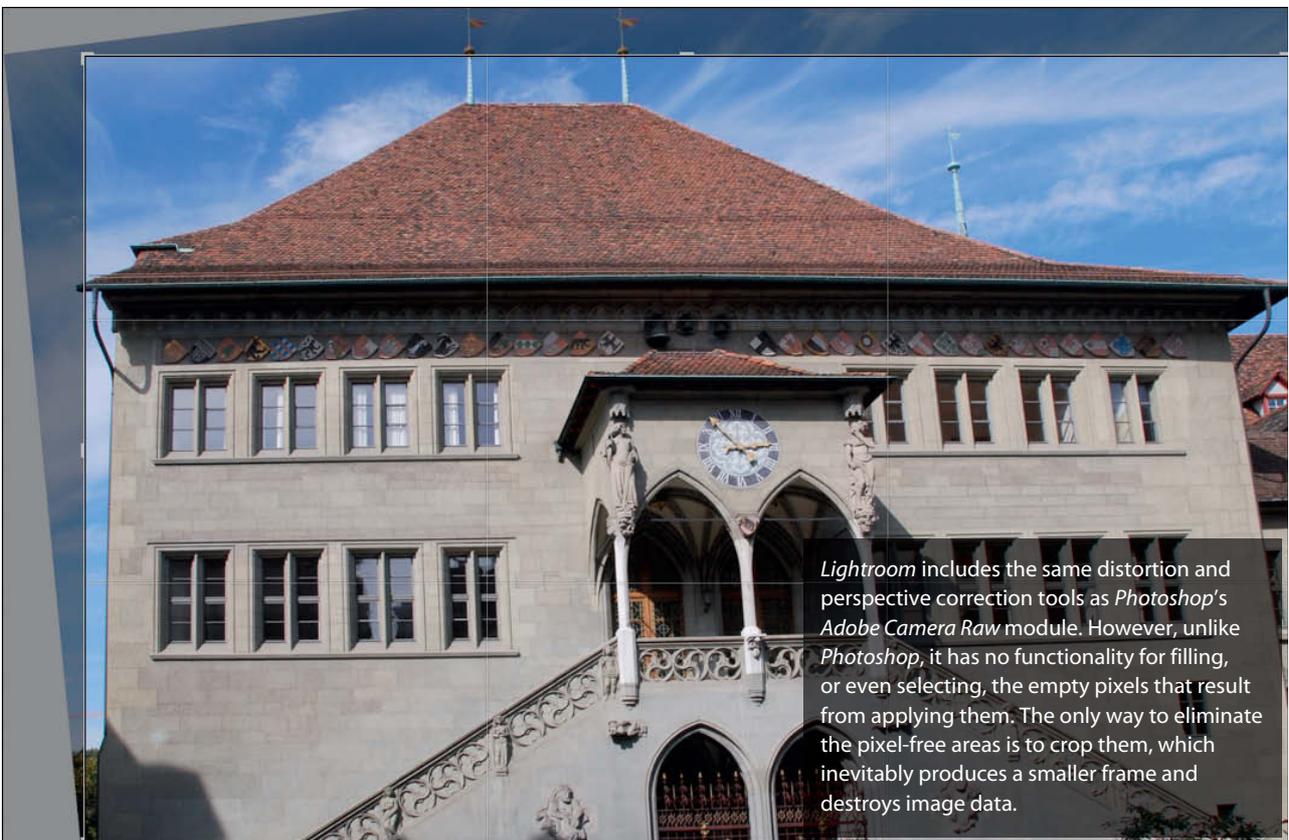
In comparison, the *Photoshop* Gradient tool is highly customizable and can be applied on its own layer or configured via the Alpha channel. This enables you to use it to create

organic-looking asymmetrical gradients and select individual objects. You can then convert the contents of the Alpha channel into a selection and use the result to perform color adjustments on a selected object or create a new adjustment layer.

The *Lightroom* Radial Filter tool creates circular or elliptical masks that can be made virtually undetectable using the Feather slider and is ideal for adding highlights to an image or accentuating a portrait subject against the background.

This filter too, is fairly simple and offers only a limited range of adjustments. There is no *Photoshop* equivalent, although the effect can be duplicated using layer masks – a process that is more complex than applying the *Lightroom* (or *Adobe Camera Raw*) filter but gives you much more control. You can, for example combine shapes to form a single filter. In *Lightroom*, you would have to apply multiple filters to produce the same effect, which has the added disadvantage of cumulating the effects of the filters you apply and seldom produces genuinely useful results.

Distortion Correction in Lightroom



Lightroom includes the same distortion and perspective correction tools as *Photoshop's* *Adobe Camera Raw* module. However, unlike *Photoshop*, it has no functionality for filling, or even selecting, the empty pixels that result from applying them. The only way to eliminate the pixel-free areas is to crop them, which inevitably produces a smaller frame and destroys image data.

Custom Gradients and Masks in Photoshop

The task:

The original image is a little dull. We want to use a custom gradient to liven up the sky while leaving the kite unchanged.



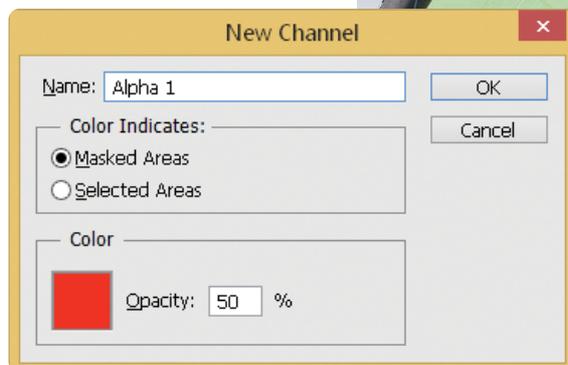
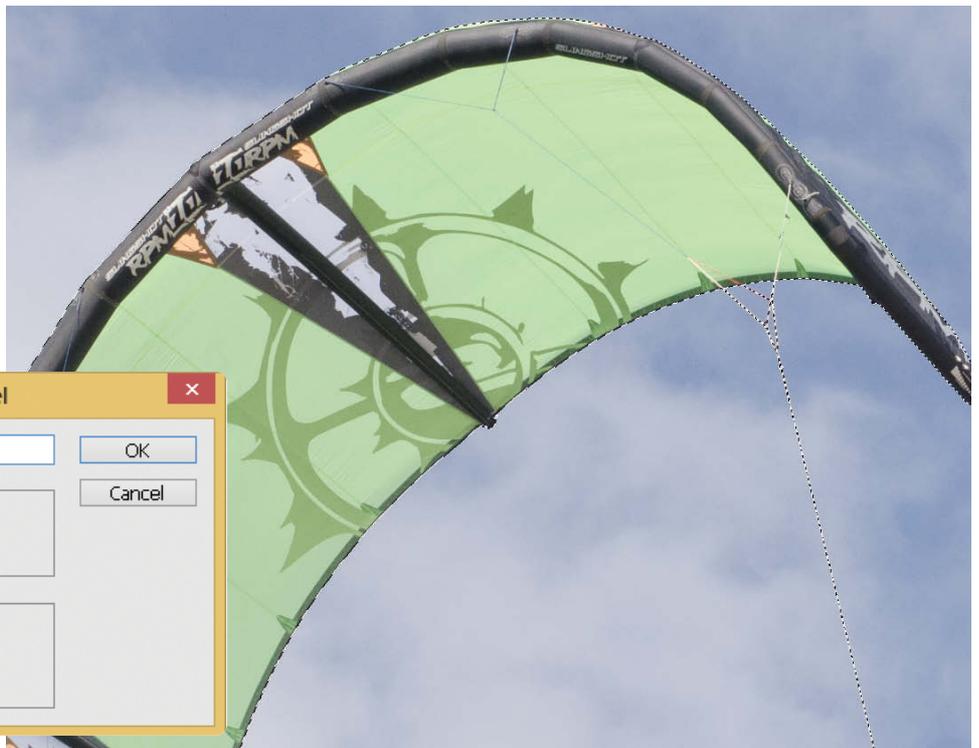
The solution:

Unlike *Lightroom*, *Photoshop* enables you to create custom gradients in which individually selected elements are excluded from the effect being applied. If we use the Alpha channel to create a gradient, we can adjust its effect at any time.

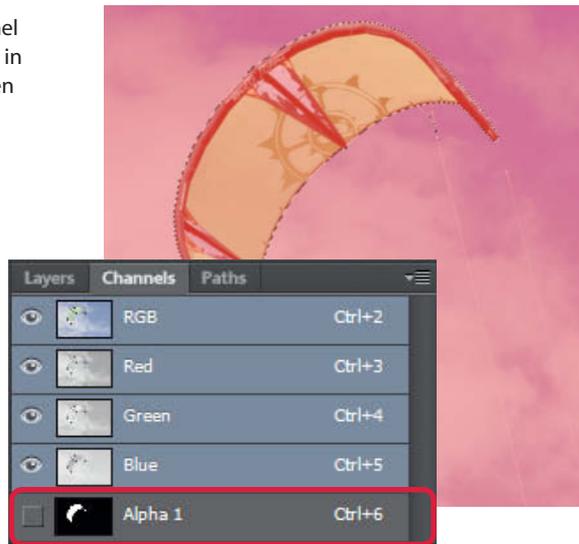


Processing steps:

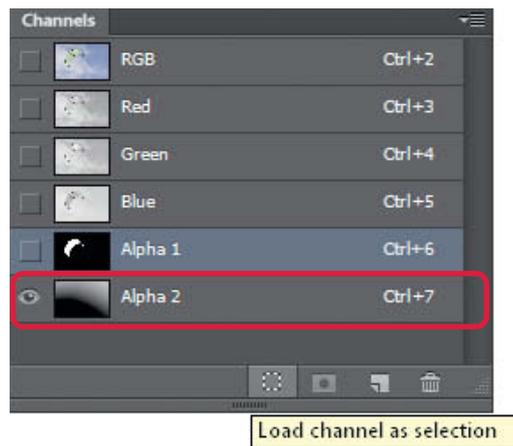
- 1 | Open the New Channel dialog in the Channels panel and create a new channel. Use the Lasso tool to select the object you wish to protect (in our case, the kite).



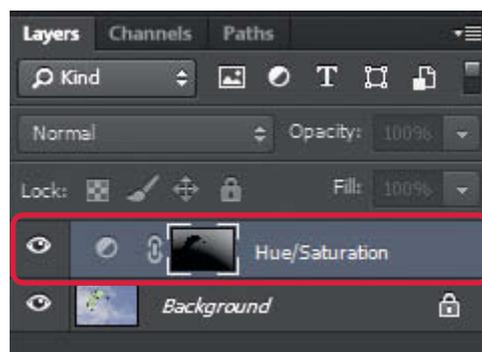
- 2 | Activate the new channel by clicking the eye icon in the Channels panel, then use the Edit > Fill command to fill the selection with white.



