

Free DVD
inside

Food Photography • Flash & Camera Tests • Serial Photos

ct Digital Photography

The in-depth quarterly for the photo enthusiast

Flash

10 Flashes Tested
plus Accessories

Serial Photography

Tell Your Own Story

85mm Zeiss Otus
Stills from 4K Video
EOS 7D Mark II
vs. Samsung NX1

How to Digitize Slides

Photos better than Scans

On the Nature Trail

with Brian Matias

Food photos

Mouth-watering Workshop (with Recipes)



www.ct-digiphoto.com

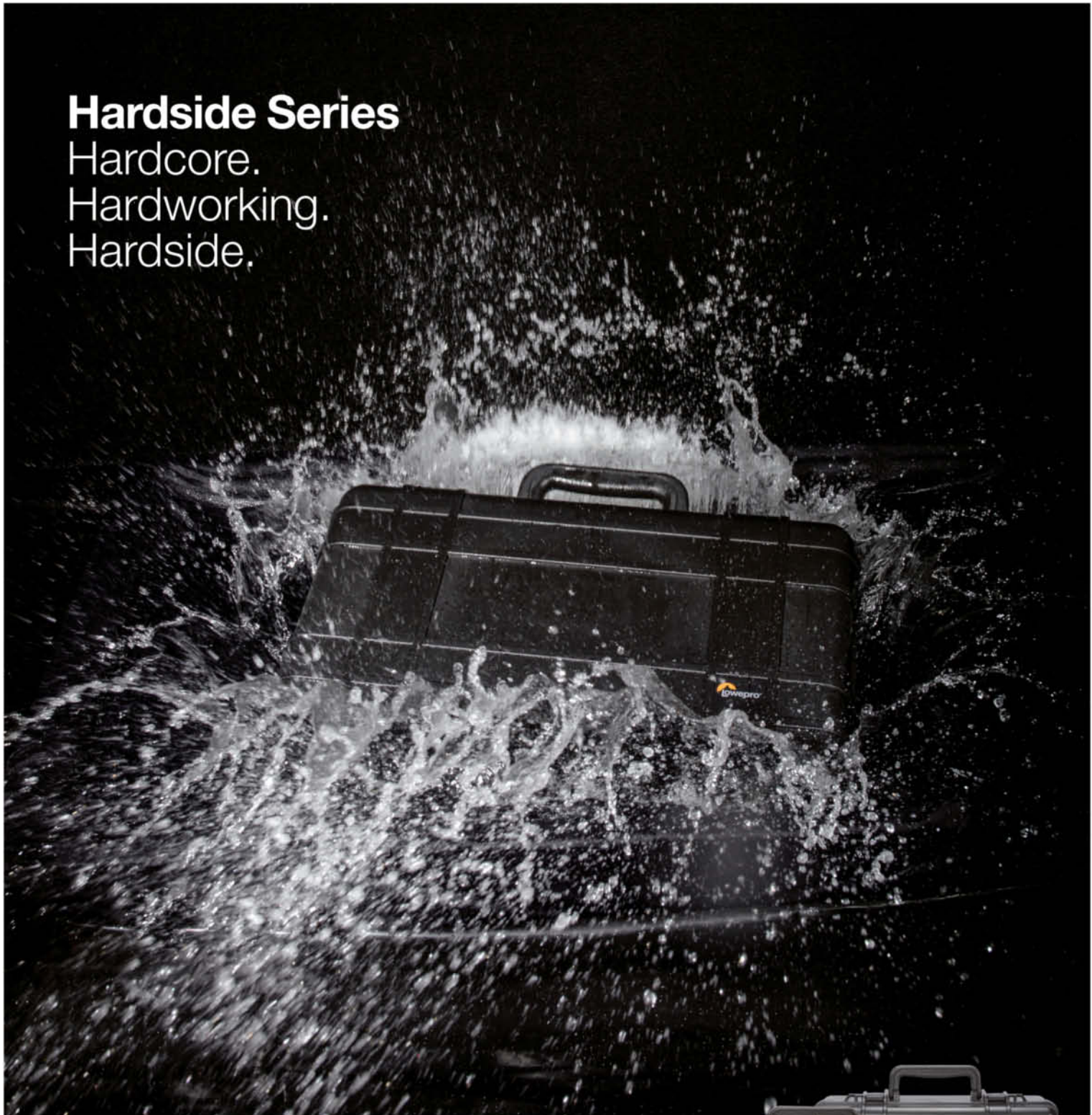
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Spring Issue



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The other day I found a photo of a beetroot risotto on my Facebook Timeline that was anything but appetizing. Instead of an exotic, mouth-watering dish, the photo revealed a close-up of a greasy pink mess that instantly conjured up associations with operating theaters. But help is at hand in the form of this issue's food photography workshop with Peter Rees, who is a master of his art and likes to share what he knows. As well as his fantastic photos, he even provided us with recipes to try out for ourselves, which is why his article gets my vote for 'Workshop of the Year'.

Elsewhere, surveys on the habits of photographers have revealed that they have very little interest in shooting moving pictures, even though today's cameras have high-end video capture functionality built in. But now, with the introduction of affordable 4K video technology, all that is about to change. A single 8-megapixel 4K

video frame offers better quality than many purpose-built stills cameras, and the temptation to simply shoot video and select the best frame later is sometimes hard to resist. Some regard these developments as the beginning of the end of photography, while others see a golden opportunity to expand their visual horizons. Instead of simply joining in the debate, we decided to look at the facts, and found ourselves in the fascinating world of video compression algorithms, interface throughput rates and hitherto unknown camera functionality. We enjoyed the ride and hope you do too!

Jürgen Link





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Stills From 4K Video 42

Portfolio

Robert Goetzfried gives stadiums, roller coasters and movie theaters a unique feeling of beauty and calm by photographing them when there's no-one around.

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Food Photography

More and more people are photographing food for books, blogs and private use. Pro food photographer Peter Rees shows you how to produce really mouth-watering food photos.

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Cover Shoot

We produce our cover photos in-house, and this issue's image was a real challenge. We tell you all about how it was created.

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Stills From 4K Video

4K video capture is now available in affordable digital cameras. We investigate the technology and explain how to extract stills from 4K video.

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Full Version Software: MakeUp Pilot

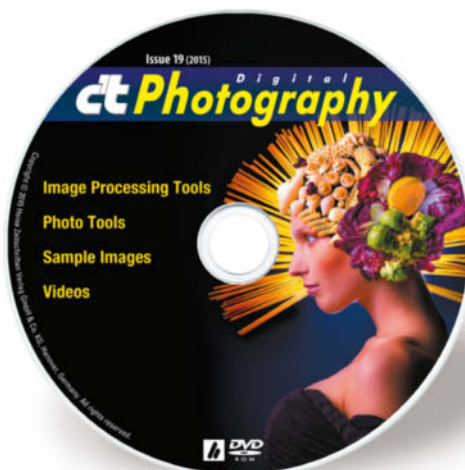
The perfect add-on for removing unwanted blemishes and adding digital makeup to portrait images.

Full Version Software: Ashampoo Photo Commander 11

A complete solution for all your image management and processing needs.

Videos

- Interview with Nature Photographer Paul Nicklen: Mission Polar Ice
- Creating a Romantic Look: Lightroom Tutorial with Wedding Photographer Kate Breuer
- Old Lenses on Modern Cameras, Part 2: Shooting on Location
- Creative Shooting: Improvising with Portrait Expert Bert Stephani

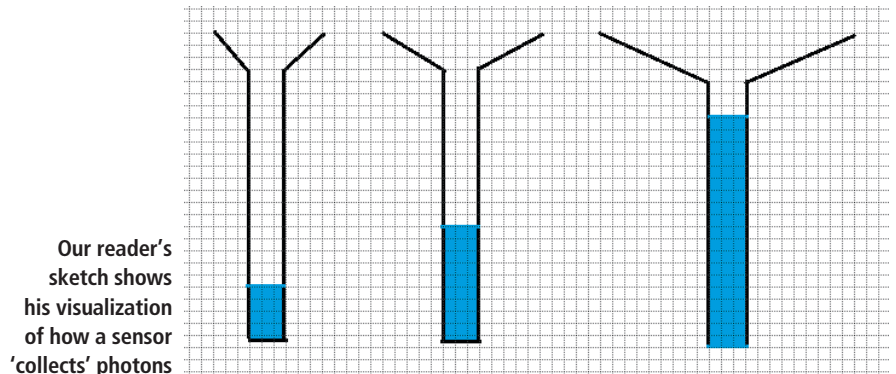


Readers' Letters

Collecting Photons

I am reading through my first issue of *c't Digital Photography* and am excited by its content. I really enjoyed your Full-frame Special article in No. 16 and feel that it helped me to understand the pros and cons of the different sensor formats. However, I think that your illustration 'Collecting Photons' (below) is inaccurate. If I put three dishes of different sizes out in the rain, and it rains one inch, each of the three dishes will have one inch of water in it, not different levels as shown in your illustration. The inch of rain in the large bowl will be a lot more water than the inch of rain in the small bowl. A more accurate picture might look like the one on the right. This is a very rough drawing, but you can see that the larger cup gives you a lot more photons and allows for much higher fidelity in measuring the amount of light.

Joseph C. H. Smith



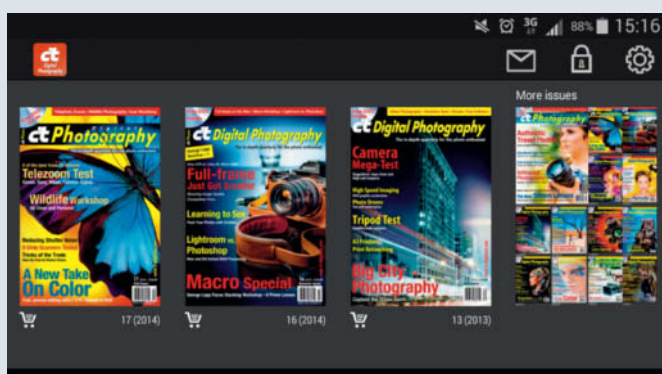
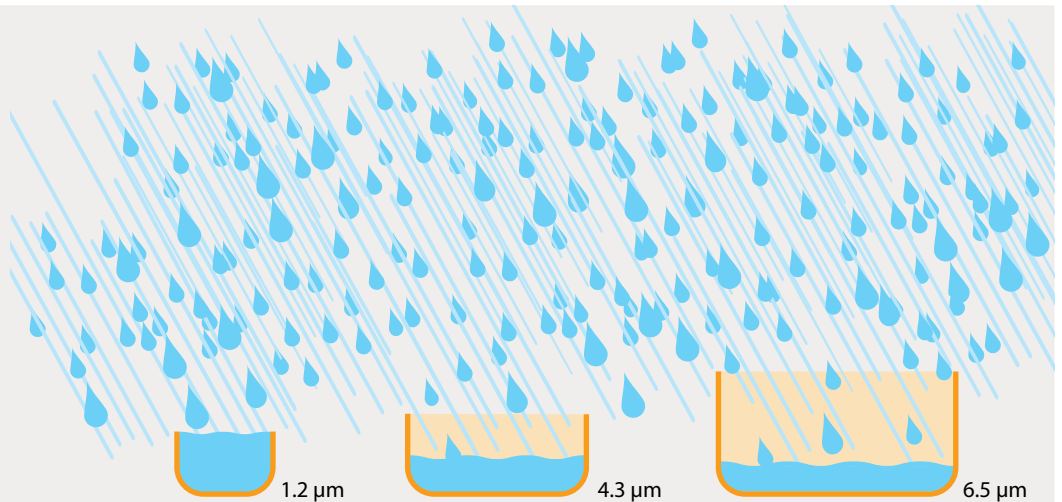
Thanks very much for your input. In a camera sensor, the size of the individual pixels is the critical factor. The pixels in a full-frame sensor are usually much larger than the ones found in a compact camera's sensor and can consequently capture much more light.

Transferring this to our raindrop analogy below, one liter of rain would indeed only cover the 'bottom' of a full-frame pixel, whereas it would cause the compact sensor pixel to 'overflow'. The pixels in your drawing are, in effect, all the same size.

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.



c't Digital Photography on Android

The *c't Digital Photography* app for browsing and reading our top-notch content is now available for Android. The new app includes search, bookmarking and sharing functionality and is virtually identical to the iOS version. You can use your subscriber login details to access all issues, regardless of when your subscription actually began. The app is compatible with Android 4.0 and higher and is available on Google Play.



Film Scanner Test

I was very interested in your article in No. 17 about slide scanners. The Epson 750 Pro flatbed scanner was tested, but I noticed that you did not test it using the fluid mount system which Epson supplies as an accessory, which I have found gives much better results than just mounting slides or film into the film holders. I have also got better results using the fluid mount system directly on the scanner. I am surprised that your testers did not use this system in their tests.

I have also seen reports using the fluid mount system that gave results much closer to those obtained with the Hasselblad scanner. Recently, I have also seen anti-Newton ring glass inserts for use with this scanner, although I have not had an opportunity to use them yet. I do not hold a brief for Epson but I am disappointed that your tests were not as comprehensive as they might have been, as your magazine is usually very thorough.

Richard Selby

Thanks for your comments. We didn't test the fluid mount because the wet scanning process is too cumbersome for most of our readers. Today's flatbed scanners unfortunately have fairly limited capabilities with regard to image quality, and we have yet to find any aftermarket accessories that genuinely improve scan quality. Best practice is to buy the best quality film scanner you can find and afford.



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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DVD Highlights & Contents

Extreme Nature Photography with Paul Nicklen

Video: There are few who know the world's polar regions as well as photographer Paul Nicklen. In this interview, he talks about how his fascinating, other-worldly images are created.



Canadian Paul Nicklen has a unique resumé. He was born and raised in a small Inuit community on Baffin Island in the Canadian Arctic and worked for several years as a marine biologist before deciding to become a photographer.

He spent his initial budget of more than \$50,000 on camera gear and travel. In this interview, he talks about how quickly his startup capital disappeared and how he

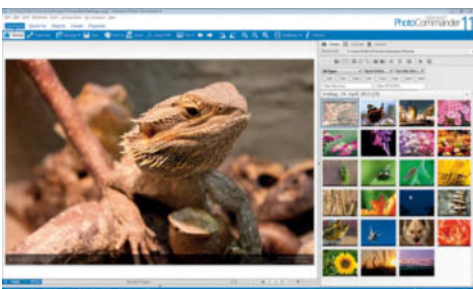
nevertheless managed to get through the difficult early years and establish himself as a professional, producing images that no-one else was able or willing to capture.

The life of polar bears is one of his favorite subjects, and he uses his images of the world's largest land-based predators to raise awareness of the effects of global warming and the melting ice caps. Nicklen's fantastic images are printed regularly in National Geographic.

Although he constantly tests his own physical endurance with long trips to the coldest places on Earth, the fact that millions of people get to see the results of his work keeps him going. The rewards for all his effort are unique images of the animals and landscapes of the Arctic and Antarctic regions. For more images and info, check out www.paulnicklen.com. (sea)

Ashampoo Photo Commander 11.1.9

Full version software: A great all-in-one solution for managing and manipulating your digital images.



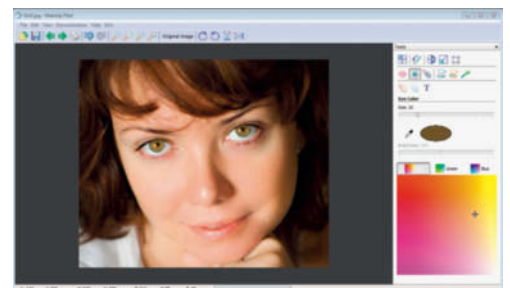
Ashampoo *Photo Commander* gives you complete control over your image archives. The program, which is included for free on this issue's DVD, offers effective tools for organizing, editing, viewing, converting and

publishing your photos. Its smart restoration and optimization tools make it easy to remove scratches, reduce unwanted noise and optimize skin tones. There is also a range of cool instant effects – such as Soft Blend, Motion Blur, Splash, X-Ray, Pixelize, Sepia, Negative and many more besides – that you can apply with a single click or combine using the pixel-precise Effects Pen tool.

To use the software, you have to register during the installation process. You will then receive a license key via e-mail. Once registered, you can upgrade from within the program to the latest full version (currently version 12) for the discount price of \$14.99 instead of the normal \$49.99. (sea)

MakeUp Pilot 4.6.1

Full version software: MakeUp Pilot is all you need to remove unwanted blemishes from portraits. You can also use it to remove wrinkles and add digital makeup with just a few simple clicks.



MakeUp Pilot is a great alternative to costly mainstream image processing packages for photographers who specialize in digital portrait photography. This issue's DVD includes an unrestricted copy of version 4.6.1 of the software. The user interface is clean and intuitive to use, and includes a set of short video tutorials to help you get started in your own digital beauty parlor.

As well as standard functions such as changing the color of a subject's eyes, you will also find easy-to-use tools for removing skin blemishes, whitening teeth, moving beauty spots, thickening lips and enhancing eyebrows. The wrinkle remover tool is really effective and, although it doesn't work miracles, makes faces look appreciably younger.

The program is perfect for experimenting and enables you to compare your changes with the original image in real time to see if you really have improved things. The digital makeup options include lipstick, rouge, face powder and eyeliner.

To achieve optimal results, you need to have some experience of applying makeup, and *MakeUp Pilot* is a simple way to add the perfect finishing touch to your portrait photos. *c't Digital Photography* readers receive a discount of 50% on the current version at www.colorpilot.com/makeup_upgr.html (offer valid until July 31, 2015). (sea)

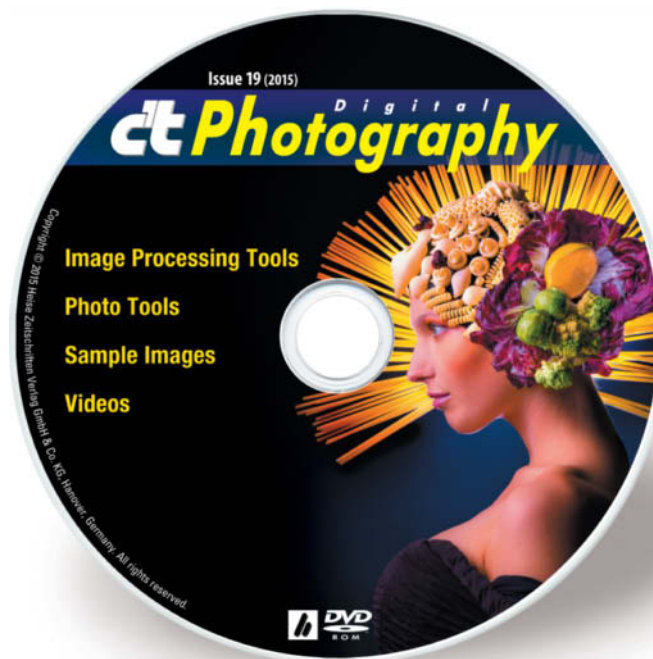


Image Processing Tools

Windows

GIMP 2.8.14
 GIMP Portable 2.8.14
 GREYCs Magic Image Converter (GMIC) 1.6.0.3
 Inkscape 0.91
 Inkscape Portable 0.48.5
 Luminance HDR 2.4.0
 MakeUp Pilot 4.6.1 (full version)
 Photo Commander 11.1.9 (full version)
 PSPI 1.0.7
 RawTherapee 4.2.1
 RawTherapee 4.2.3
 UFRaw 0.19.2

Mac OS

GIMP 2.8.14
 GREYCs Magic Image Converter (GMIC) 1.6.0.3
 Inkscape 0.91
 Luminance HDR 2.4.0
 RawTherapee 3.0.0 32-bit
 RawTherapee 4.2.1 64-bit

Linux

GREYCs Magic Image Converter (GMIC) 1.6.0.3
 32-bit
 GREYCs Magic Image Converter (GMIC) 1.6.0.3
 64-bit
 Luminance HDR 2.4.0
 PSPI 1.0.5 for Ubuntu
 PSPI 1.0.7 for SUSE 10
 RawTherapee 2.4.1 for Ubuntu 32-bit
 RawTherapee 2.4.1 for Ubuntu 64-bit

Photo Tools

Windows

Enblend/Enfuse 4.1.3
 EnfuseGUI 2.1.3
 ExifTool 9.82
 FastStone Image Viewer 5.3
 FastStone Image Viewer Portable 5.3
 GTKRawGallery 0.9.9
 GTKRawGallery Portable 0.9.9
 XnView 2.25
 XnView Portable 2.25

Mac OS

EnfuseGUI 2.1.3
 ExifTool 9.82
 MacPorts 2.3.3

Linux

Enblend/Enfuse 4.1.3
 ExifTool 9.82
 GTKRawGallery 0.9.9

Sample Images

Camera Test Sample Images
 Lens Test Sample Images
 Photoshop/Lightroom Mail Merge

Videos

Creating a Romantic Look: Lightroom Tutorial with Kate Breuer
 Creative Shooting: Improvising with Bert Stephani
 Old Lenses on Modern Cameras, Part 2: Shooting on Location
 Paul Nicklen: Mission Polar Ice
 Sample 4K Video

Get in the Picture



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

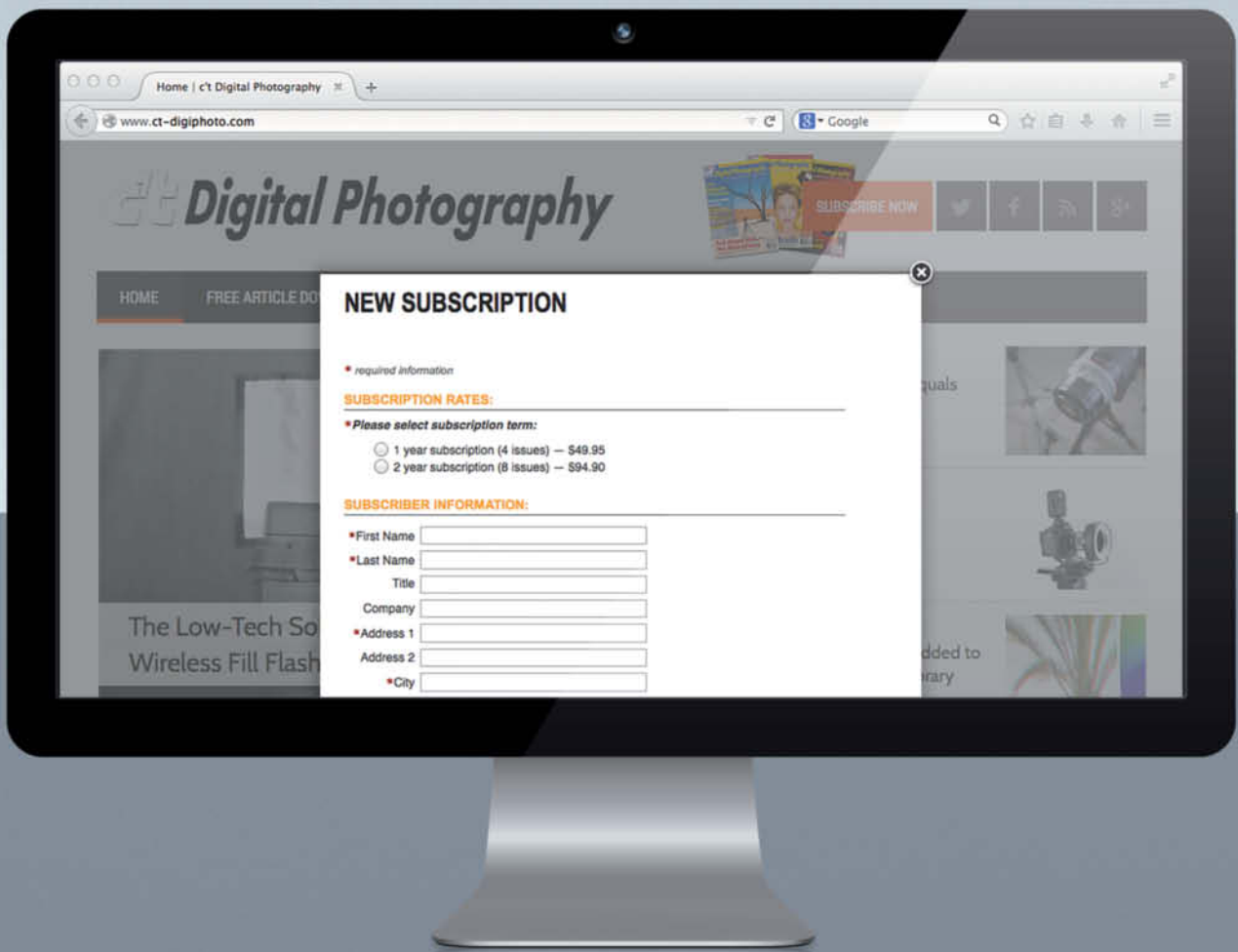
Keep on top of the latest trends and get your own regular dose of inside knowledge from our specialist authors. Every issue includes tips and tricks from experienced pro photographers as well as independent hardware and software tests.