- 3 | Create an additional Alpha channel and use the Gradient tool to insert a gradient into it. Use the Ctrl+A shortcut to select the entire channel and use the Edit > Transform > Warp command to shape it as required.

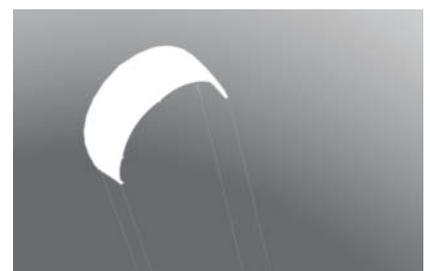


- 4 | Now create a selection from the object and fill it with black in the gradient channel. You can now use an adjustment layer to fine-tune the white areas of the combined gradient/object channel. The object itself will be protected by the black-filled selection and won't be altered by your changes. This way, the kite remains unchanged even though the sky around it has been edited.



The Lightroom Graduated Filter

Unlike *Photoshop*, *Lightroom* can only produce linear gradients, although these can be rotated. The only way to produce an asymmetrical gradient in *Lightroom* is to use the Adjustment Brush to accentuate the effect of an existing gradient in selected image areas. A *Lightroom* gradient cannot be selectively adjusted or counteracted. The grayscale versions of sample gradients reproduced below show the significant differences between the two.



Replacing Objects in Photoshop

The task:

Group portraits are often spoiled by a single subject looking in the wrong direction or moving during the exposure. Especially in large groups, it is virtually impossible to catch a moment at which everyone is looking at the camera and smiling. The solution is to create a new photo by combining elements from multiple source images.



The solution:

Photoshop's Layers functionality makes it simple to combine elements from multiple source images in a new image file. However, even in sequences shot in burst mode, you will rarely find two images that can be merged without additional fine-tuning of the details.



Processing steps:

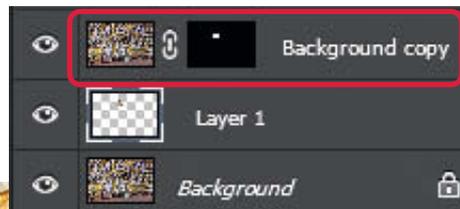
- 1 Select the source object using the Lasso tool. Use the Select > modify command to feather the edge of the selection using a value of around 0.5 pixels. This setting ensures that the inserted object doesn't display obvious edges or transitions when inserted into the target image. Now copy your selection to the clipboard.



2 | Switch to the target image and insert the selection.



3 | Select the objects that are directly in front of the inserted object and then select and duplicate the background layer. Add a layer mask to the duplicate layer to mask the selected objects and use the Refine Mask dialog to fine-tune its effect – a feathered edge is usually a good idea. The layers need to be arranged so that the one with the foreground objects is on top, followed by the inserted object and the background.



4 | If the inserted object still doesn't quite match the original image, use the Stamp tool (or similar) to fine-tune the details manually.



Precise Editing with the Adjustment Brush

The Adjustment Brush, *Lightroom's* most precise editing tool, makes it easy to edit irregular shapes by applying various effects using a brush. It has a much more subtle effect than its *Photoshop* counterpart and is ideal for retouching portraits. The basic shape of the subject remains largely unchanged, even if you apply color shifts, so while it is a great tool for enhancing an existing look, it is not suitable for making significant changes to the individual elements of an image.

If you check the *Auto Mask* option near the the bottom of the tool's panel, the program automatically determines where an object's edges are – a function that mostly works very well and saves you having to outline every detail by hand. In places where the tool doesn't correctly identify an object's edges, the color smears that result are easy to remove using the Erase function. Pressing the Alt/Option key switches the tool from brush to eraser mode, enabling you to 'paint out' any excess areas of the mask. Once again, *Photoshop's* selection and Layer-based tools are much more powerful and enable you to perform more subtle and complex edits and precisely mask the parts of the image you wish to exclude from the effect you are applying.

The default settings open the Adjustment Brush showing just a single slider. To add and adjust additional parameters, you have to click the small black triangle in the top right-hand corner of the Effect or Brush sub-panels to expand the list of available options, which includes Exposure, Contrast, Highlights, Shadows, Clarity, Sharpness and Saturation.

Replacing Objects in Lightroom

Combining files and/or objects to create panoramas, HDR images or group portraits is not possible in *Lightroom*. *Photoshop* is the obvious choice for these kinds of operations.

Content-Aware Scaling in **Photoshop**

The task:

We need to change the shape of an image from rectangular to square. The only way to achieve this in *Lightroom* is to crop it. However, because cropping the image would delete important elements of the composition, this is not the solution we are looking for.



The solution:

The answer to this particular dilemma is to use *Photoshop's* Content-Aware Scale tool to enlarge the area covered by the sky. This approach retains all of the important details in the lower portion of the frame and enhances the overall effect of the image.

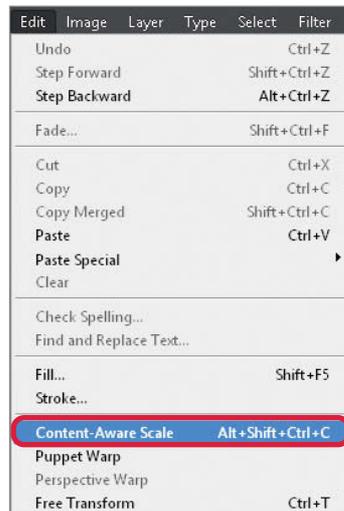


Content-Aware Scaling in **Lightroom**



Content-aware scaling is not possible in *Lightroom*. The only way to create a square image is by cropping the original, which inevitably causes a loss of image data.

Processing steps:



1 Use the Image > Canvas Size command to alter the size of the image as necessary, using the arrow keys in the dialog to select the direction in which you want to extend the canvas and the Rectangular Marquee tool to select the area you wish to scale.

2 Now select the Content-Aware Scale command from the Edit menu. This fills the additional canvas space with pixels based on the surrounding content. The effect works best for simple colors and textures.

3 You can now scale the new content to match the original image. Remember that this 'stretches' the pixels in the X or Y direction and that overdoing things can produce unwanted artifacts.

Spot Removal in Photoshop and Lightroom

The Spot Removal tool has been one of *Lightroom's* staples right from the start, but the new version can do a lot more than just edit or stamp circular image areas. It is now capable of editing freehand shapes, and every shape you draw is automatically assigned a source area. It can also be switched between Clone and Heal modes. Clone mode inserts the source pixels into the target area on a one-to-one basis, whereas Heal mode adjusts the copied content to match its new surroundings.

The quality of the results depends entirely on how suitable the source pixels are. The larger the area you wish to edit, the less likely it is that the tool will complete the job satisfactorily. The *Photoshop* Spot Healing Brush is similar in name only, and is actually a completely different tool that functions without using source pixels. However, the *Photoshop* Patch, Clone Stamp and Healing Brush tools all use user-defined source areas to apply their effects.

Of these, the Patch tool is the most similar to *Lightroom's* Spot Removal tool, although we were able to achieve better results using the Spot Healing Brush. The *Photoshop* tool appears to be based on a different algorithm. Nevertheless, compared with earlier versions or similar tools available in other RAW editors such as Nikon's *Capture NX 2*, the new *Lightroom* Spot Removal tool is a powerful feature that raises converter-based image editing to a new level and only pales when compared directly to the equivalent functionality in the almighty *Photoshop*.

We Still Need Photoshop!

There is simply no getting around the fact that *Photoshop* layers are an essential part of any complex editing process because they allow you to perform tricks like applying Clone Stamp effects to a separate layer. Custom layer masks are another feature of the *Photoshop* workflow that *Lightroom* simply cannot compete with.

On the positive side, *Lightroom's* standard toolset is now sophisticated enough to

perform a wide range of basic editing tasks without having to switch to another program. It is highly user friendly too, and much faster to use when it comes to performing basic editing tasks. On the other hand, as our examples on the preceding pages show, *Lightroom* is still unable to perform some relatively simple processing tasks, and only future versions will show whether Adobe intends to further enhance its non-destructive RAW processing capabilities.

The Future of Lightroom

The tools *Lightroom* offers become more capable with every release, but they are still not comprehensive or flexible enough to allow you to go it alone without the help of a dedicated editing program. Layer support and better masking capabilities are high on everyone's *Lightroom* wish list, as is the ability to merge images or parts of images. Photomontage is an indispensable part of the digital photo workflow and *Lightroom* isn't yet the true all-in-one package it is probably destined to become. (sts) **ct**



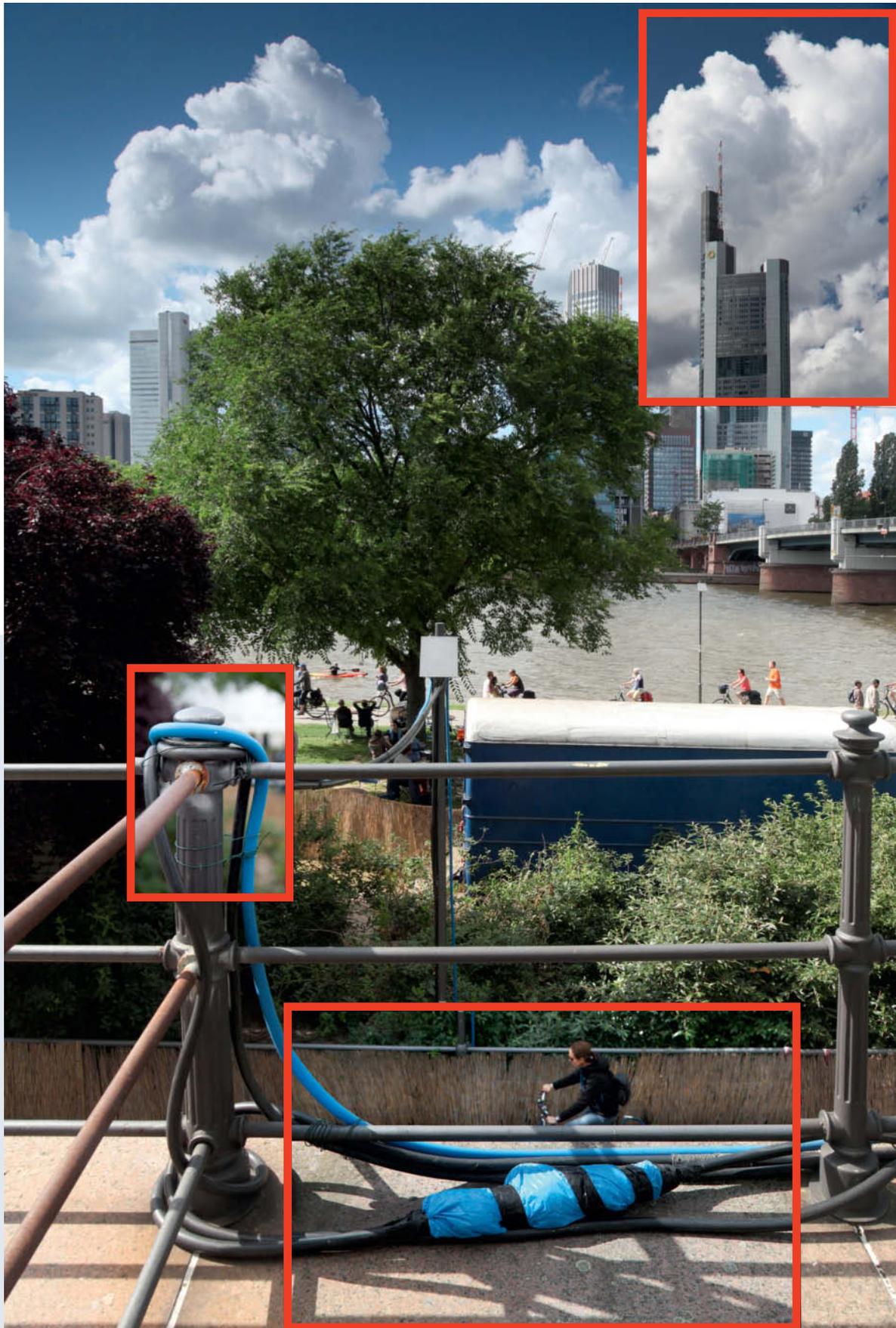
Torsten Andreas Hoffmann

Learning to **See**



There are many ways to train your photographic vision, your ability to 'see'. The simplest is to observe traditional rules of composition and then move on to expand and deepen your perception, an approach doesn't involve planning ahead but rather 'emptying' your mind and remaining impartial, open to what may happen. A person who has trained to work this way can view the world as if for the very first time. If you can immerse yourself in the magic of the moment and engross yourself in the present, you will be able to rearrange and portray it intuitively with your camera. This approach works best when we stop judging the material world and instead attempt to become part of it. Suddenly things that we might otherwise perceive as negative – like the fence full of holes shown here – seem to resonate with a beauty that speaks to our artistic side. There is more than one way to photograph the New York skyline and, seen through a crescent-shaped hole in a blue construction site fence, it looks quite unfamiliar. To find subjects like this, you need to take your time and look beyond the usual tourist traps. This photo was taken in the New York suburb of Williamsburg using a 28mm lens set to f11.

Great photographers do more than just reproduce what the eye sees. They have the ability to express emotions and sensations visually so that the viewer can empathize with the way the photographer was feeling during the shoot. To achieve this, you need great timing, a good command of composition and the right attitude. This workshop explains how to develop these skills for yourself.



Consciously observing the world through a photographer's eye is like carrying a set of picture frames around in our thoughts that we use to frame the world. Small frames represent telephoto focal lengths, medium-sized frames normal focal lengths and large frames a wide-angle viewpoint. Any location that seems to resonate for you is a good place to position such a 'frame' and release the shutter.

Photography as a 'Multiple Choice' Exercise

To be fully aware while taking photographs, we have to refine our own ability to see and extract from the surroundings only those things that are central to an image and the concept it embodies.

Photographers who have trained their imagination can envisage the effect of a change in focal length on the subject without having to actually look through the lens. They are capable of assessing their surroundings to find compositions in which form and color are consistent and produce a harmonious whole. Nothing superfluous should be visible; only the elements that are central to the photo and the idea it embodies should be seen. It's like a

multiple-choice test in which you have to choose the correct part of the content on offer and eliminate the rest.

This can be particularly difficult in a constantly changing 'street photography' environment where you constantly have to make split-second decisions.

For example, the view of Frankfurt opposite shows it as a photographer would see it initially – as a whole. Three potential subjects are outlined in red and the one showing a passing cyclist, who only makes a really interesting subject when combined with the colors and shapes in the foreground and background. The catch here is that you have to be able to spot opportunities like this in an instant.

Of course, we all concentrate on what interests us most. If our theoretical

photographer looking at the city of Frankfurt is interested in modern architecture, she may well choose Norman Foster's Commerzbank Tower (upper right), but those who are more interested in details of shape will perhaps prefer to isolate the railing post on the left.

Producing authentic photos means instinctively selecting the subjects that work for you. Criticism and analysis have their place later on, but when you're actually pressing the shutter button, it's best to rely on your intuition.



The railing post and hoses present an opportunity to photograph the scene from a different perspective. If details like this interest you, it is always a good idea to capture your subject from various angles and choose your best shot later on.

This part of the scene is interesting only because of the cyclist. It is perfectly valid to compose a photo by combining an immobile detail with a moving object.



The Commerzbank Tower looks even more striking in black and white, as the postcard-perfect sky looks almost black rather than blue. This photograph was taken using a 70-200mm lens set to 84mm.



How We Perceive our Surroundings

Human perception is extremely subjective for a very good reason: if we were to be fully conscious of all the sensory input from our environment, we would be hopelessly overwhelmed.

Seeing is a complex process. Just like the aperture in a camera, the pupils in our eyes open wider if it's dark and become narrower in bright light. Our eyes then send the images they see in upside-down format to our brain, which processes them so that they present

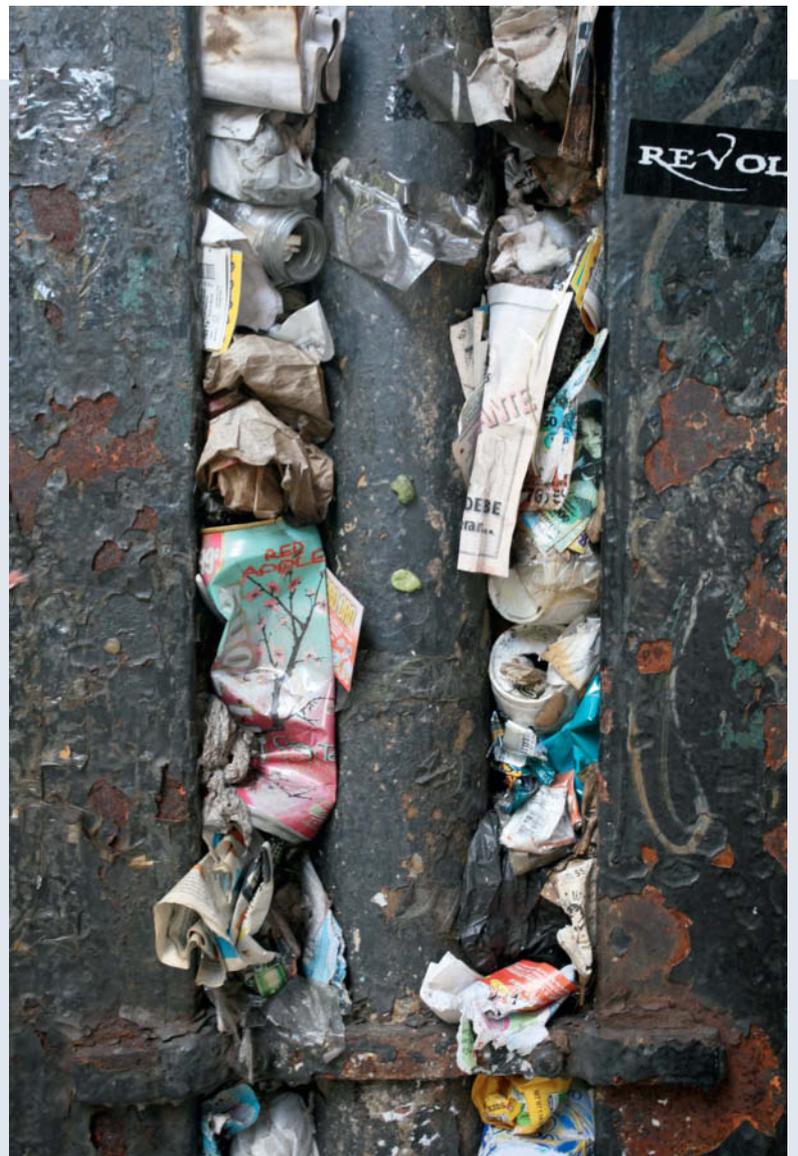
a familiar view. The poet Johann von Goethe was right when he said, "We see only what we know."

The brain also has to filter the thousands of impressions it receives every second so that we can orientate ourselves, especially in highly stimulating places like big cities. It decides which of the external stimuli should be allowed to enter our consciousness and which should be kept out so that we are not overwhelmed. In a photographic context, this filter is highly subjective and is shaped by our personal history, our interests and passions, and also by what we find distasteful.

When I teach photography, I like to help students understand this reality by having them walk through central Berlin for half an hour without talking. Their task is simply to take everything in. When they come back, I ask them to immediately write down 10 impressions that come to mind.

It almost always turns out that everyone is oblivious to about 80 per cent of the things the others noted, even though everyone followed the same route. Impressions obviously vary in intensity, and our memory is the best indicator – the things we remember best are those that make the strongest impression on us.

When walking the streets of a big city, it pays to look at inconspicuous things like this strut, which is part of the New York High Line elevated railway system. Dada artist Kurt Schwitters used his famous 'decollage' technique to declare such apparently banal objects as works of art, and photography is a perfect way to achieve a similar degree of abstraction.



Composing with What We Feel

Whatever makes it through our 'filter' into our consciousness makes an impression, either weak or strong. Only the strongest impressions are worth turning into a photograph.

Success in sharing our impressions with others photographically depends on how we compose our images. Essentially, this boils down to allowing our emotions to shape our compositions. If you want to produce emotive

images that really 'speak' to the viewer, you have to photograph intuitively without thinking too much about the rules of composition (which we will nevertheless tackle on the following pages).

However, it is still essential to train your vision. The best – in fact the only – way to do this is to analyze your results and check whether an image is too 'busy' or whether it has a recognizable center. The more often we analyze our own photos, the better we will instinctively apply our findings to future images. Switching between analysis and real-world shooting sessions is guaranteed to improve your compositional ability over time.

We need, too, to reflect on the impressions that produce the strongest feelings. If they have something in common, perhaps that is an indication that we have happened upon a theme that we should pay closer attention to. Of course, 'nice' impressions of attractive cities, landscapes or lighting moods will have quite a different effect on us than supposedly 'ugly' scenes. But it is often the unattractive places that are most fascinating and that can be transformed into unconventional and powerful images. Better still, because they make you look and think differently, these places are far less likely to tempt or trick you into producing shallow, superficial photos.