There are also regular image processing and image management workshops to help you create your own perfect portfolio.

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Howling at the Roller Coaster

Canon EOS 6D, EF 70-200mm f/4L IS USM |
200 mm | ISO 100 | f4.5 | 1/5 s

Portfolio

Robert Goetzfried

Sports stadiums, movie theaters, swimming pools, bowling alleys – Robert Goetzfried loves to capture photos in places where it's usually loud and hectic. However, he shoots exclusively after hours when these daytime hives of human activity are devoid of people and are transformed into tranquil, atmospheric places.

There are no people anywhere. Nobody in the water, nobody leaning on the railings and nobody watching from the stands. There is definitely nobody around when Robert Goetzfried presses the shutter button. He sometimes works at night, but always alone and out of hours.

His subjects are sports stadiums, subway tunnels, movie theaters and swimming pools, and the fascinating thing about his images is that most people have never seen these

places without the crowds that normally populate them. This unusual situation is one of the Munich-based photographer's main motivations: "It's an amazing feeling to have these locations to myself. If I mention a swimming pool, most people immediately think of screaming children or people swallowing chlorinated water, and movie theaters, too, offer a similar vista full of clamor." Goetzfried uses these assumptions to create contrast between expectation and



reality in the viewer's mind. We tend to perceive places that are normally full of people and noise as especially quiet when there is nothing going on. As well as calm, these images exude emptiness and symmetry, and these are the disruptive factors that make them memorable. They portray familiar places in a new and unfamiliar way.

His photos are full of 'graphical equations' that always produce a satisfying result. His constant search for patterns and symmetry has become something of an occupational malaise. Goetzfried explains: "I like to arrange things in an organized fashion and I think and work in sequences. I'm a bit compulsive, but

I'm still a long way from transforming my visual formulae into mathematical ones."

If you check out Goetzfried's website, you will find a great many photographic sequences, sometimes encompassing 30 or more individual images. His body of work is made up of countless images of museums, tunnels, bus stops, bowling alleys, mountains and cities that he has collected over the years. Each sequence has its own underlying concept, while the individual image are given additional punch by being part of a series.

This approach to photography requires a lot of advance groundwork. Thorough



Front Royal

Canon EOS 6D, TS-E 17mm f/4L |
17 mm | ISO 160 | f5.0 | 5 s





POC Tunnel

Canon EOS 5D Merk II, EF 70-200mm f/4L IS
USM | 121 mm | ISO 100 | f8 | 6s

preparation is important to Goetzfried and is one of the most important elements that underpin his teaching at the Ravensburg School of Design. Consistency is key, and individual parameters such as perspective or focus have to be the same in each image if the finished sequence is to be effective.

Getting permission to shoot out of hours at his chosen locations often involves a lot of negotiation and long hours on the telephone. Goetzfried also has to know the direction of the incident light at the time of year he is

planning to stage a shoot. He leaves nothing to chance and prefers to be in complete control of the situation at the moment he releases the shutter.

His overarching aim is to portray his subjects exactly as he sees them. This sometimes involves adjusting color or sharpness in a RAW image, but never digitally removing everyday objects such as discarded soda cans. He only ever retouches an artifact if doing so is part of the overall concept for the shoot. (keh)

Robert Goetzfried on the Web:

www.robert-goetzfried.com

Images for sale:

www.pabloundpaul.de



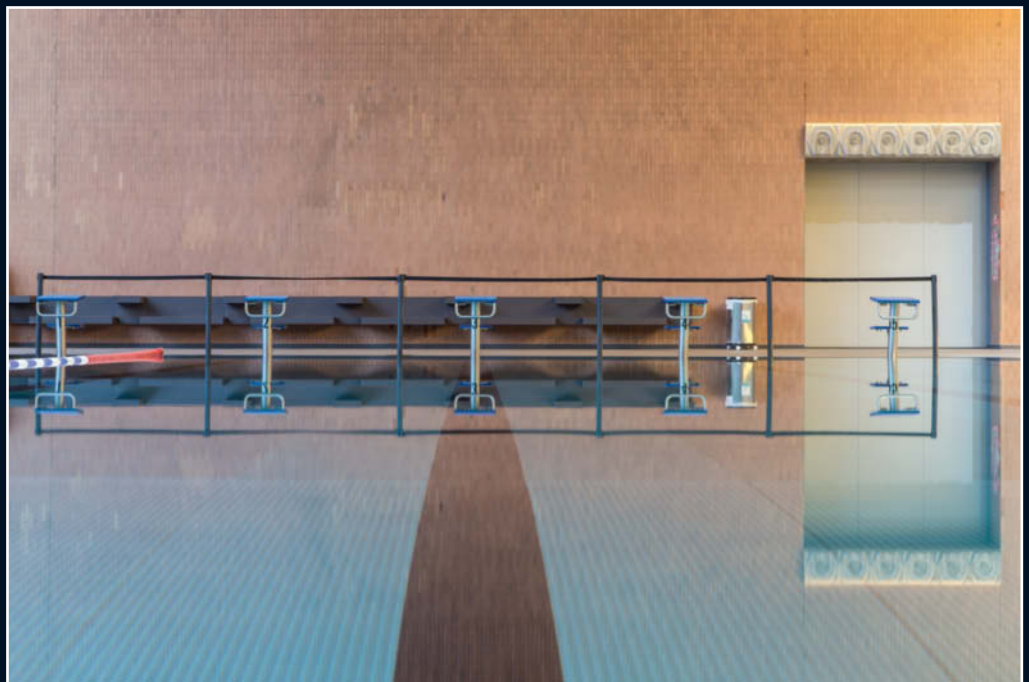
Giesing, Munich

Canon EOS 5D Mark II, EF 17-40mm f/4L USM |
17 mm | ISO 100 | f11 | 2s



The Mueller Public Swimming Pool
(‘Müller’sches Volksbad’), Munich

Canon EOS 5D Mark II, TS-E 17mm f/4L |
17 mm | ISO 100 | f11 | 1/3 s

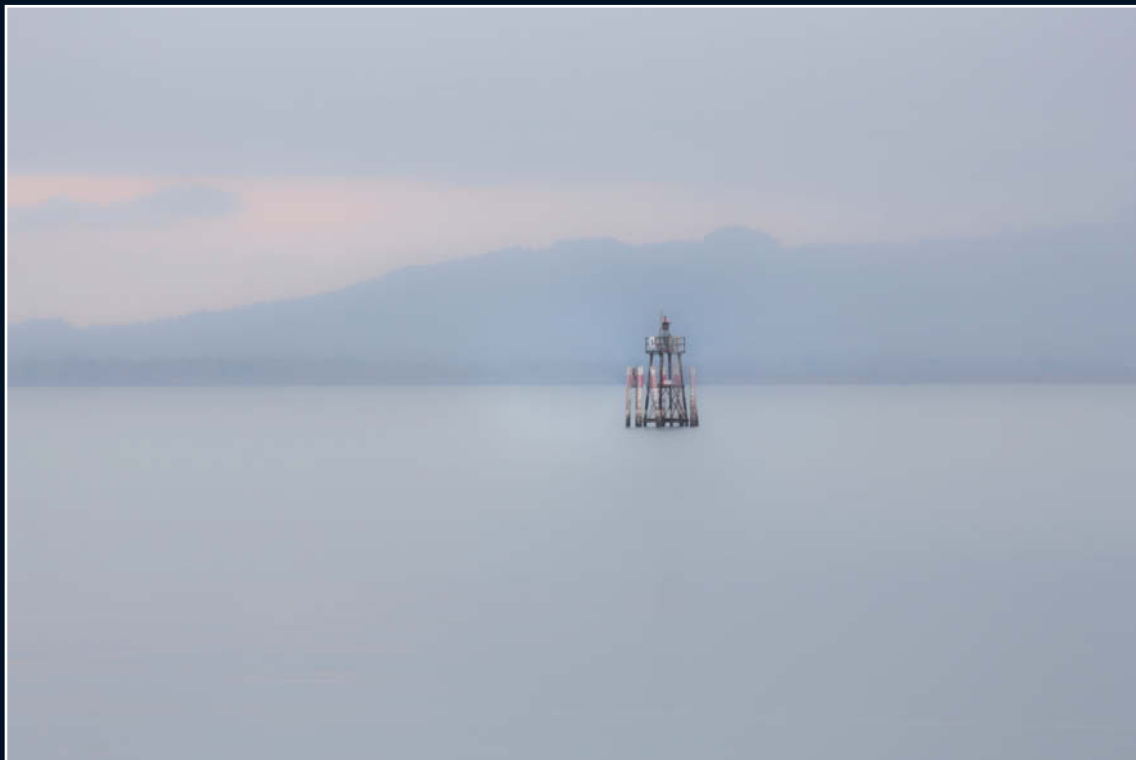


Suedbad, Munich

Canon EOS 6D, EF 24-105mm f/4L IS USM |
73 mm | ISO 100 | f11 | 6 s

Coal Mining

Canon EOS 6D,
EF 70-200mm f/4L IS USM |
111 mm | ISO 250 | f4 |
1/1600s



Lake Constance

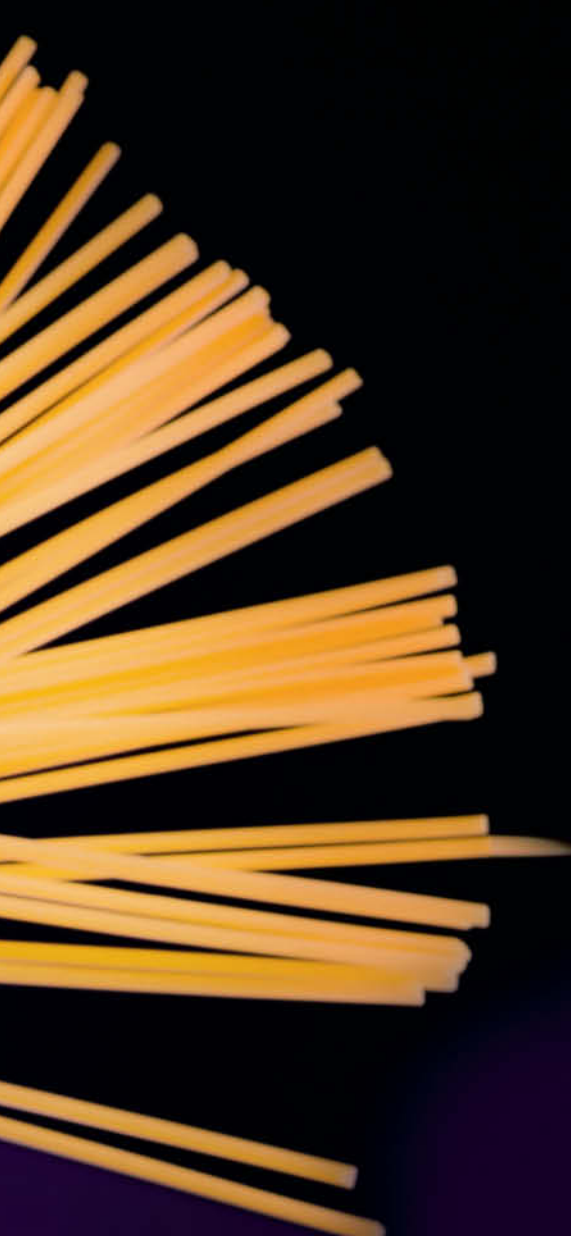
Canon EOS 6D, EF 70-200mm f/4L IS USM |
200 mm | ISO 250 | f4 | 1/200s

Royal – Purple Chairs

Canon EOS 6D, EF 24-105mm f/4L IS USM |
47 mm | ISO 100 | f8 | 13s







Peter Rees

Food Photography

The surge in popularity of cooking in recent years, accompanied by an explosion in the number of cookbooks, cooking blogs and cooking shows, has encouraged people of all ages to get into the kitchen. Many people photograph the results of their culinary efforts too, but unfortunately, most photos of food don't look very appetizing. Food photography presents special challenges all of its own, and this workshop by pro food photographer Peter Rees presents hands-on 'recipes' for great food photos that are sure to get people's mouths watering.

Because they don't really know how food photographers work, many people make false assumptions about how they achieve such mouth-watering effects. Varnish, hairspray and other chemicals are often assumed to be the secret to fresh-looking food photos, although this couldn't be further from the truth. Fresh ingredients and speed are the true keys to fabulous culinary photographs.

If you want to take great food photos, you'll need top-notch photographic and kitchen equipment, as well as a love of food (and eating!). As well as planning precisely how you want your shot to look and the aspect of the dish you wish to focus on, you also need to consider who your target audience is. And don't let too much technique get in the way of creativity – you can create great food shots using simple gear and basic props.

Choosing the Right Gear

People always ask which type or brand of camera I prefer to use. But of course there is no such thing as the perfect tool and choosing photo gear is often a highly emotional process, much like buying a car. The quality of a photo is only partly reliant on the type of gear used to capture it, and I use all sorts of different types of gear depending on the job at hand. The equipment you use has to be appropriate for the job you are working on. A smartphone camera is perfectly adequate in some situations,

but if I am shooting for a poster-sized advertising campaign, I often use medium or large-format cameras and digital backs

There is no particular type of lens that is better than any other for food photography. This is not really a technical issue and is usually much more a question of aesthetics. Wide-angle lenses with angles of view from 65 to 180 degrees are more often used for landscape and interior photography but can be effective for still life and food shots too.

Telephoto lenses compress perspective without altering the relative sizes of objects in a food photo too much. Using a telephoto lens set to a wide aperture is a great way to visually separate a food subject from its surroundings or differentiate between the various elements in an image.

Lighting

The most important light source for food photography is ambient or 'available' light. A well-composed food photo captured in early evening sunlight is quite magical and can easily produce 'vacation' feelings in the viewer.

Whether you shoot outdoors or near a window, there are countless food subjects that are perfect for capturing in natural light. Unfortunately, my studio isn't in Andalusia or some other sun-drenched location, so I often have to rely on studio lights. Available light has its downside too, as it is virtually impossible to accurately reproduce a naturally lit setup.



From top to bottom, these three shots of oranges were captured using a wide-angle lens set to f16 and a telephoto lens set to f16 and f8

Captured using a Phase One AF back with a 45mm lens (top) and a 150mm lens (center and bottom)



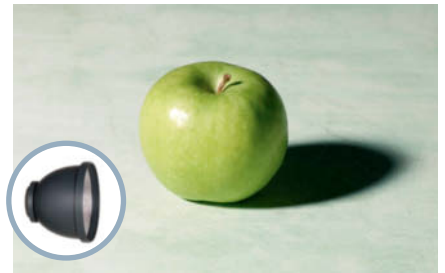
Using studio lights makes you independent of the quirks of natural light. You can plan exactly how you want an image to look and produce lighting effects that precisely suit a client's or your own ideas.

Producing natural-looking lighting is one of the first hurdles you will have to negotiate. If you get the combination of technique, composition and props right, your recipe shots will look really mouth-watering.

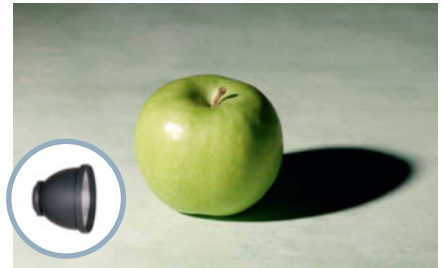
If you opt for studio lights, you have a choice between continuous or flash light. This is partly a matter of personal preference, but also depends on the type of shot you are working on. I recommend using flash if any part of your subject is likely to move during the exposure, as this is the simplest and most reliable way to prevent unwanted motion blur from spoiling a shot.

Studio flash is made up of either compact units with a built-in generator or larger, more

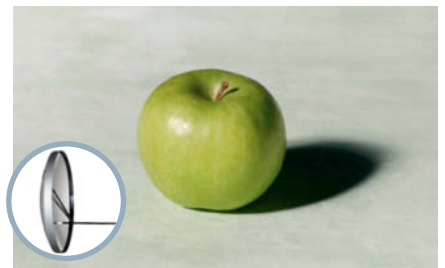
Different lights and light shapers can be used to produce a whole range of lighting moods, from 'soft' to 'hard'



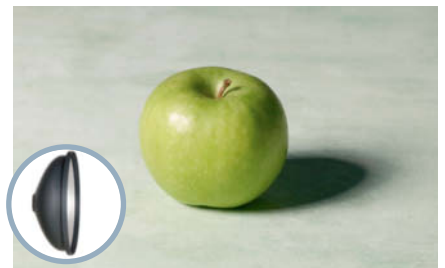
Studio flash with a standard reflector



Compact studio flash with a standard reflector



Studio flash with a wide parabolic reflector



Studio flash with a 'Softlight' reflector



The broncolor Siros is a typical compact studio flash kit

Image: broncolor

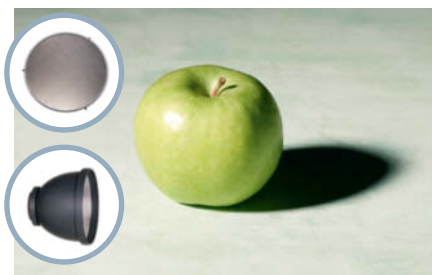
powerful systems with separate generators. A compact flash gun used either on- or off-camera is often sufficient for lighting smaller subjects (see the article on page 88 for more details).

An effective flash system needs to be modular so that you can combine the individual effects of the various reflectors, diffusers and other light shapers as required.

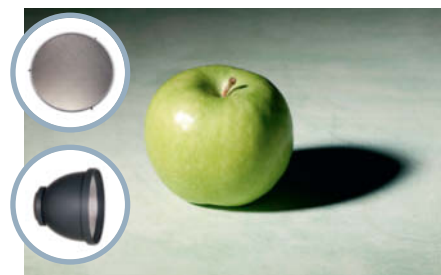
The photos of an apple shown above demonstrate the effects produced by different types of reflector. The differences



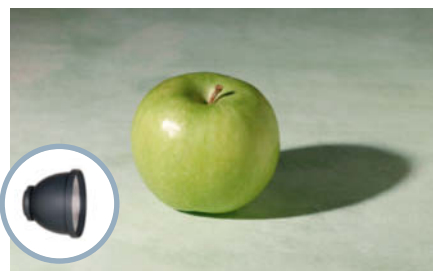
Studio flash with a standard reflector and an additional Styrofoam highlight



Studio flash with a standard reflector and a wide-gauge honeycomb grid



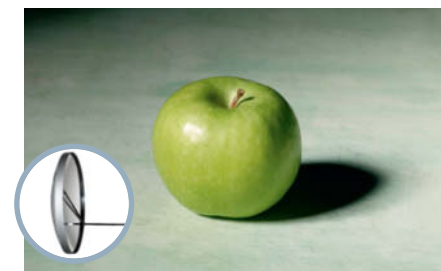
Studio flash with a standard reflector and a narrow honeycomb grid



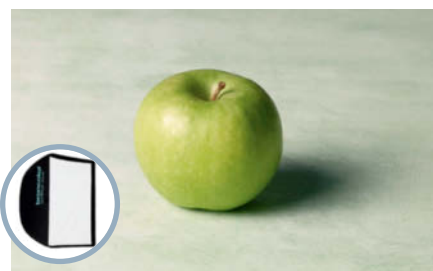
Compact studio flash with a standard reflector and an additional Styrofoam highlight



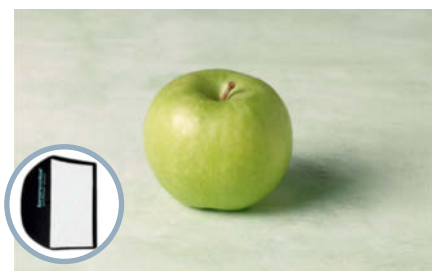
Compact studio flash with a narrow honeycomb grid



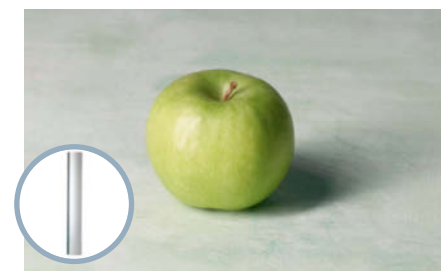
Studio flash with a narrow parabolic reflector



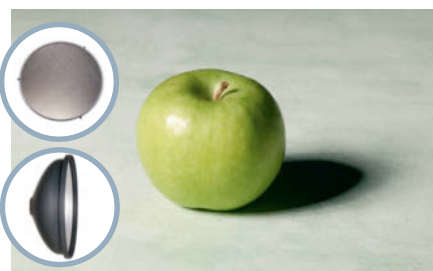
Studio flash with a softbox



Studio flash with a softbox and a highlight reflector



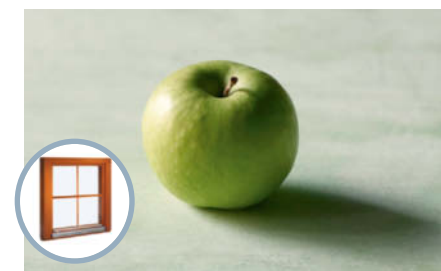
Vertical 'Lightbar'



Studio flash with a 'Softlight' reflector and a honeycomb grid



Studio flash with a 'Softlight' reflector, a honeycomb and an additional highlight reflector



Daylight from the side

are sometimes quite subtle but range from really 'soft' to quite harsh and contrasty. These basic effects can also be fine-tuned using additional Styrofoam highlight reflectors or honeycomb grids.

Styrofoam Reflectors

Styrofoam is one of the most important studio lighting accessories. You will often find that a single light and a couple of cleverly placed sheets of Styrofoam are all

you need to create an effective lighting setup. Using Styrofoam reflectors is a simple but effective way to control your main light and brighten unwanted shadows or selected subject details. The matte surface of Styrofoam reduces the strength of the light it reflects, producing a 'soft' lighting effect that reduces contrast in the details it illuminates. Mirrors or aluminum foil produce stronger, harsher reflections.

I also like to use diffusers made from tracing paper attached to a simple wooden

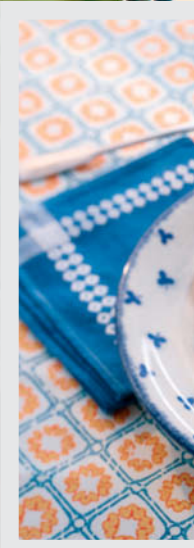
frame (see page 34), which can be positioned between the subject and the main light to soften the overall effect.

Light shapers and accessories can be combined with main lights in a virtually endless variety of ways. When you are starting out, it is a good idea to practice on a simple subject like the apple shown here to get a feel for the way different lighting effects work. You can then move on to combine individual effects in more complex experiments (see page 26 for tips on composition).

Kitchen and Props



My props room



Other Useful Bits and Pieces

As well as the essential camera gear, every food photography studio needs a well-equipped and fully functional kitchen not unlike the one you probably have at home. A studio kitchen should be as close as possible to the studio itself, as the appearance of freshly prepared food changes quickly and you need to be prepared to shoot fast once a dish is ready.

Effective food photography requires the use of countless props. Using the right crockery, glasses, cutlery and table accessories is essential if you want your food shots to look authentic. If you don't have the right props on hand, borrow or buy them.

The background, too, is an important element of every food photo. You can use a wooden table, a tablecloth, a chopping board, wrapping paper, all manner of textiles, wallpaper, metal and even stone as your background. In food photography, anything goes, so don't shy away from using an imperfect background that shows signs of use. 'Used' scenery adds authenticity.

Feel free to experiment and create your own props. Discarded wooden boards can be painted up in any number of colors, and plaster applied to a simple piece of plasterboard makes a great 'Mediterranean' background.

These traditional German curd cheese dumplings look perfect presented in appropriate surroundings. The 'tablecloth' is actually wallpaper from a DIY store.



Toothpicks, cotton buds, mounting putty, tweezers and eyedroppers are some of my important little helpers

The following is a list of just some of the useful things I often end up using on a shoot:

A **plant sprayer** filled with water or a mixture of water and glycerine

Mounting putty is an essential tool for positioning reflectors and small props in tricky places

Tweezers in a variety of sizes

Cotton buds for removing unwanted specks, smears and drops of moisture, which always appear at some point in a shoot

Dentists' instruments can often be found at flea markets and are perfect for fiddly positioning work

Eye dropper for adding water droplets and bubbles

Toothpicks and **sewing pins** to fix all sorts of things in place

Watercolor brushes for adjusting the flow of a sauce or moisturizing cuts in meat and vegetables

Makeup brushes for removing unwanted dust and crumbs

Syringes and **plastic bottles with spray nozzles** for applying sauce in just the right place

Water droplets stay put for longer on glass that has been treated with **car wax** or **clear varnish**

Wooden blocks of various shapes and sizes for supporting props and dishes and filling out empty space

Clothes pegs, office clips and **builder's clips** in a variety of sizes are always useful

Kitchen towels for drying surfaces and removing unwanted smears and droplets

Food coloring for altering the color of all sorts of things

A **spirit level** is essential for leveling the surface of liquids

Grayscale wedges for making manual white balance settings. This helps to prevent unwanted color casts in tricky lighting.



Slices of meat and salad garnish can be fixed in place using toothpicks

Composition

What makes one image attractive while another appears dull and uninteresting? Some images generate feelings and reactions in the viewer while others don't get noticed at all. Successful composition is the most important factor in getting an image noticed.

Creating a composition involves arranging the formal elements within the frame creatively to form an aesthetically pleasing whole. Photographic composition is not rocket science, and there are a number of basic rules that anyone can learn.

The most important aspects of photographic composition are the format of



Opposing diagonals

the image, points within the frame, shapes, lines, perspective and the way these all relate to one another. You will also need to consider the effects of color, contrast and sharpness.

Use of Lines

Used cleverly, lines can help to direct the viewer's gaze. Compositional lines can be vertical, horizontal or diagonal but don't have to be straight or precisely described. In fact, they can be curved or freeform, and tiny changes can completely alter the effect they have on the look of an image. Depending on its shape and position, a line can give very different emphasis to the portions of the frame that it separates.

Horizontal lines run more or less parallel to the top and bottom edges of the frame and often create a horizon, or at least the impression of one, while vertical lines tend to 'block' the view and make it more difficult to perceive the full depth of the subject. Horizontal and vertical lines generally produce calm, static-looking compositions.

Diagonals, on the other hand, produce tension and create an impression of movement. Appropriately positioned diagonals can be used to precisely direct the viewer's gaze to the most important place in the frame and are often used to change the way we see things. However, to avoid steering the viewer's gaze beyond the edge of the frame, it is essential to place a 'braking' element, such as an opposing diagonal or a change of color or brightness, at the end of a significant diagonal. Multiple lines form triangles, rectangles, squares and angles that can be used to make an image more vibrant and create a feeling of depth.

Spatial Relations

Humans always 'read' images in a specific direction, so certain elements in an image will always be perceived before others. The direction in which people 'read' images



The bowls of candy form an obvious line through the frame

depends on the cultural habits of the society they live in.

Those who read from top left to bottom right tend to view the top left-hand corner of an image first and only look further toward the center of the frame and on to the lower right-hand corner later. If these three points are connected, we once again find ourselves being influenced by a diagonal line.

These visual habits also give rise to the symbolism of direction, as seen in relation to the center of the frame. We automatically relate certain images to particular terms. In western cultures, for example, 'above' often relates to concepts such as heaven, freedom, brightness and light, while 'below' has connotations of earthiness, darkness, heaviness and perhaps a lack of liberty. 'Left' reminds of us of setting out, of distance and freedom, while 'right' symbolizes return, home and bonding.

Focus

Careful use of focus is a widely used compositional tool in food photography, and targeted use of sharpness and blur can create highly specific effects. An image that is sharp from the foreground to the farthest distance is highly informative and leaves nothing to the viewer's imagination. This type of image is perfect for commercial and technical images or for portraying the various phases of a movement. Selective focus, on the other hand, can be used to emphasize an object and separate it visually from its surroundings. A viewer will automatically look for the object with the sharpest focus in an image, and this technique is often used when illustrating cookbooks.

Motion blur is most often used to accentuate movement and is seldom part of a food photographer's repertoire.

Perspective

Altering the position of the camera enables us to alter perspective to suit the subject. A



head-on viewpoint places the viewer on the same level as the most distant point in the subject (i.e., the horizon), while a worm's-eye view shifts the horizon toward the top of the frame, making objects appear larger and more dreamlike. A bird's-eye view shifts the horizon downward so that viewers may feel they are falling.

The only way to alter perspective is by altering the camera position. Changing the lens doesn't work because a different focal length only alters the parts of the scene that the camera captures, although it can emphasize the effect of a particular perspective too – for example, by creating converging lines in a bird's-eye or worm's-eye view.

In the image below right, the bright colors of the bottles differentiate them strongly from the subtly-colored background, while the bird's-eye view forms a visual triangle that captures the viewer's gaze. Red, yellow and orange are 'warm' colors that contrast nicely with the cooler blue tones in the background. Only the bottle in the front is in sharp focus, so we automatically look at this one first before the other two and finally the other objects in the background. Our gaze follows a distinct line that is crossed only by the gaps between the boards the bottles are standing on.

Careful use of focus and opposing diagonals guides the viewer's eye into this shot

Using a bird's-eye view creates a visual triangle in this composition



Styling

Perfect styling is another essential component of successful food photos. Professional food photographers usually work in tandem with a food stylist, who needs to be a great cook as well as having a highly developed sense of visual aesthetics.

Food photography often involves unusual cooking techniques that go beyond what you would normally do when preparing a dish. However, there are no hard and fast rules for food styling and every food stylist has his or her own approach. The result is what matters, and the following sections are based on my own experience.

Buying Supplies and Preparing a Shoot

Styling a food shoot begins when you purchase the ingredients. It is essential to buy fresh, attractive-looking ingredients with a typical shape and without any bruises or blemishes. For example, a banana should be nicely curved and shouldn't have any marks on its skin. You can, of course, retouch minor blemishes digitally, although this usually involves more effort than acquiring blemish-free ingredients in the first place.

Make sure that you cut vegetables and meat carefully and evenly, but use different styles of cut for the various ingredients in a dish so viewers can easily identify them. The different cuts also help produce an attractive composition.

Overcooked food quickly loses its color and texture, so it is important to err on the safe side when preparing your dishes. Vegetables look best if you blanch them for

just a minute or two and then douse them in iced water. Green vegetables like broccoli and beans stay greener if you add a little baking soda to the water.

Because some foodstuffs quickly lose their freshly cooked look when served, it is important to work quickly. If you are working with peeled apples, pears or avocados, a little lemon juice applied to the fruit flesh can prevent it from going brown too quickly. But don't apply acid liquids to raw meat or fish, as this just turns them gray or even white.

Use water to keep the cut surfaces of vegetables and meat moist. The best way to do this is either with a bowl of water and a brush or using a plant sprayer.

Fruit and vegetable stalks dry out quickly too. Tomato stalks stay fresh if you remove them and put them in warm water until they are required. They absorb the water and look perfect if you pin them back onto the fruit shortly before you make your exposure. Small pieces of wet paper towel pressed gently onto strawberry stalks keep the stalks looking fresh until you need them.

'Serving' and Fine-tuning a Dish

Paper towels and mashed potatoes (or dumpling mixture) are two of the most widely-used accessories in food shoots. Paper towels are not only indispensable for cleaning and drying props, but also make perfect stuffing – a roast chicken stuffed with kitchen towels is guaranteed to keep its shape during a long shoot.

Mashed potatoes are also great for stuffing, shaping and propping up food. You can, of course, use normal mounting putty too, but this tends to produce an ugly gray shimmer in light-colored or semi-transparent foods such as crêpes. You can also use mashed potatoes to fill the space in a hotpot – this way you don't have to prepare so much of the actual dish for each shot, and larger ingredients are less likely to sink out of sight.

The same technique works with any type of deep bowl or dish, but here too, care is required. Mashed potatoes dry out fairly quickly and begin to exude starch, which would completely spoil the look of a soup or clear sauce. The trick with soups and sauces is to use a cooled layer of gelatin as a base. If you use this approach, take care to use only lukewarm soup, otherwise the gelatin will melt.

Painted Details

Once your scene is set up, you are sure to find that there are some details that don't quite have the right color. At this stage, fashion photographers call the makeup artist, whereas food photographers get out their paints and brushes. Most of the required colors can be mixed from food coloring and water or edible oil. The edges of cuts of meat, gratins and fries often lack definition, so painting in a little extra 'crispiness' is the answer. The edges of a pizza base or soft cheese also benefit from this type of treatment. 'Painting' works for larger objects too. The skin of poultry, for



Removing the stalk from a tomato and putting it in warm water keeps it looking fresh until you need it



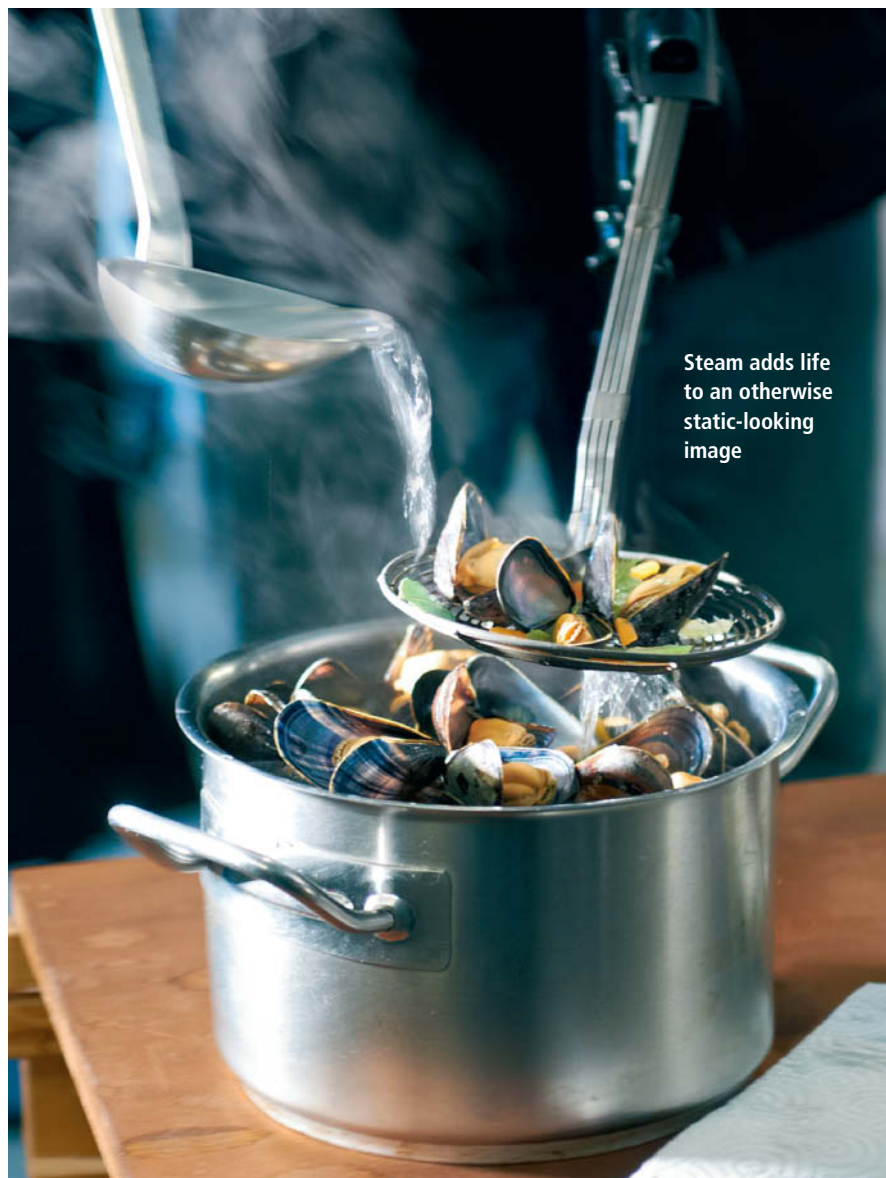
Covering strawberry stalks with damp kitchen towels keeps them green and fresh-looking

example, often looks quite unattractive when cooked. To prevent this from happening, first stuff your bird with kitchen towels or dumpling mixture and then paint its entire surface with a mixture of oil and herbs. Then cook it for a short time at a lower temperature than the recipe suggests, so that the skin looks cooked but not shriveled. The next step involves painting on a layer of a yellowy mixture of turmeric and chili powder mixed with water or oil before adding a layer of cayenne pepper mixed with paprika and a little turmeric and cinnamon. This final layer provides a natural-looking brown color with the random flecks that 'real' cooking produces.

Solutions such as this are, however, an exception to the rule and aren't usually part of a food photographer's everyday workflow. The more carefully you prepare a dish for a shoot, the less you will have to touch up the details later.



We painted the edges of these potato wedges to enhance their crispy look



Steam adds life to an otherwise static-looking image

Steam

Steam effects can be produced in a number of ways, most of which involve making existing steam visible. The most important thing to remember is that steam is most effective and easiest to capture if photographed against a dark background. Using a 'hard' backlight such as a focused spot aimed directly at the steam combined with a short exposure time also helps to accentuate the effect.

If a shot doesn't contain enough steam of its own, you can produce an appropriate effect using a kettle, cigarette smoke, metallic crystal 'steam chips', dry ice, a blown-out candle, an ultrasonic nebuliser, a fog machine or *Photoshop*. Each of these techniques has its own particular quirks: cigarette smoke has a blue tone, while steam chips can be quite expensive, not to mention dangerous, so be sure to follow the instructions carefully if you do decide to use them.

I usually try to enhance the look of the steam produced by the dish itself. For the mussel recipe illustrated on page 32, I poured almost boiling water from a separate pan over the mussels. Because it is impossible to control how steam behaves, I usually repeat this kind of shot several times until I get one or two results I am happy with. I then touch up any final details digitally. Now we have covered the theory, I hope you have fun trying out my photo 'recipes'!

(pen)

Salad

A minimalist approach often produces impressive photographic results.

The key to this shot is its simplicity, and the lighting owes its effectiveness to the strong patterns and colors in the subject itself.

Food photography seldom requires a large studio and complex equipment, and in this shot I used just one light to illuminate the ingredients from behind. But there is still one critical factor that helped make this shot so effective ...

Ingredients

Food

Iceberg lettuce
Oak-leaf lettuce
Tomatoes
Onions
A lemon
Flat-leaf parsley

Props

1 sheet of Plexiglas (approx. 20×20 inches)

Photography

Medium-format camera with digital back and 150mm short telephoto lens set to ISO 50 and f16
1 studio flash with a small softbox
Plant sprayer
Tweezers
Nail scissors
Black card

Getting Ready

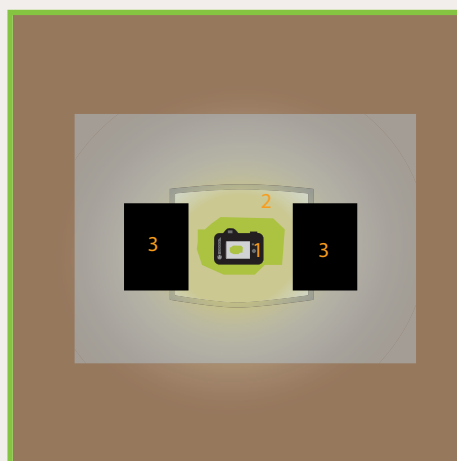
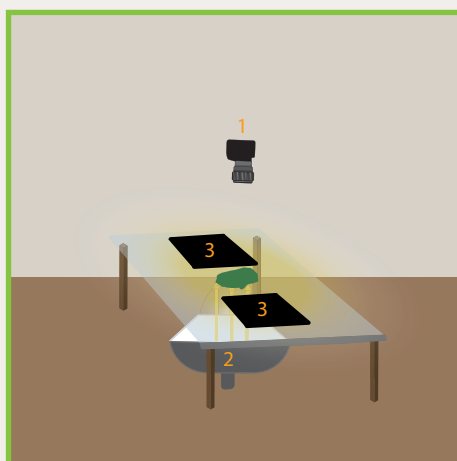
I arranged the ingredients on the Plexiglas sheet and lit them from below. The ingredients all have different degrees of translucency, so it was important to cut appropriately thin slices of lemon and tomato. I began by setting the flash to produce even lighting in the salad leaves with good detail definition throughout the frame. If the tomato in a shot like this appears too dark but everything else looks right, you will have to cut thinner slices.

The trick I used to ensure that the lemon had a natural-looking color and the tomato retained its deep red tone was to cut away the salad leaves beneath them using the nail scissors. If I hadn't done this, the colors would have looked muddy and not sufficiently translucent.



The Setup (viewed from the side)

1. Camera
2. A standard studio flash fitted with a small softbox located about 15 inches below the Plexiglas 'table'
3. The black card is arranged around the setup to prevent stray light from spoiling the overall effect. This is important but not crucial in a purely backlit shot like this one.



Rhine-Style Blue Mussels

This shot is designed to get your mouth watering with a recipe local to my region, where it is said that months with an 'r' in their name are the best for eating mussels.