Top-notch technical skills are required here. Under normal conditions, most sensors would burn out the highlights on the right, so the solution is to use a graduated filter to darken the right-hand part of the sky by two or three stops.

This old industrial building in New York is not particularly attractive at first sight but, like many such subjects, has a beauty all its own



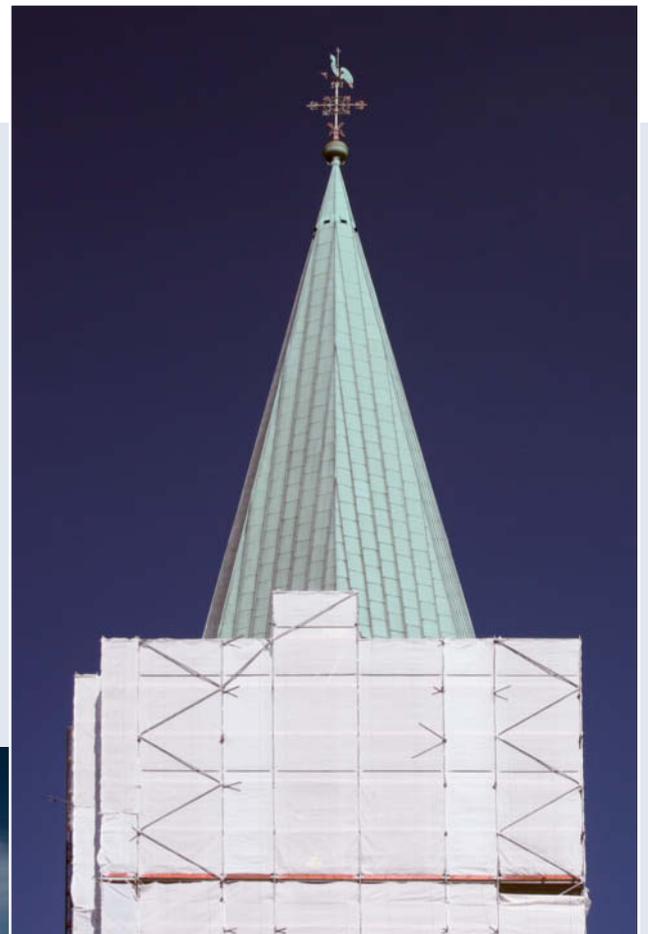
Traditional Compositional Rules

Taking photographs involves arranging visual elements within a defined area. Visual language is anything but logical, but nevertheless incorporates several hard and fast rules. Whether or not you observe these determines whether your photographs will be potent or pathetic, harmonious or horrible.

The Golden Section, the effects of triangles on a composition and other visual rules are not artificial standards that have been dreamed up recently. They reflect the basic tenets of human perception and describe what most people find visually pleasing when they look at an image. The idea of the Golden Section dates back to Ancient Greece and refers to the division of an image into sections defined by a ratio of 1:1.618 (i.e., approximately 3:5). The horizontal and vertical lines that make up the Golden Section are often referred to as

harmonious dividing lines. Together with the axes of symmetry and the diagonals, these lines comprise the basic visual framework in an image. If you align key elements of your composition with this framework, they will look and feel like they have been arranged 'properly'. It is easier for the human eye and brain to take in images laid out like this, which is why advertising images are often composed this way.

Other important visual elements include circles, slanted lines and dots or points.



Never mind that one steeple of the cathedral in Bremen is obscured by scaffolding. Using a telephoto lens to zoom in and reduce complexity produced an image with a clear a clear-cut visual language. The contrast between the rectangle and the triangle gives the image above its vibrancy and the smaller rectangle at the top of the scaffolding connects the two shapes. I used a polarizing filter to darken the blue of the sky.

Images that are more obviously oriented to the vertical and horizontal lines or the axes of symmetry generally appear more static and stable, sometimes even rigid, whereas images oriented to the diagonals or other sloping lines are more dynamic and less stable, but certainly never dull.

Rules of composition are subject to the viewer's cultural expectations too. For example, it's useful to know that native speakers of right-to-left languages like Mandarin and Hebrew read images in the

same direction that they read text, while Western viewers read images from left to right.

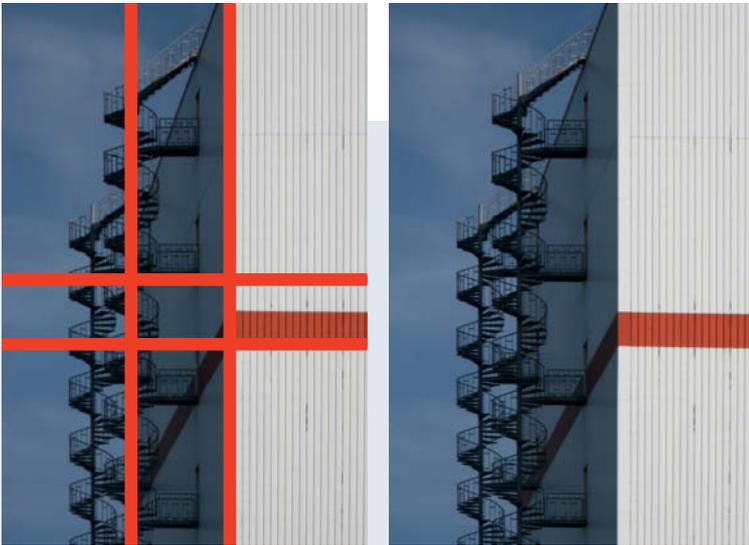
Keeping It Simple

Research has shown that, for Westerners, the first point of entry into an image is a little to the left of the vertical and a little above the horizontal axis of symmetry. If you know this, you can deliberately place important elements in this position and automatically direct the viewer's gaze in the direction it

would take when reading. If you intend to look at life through a camera, you need to learn how to arrange visual elements.

Most amateur photos simply have too many elements in them so it is a good idea to practice composing simplified images that contain just a few selected objects like the triangle and rectangle in the steeple and scaffolding shown opposite.

Like many aspects of the visual arts, great photography often lives by the tried and trusted post-modern motto "less is more".



The Golden Section at work. The key lines in this photo of a storage tank in Bremen are oriented around the harmonious dividing lines. Typical of an image that adheres closely to the Golden Section, this image is calm and pleasing but also rather static.

The photo below is much more dynamic, and not just because it was taken in New York. The steps to the High Line overhead railway form an almost perfect rising diagonal, a visual element that is often perceived as positive and further emphasizes the fact that Western cultures 'read' images from left to right. The blur of the car in the foreground reinforces the feeling of momentum.



Classic Black and White Composition

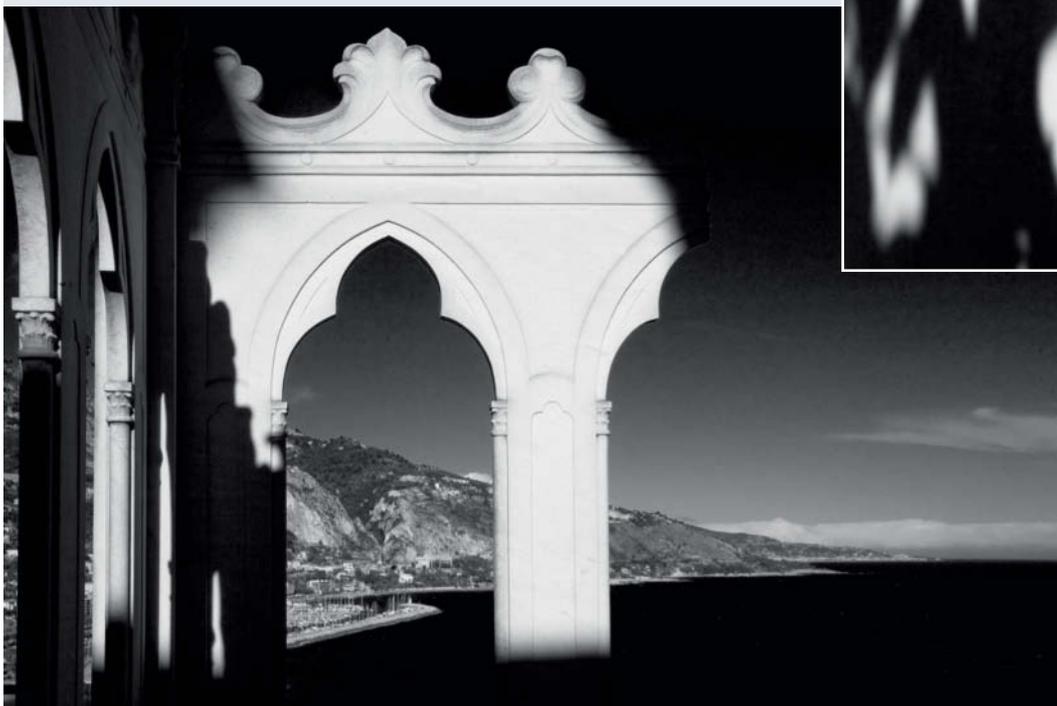
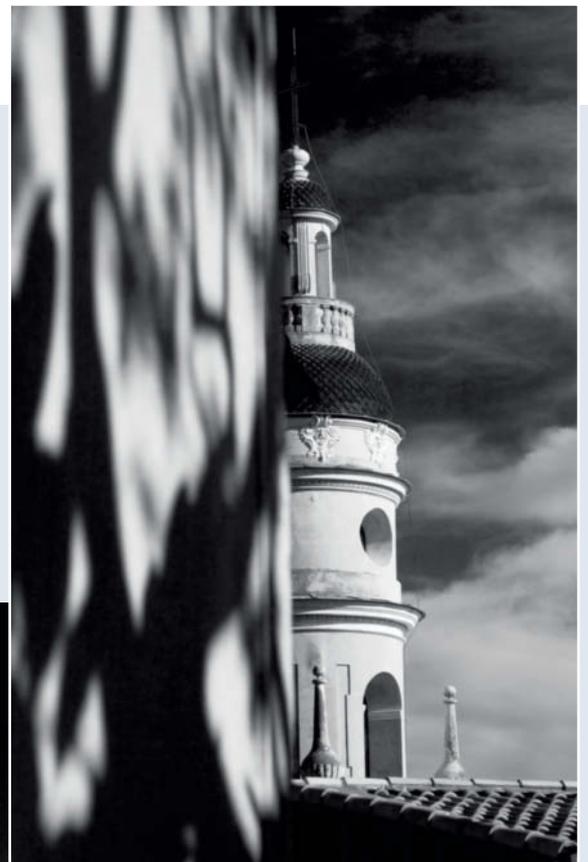
Because you don't have to think about whether the colors clash, it is sometimes easier to compose images in black and white than in color. However, you have to take care that the beauty and intensity of the medium don't blind you to other important factors.