My plan was to produce a simple, eye-catching image rather than an everyday cookbook-style photo. To keep things interesting, I decided to jazz things up with a real-life steam effect.

Ingredients

Food

5 lb washed blue mussels
1 carrot
1/2 bunch of celery
1 small leek
1 onion
2 cloves of garlic
Pepper
1 bay leaf
Thyme
Parsley
750 ml white wine (or water)

Props

Stainless steel pan
Skimming ladle

Photography

Medium-format camera with digital back and 150mm short telephoto lens set to ISO 50 and f16
1 standard studio flash with a spot reflector and a honeycomb grid
1 large Styrofoam reflector
1 matte silver highlight reflector card
2 sheets of white letter paper
Black card or cloth for the background
Tripod for fixing the ladle in place
Cotton buds for removing unwanted water droplets
Kitchen towels
Small electric cooking ring
A pan of boiling water
Soup ladle
Small stainless bowl and/or wooden blocks
Dessert plate

The Recipe

- Wash the mussels thoroughly and remove any remaining hairs
- Dice the onion and garlic, chop the carrot into strips and slice the leek and celery
- Steam the vegetables for about a minute then add the mussels, spices and the bay leaf
- Add the wine
- Simmer at medium heat for eight minutes. Remove the mussels and put them in a bowl of cold water. Select the best-looking mussels and put them aside. If you want to eat the mussels when you're done, keep them warm, add some salt and pepper to the wine sauce and then reduce it a little. This dish is perfect served with French bread.

The Studio Setup and the Shoot

Because only the top of the pot and the ladle are visible in the final shot (and to avoid wasting mussels), we filled most of the space in the pot with a smaller pot (you can use wooden blocks too), placed a small dessert plate on top to give us a level working surface and arranged the less attractive mussels on the plate.

I then fixed the ladle in place a few centimeters above the pot. The setup wasn't really finished yet, but the basics were in place and we could begin to set up the lighting and the camera.

We then placed the best-looking mussels on top of the pot and in the ladle before arranging the vegetables on top of these. The whole thing was designed to look as if the hot mussels had just been ladled from the pot, so the only thing missing was the steam.

Full Steam Ahead!

I prepared a small pot of boiling water just out of view and used a soup ladle to pour this over the mussels just prior to releasing the shutter.

I had to take care not to jog the mussels or the vegetables with the boiling water. Two ladles of water were enough and I got my assistant to release the shutter while I poured.

Because steam constantly changes its form, you should repeat this kind of process often enough to be sure of getting several really good images. We ended up with about 100 shots to choose from.

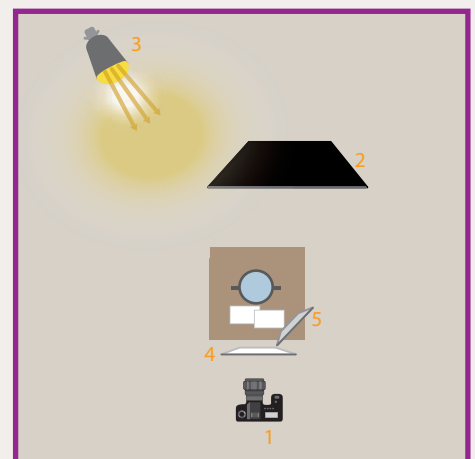
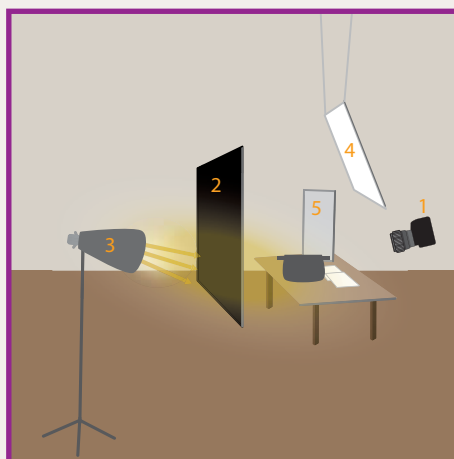
My tip:

Mussels that are already open before you cook them and those that remain closed after cooking are inedible and belong in the trash



The Studio Setup from the Side and Above

1. The camera is positioned at a very shallow angle about 20 inches from the subject
2. A black cloth hung about three feet behind the subject ensures that the steam is visible in the final shot
3. The main light is a narrow spot located about 10 feet from the subject and fitted with a honeycomb grid set up to provide a 'hard' backlight that perfectly illuminates the steam
4. The Styrofoam reflector is positioned above the camera to provide a soft fill light
5. The matte silver reflector is positioned next to the setup to the right of the camera and the two sheets of paper are positioned in front of the pot to provide an additional fill light and a subtle highlight on the side of the pot.



Rhubarb Mascarpone

For this shot of a summer dessert, I used my main light to produce an impression of diffuse sunlight playing on the subject and the background

Ingredients

Food

6 rhubarb stalks
1 organic orange
7 oz sugar
10 oz mascarpone
3 dessert spoons of Grand Marnier

Props

1 glass
1 napkin
Painted wooden slats
Palmiers (puff pastry treats)

Photography

Medium-format camera with digital back and 80mm lens set to ISO 50 and f11

1 'Pulso' spot with a warm filter gel
1 large hanging diffuser
1 standard studio flash with a 'Softlight' reflector and a pale blue filter gel
3 x 3' wooden frame covered with tracing paper
1 standard studio flash with a softbox
1 matte silver highlight reflector
Box cutter
Tweezers
Cotton buds
Kitchen towels

My tip:

Cook the rhubarb for less time than you normally would to keep it from getting too soft. Soft rhubarb may taste better, but is useless for styling!

The Recipe

- Wash the rhubarb, remove any remaining fibers and cut it into one-inch chunks
- Wash the orange and grate the peel
- Boil half the sugar in 7 oz (200 ml) of water
- Add the rhubarb and grated orange peel to the sugar water, put the lid on and cook for two minutes
- Remove the rhubarb from the heat when it begins to go soft, transfer it to a bowl and put it aside to cool
- Use an egg whisk to mix the mascarpone with the rest of the sugar and add Grand Marnier to taste
- Mix the rhubarb with the mascarpone

The Studio Setup and the Shoot

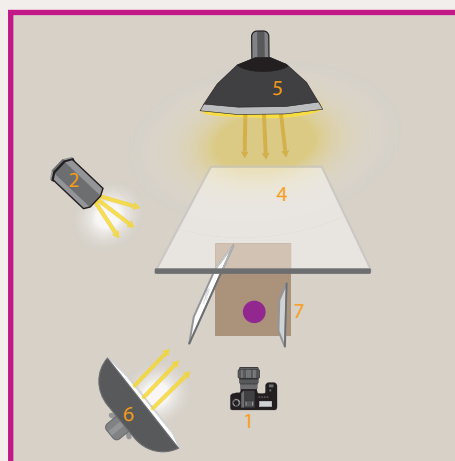
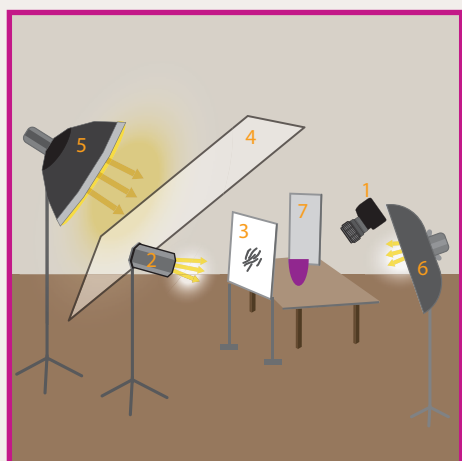
The usual way to create a dappled lighting effect is to use either a follow spot or a normal light fitted with a gobo projector.

A simpler (and cheaper) way to create a similar effect is using a home-made diffuser like the one we built using a three-foot square wooden frame covered with tracing paper. Positioned between a 'hard' primary light and the subject, such a diffuser softens the light reaching the subject. To create a dappled effect, all you have to do is cut some random slits and holes in the tracing paper using a box cutter. You can then vary the effect of these by rotating the lamp's reflector and/or adjusting the distance between the light source and the diffuser. This is a simple but really effective way to simulate the effect of summer sunshine.



The Studio Setup from the Side and Above

1. Camera
2. The 'Pulso' spot (our main light) is fitted with a warm-colored filter gel and positioned to the left of and slightly behind the subject
3. Our home-made diffuser with its slits and cuts is positioned between the main light and the subject. This softens the overall effect and provides a dappled 'summery' effect
4. The large diffuser (a frame covered with translucent foil) is mounted diagonally above the setup
5. A standard studio flash with a 'Softlight' reflector and a pale blue filter gel is set up as a backlight about 15 inches behind the large diffuser
6. A softbox is positioned to the left of the camera to serve as a fill light
7. The matte silver highlight reflector is located to the right of the subject and reflects the main light onto the subject



Beer

To finish, let's have a go at a refreshing bottle of cold Pilsener beer. There are lots of ways (including using chemical additives) to get beer looking good in a photo, but for this shot, we didn't cheat at all and the beer you can see in the photo is guaranteed to adhere to the strict tenets of the German beer purity law. As ever, whichever approach you take, it's the result that counts. Cheers!

Ingredients

Food

A bottle of Pilsener beer

Props

Beer glasses

Backup bottles of beer

A sheet of brushed metal

Photography

Medium-format camera with digital back and 150mm short telephoto lens set to ISO 50 and f16

1 standard studio flash with a spot reflector

1 standard studio flash with a 'Softlight' reflector and deep yellow filter gel

1 large hanging diffuser

1 striplight

1 'HazyLight' softbox

1 projector spot or a standard studio light with a projector attachment

Black card

Styrofoam reflectors

Aquarium tubing

Soup spoon

Car wax

Plant sprayer

Bottle opener

Kitchen towels

The Studio Setup and the Shoot

The most important step for a shoot like this is to apply car wax to the glasses before you start.

Prepare plenty of bottles of (uncooled) beer, the bottle opener, the tubing, the spoon, the plant spray and your kitchen towels and place them close to your setup.

Use a mixture of water and a little glycerin and the plant sprayer to add water droplets wherever you need them (in our case, on the glass and in the background).

Carefully open a bottle of beer and pour it slowly into the glass until the foam head forms. If necessary, use the spoon to model the foam to your taste. If things don't work out on your first attempt (and they usually don't), use the tube to suck out a little beer and then pour more fresh beer into the glass. If you don't get the effect you are looking for after two or three attempts, you will usually need to start over using a fresh glass.

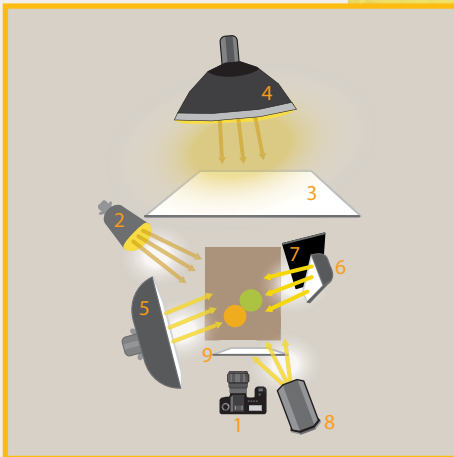
With practice and a little patience, you are sure to get great-looking results.

The Studio Setup from the Side and Above

1. Camera
2. The standard flash with its spot reflector is set up as a backlight on the left-hand side
3. The large diffuser is positioned about three feet behind the subject
4. The flash with the 'Softlight' reflector and the deep yellow filter gel is positioned about six feet behind the large diffuser and produces a wonderful golden gradient in the background
5. The 'HazyLight' is positioned to the left of the subject and provides a subtle fill light
6. The vertical striplight is placed to the right and produces a nice strong accent on the bottle and the glass
7. A long, thin piece of black card prevents stray light from the striplight from spoiling the background effect
8. The projector spot is positioned above and to the right of the camera to produce a natural-looking dappled effect, which you can see clearly in the label on the bottle
9. The Styrofoam reflector is positioned above the camera to provide fill light and some subtle accents in the label on the bottle

My tip:

Make sure that you position the camera so that the viewer cannot see up into the foam head on the beer



An Interview with Peter Rees

Peter Rees has worked as a pro food photographer for more than 20 years. He has his own studio near Cologne and works regularly for major clients in the frozen food, dairy product and beer sectors.

In this interview, he tells us about the challenges involved in photographing food, the pitfalls for newcomers and why it is not always a good idea to eat what you shoot!

c't Digital Photography: How did you get into photography?

Peter Rees: Two friends of mine who were both Nikon FM fans 'infected' me with the photo bug when I was about 18, and my own first SLR was a Nikon FM too. During my military service, I decided to train as a photographer instead of studying engineering as I had originally intended. During my apprenticeship I came across two books by internationally renowned food photographer Arnold Zabert that influenced me a great deal, called *Baking: Cakes, Cookies, Breads, Pastries* and *The Art of Cooking: Preparing and Presenting Fine Food*. Once I had finished my training I worked as an assistant to Arnold Zabert and later for Christian Teubner. I began my freelance career in 1994 and moved to my new studio in Brühl (near Cologne) in 2013.

c't: What are the most stressful moments during a shoot?

Rees: The problem with photographing food is that it changes its appearance all the time. For example, sauces often flow too quickly off a cut of meat and form a skin when they cool down. Constructing and capturing just the right moment when everything looks really appetizing can be a real challenge.

c't: Do you have favorite subjects?

Rees: Not really. My work is seasonal and follows a similar pattern every year. The asparagus and strawberry seasons come at the same time and Christmas-themed jobs start appearing in September or October. Champagne shoots have to be in the bag



Food photographer Peter Rees

in time for new year and in the time running up to Mardi Gras, my clients are all busy making up recipes for curing hangovers.

c't: How carefully do you plan your shoots?

Rees: The logistics of preparing and dismantling a job are just as important as the photography itself and have to be thoroughly planned in advance.

c't: Has your work changed your attitude to food?

Rees: During a shoot, food is simply a prop and a means to an end. In private, I pay a lot of attention to the quality of the food I eat.

c't: Are the dishes you photograph edible once the shoot is over?

Rees: Theoretically yes, in about 75 per cent of cases, but who really wants to eat something that has been standing around for a while and has been thoroughly 'handled'?

c't: You recently moved to a new studio. What are the differences between food photography and portrait studios?

Rees: Instead of a makeup room, I have a fully functional kitchen with a large cooker, deep freeze and fridge. I also have a huge selection of crockery, glasses, tablecloths, napkins, wood and stone backgrounds and other props that I have collected over the years.

c't: How many people do you have in your team for a complex food shoot?

Rees: I usually work with a stylist and an assistant, and the client is often there too. Sometimes I have a second stylist on hand to help me with the preparations.

c't: What tips would you give someone who is just starting out as a food photographer?

Rees: Start by shooting in daylight. This keeps things simple, even if daylight situations are more difficult to reproduce. And try not to shoot subjects that you know you will want to eat.

c't: Do food photographers and stylists have their own personal tricks and techniques that they never reveal to anyone else?

Rees: Of course! That's how we keep ahead of the game. The workshops on the previous pages and my books provide plenty of tips on how to create appetizing food photos. Photography is a creative process and I can only ever nudge people in the right direction. It is up to my readers to use their imagination to build on these basic ideas. Articles like this one also provide a glimpse behind the scenes and help to clear up some of the myths surrounding food photography. Many outsiders still think that we drench our subjects in hairspray or varnish to get them looking good, whereas the truth is that a good photographer depends on fresh ingredients, a great team and working quickly at the crucial moment – if you are skilled enough, you don't need chemicals.

Interview by Sebastian Arackal. (sea)



Get Trained by the Pros

World's biggest WebTV about Photography: >500 videos online!



Videotrainings with Pro-Photographers

Expert teachers share tips and tricks in online video courses.

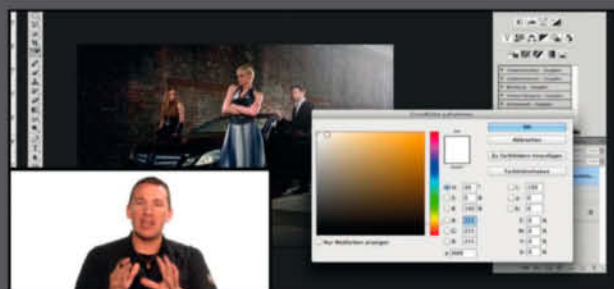


Image editing tutorials

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.

Sophia Zimmermann

Inside Our **Cover Shoot**

We produce the cover images for *c't Digital Photography* in-house. This always involves a lot of effort and artistic input, but this issue's shot, with its fast-wilting vegetables and fragile pasta, presented the biggest challenge yet. Read on to find out how the team approached this highly unusual job.



Inspiration and a Macaroni Halo

We wanted to make this issue's food photography workshop our cover theme and art director Thomas Saur refused to fill the brief using a simple still life – he had much bigger ideas. His concept was based on traditional sacral images and involved covering our model's head with a multi-colored bouquet of edible ingredients, crowned with an 'aura' made of macaroni.



Initial Sketches

Thomas began by making sketches of his ideas. The complex nature of the ingredients themselves meant that the basic concept had to be as simple and graphic as possible. He also had to leave space for the headlines that are added to the image later on. Once he was happy with his drawings, Thomas presented them to stylist Mareike Hildebrand.



Pasta Patterns

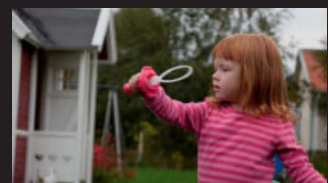
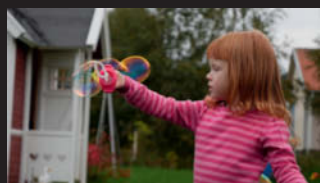
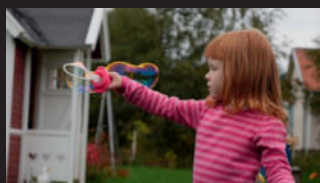
Mareike then headed off to the supermarket and got a lot of strange looks as she held various different types of pasta up to her head! She ended up buying more than 15 lb of ingredients. Back in the studio, Thomas and Mareike began to create a range of pasta patterns, and arranged the rest of the vegetables and pasta shapes on a dummy head using a rubber cap as a base. They ended up with a selection of different looks that they then used to make some test shots. The macaroni 'aura' was thoroughly tested too and, because it was quite fragile, Mareike decided to create the final version on the day of the shoot itself.



The Shoot

During the shoot, Thomas took test shots of a number of different setups before deciding on the final look that you can see on this issue's cover. The photos were captured using a Hasselblad H4D-40 with a 100mm f/2.2 HC lens. While Thomas was making his test shots, Mareike put together the 'aura' and mounted it on a tripod positioned behind the model's head. The other ingredients, too, were only put together once everything was set up. The radicchio leaves were particularly uncooperative and wilted much too quickly. Although pro food photographer Peter Rees prefers to shoot without using hairspray (see his workshop on page 20), we had to break this rule to keep the radicchio and other ingredients looking fresh. Although the final 'hat' weighed only 1 lb and the 'aura' another 1 lb on top of that, Mareike used a total of 8 lb of vegetables and pasta in the course of the shoot.

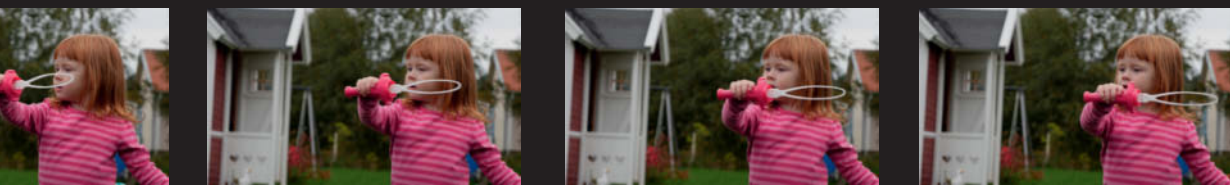




Sascha Steinhoff, Martin Wallgren

How to extract stills from a **4K Video Stream**

Growing numbers of digital cameras can capture 4K video in which each frame is equivalent to an 8-megapixel photo. Some photographers see this as an extension of their medium while others see it as the beginning of the end of stills photography. This article explains the basics of 4K video capture and shows you how to extract photographic gems from your video streams.



4K video: Martin Wallgren

Introduced in 2012, Canon's EOS-1D C was the first widely available camera that came with built-in 4K video capture functionality, although its prohibitive price of around \$12,000 (for the body only) ensured that it didn't find many takers. Since then, technological development has followed its usual course, and 4K video is now available in cameras that cost as little as \$900 – although you can still spend a five-figure sum on one if you want. Nikon and Canon have yet to join the fray and have left Samsung (with the NX1), Panasonic (with the DMC-GH4 and the LX100) and Sony (with the a7S) to lead the way.

Although there are still few 4K monitors available, the format has gained popularity with videographers who use it to shoot raw material for output in Full HD. 4K footage

offers you unparalleled flexibility when it comes to cropping and losslessly enlarging details within the frame. Even if you don't crop at all, scaling 4K footage to fit a Full HD frame provides much better image quality than conventional Full HD.