Black-and-white photography has its own rules: it is more sparing with sensory stimuli and therefore more ascetic than color photography, but it forces you to use light and shade more frequently. When you are starting off, sunny days are the most suitable for getting the hang of black-and-white photography – you'll soon discover that it is a highly graphical

medium. For instance, it is easy to create visual rhythm using carefully selected lines. The rhythm can be woven into the image in an obvious way or more subtly and can be chaotic, organic, or quite strict, as in the main photo opposite, in which the passer-by contrasts most pleasingly with the strong, constant rhythm of the tapering lines of the building.

Image composition in black and white involves a great deal of experimentation with light and shade. In this image, the shadow of the tree and the clouds form an obvious but highly organic rhythm.

Both images on this page were shot in Menton, France.



This dramatic image of a ruin has a surreal effect due to the way the Gothic arch on the right is simply 'cut off'. A polarizing filter and the *Photoshop* yellow filter were used to darken the ocean and the sky.

A word of warning: don't let compositional theory tempt you to use the Golden Section or triangular patterns and strong rhythms in every shot. All these rules do is describe what we subconsciously recognize as harmonious, and that is already part of the way we experience things. Always try to work intuitively, go with your gut feeling and wait

until later to evaluate your images intellectually according to formal criteria. This approach works particularly well if you discuss your work with friends or other keen photographers. Insights we gain by analyzing things with others automatically become part of our intuitive way of seeing things and improve our photographic 'eye'.

Perfect timing is a must in black and white photography and was absolutely crucial in both of these photos.

I waited a long time outside the Schirn Art Gallery in Frankfurt for the right person to happen along and give this image its all-important finishing touch. The vibrancy of this image comes from the strong rhythm of the graphic lines and the off-center composition.

This boy is about to run exuberantly down the steps in front of the Castel Sant'Angelo in Rome. Setting up a shot and then waiting for the key moment is an important lesson to learn.



How Do You Want to Portray the world?

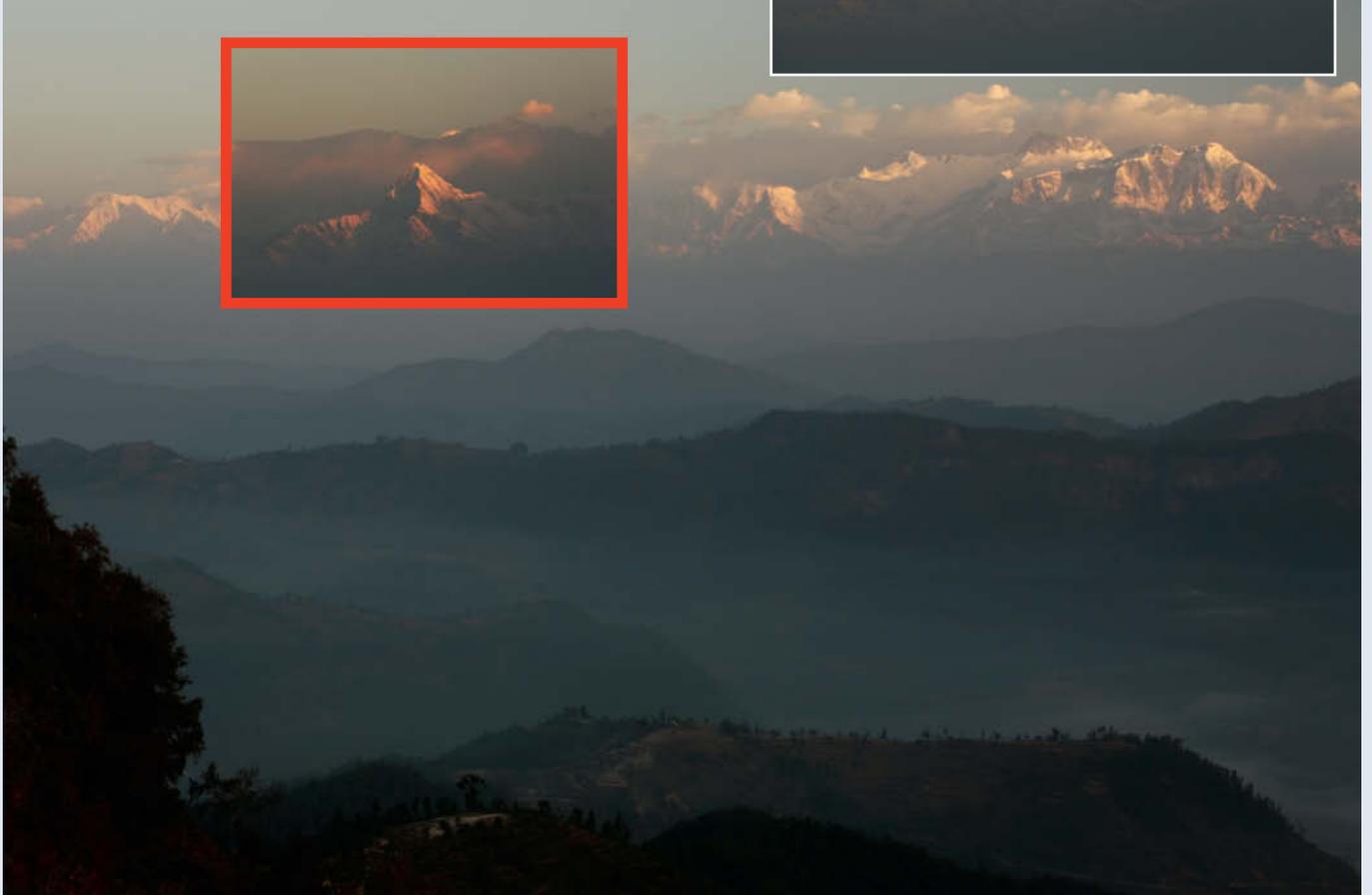
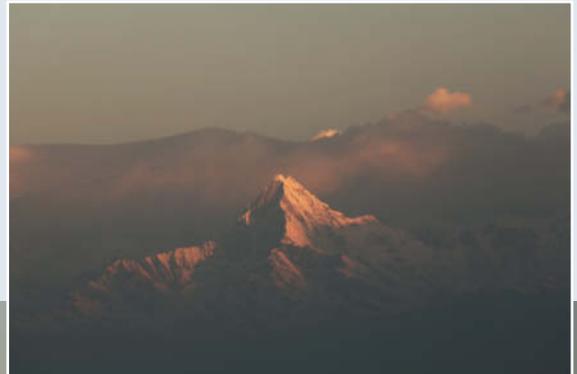
One way to approach photography is to give careful thought to what you want to portray before going anywhere near the shutter button. What you end up capturing depends very much on how you see the world – or how you would like to see it.

Ansel Adams was a master at portraying the poignancy of an intact world, and this is an approach that is still legitimate today. You can interact with the natural environment and capture especially beautiful moods, or maybe travel somewhere distant that's really different for you. A trip like the one to Nepal that yielded the photos on this page can be very hard work. You need to be enthusiastic and motivated, and the price to be paid for incredible views like these is a lot of legwork

and lack of sleep, especially if you are visiting a developing country. The Dhaulagiri massif, Machapuchare (Fishtail Mountain) and the Annapurna section of the Himalayas are so stunning in the early morning light that it is almost impossible to come away with a poor photo.

For many Westerners with a conscience about the environmental damage caused by humans, photos like this create a conflict. Should we really engender such a utopian

With a beautiful scene before me, like this sunrise along the Annapurna range in Nepal, I find it almost impossible to shoot a bad photo, though sadly it is equally difficult to squeeze the grandeur of the mountains into a tiny photo. A telephoto lens creates a slightly flat tableau-like impression while a wide-angle combines the mist in the valley with the receding rows of peaks to create a feeling of depth.



take on the world? On the other hand, there are very few contemporary photographers who concentrate on unspoilt natural beauty.

Since the mid-20th century, a new approach to landscape photography developed as photographers begin to reveal the less attractive side of modern landscapes. In industrial countries it has become almost impossible to photograph intact landscapes without being suspected of falsifying the

world or at least glossing things over. For the same reason, 'Realist' painters had already begun to distinguish themselves from the 'Naturalist' movement by portraying society's paradoxes instead of just an idealized view of the world.

Contemporary photographer Hans Christian Schink, from Leipzig, Germany, shows the ruthless intrusion of the modern world on the landscape in his images of highway and railway bridges in eastern

Germany. His unequivocal large-format photos show clearly how concrete destroys the innate harmony of natural landscapes.

I am among those who believe that it would be an artistic lie to allow my photos to suggest that all is well in the natural world in the early decades of the 21st century.

Nepal, too, has problems galore – poverty and a lack of infrastructure to name the most pressing – which are rendered invisible if we portray only the beauty of the Himalayas.

Unlike the images of the Himalayas, this idyllic, typically Italian landscape near San Remo with its chapel, pine trees and cypresses, takes great liberties with the truth. In the next section, we will see how profoundly and convincingly photos can 'lie' to us.



Can Photography be Objective?

It is often claimed that photography is an objective medium because it depicts something that really existed at a certain place at a certain time.

Not depicting an object is an act that can be just as significant as depicting it, and both approaches can interfere with objectivity. Consider, for example, what is going on behind the photographer's back at the moment the shutter is released. My 'Janus' sequence explores precisely this question. Janus was a Roman god who could look in

two directions at once. The images in this series speak for themselves and clearly show what a fragile thing supposed objectivity is.

This makes it all the more astonishing that the renowned Becher School of photography postulates that photography is an objective medium, when it is so easy to prove otherwise. Hilla Becher and her late husband Bernd were of the view that photographers should be as unobtrusive as possible and allow their subjects to speak for themselves. In their own photos, they always show their subjects in medium gray light from a static full-frontal viewpoint.

Their extensive body of work deserves recognition, but these apparently neutral images of old industrial buildings are just as lacking in objectivity as those of Reinhart Wolf, who created intense atmosphere by photographing industrial buildings in glittering sunlight in a way that almost made it possible to make out faces in the façades.

Photography is definitely not objective but is certainly authentic. The difference between objectivity and authenticity is critical and something that photographers quite literally have to keep an eye on when searching for subjects.



This view of a beach and the sea in Noli, Liguria, suggests beautiful surroundings, even in overcast weather. The right-hand image gives no hint of the less attractive view behind the boat.

Subjective Photographic Impressions

Photography makes a statement, not just about the material world, but also about our thoughts and feelings. It is an expression of our subjective experience.

Photographer and lecturer at the Folkwang University of the Arts, Otto Steinert, coined the idea of 'subjective photography' back in the 1960s and 70s. To his way of thinking, photographs are not logical and rational but

rather ambiguous and emotional, so it makes good sense to portray one's own subjective moods in photographic images.

Therefore, learning to see involves finding and discerning counterparts in the tangible world for everything we sense internally, so that we can effectively communicate what we feel in a visual way.

To find out more about yourself, pick a time when you are feeling relaxed and simply allow your feelings to guide you. Which places really capture your imagination or intrigue you? These might be the entire countries, cities, certain types of

landscape, or smaller details within your surroundings, like the Jewish cemetery around the corner, a courtyard between buildings in the Turkish part of town, a refuse dump at the edge of a city or majestic old trees in a park or forest. It is always better to avoid the well-known locations listed in guidebooks, as these usually produce disappointing results.

Get to know your special places using your camera. Take your time about it and try to explore alone so that you are not under pressure to move on or intellectualize your feelings.



Photography is the ideal medium for conveying mood. The image on the left has a bright, magical mood that conveys spaciousness and beauty. It was taken in winter on the Island of La Palma. This is another image in which I had to take care to prevent the highlights in the ocean from burning out.

The image on the right – of a pedestrian walkway under a highway – expresses confinement and constriction. Both images on this page were captured using a central viewpoint, but the vanishing-point perspective in this one really draws the viewer in.



What is Direct Perception?

In the first part of this workshop, we concentrated on consciously setting up the world around us to capture it photographically. Now let's turn our attention to letting go of conceptual thinking and starting to see things 'directly'.

We have already considered how to use our intellectual perception of the modern world

as a basis for creating photographs of our surroundings. In contrast, we can also learn to see our surroundings 'directly' without the filter of knowledge or preconceptions.

Our normal way of perceiving the world involves incorporating everything that we know and our own experiences into a frame of reference – a framework that is often referred to as a person's 'world view'.

It works more or less like this: we see something and try to fit it immediately and directly into our world view. To do this, part of

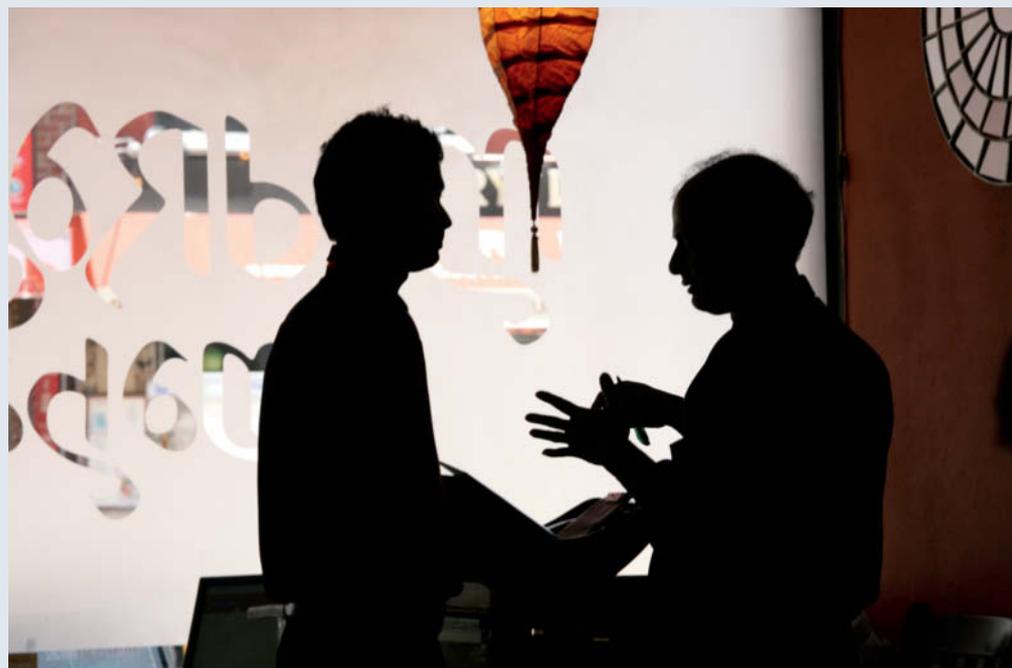
our being has to exit the experience of seeing and begin to make comparisons. We compare what we have seen – be it a landscape, a plant, a person, a city or a castle – with similar, previous visual experiences and attempt to align it with our knowledge of that type of object. Processing all this input, our mind evaluates what we have seen and fits it into our own personal frame of reference.

While fitting our perceptions into safely labeled 'boxes' may help us feel more secure, it distracts us from simply seeing



Heading off into the city without a predetermined concept while simultaneously opening your mind to new experiences is a journey of discovery – there is always so much new to see. Silhouettes are one of the first stages of composing images in a more abstract way. This image works because of the contrast between the the silhouettes and the red-lit wall. The image was captured at ISO 1600 and 1/64s using an 82mm focal length with the stabilizer activated the lens to prevent unwanted camera shake.

Another powerful silhouette image captured in an Indian restaurant in New York. The structure is clear and simple, and the paper lampshade and the Indian script on the window blend nicely into the overall composition. The image was captured at 1/100s using a 135mm lens.



what is there. We end up thinking we know the world already, instead of experiencing and discovering it with the impartiality of a child.

Let Go of Labels

There is nothing wrong with approaching the world rationally. On the contrary, there are many situations in which it is extremely useful – getting to know a new city or photographing a specific topic are two good

examples. But ‘seeing directly’ is quite different and is all about taking things in without any filters so that our intellect is kept at bay while we simply go ahead with an experience.

And why should you take this approach? Because the rational part of our intellect, which judges, evaluates and allocates things to a place in our world view, is the part of our mind that separates us from the true depth of the experience and the immediacy of perceiving it. Rational understanding

packages everything we experience in language. The problem with that is that the word for an object is not the same as the object itself. It restricts us, confuses us, diverts us and leads us down the wrong path.

The surrealist painter René Magritte explored this phenomenon by painting things like apples and pears and labeling them with the wrong names. He was aiming to confuse viewers and make a pear, for example, seem more alive, rather than have viewers follow the same old tracks in their



Framed vistas, simply by the way they are set up, add an additional layer to a photo and almost always establish a feeling of depth. Here, a beautiful heritage window leads the eye into a courtyard full of bright primary-colored umbrellas, while the figure in the background provides a nice finishing touch. An intuitive approach was key in this shot, although a good understanding of the relationship between aperture and depth of field enabled me to instinctively select f13 to provide sufficient detail throughout the frame.

Photographs shot in the rain often have a certain poetic melancholy. In this shot, it was important to focus on the raindrops and bathe the fruit stand in the background in blur. To achieve this effect I used a relatively wide aperture of f5 and a 19mm wide-angle lens. The viewer's eye is drawn diagonally from bottom left to the red umbrella in the top right-hand corner, which provides the composition with an important anchor. At ISO 800, it was still just possible to shoot handheld at 1/25 s.



mind and just think of the word 'pear'. He wanted viewers to experience the pear in all its real-world sensuality rather than simply reduce it to a label.

And that is exactly what 'contemplative photography' is all about: expanding our ability to perceive things by not automatically labelling everything we see, allocating it to a defined position in our world view and evaluating it, but instead switching off our rational side and simply observing and taking things in via our senses. If you manage to clear your mind and throw off your

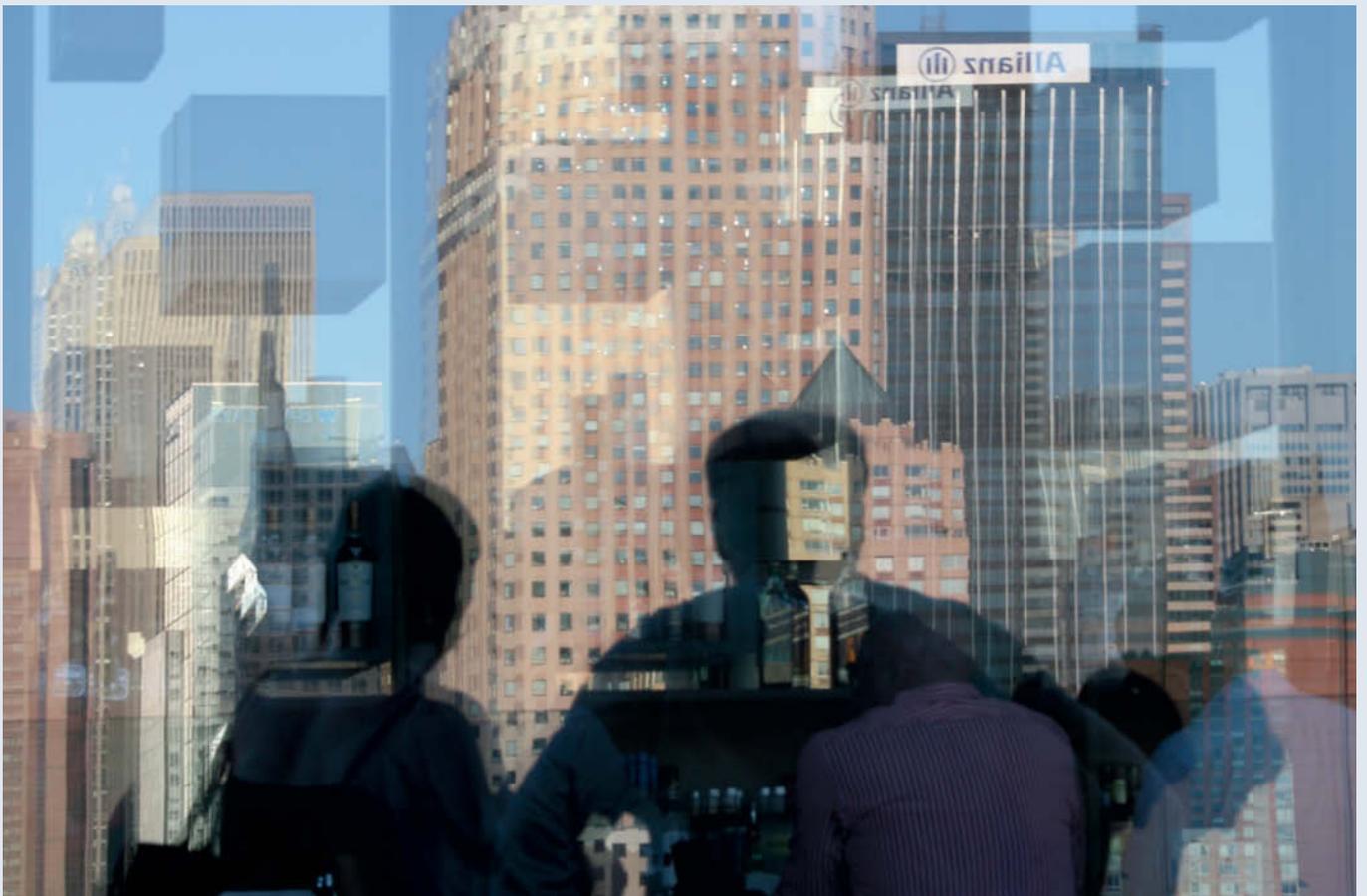
prejudices, it is as if you are seeing the world for the first time. This is a deep-set feeling that enables us to compose photos easily and intuitively.