Every unprocessed 4K frame is equivalent to an 8-megapixel photo. 'Real' 4K video frames measure 4096×2160 pixels, which is sufficient to produce frame-filling clips on the latest monitors, or 14×7-inch prints at 300 dpi. UHD frames are only slightly smaller, measuring 3840×2160 pixels. Although the UHD and 4K formats are precisely defined, '4K' is often incorrectly used as an umbrella term for both. With its potential to enhance or even completely change the way photographers approach shooting, the technology is the

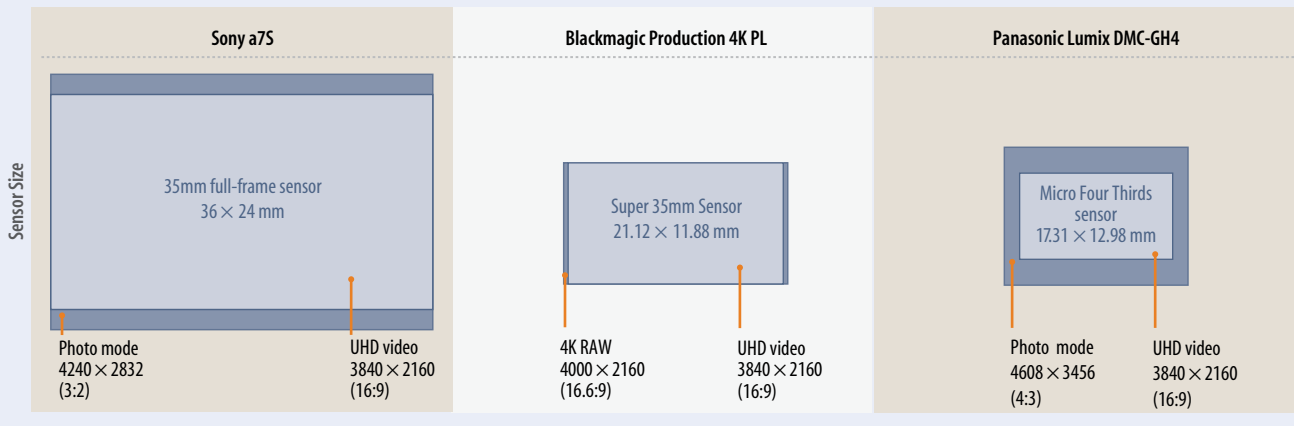
subject of hot debate in countless online forums. Just how good are stills taken from 4K video? When does it make sense to use this technique? What do you need to know about video compression? The following pages answer all these questions and more, so that you can decide for yourself.

Capturing Precious Moments

The greatest advantage of using stills taken from video footage is having the ability to capture fleeting moments that would otherwise remain elusive. The art of great photography lies in releasing the shutter at precisely the right moment, and burst shooting greatly increases your chances of success. The downside of burst shooting is the amount of

Sensor Sizes and 4K Video Formats

The Sony a7S uses the entire width of the sensor when capturing UHD video and interpolates the resulting signals to fit the format. Panasonic uses a different approach that records footage pixel for pixel. Professional video cameras such as the Blackmagic Production 4K PL have comparatively small sensors.



noise a mechanical shutter creates when working at high speeds and the relatively low shooting rates that current technology provides. A pro-grade camera like the Canon EOS-1D C has a maximum rate of 14 frames per second (fps), while mid-range models like the Nikon D7100 manage 'only' 7 fps, which is still very good for this class of camera. These frame rates are slow compared with normal video capture rates of 24 or 30fps. Some cameras have special shooting modes that use an electronic shutter to reduce noise and increase frame rates (see *Keeping It Quiet* on page 88 of issue 17 for more details). For example, the Panasonic Lumix DMC-GH4 has a maximum frame rate of 12 fps in high speed (mechanical) mode but manages 40fps when used in 'super high speed' (electronic) mode. However, because camera firmware cannot handle such large amounts of data fast enough, a camera like the DMC-GH4 has to take a break every 40 RAW (or 120 JPEG) frames, making the maximum possible clip length somewhere between one and three seconds. This is obviously not a realistic alternative to 4K video.

Shooting Video instead of Photos

Dedicated video modes are designed to shoot noiselessly for long periods without a break. Remember that a video stream is nothing more than a continuous sequence of individual frames. 4K video is usually captured at between 24 and 30fps and each frame has a resolution of around 8 megapixels. Most modern camera sensors have much higher resolution than this, so shooting video wastes a lot of potential sharpness. As an example, in 4K video mode, the resolution of the Lumix DMC-GH4 is halved from its nominal 16 megapixels. The Sony a7S has a nominal sensor resolution of 12

megapixels, so the loss of image area is less pronounced. However, for most applications, the quality of the captured footage is more important than its absolute size.

The 4K Crop Factor

Most 4K-capable cameras capture video using only a portion of the available sensor surface area, so you have to add a secondary crop factor to your calculations when shooting. Panasonic uses a technique that records directly cropped 4K video (i.e., pixel for pixel), so the size of the resulting frames matches the area of the sensor used to capture them. Although this means you don't necessarily have to scale your clips, it also alters the effective focal length of the lens.

Let's look at an example. In photo mode, the Panasonic Micro Four Thirds sensor has a crop factor of 2 compared with a full-frame sensor. Using a 14-140mm (28-280mm full-frame equivalent) lens, the Panasonic's 4K video mode adds an additional crop factor of 1.3, resulting in an effective 4K video crop factor of $2 \times 1.3 = 2.6$, transforming the zoom range of the lens into the equivalent of 36.6-364mm. This is, of course, not particularly useful for wide-angle shots. The smaller effective sensor size also produces greater depth of field in 4K mode.

Unlike Panasonic, Sony and Samsung use the entire sensor width when capturing 4K video, so you don't have to account for an additional crop factor. The downside of this approach is that the signals captured by the sensor have to be scaled to fit the video format, which puts extra strain on the camera's processor and reduces the quality of the resulting footage.

In HD mode, most current cameras use the entire width of the sensor and scale the video

signals they capture. For a table of reference 4K crop factors, see page 53.

The Advantages of Full-frame

The greatest advantage of using a stills camera rather than a video camera to shoot video footage is that the stills camera has a larger sensor. Although analog still and movie cameras use the same 35mm film stock, it is transported vertically through a movie camera rather than horizontally the way it is in a still camera, resulting in movie frames that measure 18×24 mm compared with the full 24×36 mm dimensions of an equivalent photo, which is why full-frame digital cameras are popular among digital movie makers as an alternative to pro-grade video cameras. Video capture that utilizes the entire surface area of a full-frame sensor has correspondingly shallow depth of field, allowing you to enhance the look of your clips with photo-style depth-of-field effects that camcorders simply cannot achieve. The Sony a7S is the only full-frame stills camera currently available that is 4K-capable. The others, including the Canon EOS 5D Mark III, can capture 'only' HD video.

Conclusions

The huge amount of image data that 4K captures is a boon to photographers and video-makers alike. However, photos are viewed for a lot longer than a single video frame, and many of the compromises involved in processing sequences of high-speed video frames are all too obvious when you view a single frame for more than a split second. The following pages explain the steps you can take to optimize the quality of stills extracted from 4K video.

Choosing the Right 4K Hardware

Shooting 4K video requires a lot of resources and the market has responded with a slew of products designed to improve the quality of the footage you capture. Even if you don't need a full 4K video rig to capture and extract 4K stills, a high-end camera on its own won't get you very far. The following sections look at some of the myths and realities of 4K capture.

The 'Dr. House' Myth

DSLR and mirrorless system camera can now capture such high-quality footage that they are often used to shoot film intended for broadcast. Video-capable stills cameras have all but replaced camcorders in the advertising and documentary fields, and it is surely only a matter of time before 4K-capable cameras such as the Sony a7S and the Samsung NX1 begin to play a significant role in mainstream film production. In 2010, an entire episode of the hit TV series 'Dr. House' was shot in Full HD using a Canon EOS 5D Mark II. Producer/Director Greg Yaitanes publicized his then unusual choice of camera via his Twitter stream and, unusually for a busy Hollywood executive, even offered to answer technical questions on his work. This was manna from heaven for Canon, and shifted the spotlight squarely onto its brand-new HD video capture technology. The Twitter images also suggested that pro-grade footage could be captured using little more than the camera and a tripod.

This optimistic view of things was highly tempting to video newbies and, because ever-increasing pixel counts had long since ceased to serve as a selling point for new cameras, improved video functionality became a good reason to consider an upgrade. What the camera manufacturers didn't let on was that shooting high-quality video using a DSLR involves a lot of effort and subsidiary gear, and that the camera itself is often one of the cheaper parts of the setup.

The Effort Involved in Video Capture

On a professional shoot, the camera all but disappears beneath a whole raft of add-ons and accessories. You need a heavyweight, oil-damped tripod to capture smooth pans, and a conventional photo tripod simply cannot compete with the stiffness and dependability of a purpose-built movie tripod. 'Handheld' video shots are usually made with the help of bulky, expensive rigs or Steadicams that eliminate the inevitable camera shake that is the result of genuine handheld shooting.

Serious movie-makers rarely rely on autofocus, although smooth manual focus and silent, stepless aperture rings are usually the preserve of purpose-built movie lenses rather than the conventional stills lenses built for use with DSLRs. Shooting video with stills

lenses always involves compromise and a camera's built-in monitor isn't large enough to enable the precise focusing necessary for shooting 4K footage. A large bolt-on monitor is essential, as is a geared 'follow focus' device that enables you to produce smooth transitions between scenes without unwanted jumps in focus.

Built-in microphones cannot handle the task either, so you will need to invest in a high-quality microphone and a separate sound recorder. Capturing decent sound is a complex business, especially on location when wind and other extraneous sounds conspire to ruin every take. Subsidiary lighting is usually required as well, so a video team often comprises camera, lighting and sound personnel.

If you shoot video footage in available light with a view to extracting stills later on, you can usually do without most of the additional gear and personnel listed above. Stills don't require sound, and smooth pans and focusing are unnecessary when you are capturing photos. Unlike in a video, a photo shows only a selected moment from within a sequence of movements, so you need to consider the purpose a stream is to be put to before you begin a shoot. Videos generally require longer shutter speeds than stills to keep the transitions between frames smooth, especially for moving subjects, but motion blur is taboo in extracted stills. Conversely, using too short a shutter speed causes video footage to look jerky and unintentionally comical. You can only use the same settings for video and stills if you are capturing a stationary subject and, the faster the frame rate, the less important the shutter speed will be. Note, however, that you can't simply increase 4K frame rates the way you can for HD. Most current cameras and recording systems cannot handle 4K frame rates of more than 24 or 25 fps.

In-camera Encoding

The simplest way to save 4K video is directly to an in-camera memory card. However, an uncompressed 3840×2160-pixel video stream creates data at a rate of almost 400 megabytes per second (without audio or other overheads) – amounts that even the fastest desktop SSDs (solid state disks) have

A Twitter feed launched by the producer of 'Dr. House' implied that all you need to capture broadcast-grade video is a DSLR and a tripod



Image: Twitter screenshot





Image: Atomos

The Atomos Shogun is a 4K video recorder with a built-in monitor that costs around \$2,000. Cheaper recorders are available but can only record HD.

trouble processing. The amount of video data DSLRs and system cameras can save in real time is limited by the power of the onboard processor, the bandwidth of the memory controller and the write speeds of the memory card, so in-camera video capture always involves the use of fast codecs with high compression rates.

Memory Card Bottlenecks

The two most significant factors in determining the quality of the video a camera can record are the camera's processor speed (which is difficult for a potential buyer to ascertain) and the write speeds of memory cards. Compact Flash (CF) memory cards have been superseded in most cameras by the smaller Secure Digital (SD) cards. This is a disadvantage for most videographers, as CF technology is faster than SD, which is why high-end 4K-capable cameras like the Canon EOS-1D C and the Leica S still have CF card slots and record video using the Motion JPEG compression format, which produces higher quality but larger files than the

H.264/H.265 compression algorithms used in many video devices with SD card slots. Although CF and SD cards with read/write speeds similar to those of SSDs are now available, they are still very expensive and there is no guarantee that your camera's hardware can deliver data at rates fast enough to utilize their potential. High capacities combined with fast write speeds are less common in SD cards than they are in their CF counterparts.

For example, a 256GB *Lexar Professional CFast 2.0 3400x* currently costs around \$1,000 and has a nominal maximum write speed of 510 MB/s, which is similar to that of a high-quality SSD. The manufacturer does not, however, provide any data regarding the continuous performance necessary for successful 4K video capture.

The allegedly 'fastest SD card in the world', the *SanDisk Extreme PRO SDXC UHS-II*, has a specified maximum write speed of 280 MB/s and costs around \$225 for the 64GB version, which doesn't give you much leeway when recording high-quality 4K video. Here too, the manufacturer doesn't make any

commitments regarding continuous write speeds. Of course, you can extend your recording capacity by using multiple cards, but slow write speeds (especially in SD cards) are a system-wide issue that limits the usefulness of 4K technology in general.

Using SSDs to Record Video

Though too bulky for use in conventional digital cameras, SSDs are beginning to find their way into purpose-built video cameras. For example, the Blackmagic Production Camera 4K is a digital cinema camera that records footage on removable 2.5" SSDs, which are fast becoming the standard medium for recording RAW video. A 256GB SSD costs about \$180 and can record up to about 20 minutes of CinemaDNG footage. If you want to record high-quality 4K footage using a DSLR or a system camera, you will have to use more powerful external hardware connected via HDMI/SDI.

Full Speed Ahead with HDMI and SDI

HDMI (High Definition Multimedia Interface) and SDI (Serial Digital Interface) are fast and well suited for use with 4K video. Micro HDMI connectors are small and cheap, so virtually all digital cameras in all quality segments have a built-in HDMI interface, while SDI is usually found only in pro-grade devices. HDMI 2.0 is capable of data throughput of up to 14.4 Gbit/s, making it capable of recording 4K video at up to 60 fps.

Micro HDMI connectors are not particularly robust and are better suited to occasional home use. Continual heavy-duty use on location can make plugs and sockets loose and unreliable. Cables with special anti-kink plugs and accessory cable protectors can help to alleviate this.

Pro-grade Interfaces

The SDI interface uses the tried-and-trusted coaxial BNC connectors that have been around since the early days of networked computing in the 1980s. These are made of metal with a robust bayonet connecting mechanism. The latest SDI version is designed for data rates of up to 12 Gbit/s, and multiple SDI interfaces can be used in parallel to

'Handheld' pro video capture requires the use of bulky and often expensive accessories



Image courtesy of Sony



Dedicated 4K recorders like the Blackmagic HyperDeck Studio Pro have more computing power and memory and offer higher throughput rates than even the best video camera. Pro-grade codecs like ProRes offer better image quality than you can capture using a conventional camera and memory cards.

increase bandwidth. Video professionals on a large budget and with no space constraints still prefer SDI to any other interface. Consumer-grade cameras, such as the Panasonic Lumix DMC-GH4, can be upgraded to work with SDI. The bulky Panasonic DMW-YAGH interface unit offers four parallel SDI ports and can output 4K signals at color depths of up to 10 bits with 4:2:2 color subsampling. Just remember that this is processed output, not true RAW video export. At around \$1,600, the interface unit costs almost as much as the camera body.

HDMI Is Not RAW-capable

Although the high bandwidth of the HDMI interface appears to make it highly suitable for transferring RAW video data, there are not yet any cameras that support this capability. This is because HDMI was originally designed for the real-time transfer of digital audio and video data to entertainment devices, not for the universal transfer of all types of digital data. As a result, the HDMI specifications only cover real-time transfer of sRGB and YCbCR image data but not raw sensor data. Some of the available data channels (Fast Ethernet, for example) cannot handle data rates that are fast enough for 4K video applications

SDI is More Flexible

Like HDMI, the more expensive SDI interface is designed for the transfer of audio and video data but can also be used to transfer other types of data at high speeds using the SDT (Serial Data Transport) interface.

The Sony NEX-FS700R pro camcorder, for example, uses the SDI-based HXR-IFR5 interface unit to connect it to the AXS-R5 RAW recorder, providing true RAW video data export.

External Recorders

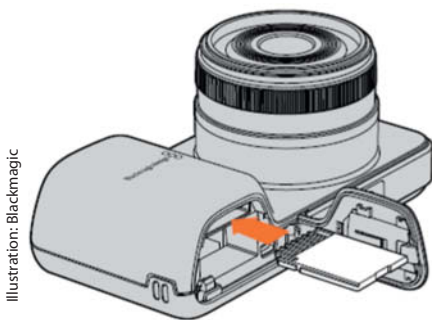
DSLRs and system cameras do not yet support RAW video data export via an appropriate interface, although there are various uncompressed formats that can be outputted via HDMI or SDI (see the table on page 48 for more details). However, not every 4K-capable camera with an HDMI interface supports 4K HDMI data transfer. For example, the Leica S and the Canon EOS-1D C can output HD but not 4K via their HDMI connectors. 'Uncompressed' video data is more like TIFF

than RAW and uses reduced-quality color data that requires the use of an external recorder. 4K recorders are more expensive than HD recorders, starting at around \$2,000 for the Atomos Shogun (see opposite).

4K recorders use compression techniques to write the enormous amounts of data produced by 4K video streams to SSD. External recorders usually have more powerful hardware than their in-camera counterparts and can thus utilize higher-quality codecs to encode footage. If you want to use your home computer as a 4K recorder, you'll need a 4K capture card such as the Blackmagic Decklink SDI for around \$300.

Conclusions

It is now possible to capture in-camera 4K video without the use of accessories. However, the footage is highly compressed and there is little leeway for improvement during post-processing. An external recorder is the first step on the way to using high-quality codecs to produce higher-quality 4K video.

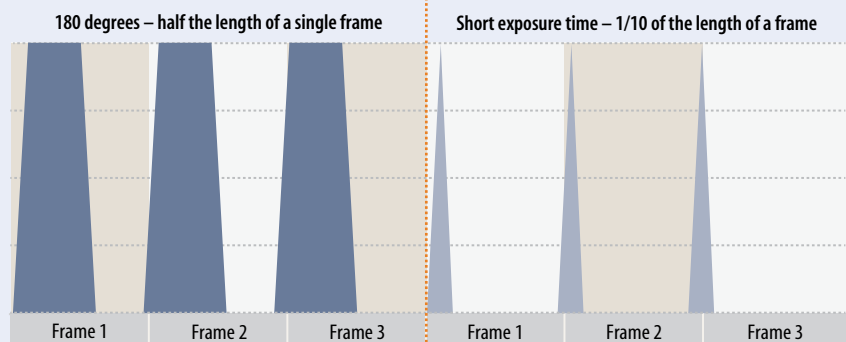


The Blackmagic Pocket Cinema is a compact HD movie camera that records on SD cards and can even capture CinemaDNG clips

Video and Still Shutter Speeds

180-degree shutter rule (video):
The shutter speed is calculated using the formula $1/(\text{frame rate} \times 2)$, which produces smooth movements in video footage

Short exposure times (photos):
Shorter exposure times only capture part of the movement and result in jerky-looking footage



Video Codecs and the Quality of Individual Frames

The current popularity of digital video is largely due to the widespread use of lossy compression algorithms that enable devices to record videos in files of a manageable size. The problem with compression algorithms is that they produce poorer-quality clips, so it is useful to know how the various common codecs work.

The Difference between a Frame and a Photo

As with other compression processes, it is impossible to predict what size a video file will be once compressed. It all depends on the nature of the subject and the degree to which the codec you are using compresses each frame. The same is true of JPEG photo files, which vary in size even if they are of the same subject. Because the camera moves only slightly during a shot, the content of a video varies only marginally from frame to frame, so video files often consist of groups of extremely similar frames. It is often necessary to fully encode only one of a group of 25 frames, and the content of the others in the group is extrapolated from the encoded frame using a process called intra-frame coding. This type of coding is fully transparent during post-processing, and editing software automatically prepares and displays the content of each frame as necessary. Because the individual frames have to be merged first, this process requires a great deal of computing power.

DVD Quality

Even the latest 4K-capable cameras include some outdated DVD technology. Recording a DVD requires use of the H.262 (MPEG-2) video codec to produce video with manageable file sizes. MPEG-2 is definitely old-school but is still occasionally used to encode Full HD Blu-ray disks. New versions of these codecs are

constantly appearing and the one currently used most often for coding Full HD video is H.264/MPEG-4 AVC, widely known as 'H.264'. The developers of H.264 concentrated on coding efficiency (i.e., the production of smaller files) rather than improving the overall quality of the resulting material. This means that although they are only about one third of the size of their MPEG-2 counterparts, H.264 (MPEG-4) files have the same overall image quality as their MPEG-2 predecessors and require two or three times as much computing power during processing. H.264 is now the standard codec used in digital cameras, video conferencing, high-resolution TV, smartphone and tablet video, YouTube and a whole host of other applications.

H.264 vs. H.265

H.264 is currently the most widely used codec for 4K video coding, even though 4K data rates are four times those of Full HD. But technological progress continues and H.265 (known officially as High Efficiency Video Coding/HEVC, or MPEG-H Part 2) is now included in a growing number of devices. The new codec has further increased the amount of computing power required to process it, so cameras like the Lumix GH4 still rely on the older H.264 codec. The Samsung NX1 is one of the first cameras to utilize H.265, which produces video files that are half the size of their H.264 counterparts while retaining the same level of image quality. Because H.264 has been around for a while, it is supported by a wide range of hard- and software, making encoding and decoding a sure-fire thing using most current devices. Support for H.265 is still rare, so using it can be quite laborious. Although the size of the pictures has steadily increased from DVD through Full HD to 4K, overall image quality hasn't improved at all since the introduction of the first H.26x standards. The quality of videos compressed

using H.264 is roughly equivalent to that of a highly compressed JPEG photo.

High-quality Lossy Codecs

H.264 offers acceptable quality for outputting processed video but, because of its relatively low image quality, it is not suitable for producing input-quality footage. Highly compressed video slows even the fastest editing computer right down. The answer is to use a codec that offers greater image quality and less compression, and these are of particular interest to photographers as they provide much more processing leeway in the individual video frames. Video files produced using such codecs are larger but require less computing power at the editing stage. Apple's ProRes codec puts increased emphasis on image quality while keeping file size to a minimum. ProRes offers a range of quality levels but, although it can be decoded using Mac and Windows computers, it can only be saved to a Mac desktop. It has quickly become one of the most important codecs in current use and is widely used in external 4K recorders too. The DNxHD (Digital Nonlinear Extensible High Definition) codec from Avid is similar to ProRes and can be processed without any limitations on both Windows and Mac computers.

RAW Video Only for the Pros

RAW (i.e., unprocessed) stills formats are widely used by professional and keen amateur photographers. Although the Term 'RAW' suggests otherwise, these types of files are subject to a degree of automatic processing by the camera's firmware in spite of being saved at full (sensor) resolution and full bit depth. Even the demosaicing that usually takes place in the camera and extrapolates color image data from the signals captured by a Bayer Pattern sensor takes place during

DATA RATES FOR UNCOMPRESSED VIDEO

	Full HD			UHD-1 (~4K)			UHD-2 (~8K)		
Width x Height	1920 x 1080 pixels			3840 x 2160 pixels			7680 x 4320 pixels		
Resolution	2.1 megapixels			8.3 megapixels			33.2 megapixels		
Bit depth ¹	24-bit RGB			24-bit RGB			24-bit RGB		
Single frame	5.9 MB			23.7 MB			94.92 MB		
Refresh Rate	24 Hz	30 Hz	60 Hz	24 Hz	30 Hz	60 Hz	24 Hz	30 Hz	60 Hz
Data rate	142.4 MB/s	170 MB/s	356 MB/s	569.5 MB/s	711.9 MB/s	1,423.8 MB/s	2,278.1 MB/s	2,847.7 MB/s	5,695.3 MB/s
	0.1 GB/s	0.2 GB/s	0.3 GB/s	0.6 GB/s	0.7 GB/s	1.4 GB/s	2.2 GB/s	2.8 GB/s	5.6 GB/s
1-minute clip size	8.3 GB	10.4 GB	20.9 GB	33.4 GB	41.7 GB	83.4 GB	133.5 GB	166.9 GB	333.7 GB

¹ RGB is equivalent to 4:4:4 color subsampling. Only cameras with separate RGB color sensors can deliver a full RGB signal. Digital cameras use Bayer Pattern sensors that produce color subsampling equivalent to roughly 4:2:2. The values quoted here are video data rates without an audio track and the other overheads that are usually involved in video capture.

post-processing for RAW files (using *Lightroom*, for example). The major advantage of this complex process is that it enables you to make adjustments to fundamental image parameters such as white balance and exposure after an image has been captured. Of course, we would like to be able to make these kinds of adjustments to photos extracted from a 4K video stream too. The Red Digital Cinema Camera Company is the market leader in digital movie technology (its products were used to film *The Hobbit*) and has developed its own proprietary REDCODE RAW (R3D) multimedia audio/video format. Cost often plays a secondary role to image quality in the pro movie sector, and a camera like the Red Epic-M Red Dragon costs around \$30,000 for the body only. The R3D format isn't completely compression-free, but utilizes the visually lossless JPEG 2000 algorithm, which is already established in the stills photography realm.

Video camera maker Blackmagic uses the open source CinemaDNG capture format instead. Like the DNG photo format, which is not supported by Canon and Nikon, this was developed by Adobe as a universal open RAW video standard. CinemaDNG enjoys only limited support in the marketplace. Like JPEG 2000, it utilizes visually lossless compression algorithms. Regardless of the format you use, RAW video capture produces enormous amounts of data that can only be written successfully to SSDs. RAW video is not yet offered as an option in digital stills cameras, while movie camera makers are busy stealing the stills camera manufacturers' thunder by offering built-in 4K stills capture functionality.

Magic Lantern: RAW and 4K

Canon users who are happy with Full HD (i.e., 2-megapixel) resolution can use the unauthorized Magic Lantern firmware hack to capture RAW video footage. Magic Lantern is not yet available for any of the EOS-1D cameras (which include the 1-D C with its 8-megapixel 4K video functionality) and Canon has allegedly threatened the makers of the software with legal action if they attempt to hack the 1D models. Technically speaking, hacking 4K video streams is extremely complex, especially in view of the ultra-high-speed memory cards that are required to save 4K data streams. Magic Lantern doesn't currently support CinemaDNG.

The existing hack writes a separate DNG file for each frame in a clip – in other words, it converts a video stream into a series of RAW

DATA RATES FOR COMPRESSED VIDEO

Resolution	3840 × 2160 pixels	
Color depth / Subsampling	8-bit/4:2:2 YCbCr	
Frame rate	25 fps	
	Data throughput	Size of a 1-minute video
Video signal via HDMI/SDI	395.5 MB/s	23.1 GB
ProRes HQ	90.45 MB/s	5.3 GB
ProRes	60.92 MB/s	3.57 GB
H.264	11.8 MB/s	708 MB

photos. This is a cumbersome approach, as you have to process each frame individually before merging them to make a clip. Even short films consist of thousands of frames, so post-production is extremely complex.

Uncompressed instead of RAW

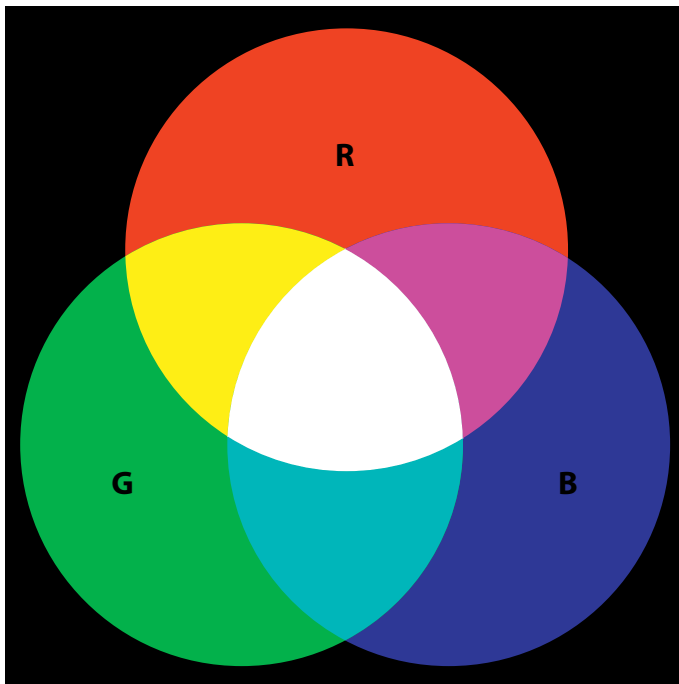
Uncompressed footage makes a useful alternative to shooting RAW video. Most 4K-capable cameras can output uncompressed video streams via their built-in interface connectors, which have to be appropriately configured in the camera menu. The main difference between uncompressed and RAW video is that uncompressed footage is already demosaiced – in other words, white balance, contrast and other basic settings are already 'set in stone' when it is captured.

This type of footage is of better quality than that provided by a lossy codec such as H.264 and still offers plenty of processing headroom. Uncompressed video data, often incorrectly referred to as RAW video, is more like a TIFF photo file than a RAW file. Uncompressed is always a good option if a RAW video workflow is too complex or simply not possible. Uncompressed video streams are processed using the camera manufacturer's chosen software, so it is useful to know how your camera deals with the color model, color



The Panasonic Lumix DMC-GH4 records stills with 12-bit color depth but video with only 8 or 10 bits

Image: Panasonic



On a computer monitor, the RGB color model mixes the three primary colors to produce all the other colors, including white. The background of the screen is black.

subsampling and bit depth of footage it captures. For example, Panasonic specifies the uncompressed 4K video outputted by the Lumix DMC-GH4 as *YCbCr, 4:2:2, 10-bit*.

Reduced Color Depth

Digital cameras usually only utilize the sensor's full color depth for stills, whereas video output has reduced color depth, either to reduce the file size or for compatibility reasons. For example, the Panasonic Lumix DMC-GH4 records stills with 12-bit color depth but video with only 8 or 10 bits. In its early days, HDMI was only able to support

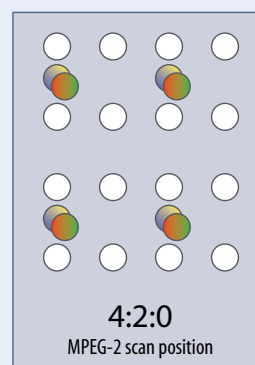
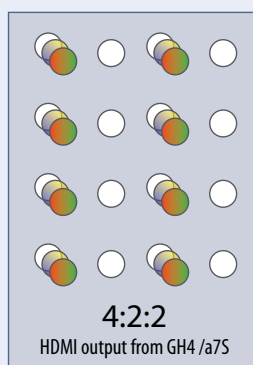
8-bit color depth, although the 1.3 version now uses Deep Color technology to transmit 10-, 12- and 16-bit data. Video capture with full color depth would, of course, be a boon for photographers who wish to extract and process stills from their videos but unfortunately, commercially available cameras do not yet offer this option.

Video Color Models

RGB is the standard desktop color model. It functions additively and mixes the primary colors (red, green and blue) to create all visible hues, including white. Digital images are

usually created, processed and outputted on a monitor using the RGB color model at every stage in the process. However, in the world of video, several different additive color models are necessary to display footage on old-school CRT (cathode ray tube) monitors. Like computer monitors, modern TFT televisions can be controlled using RGB technology, whereas the YCbCr color model was developed specifically for digital TV. In this model, 'Y' represents the luma (brightness) component, while 'Cb' and 'Cr' represent the blue-difference and red-difference chroma (i.e., color) components. YCbCr is an established digital video format and, because it saves brightness and color data separately, color subsampling makes coding more efficient by enabling you to reduce bit rates. Color (or 'chroma') subsampling involves saving the color data at a lower bit rate than the brightness data and is quoted in terms of three numbers – for example, 4:4:4 subsampling represents complete color data (i.e., a perfect RGB signal that is theoretically ideal for post-processing). Digital cameras usually record video using 4:2:2 subsampling and, because they use Bayer Pattern sensors that don't record full color data for each pixel, this actually represents the entire RGB signal. The Lumix DMC-GH4 outputs video at 4:2:2 via its built-in interface, which is sufficient for comprehensive post-processing. 4:2:0 subsampling, which produces smaller, lower-quality files than 4:2:2, is often used as the output format for MPEG videos, even though it is not suitable for processing. The YUV color model is a relic from the days of analog color TV and is only mentioned here because it is sometimes erroneously used to describe video captured using the YCbCr model.

Data Compression Using the YCbCr Color Model



- Luma (brightness) Y
- Chroma (blue-difference) Cb
- Chroma (red-difference) Cr

4K Video in Practice

We used the Sony a7S and the Panasonic Lumix DMC-GH4 to test the practicality of current 4K video implementations in stills cameras. Video capture is the main function of a camcorder, but is only of secondary importance in digital stills cameras, and is sometimes tricky to use. Most importantly, we wanted to check out the quality of still images extracted from our test video streams.

Onboard Capture

By far the simplest way to capture 4K video with a digital camera is to save it directly to the memory card. Panasonic has obviously gone to a lot of trouble implementing this feature, offering different preset capture styles that save you having to post-process your footage, which is really useful, as the H.264 clips the camera saves have very little processing leeway. Video styles can be customized too, and the sample 4K video by Martin Wallgren included on this issue's free DVD was recorded using a customized style. The photo on page 42 should help you decide whether an individual frame capture is of sufficient quality to view in print. In spite of the high compression rate involved, our sample video used about 700 megabytes of disk space per minute.

Recording Limits

Our test GH4 automatically stopped recording after 29 minutes and 59 seconds. There is no technical reason for this – the firmware-controlled limitation is actually a tax dodge. Any digital recording device imported

into the EU that is capable of recording moving pictures for 30 minutes or more is classed as a video camera and is subject to additional import duties. Fortunately, Panasonic has included a counter in the firmware that displays the remaining recording time and has also included audible and visual signals that are activated when you are approaching the end of the maximum recording time. Check your camera and manual to see if these limits apply to your particular model. In our test, a 30-minute video took up about 20GB of memory. The camera automatically records video in 4GB chunks that you have to reassemble on a computer if you want to view them as a single clip. The GH4 includes functionality that enables you to extract JPEG stills from a video clip in-camera, as well as a variety of user-configurable video aspect ratios (16:9, 4:3, 2:3 and 1:1).

Slow Autofocus

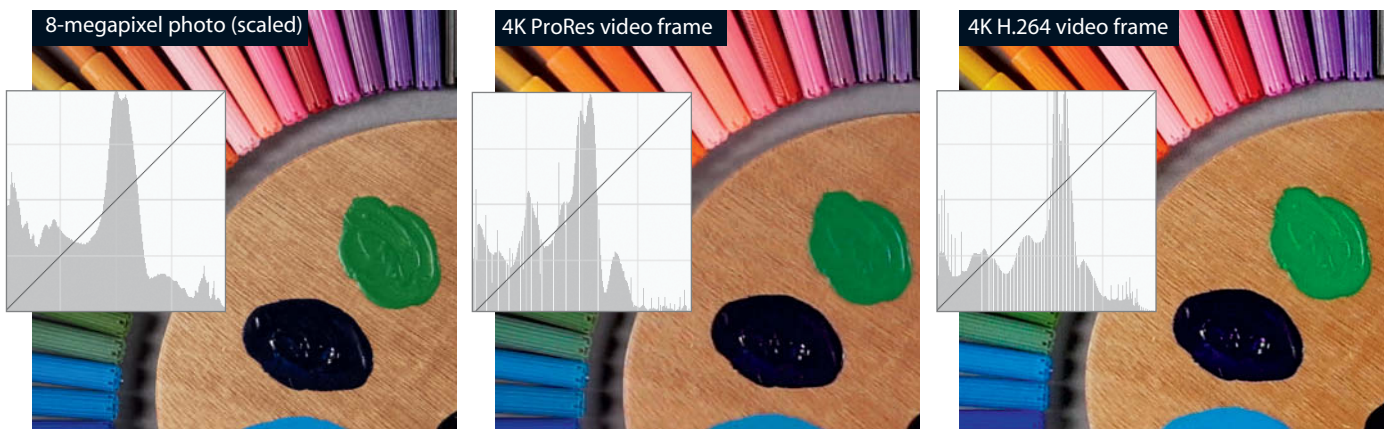
Autofocus was much slower in 4K than in Full HD mode and our 25mm f/1.4 Summilux test lens spent a lot of time searching for focus regardless of whether we were filming moving or stationary subjects. You can, of course, focus manually using the monitor or the electronic viewfinder, but the viewfinder magnifier function doesn't work while the camera is saving video to the memory card. It does work if you output the video signal via the HDMI interface but then it corrupts the signal captured by the recorder. The only reliable way to use manual focus is with a separate monitor.

Using an External Recorder

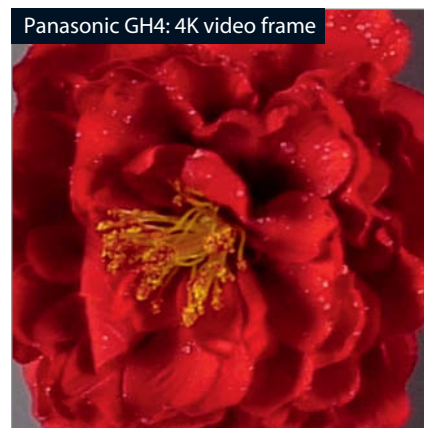
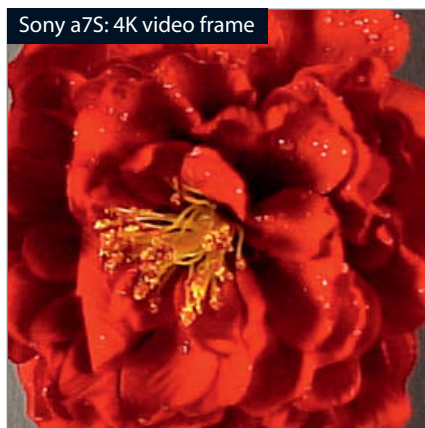
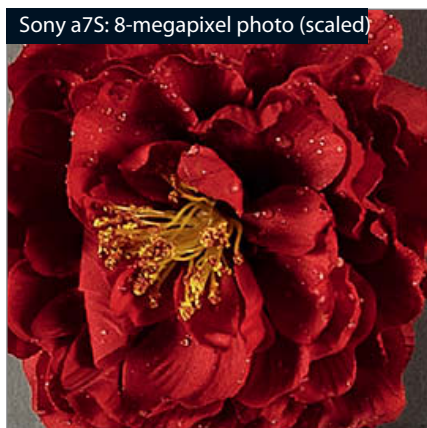
The only way to record 4K video streams with the Sony a7S is to use an external recorder, whereas the Lumix DMC-GH4 is capable of using external recorder functionality to capture 4K video using a high-end codec such as ProRes. Blackmagic loaned us the HyperDeck Studio Pro, which looks (and sounds) like a conventional server. We fitted the recorder with a 512GB Samsung 850 Pro SSD and, once it was set up, found it to be just as simple to operate as an old-school analog tape deck. It has large 'Record' and 'Stop' buttons and a tiny monitor that makes the ones built into our test cameras look quite large. Both cameras tended to randomly switch off their monitors while streaming video via the interface – another good reason to use an external monitor when recording this way. Stationary recorders like the HyperDeck Studio Pro allow you to display the record signal on a separate monitor, while smaller, portable recorders usually have a monitor built in.

Anti-kink Interfaces

Using the bulky DMW-YAGH SDI interface unit with the Lumix DMC-GH4 is a complex business that involves attaching the unit to the camera and then connecting four thick BNC cables. Add the external power block too, and you have a cumbersome assembly that is only of real practical use in a studio environment. There is no similar interface unit for the a7S so, to make sure we produced comparable results, we tested both cameras



The photo captured with the Panasonic Lumix DMC-GH4 shows significantly better detail rendition than either of the video frames. Levels adjustments made in the photo worked well, but caused posterization and color errors in the video frames. The errors in the H.264 frame are much more obvious than those in the ProRes frame.



The ProRes video frame we captured with the Sony a7S shows much less detail than the photo captured using the same camera. The H.264 video frame we captured with the Panasonic Lumix DMC-GH4 is of even poorer quality, with inferior detail rendition and washed-out colors.

using HDMI output. The Sony is supplied with a plastic cable protector designed to save the fragile micro HDMI from kinks or accidental damage. In practice, the protector is tricky to install and prevents the camera monitor from closing completely. There is no HDMI cable supplied with the camera and the protector wasn't physically compatible with our own cable, so we ended up not using it. In the end, we used conventional cable ties to secure the cable against unwanted movements. This is not a pretty solution, but it works. However, it still doesn't prevent accidental knocks from loosening the connector over time. LockPort sells solid bolt-on adapter plates that convert the Micro HDMI port into a robust normal HDMI port. The model for the Sony a7S costs about \$130 and is definitely a worthwhile investment if you use your camera's HDMI port regularly.

HDMI Recording with the GH4

Capturing video via HDMI is a simple matter of handing on the signals captured by the sensor to the HDMI port, which means the recorder attached to the interface determines how the signal is recorded. When you record via HDMI, the in-camera recording time limits described on page 51 no longer apply. The camera produces a signal the moment it is connected to the recorder, so you no longer need to start the capture process using the camera shutter button. Also, recording via HDMI deactivates autofocus tracking and we only managed to get autofocus to work during capture by pressing the shutter button halfway. However, even with the shutter button pressed, the Panasonic's AFC (continuous AF) had trouble tracking even the simplest subjects. Autofocus was much more reliable during onboard recording, but still not

perfect. We helped things along by switching to AFS (single AF) mode, which worked much better but required us to press the shutter button halfway every time we needed to adjust focus. Future firmware updates may help but for now, the only practical way to recording video via HDMI with the GH4 is to use manual focus.

4K Video with the Sony a7S

The only 4K video setting in the Sony a7S is the *HDMI 4K Output* option that you can select using the Menu button, but everything else has to be set via the attached recorder. In principle, the Sony's low-resolution full-frame sensor is well suited to 4K video capture. Unlike the DMC-GH4, the a7S uses the entire surface area of the sensor to capture video before scaling the signal digitally to UHD. This means you don't have to account for an additional crop factor when shooting video and enables you to switch seamlessly between photo, HD and 4K modes without having to alter the camera position, which is a unique and really useful feature. The Sony's extremely impressive high-ISO capability (up to 409600) captures clear images in situations in which the human eye cannot perceive any detail at all, while the DMC-GH4, with its smaller sensor and maximum ISO setting of 6400, quickly reaches the limits of its low-light capability. Unlike the Panasonic, the Sony's continuous focus tracking still works during HDMI video capture, although it still doesn't win any prizes for speed.

Lab-based Resolution Tests

We used our custom test software to analyze our sample stills and extracted video frames. The software measures the resolved line pairs

in relation to the height of the frame, so the higher the value, the greater the resolution. Because it is impossible to directly compare material captured using different-sized sensors, we scaled all our test photos down to a resolution of 8 megapixels to match the size of the extracted 4K frames. In our non-scaled test, the 16-megapixel GH4 recorded resolution of 1487 line pairs compared with the 12-megapixel Sony's result of 1184. The GH4's 8-megapixel video frame recorded only 1021 line pairs, which is not surprising in view of the image quality loss caused by the H.264 compression the camera uses. We tested the Sony a7S using an external recorder and the supposedly higher-quality ProRes compression, but still only managed to record 981 line pairs of video resolution in spite of the 4 GB of image data the camera captured per minute of footage. In other words, we put in a lot of effort for little gain.

Real-World Image Quality

Lab-based test results don't always reflect subjectively analyzed image quality. Even high-quality codecs like ProRes are not completely lossless and compression artifacts have different effects depending on the type of subject you are recording, as shown by our test charts. The Sony's 12-megapixel sensor captured a lot more clarity and detail than the Panasonic's nominally more powerful 16-megapixel sensor and the difference became even more evident at higher ISO values, where the advantages of a larger sensor become abundantly clear. Scaling the test images down to 8 megapixels obviously reduces their overall quality, but the video frames captured by both cameras were nevertheless clearly of inferior quality to the scaled photos. The video frames we extracted

from the Sony footage were of much higher quality than those we extracted from the Panasonic, in spite of using the complex and processor-hungry ProRes codec. To compensate for potential qualitative anomalies caused by the differing compression formats, we also captured frames from the Panasonic using ProRes via HDMI, which showed a lot more detail than their H.264 counterparts but had a rather streaky, grainy look. ProRes produced image noise that was slightly reminiscent of analog image artifacts. Overall, we were unable to capture video frames with the GH4 that were of comparable quality to its stills.