Putting Theory into Practice

Seeing the world with such enhanced perception and blending what we perceive with the view through the camera can be a real joy. It is like diving into a very special river, which is perhaps why people talk about the 'flow'. It's a river in which everything simply

unfolds and happens all by itself, and it is always a river of enthusiasm. Without enthusiasm, it is unlikely that a photo will turn out well.

Having got into the flow, you find that photographs just seem to happen and almost compose themselves. You will begin to swap lenses automatically as if the images you are shooting have taken hold of you and are guiding you, rather than the other way around. You lose track of time, you don't even notice that you're hungry and you simply plow on until you find that you are no longer



Using reflections is a brilliant way to merge two or more perceptual layers in a single image. Here, on the roof terrace of a New York bar, life inside merges with the outside world to form a most unusual composition. Shot using a focal length of 100 mm, I had to stop down to f13 to produce sufficient depth of field.

in the flow and that the traffic signal has turned red, the city stinks of vehicle fumes and that you're surrounded by ceaseless noise. None of these things penetrated your consciousness while you were one with your immediate experience, because your evaluative consciousness was temporarily switched off.

I deliberately encourage people to take photographs in this way because we Westerners have been schooled too well in approaching life rationally. Yes, it's important to use your equipment well and practice

analyzing images, but don't photography books suggest that technology is responsible for at least 80 per cent of the quality of a photo? I simply don't agree!

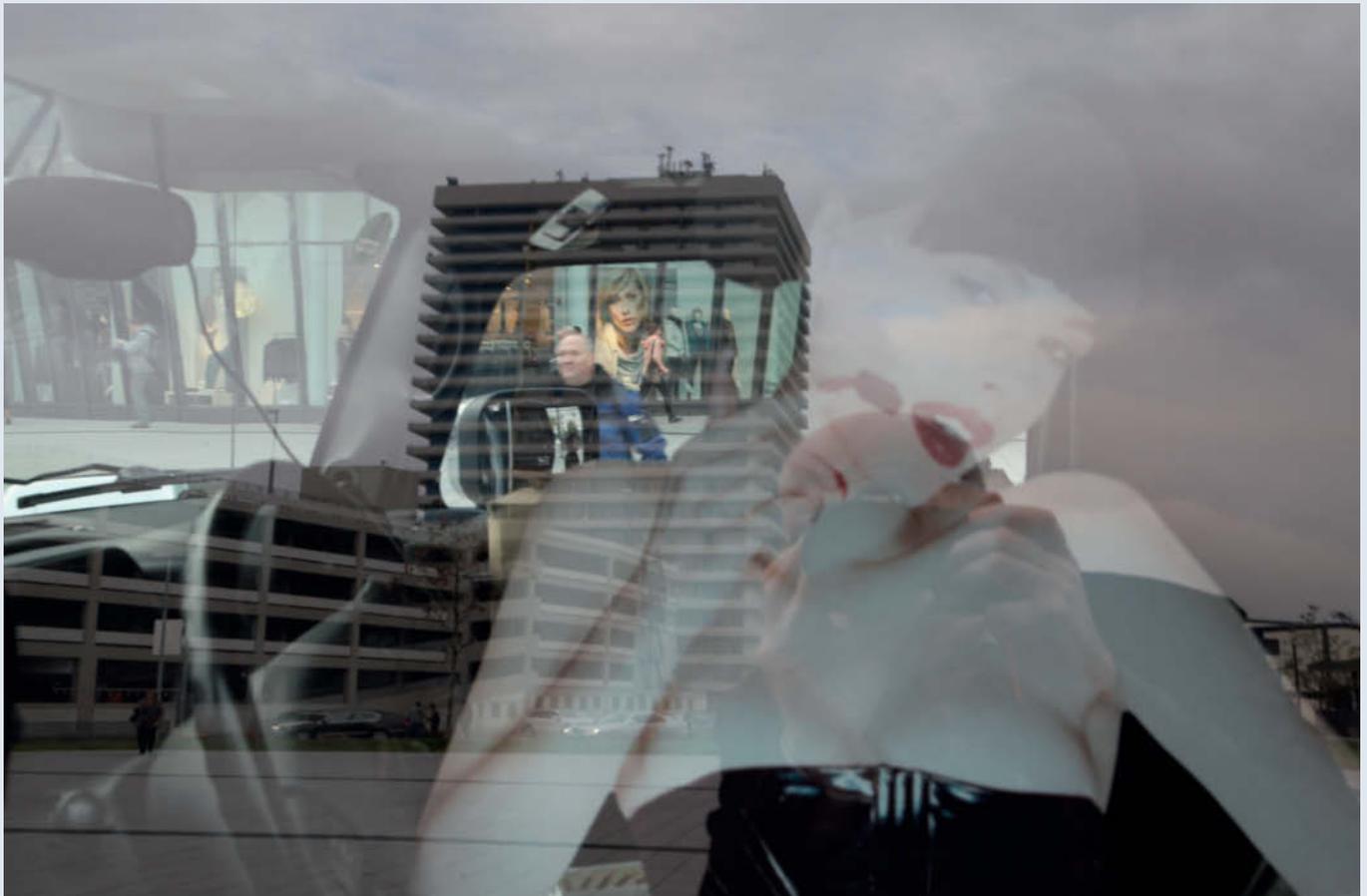
Discover New Worlds

It is much more important to be able to devote yourself to the experience of seeing, and too much thinking about equipment can prevent you from doing just that, especially if you are still experimenting with your gear and your photographic style. But learning to see

also means learning to look intensively, which works best if you forget everything else and rely completely on your intuition to guide you and help you capture an image.

Once you start seeing this way, you'll find whole new worlds opening up. You may discover silhouettes, interesting vistas or intriguing reflections that allow themselves to be condensed into intriguing, abstract image compositions. The more you practice, the easier it will become to intuitively consolidate several layers of perception into balanced works of art.

Another multi-level composition, photographed in Baden-Baden, shows the reflections of two women window shopping.



This image was photographed through the window of a car with a mannequin inside it. So many layers are combined here that it is not immediately apparent how they relate to each other. But don't feel you have to rush off to New York to hunt down such opportunities: this photo was shot in Ludwigshafen, Germany.

Abstract and Meditative Views

The term 'meditation' is often dismissed because of its association with esoteric practices, although all it really is is a way of calming your spirit and opening your mind to new experiences.

At times when we are alone and take notice of what is going on within us, we discover our 'internal storyteller' – a voice that is

seldom completely silent. Even in good and happy times, our subconscious can pop up with thoughts of an unfinished tax return or a noisy neighbor, and spoil the intense experience of a beautiful moment. Meditation is all about freeing oneself from these unprofitable thoughts and fully savoring and appreciating the moment. As we saw in the previous section, photography can do a brilliant job of leading and guiding us into the moment and encouraging us to concentrate on seeing while leave unhelpful

thoughts behind. This is what I mean by 'meditative photography'.

Meditation is all about immersion, and you can practice meditative photography anywhere, concentrating on seeing to achieve a feeling of peace and freedom from prejudice. Once you have got into a meditative flow, you will also be able to rediscover the commonplace and use your camera to create art from things you would neither see nor value in an everyday state of mind. (keh)



This prayer flag blowing in the wind throws a distinct shadow and is balanced by the red detail on the right. It was a very bright day, so I was able to stop right down to f16 to retain sufficient depth of field.



This traffic sign behind a fabric barrier looks even more commonplace seen from behind but, if we disregard its intended function, we begin to discern an attractive interplay of shape and color. This image was shot with a 190mm telephoto lens set to f6.3 to keep the background out of focus.

About the Author

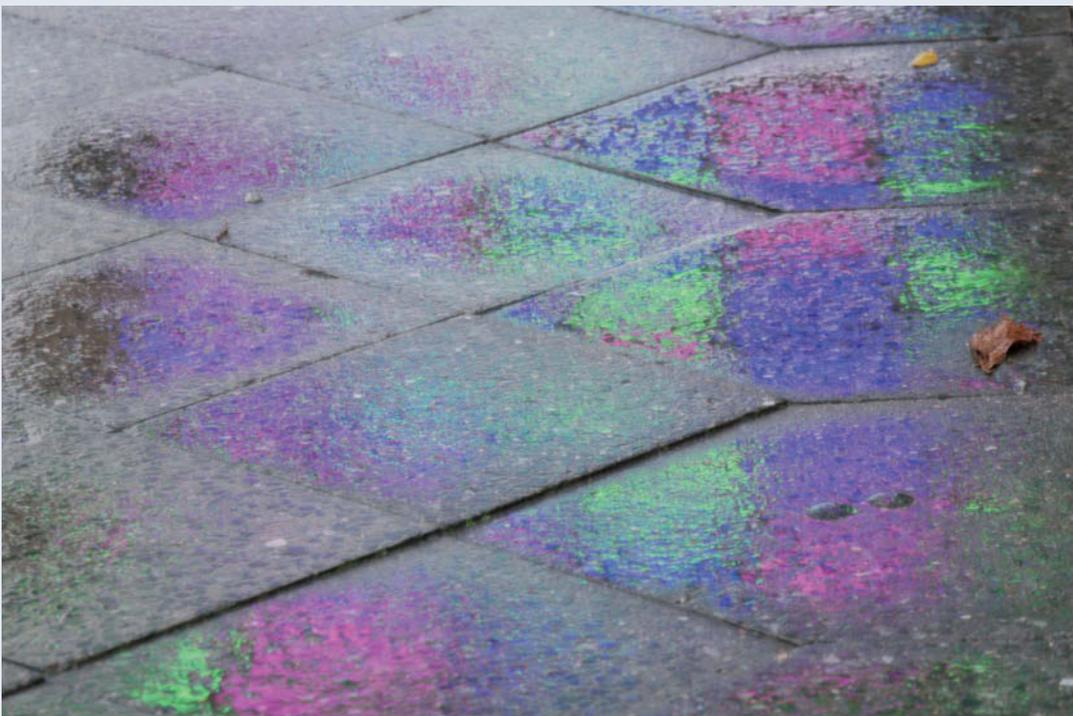
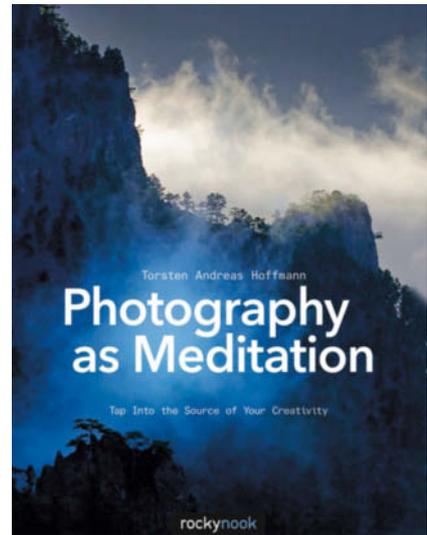
Photographer, author and photography tutor Torsten Andreas Hoffmann was born in Duesseldorf and studied photography at the Braunschweig University of Art. His work has taken him to India, Indonesia, Mexico, Nepal, Turkey, the USA, the Sahara and the UAE. His photographs have been displayed at many leading galleries and have appeared in more than 20 books as well as in many national and international magazines.