Conclusions

Regardless of the capture process used, 4K video frames are universally of inferior quality to stills of the same size captured using the same camera. The differences are quite clear when viewed on a high-end monitor but less obvious in print. The clearly inferior quality of video frames compared with stills is not

necessarily evident in our lab test results. The effects of compression and the artifacts it produces depend very much on the type of subject, but are always visible. 4K frames captured using the GH4 look like photos captured using a high-quality smartphone, whereas the full-frame Sony's frame captures were more like photos taken using a compact camera.

This '4K effect' is not as serious when the photos are viewed at less than 100% magnification, and photos captured this way are easily good enough for online viewing and other low-res applications. We have included our test photos and frames on this issue's free DVD to help you evaluate the differences for yourself.

Pro video-makers swear by external recorders and high-end codecs, but we don't recommend taking such a complex (and expensive) approach just to capture stills. Photos look better than video frames of the same resolution however you capture them. Like any new technology, 4K video capture still has some teething troubles to deal with,

RESOLUTION TEST RESULTS		
	Sony a7S	Panasonic DMC GH4
Photo (original size)	1184 lp (12 MP)	1487 lp (16 MP)
Photo (8 megapixels)	1116 lp	1312 lp
4K video frame (8 megapixels)	981 lp (ProRes)	1021 lp (H.264)
lp = line pairs (measured in the center of the frame) Sony a7S with a Zeiss Sonnar T* FE 55 mm f/1.8 ZA at ISO 100. Panasonic DMC GH4 with a Leica DG Summilux 25mm f/1.4 at ISO 200. All test shots captured at f5.6.		

but the larger video frames become, the more likely it is that extracted frames will begin to take over from photos. The electronic shutters used in 4K video capture are another reason for the lower quality of stills captured this way, especially in action scenes, where the 'rolling shutter' effect often causes obvious artifacts.

It is now up to the camera manufacturers to improve their video capture technology. At the end of the day, slow autofocus rather than inferior image quality is the greatest hindrance to the proliferation of 4K video capture for the masses. (sts)

DIGITAL CAMERAS WITH 4K VIDEO CAPTURE CAPABILITY								
Camera	Canon	Samsung	Panasonic	Panasonic	Panasonic	Sony	Leica	Pentax
Model	EOS-1D C	NX1	DMC-GH4	FZ 1000	Lumix DMC LX 100	a7S	S (Typ 007)	645Z
Type	DSLR	Mirrorless system camera	Mirrorless system camera	Bridge camera	Compact camera	Mirrorless system camera	DSLR	DSLR
Bayonet	EF	NX	Micro Four Thirds	–	–	Sony E	Leica S	645AF2
Price (body only)	\$7,999	\$1,500	\$1,700	\$900	\$900	\$2,500	\$25,500	\$8,500
Sensor								
Type	Full-frame	APS-C	Micro Four Thirds	1-inch	Micro Four Thirds	Full-frame	Medium-format	Medium-format
Size	36 × 24 mm	23.5 × 15.7 mm	17.3 × 13 mm	13.2 × 8.8 mm	17.3 × 13 mm	36 × 24 mm	30 × 45 mm	32.8 × 43.8 mm
Aspect ratio	3:2	3:2	4:3	3:2	4:3	3:2	3:2	4:3
Photo crop factor	1	1.5	2	2.7	2	1	0.8	0.76
Additional 4K video crop factor	1.3	–	1.3	n/a	n/a	–	1.875	–
Effective 4K video crop factor	1.3	1.5 (as for photo)	2.6	n/a	n/a	1 (as for photo)	1.5	0.76 (as for photo)
Photo mode								
Max. image size	5184 × 3456 pixels	6480 × 4320 pixels	4608 × 3456 pixels	5472 × 3080 pixels	4480 × 2520 pixels	4240 × 2832 pixels	7500 × 5000 pixels	8265 × 6192 pixels
Max. resolution	18.1 megapixels	28.2 megapixels	16 megapixels	20.1 megapixels	16.8 megapixels	12.2 megapixels	37.5 megapixels	51 megapixels
Max. color depth	14-bit	14-bit	12-bit	n/a	n/a	14-bit	16-bit	14-bit
4K Video								
In-camera capture								
UHD (3840 × 2160), 16:9	–	30 frames/s	30 frames/s	25 frames/s	25 frames/s	–	–	–
4K (4096 × 2160), 19:10	24 frames/s	24 frames/s	24 frames/s	–	–	–	24 frames/s	24 frames/s
Other 4K resolutions	–	–	2880 × 2880 (1:1) 3328 × 2496 (4:3) 3504 × 2336 (3:2)	2880 × 2880 (1:1) 3328 × 2496 (4:3) 3504 × 2336 (3:2)	2880 × 2880 (1:1) 3328 × 2496 (4:3) 3504 × 2336 (3:2)	–	–	–
Compression format	Motion JPEG	H.265	H.264	H.264	H.264	–	Motion JPEG	Motion JPEG
Memory card type(s)	CompactFlash	SD	SD	SD	SD	–	SD, Compact Flash	SD
Uncompressed 4K video via camera interface								
UHD (3840 × 2160), 16:9	–	24 frames/s	30 frames/s	–	–	30 frames/s	–	–
4K (4096 × 2160), 19:10	–	30 frames/s	24 frames/s	–	–	–	–	–
Other 4K resolutions	–	–	2880 × 2880 (1:1) 3328 × 2496 (4:3) 3504 × 2336 (3:2)	–	–	–	–	–
Max. Color depth	–	8-bit	10-bit	–	–	8-bit	–	–
Chroma subsampling	–	4:2:2	4:2:2	–	–	4:2:2	–	–
Interface(s)	HDMI	HDMI	HDMI, SDI with additional equipment	HDMI	HDMI	HDMI	HDMI	HDMI
<small>¹Compared to full-frame (24 × 36 mm) – Not included n/a Not applicable</small>								



Meike Fischer

Serial Photography

Would you like to take more than just single photos? Then it's time to get to grips with sequences, photographic essays and photo stories. In this article, we introduce new ways of presenting multiple images and give you tips for choosing a theme, planning your shoot and pulling everything together, along with some exercises to help you get started.



Anyone who takes a lot of photos will eventually want to assemble their first 'work': a portfolio, a website, a photo book or even an exhibition. Grouped images work well as pairs, sequences, visual essays and photographic stories, with images that are more effective displayed together rather than individually. Grouping images often creates a unique message, the whole being greater than the sum of its parts.

However, this doesn't happen all by itself. Whether on vacation, in the city, or on a carefully planned photographic trip, many

photographers have their camera with them most of the time and photograph everything that strikes them as worthwhile. While many of the results may be great individual images, there is little to link them except that they were taken on the same day or in the same place.

From Standalone to Sequence

If you study high-quality magazines or books with photos by well-known photographers, you will often notice work that has a special

quality to it, something beyond what you yourself can produce at this stage, although the difference is not necessarily anything to do with the technical quality of the individual images.

While a great photo may be a lucky 'snap', captured because you happened to be in the right place at the right time, photographic sequences and essays require some thought in advance. But what really makes the difference, and how do you get from an individual image to a successful sequence or essay?

Sources of Inspiration

If you decide to photograph groups of images, you will need to do some preparation and get in a bit of practice. It all begins with the question ‘What do I really want to portray?’

Peruse Your Archives

Looking carefully through your own archives from a fresh point of view can be the first step toward a photo sequence or essay. If you take the time to do this, you will realize that certain topics are very close to your heart. These may be recurring subjects, such as animals, landscapes, portraits, architecture, specific shapes and colors, or a preference for portrait formats or particularly light or dark subjects.

Look through your work with an eye to discerning your main themes and you could be in for a surprise. Your archives often reveal that you have been concentrating on topics that you weren’t even consciously thinking about. You might find, for example, that you have photographed mainly reflections, macro textures or a certain type of person in the city.

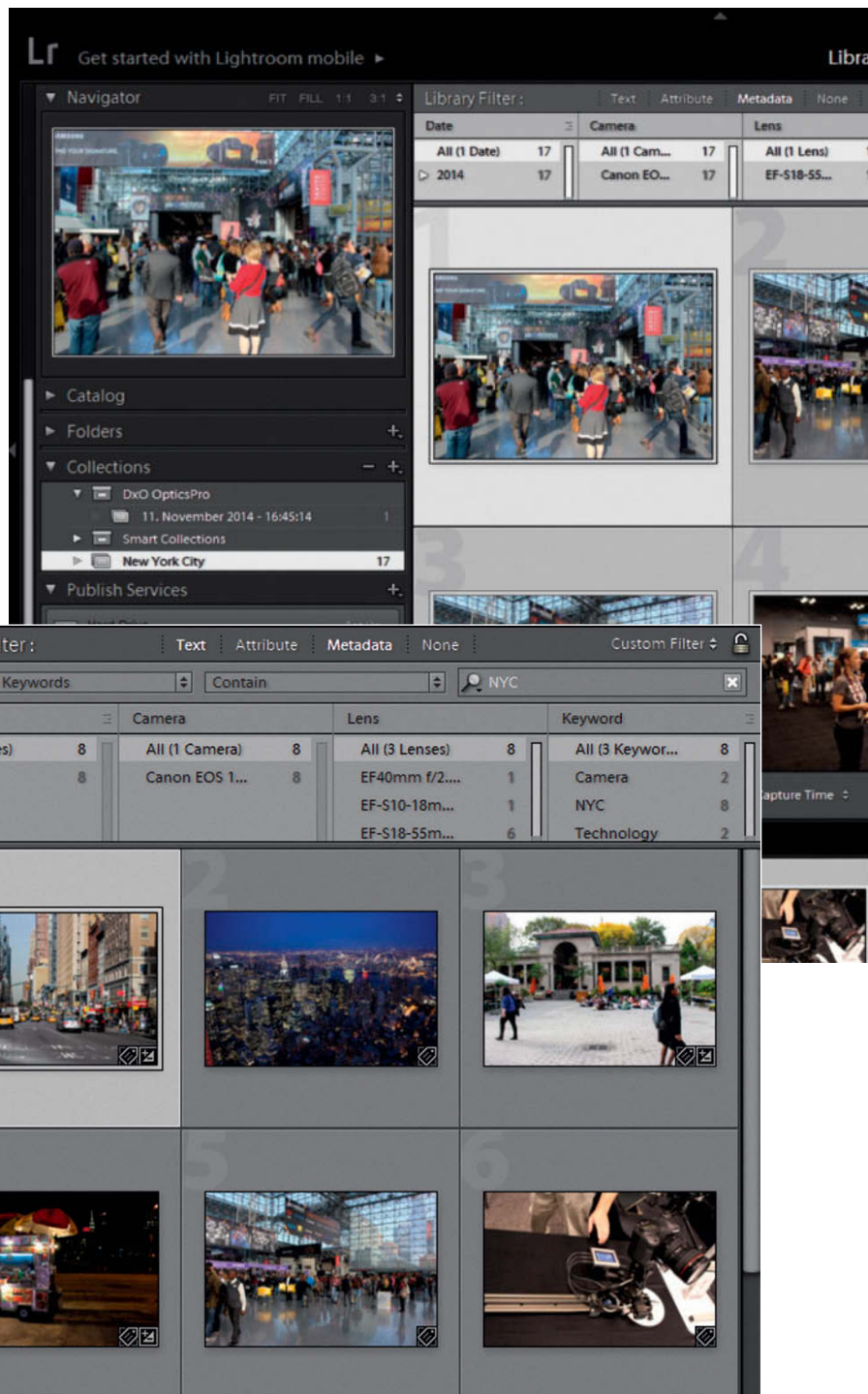
These themes are often clearly recognizable, yet it is not always easy to bring them together to form a cohesive project. Sometimes you will be able to link images by processing them in a similar way; other times, you will find ideas for potential projects that spur you on to take more photographs.

Whatever the case, your archive is a useful source of inspiration. To make it work for you, reflect in writing about why you keep coming back to your favorite topics and what it is that draws you to them.

Choosing a Theme

For your first major work, select a theme that will be easy to approach logistically. If you love prowling through the flea market in your city, then that is the place to begin. Don’t make it harder for yourself at the start than it needs to be.

Once you have some experience and feel confident in your planning, you can start tackling more ambitious projects. Going for something that sounds awkward or unsuitable can trigger creativity and skill, and I often take my students out of their comfort zone by setting them tasks that don’t appear to hold much promise. I always find that people learn the most from exercises that require commitment and perseverance.

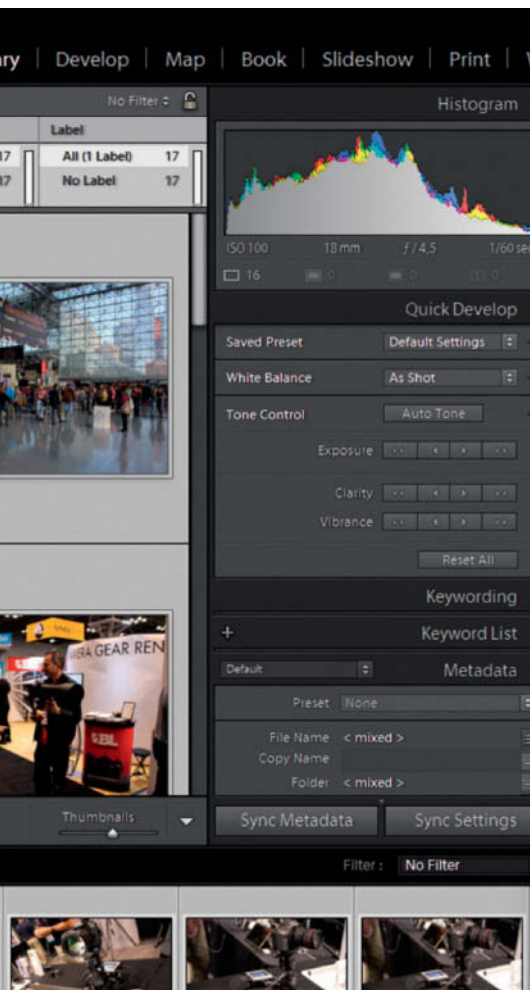


Searching for Model Projects

Choosing a theme is one thing; choosing the right form for it is another. Next we will look at the essential differences between groups of images and their fundamental qualities, giving you some guidance for your

first few projects. To get a feel for the myriad ways this can be done, go to exhibitions and study books on the work of famous photographers. Consider which of the themes they cover appeal to you and why, and how you might approach one of these themes yourself.

Planning Short- and Long-term Projects



These screenshots from Adobe *Lightroom* show images that have been put together in a collection (above) and others that have been sorted according to a keyword (below). Systems like this help you quickly find images that represent a particular topic and to search your archives for your own personal themes.

Recommended Reading

- [1] *Series* by Thomas Ruff
Published by La Fábrica
- [2] Thomas Ruff: www.davidzwiner.com/artists/thomas-ruff/
- [3] *Serial Photography* by Harald Mante
Published by Rocky Nook

Professional photographers rarely go out to take photos without planning what they want to shoot, particularly if there are limits to the time and budget available. Some kind of framework that prevents you being overwhelmed by the multitude of potential subjects is extremely helpful.

Don't Waste Those Ideas

Start keeping a sketchbook of your ideas. Whenever you have the opportunity, make notes about how to photograph your planned project. It can be a good idea to include small prints so that you have an overview of successful photos you have already shot, what still needs to be photographed and which ones you need to shoot again. A sketchbook can jog your memory when you have been forced to interrupt work on a project and, when you are working on several sequences at once, it helps you organize your thoughts and your work.

Prepare Well

Consider how long it will take to finish your project. Some projects can be completed within a relatively short time frame, while other themes are better suited to a long-term approach.

To warm up, have a go at an easily implemented short-term project on a topic like 'At the Amusement Park', 'Cooking Dinner', 'A Day at the Beach', or 'From Dawn to Dusk'.

Just because a project takes less time does not automatically mean that it takes less work. Some one-day projects actually require even more conceptual planning than longer projects. If the planned theme, such as a day trip to a city, a commission on a fixed date, or a special event, can only be photographed on a certain day, you have to brainstorm everything that could possibly go wrong. What will you do if it rains all day? What if you can't position yourself where you wanted to as the parade passes by? If things don't go as you planned, it pays to have a 'Plan B'.

It's also important to clarify when you are allowed to take photographs at the location or event you have in mind and, if necessary, organize access as well as permission to take and publish photos.

Alternatively, if you can visit your chosen location at any time, you can always come back later if things don't work out. If, for example, you are photographing an essay at a local museum, it may be possible to do it all in one day, but you also have the option of returning several times to do even better. However you decide to approach your work, never count on being able to re-shoot a scene while planning a project.

True long-term projects are based on themes that have to be shot over a long period – the construction of a house, for example, or following a child from birth to adulthood, or chronicling the way a city changes over the years. Projects like these may take weeks, months or even years to complete.

Of course, you can always put together a cheerful collection of photos of your child in an album, but if you want to create a significant photographic work you need to think in advance about how you want to approach your theme (see page 64 for more) and then stay on the ball for the duration of the work.

Exercises

Short-term Project

Set yourself three quite different one-day projects – the next few pages will give you some ideas to get you started – and photograph each on just one day.

Long-term Project

Think of two long-term projects that you would like to undertake and decide beforehand on the formal parameters and the impression the images should make (see page 64), then execute both projects according to your plan.

Serial Photography Overview

Pairs of Images

A pair of images brings together two photographs that are either obviously related, or are so different that the connection is not apparent at first glance and forces the viewer to think outside the box.

Suitable form-based pairings could be a macro and micro view of the same object, or two photographs of the same object with one in sharp focus and the other blurred, or an object when it is moving and then when it is stationary. There is no limit to the possibilities.

Presenting a subject in duplicate or even triplicate heightens the visual effect, just as repetition does in literature (“No, no, no!”).

A pair of images can also comprise two photographs with a connection that is not clear until we look deeper. The moment two photos are displayed together, they have a ‘relationship’, whether they make up a double-page spread in a book or are part of a simple photo album.

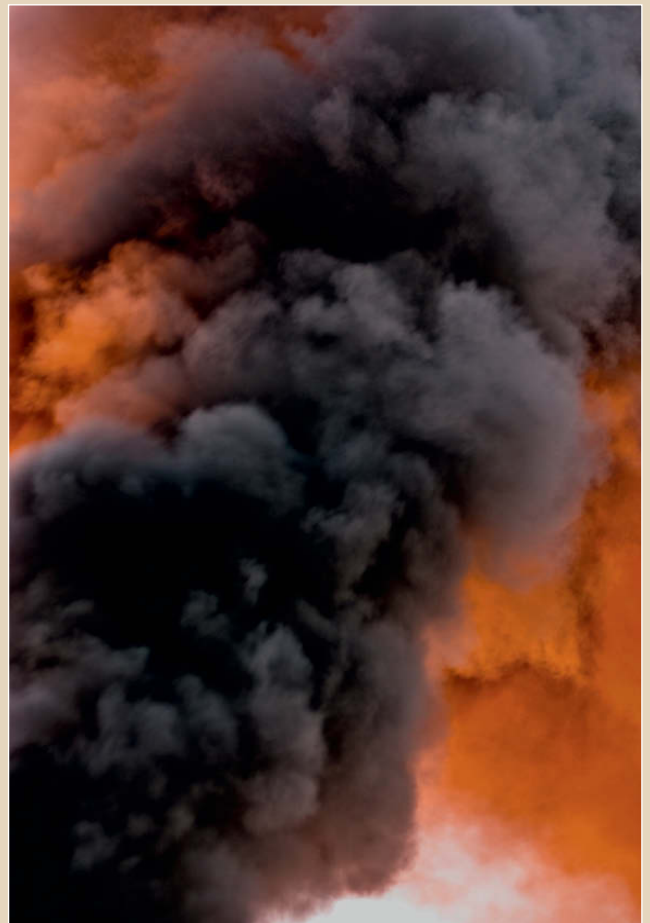


This pair of images shows objects from the same display case in a museum. The ‘faces’ are arranged so that they are facing toward the center and seem to be communicating with each other.

Triptychs

In the fine arts world, the word ‘triptych’ is used to denote three images that are displayed together. Altar images were originally crafted in threes, while in the modern era, Francis Bacon was one of the most prominent proponents of this form. Depending on how the photos are framed, the subject in the center can be given special significance, but another option is to infer a story that unfolds in sequence. You can show the passing of time or link events, whether or not they occurred like that in real life. In the Western world, a triptych is usually read from left to right.

In this triptych, the viewer’s eye is drawn principally to the statue in the center. The outer photos function as ‘bookends’ and, taken together, the images have an associative effect on the viewer and seem to tell a story, even though they were actually taken at different times and in different places.



Exercises

Pairs of Images

First spend some time looking through your archives (see page 56) for pairs of images that stand out. Then, for a whole week, photograph nothing but pairs of images. Look for pairs that definitely belong together, as well as for pairs whose relationship is not so obvious. You might also want to have a theme running through the whole project.

A Mini Story

Photograph pairs of images that show the beginning and end of an event and therefore tell a complete short story.



Just two images can tell a story. Here, photos of a single step in a process and the final result provide enough information for viewers to appreciate the entire event.

The right companion can have a huge effect on an otherwise unspectacular image; some photos do not 'work' until they are

displayed as half of a pair. When images convey a similar impression, it supports the message of your work – and this is true not just

for pairs of images. For more tips on ways to achieve this type of effect, see page 64 and beyond.



Sequences

The essence of a successful photographic series is that it shows the differences between several images of the same or similar subjects. For example, you might photograph all the manhole covers in your city. For a series like this to work, you should try to photograph each individual motif from a similar angle and in similar lighting conditions. Any fine-tuning can be done later. However, just photographing manholes as you pass and hoping that color, contrast and cropping will all come together at the post-processing stage won't do the trick.