Hoffmann is also known internationally for his New York photo books and art calendars, and especially for his pictorial analysis of the events surrounding 9/11.

Hoffmann works in both the traditional black and white and conceptual color

photography genres, often using paired images to deliver his message (see the example from the *Janus* sequence on page 128). He has also published a pictorial comparison of Frankfurt and New York in book form. His latest work is a sequence called *Natur-Architektur*.

Participants in Hoffmann's workshops are encouraged to forge their own individual path, drawing from his numerous instructive articles and his book *The Art of Black and White Photography* (published by Rocky Nook). His latest book, *Photography as Meditation* (due for publication this summer, also by Rocky Nook), he investigates how to train your intuition to become an integral part of your creative drive.



Who wants to go out on a rainy day in November? However, days like this are opportunities to discover some fabulous subjects simply by changing your point of view. Look down to see the reflections of neon lights and turn them into a photo. Because I was shooting at f13 to retain depth, I had to use a tripod to keep the camera steady during the long 2.5-second exposure.

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Book Review



200 Best Ad Photographers Worldwide 2014/2015

By Michael Weinzettl
Published by Lürzer's Archive
400 pages
English text
11.2 x 8 inches, Paperback
US\$34.50
ISBN: 978-3902393197

Advertising Photo Gems

Lürzer's 200 Best Advertising Photographers

Lürzer's Archive is an advertising trade journal with a global reputation, and appearing in its pages is considered a serious accolade for advertising photographers all over the world. For each bi-annual volume, a prestigious jury combs the archives and chooses the 200 best advertising photographers worldwide. These lavishly illustrated books contain virtually no text, but the large-format photos mostly speak for themselves anyway.

Each volume showcases photos shot in the course of the creation of real ad campaigns but doesn't use the actual advertising posters that result. This means that – apart from the obvious car photos – you will have to read the captions to find out which product each image relates to. When top-flight photographers are given a brief in the monied world of advertising, the results are always enthralling and often electrifying too. In addition to the advertising shots, the book includes a sprinkling of the photographers' own publicity images. These are not always up to the same technical standard as the contract work done for clients like Samsung, Schweppes and Guinness, and

sometimes look more like snapshots alongside the other sophisticated campaign shots and *Photoshop* creations. Nevertheless, the images on display here include everything from high-end beauty shots to some real shockers – in the advertising world anything that attracts attention is permissible.

The range of subjects covered is broad although, as can be expected, the colorful world of product placement leaves sensitive themes such as politics and religion completely out of the picture. Otherwise, the work on show covers just about all branches of the photographic oeuvre, including sports, landscapes, industrial scenes, people, food and still life.

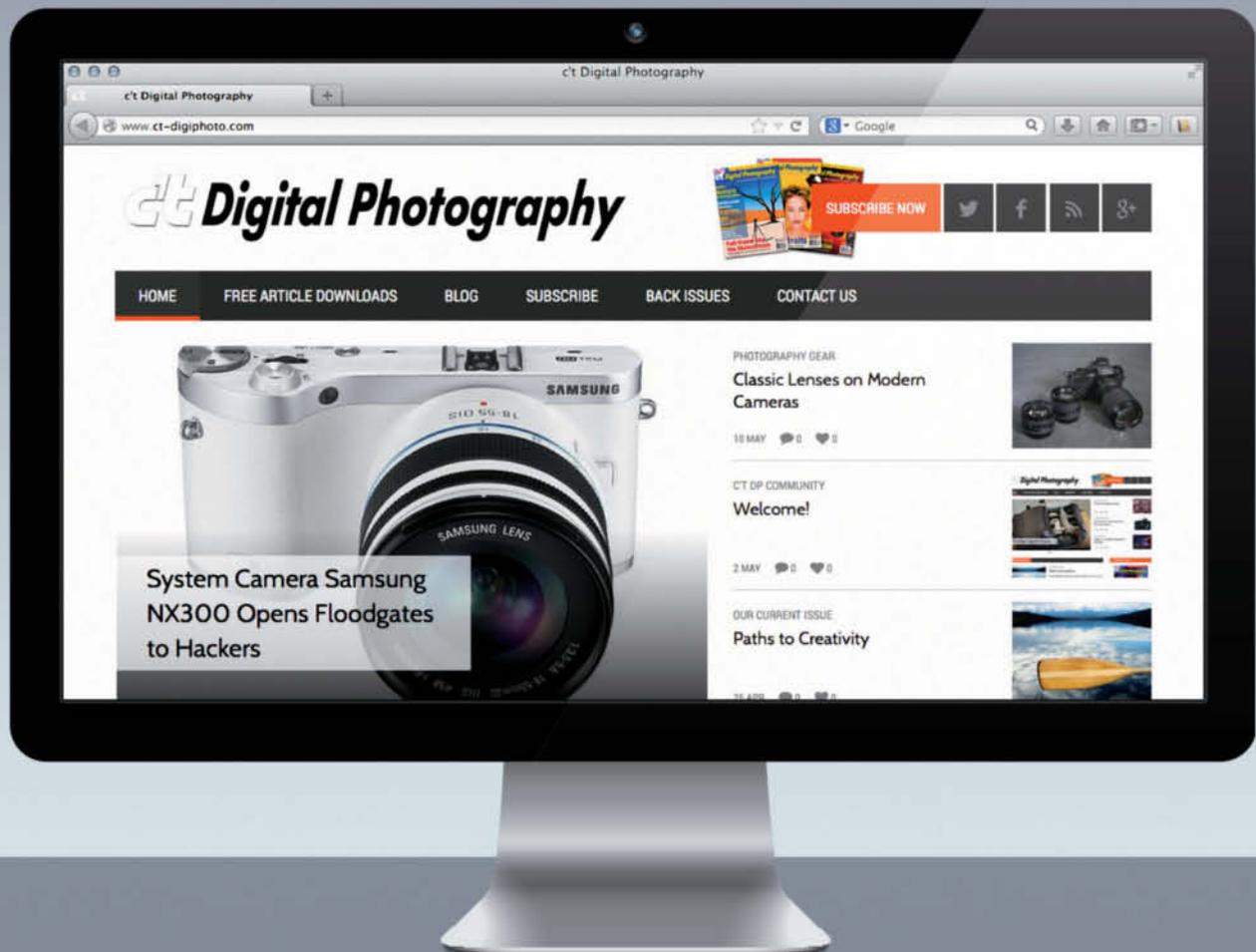
This book provides great reference images for all these sub-genres and more. Above all, as an entertaining and inspiring collection of high-end eye candy, it is a treat for lovers of advertising and high-class photography. (sts)

Soft pastel shades and a dignified atmosphere set the perfect stage for the girl and her outrageously colorful donuts. This shot for the *Claire's* jewelry brand is a real eye-catcher.



Image: Todd Baxter/Claire's

New Website!

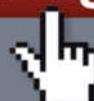


We invite you to look around the new **c't Digital Photography** website! The teams in both the U.S. and Germany are beyond excited to present this shiny new online home for c't Digital Photography. Apart from the sleek new look, the website boasts an integrated blog, which is continually updated with industry news and original content from our editors in Germany, the U.S., and our professional photography friends who want to share their knowledge. ct-digiphoto.com will bring our stellar online community closer together, spark lively and

important discussions about this quickly changing photo industry, and offer artistic support and knowledge for those seeking it.



ct-digiphoto.com



Coming up in Issue 17

● ● ● ● ● available from September 25



Photo: Benny Rebel

Wildlife Photography with Benny Rebel

■ Benny Rebel is one of the brightest stars on today's wildlife photography scene. His work has taken him to Kenya, South Africa, Uganda, Costa Rica and India, where he has produced many of his well-known photos of animals shot from extreme perspectives. In our exclusive workshop, Benny explains some of his favorite tips and tricks for producing extraordinary wildlife photos.

Color Corrections in Lab Mode

■ Performing color edits in RGB mode often takes time and patience. In contrast, the clear separation of brightness and color values in the Lab color space makes it a lot easier to achieve the effects you are looking for. Our in-depth article explains the basics of Lab-mode processing and introduces the appropriate tools in three different Lab-capable programs.



Image: Tamron

Telephoto Zoom Test

■ Telephoto zooms are the tool of choice for photographers who want to get close to their subjects but keep their composition options open. Wildlife and travel photographers especially appreciate the versatility of this type of lens. We test the best of today's offerings in the lab and on location, and give you the low-down on what they do best and what could still be improved.

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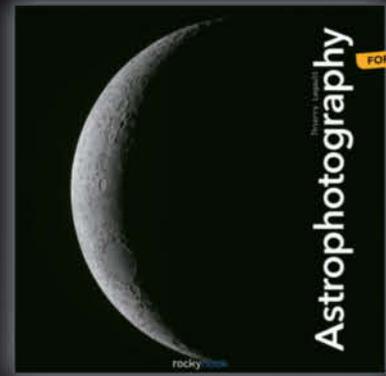
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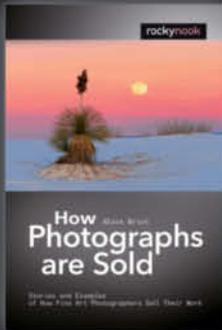
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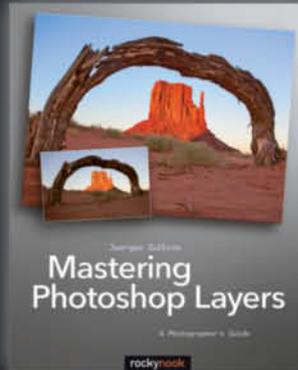
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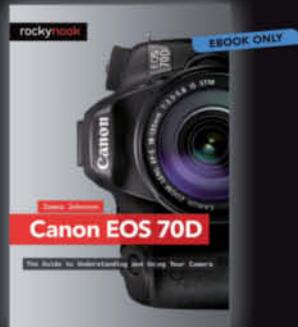
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