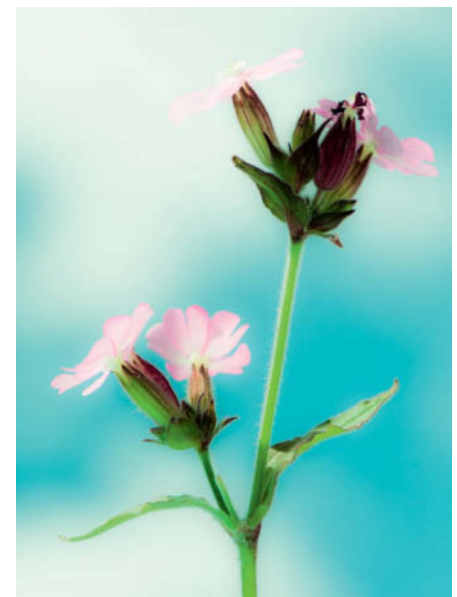
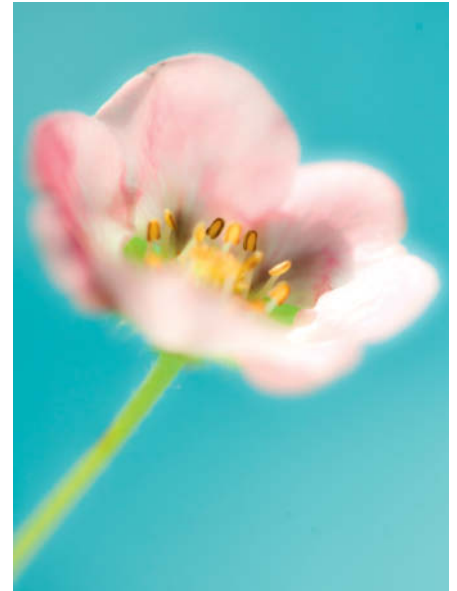
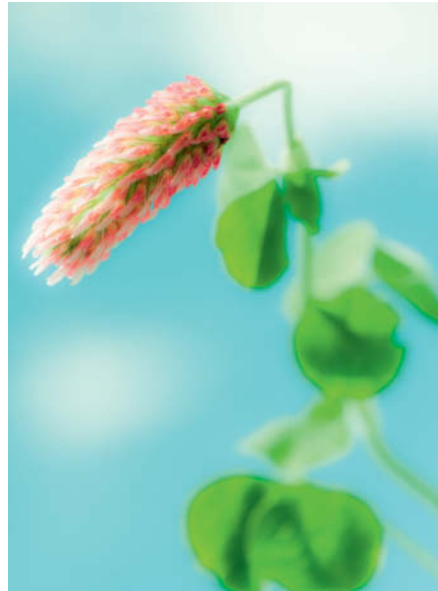
The same maxim applies in serial photography as in all other subgenres: the more effectively you capture a subject, the more arresting your photographs will be, so you'll always get better results if you plan your sequence carefully.

However, the photos in a sequence don't all have to be composed in the same way. You can also investigate a subject by 'zooming in' from a broad overview to a small detail – moving, for example, from a garden to a flower bed to an individual plant and finishing up with a close-up view of a single bloom. The subjects can, of course, be completely abstract, and themes such as reflections, a color, a shape or contrast lend themselves to consideration as the framework for a series.

Such a framework can involve portraying a subject at the same size and from the same perspective in each photo (see the 'boiled eggs' series below). You can capture your subjects on location or, in the case of mobile subjects, under similar conditions in a studio. Thomas Ruff's portraits, taken in the late 1980s, are a well-known example of this type of strictly composed but nevertheless highly artistic sequence.

A series that is 'looser' and less formal but with more complex content is more likely to belong to the category photo essay (see page 62).

There are so many potential topics for serial photography that all you have to do is pick one you feel passionate about.



A simple idea that is easy to implement but very effective: a selection of different flowers photographed against a background of light cloud on a sunny day and captured using a macro lens. A little post-processing helped to give all four images a similar feel.

Exercise

Photo Sequence

Try an experiment with two different types of recurring subject.

For the first, pick a subject like the flowers shown above, which can be found in a similar form in multiple locations.

For the second, photograph a subject that is fixed in place but changes over time.



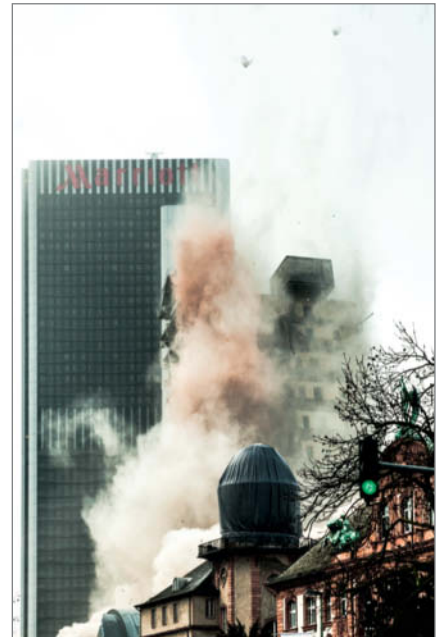
Lifting the lid on the humble boiled egg: each egg was photographed from above in ambient light using a smartphone. Instagram filters were added later.

Photo Stories

This type of sequence tells a story in chronological order. For a flower, it might document the progression from the bud to the bloom to the shriveled flower head. As long as it comprises all the photos a viewer needs to make sense of the event, it doesn't

matter how many photos a sequence contains. The number of photos will depend on the complexity of the theme and, in some cases, just two images are enough to tell a whole story.

In fine-art stories and photo comics, the emphasis is on the narrative, the storyline and the scenario, whereas in photo stories, the story is told purely through the photos, so you have to plan which images you need to tell your particular tale.



The demolition of a high-rise building: these photos were taken only seconds apart and provide a simple but vivid story documenting the disappearance of a building. The images were shot handheld from the middle of a jostling crowd located behind safety barriers. Using a tripod is essential if you want to be sure of capturing consistent framing throughout a sequence.

Exercise

Shooting a Photo Story

For your first training exercise, choose a project that will not take longer than a day.

With a story that unfolds over a short, manageable period of time, like the preparation of a meal, you should take all the photos in a single session.

Plan which photos are necessary to make the storyline clear. Where will you start? Which is the key image? How deep do you want to go?

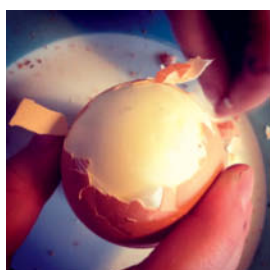
Should the story begin with shopping for the ingredients, or not until work starts in the kitchen?

If you have to re-shoot one of your photos later, make sure you use exactly the same props and have any people in your photos wear the same clothes as they did the first time. Keep the lighting the same, too, otherwise the story will seem jerky and inauthentic.

If, on the other hand, you are producing a story that takes place over a longer period of time, it doesn't matter if props or other elements change during the sequence.

For your first photo story, use a fixed focal length lens, but vary the distance from the subject to produce changes in your compositions. Tell your story using seven, eight or nine photos.

This time, the recurring subject is captured in chronological form and tells a story from beginning to end



Shooting a Photo Essay

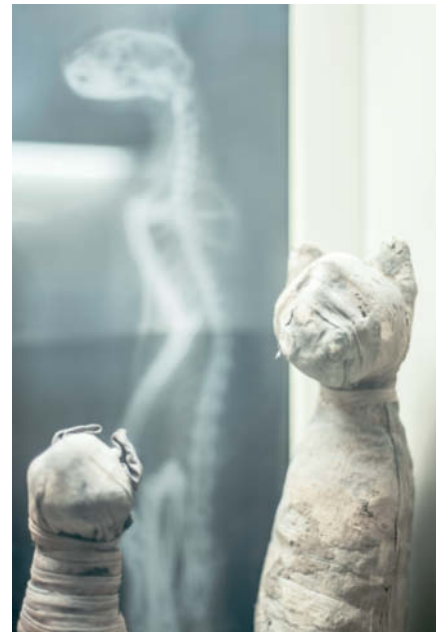
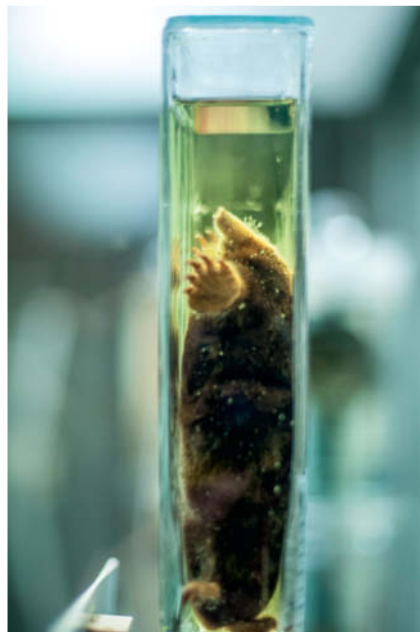
An essay is a collection of photographs that work as individual images but have an associative thematic overview when viewed as a group. An essay doesn't have to include a common thread or cover a distinct passage of time the way reportage or photo stories do. In an essay, the way the images are grouped provides a personal and subjective view of the theme. The idea is to tackle as many different aspects of your chosen theme

as possible, in order to illuminate the subject from various points of view. Depending on the topic and your particular intentions, an essay can be factual, dramatic or even poetic. Intriguing imagery that requires viewers to engage at a deeper level makes for a very successful essay.

Simply taking photos out of the window of your car every time it rains (see the example on page 65) won't help you produce a

successful essay. Even though the photos show different places through the car window, the result is more like an informally structured image sequence than an essay. In this case, the work does not become an essay until a variety of aspects of the subject are shown, such as rain seen from the car, raindrops falling in a puddle or people with umbrellas.





The photos reproduced in this spread and on page 55 were taken at the Senckenberg Museum in Frankfurt. This kind of essay can be planned and carried out as a short-term project or, if you visit a museum regularly, by gradually accumulating impressions of the different spaces and exhibits to produce a truly multifaceted essay.

Developing and Realizing Visual Concepts

Giving a bit of thought to form and composition before you set off on a shoot can help you produce a really successful series of images. Particularly for sequences that are not necessarily linked by the content of the images, the best way to make the connection clear is to use a distinct style or structure for each individual photo. In any sequence, light, perspective and focal length are the most important parameters.

Light

Take the theme 'Summer in the City' as an example: you could use bright, glittering sunshine as a common element that links the various images. Having similar lighting in all the photos in a series is often helpful when producing a sequence. This is easy to achieve in the studio, but you will need to muster up all your patience if you want to use natural light as a link between shots captured on location. On the other hand, a sequence that involves the passage of time through a day, a month or a year will always involve a range of different lighting moods.

Perspective

Which direction should you shoot from? Do you want to make viewers feel that they are

looking at an event at eye level, or would you rather use a dramatic perspective, perhaps by placing the camera near the ground? Unusual camera placement makes the resulting images much more exciting.

Focal Length

Limiting yourself to a single, fixed focal length can be a very practical way to make a sequence cohesive. The formal strictness of a series shot with a 50mm standard lens will be far more potent than one in which every photo was taken using a different angle of view. Do you want to show people and places in full view or do you prefer to use a tighter crop? Consider portraying a large, complex building by means of a variety of small, expressive details.

Think about which lens will do the best job for the type of image you want to produce. If you decide you need to use multiple focal lengths, a maximum of three will ensure that your concept doesn't come unraveled.

Formal Themes

In a sequence developed from a purely formal concept, form determines your approach. For instance, to shoot the theme 'circles', you can use any focal length,

because the key to the sequence is how well you portray the subject, regardless of its size. To really emphasize the theme, you might decide to produce square prints, thus highlighting the contrast with the circular subjects. While thematically connected sequences link images of different subjects, in this case, it is a single shape that provides the underlying structure. The more images this kind of sequence contains, the more effective it will be.

In the same way, a key color, an extreme perspective or the structure of the objects themselves may be what catches the viewer's eye and brings together a range of different subjects. Try spending a whole day photographing only objects of a certain color, or concentrating on the details in the corners of the frame, or 'hunting' frame-filling microscopic textures and patterns using a macro lens. There is no end to the constraints you can set yourself to make a day's photography more interesting.

If you let a theme determine what you photograph, the result will certainly be more satisfying than if you take photos at random before throwing them together and trying to make them 'fit' using editing techniques. Your reward for thinking ahead and planning your shoot will be a visually interesting set of photos.

Exercise

Visual Concepts

Imagine you want to use photography to show a friend a place the way you see it. Think about the mood you would like to create and what kind of lighting would be most effective.

Which perspectives will work best for your idea? Should it be matter-of-fact and documentary or poetic? Determine as many parameters as possible in advance; this makes the actual photography a thousand times easier.

Choose a maximum of two focal lengths. For this exercise, you need to allow plenty

of time and assume that you will have to make several trips to complete your sequence.

Step 1: Photograph all the subjects that you feel are important to your sequence, keeping in mind all the time the parameters you have planned (focal length, perspective, etc.). Take your time and spend at least two hours concentrating on taking photos. Back home, select the 12 best photos and then get really critical and thin them out to just five. Now consider whether some of the shots you have selected could be photographed in different ways and whether or not the series is complete.

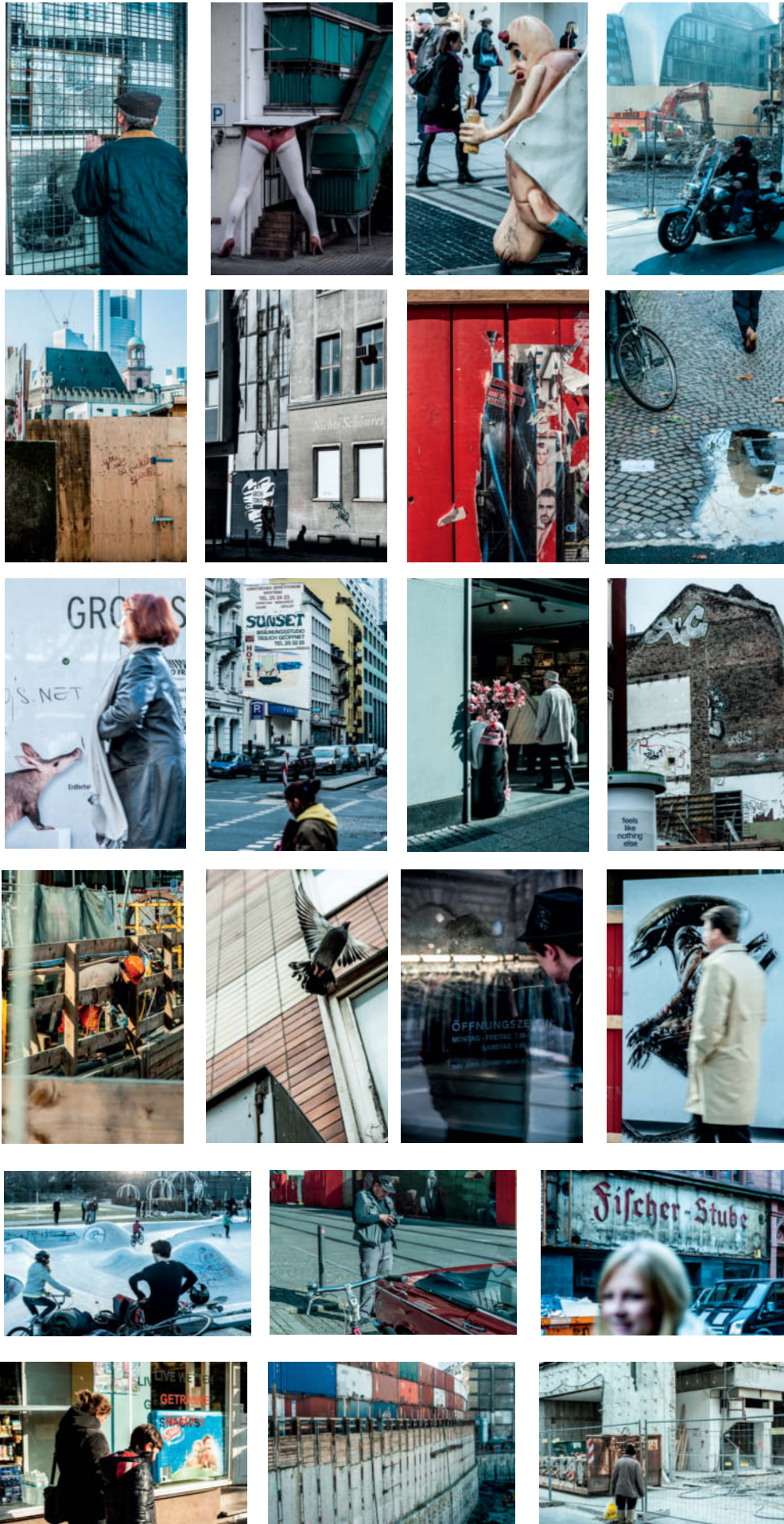
Step 2: Complete your sequence by re-shooting the subjects that didn't turn out well the first time.

Step 3: Next, photograph the same subjects in other lighting conditions and using different focal lengths from the ones you used previously.

Finally, compare the two experiences and the two sets of photos. Which one comes closest to expressing your intentions? If you decide in advance how an object or place should be portrayed and select accordingly from the available equipment and shooting strategies, you are already miles ahead of someone who just take snaps.



This series of images, photographed from a moving car in the rain, does not quite count as an essay, because it does not show us different aspects of the rain or driving. However, it clearly demonstrates how fluid the borderline between different types of image sequences can be (in this case, the difference between a sequence and an essay).



Editing

When working on photographic sequences, it is helpful to keep rearranging the groups of images. The photographic process is by no means over once you have made the exposure and, when you are shooting to a plan, it also includes selecting, sorting and grouping images on a computer. Selecting a small number of images from a large collection takes patience and concentration. The fewer images you want in your final sequence, the more difficult the process becomes.

The subjects you select and the order in which you present your images will change the effect of a sequence. Keep asking yourself whether you are still working toward your original goal, whether your approach has changed and what the best form of presentation will be for the finished work. Discard any photographs that don't fit in with the theme or that aren't technically up to scratch.

Creating Collections

To be able to use your archives systematically, it is worth adding keywords to all the photos that you didn't tag when you downloaded them from your camera. What do they have in common? Can you sort your photos more thoroughly using additional tags that describe form as well as content? Programs like *Lightroom* make it easy to create collections, and a single photo can of course appear in several groups.

The two groups of images opposite were chosen from the collection shown on this page.

The upper group shows different facets of the city, while the thematically stronger lower group shows some of the many construction projects that give Frankfurt the appearance of a huge patchwork rug.

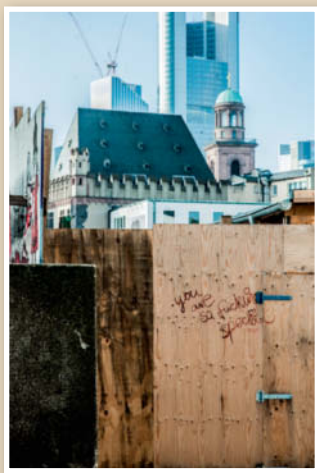
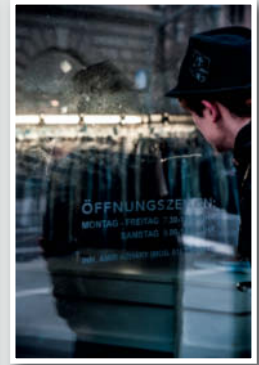
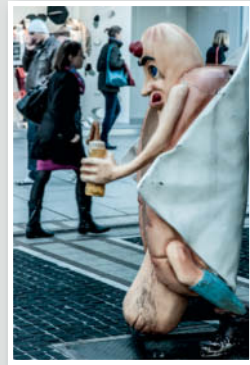
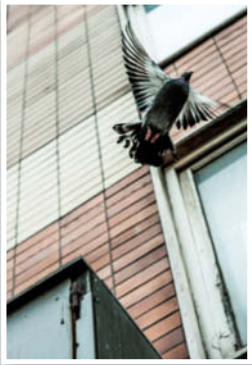


Image Processing

To achieve better formal cohesion, you can process all the images in a sequence to give them a more connected look.

If, for example, you want to emphasize the gloom of an urban location, you can tone your images and desaturate them to look like the ones of Lüttich in Belgium reproduced below. In a series on the color red, it helps to increase saturation in the red tones and desaturate the other colors.

Because images with different color temperatures rarely go well together, you can unify a sequence by adjusting the white balance setting. You can also increase the contrast in selected shapes to make them stand out from their surroundings. Structures with a distinct shape look even more striking in black and white.

Ready-made filters such as the ones built into *Lightroom* can also help to give groups of images a shared look, but take care not to make everything so similar that it becomes

boring, which can happen if the filter effect is too obvious.

Always print your results (postcard-sized prints will do) and pin them up on a wall or lay them out on an empty table for viewing. This way, you can shuffle them by hand and evaluate the effects of different arrangements. Narrow down the choice of photos, then further reduce their number until you are happy with the result. It is often difficult to be objective about your own work, so always ask other photographers what they think.

Presentation

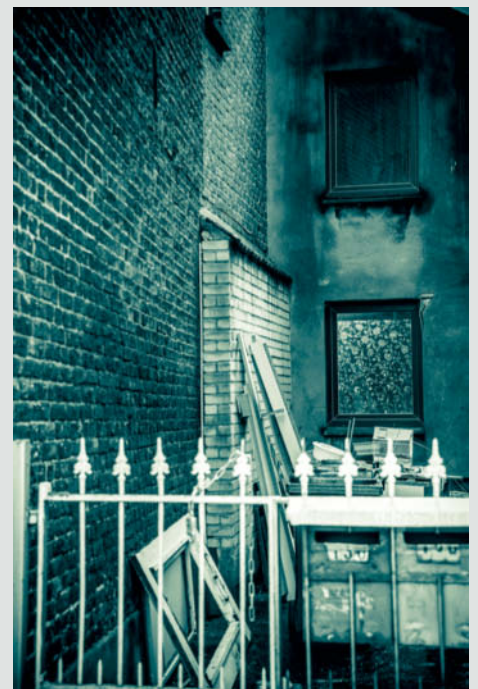
Once you have made your final choice, you can complete the project by presenting the images on the Internet or making them into a book. You may even be able to hold your own individual or group exhibition with like-minded colleagues.

In any case, you will have to decide on the right format for your project and, in some cases, for the individual images, since the

photos in a sequence do not all have to be the same size. The format you choose should show them at their best.

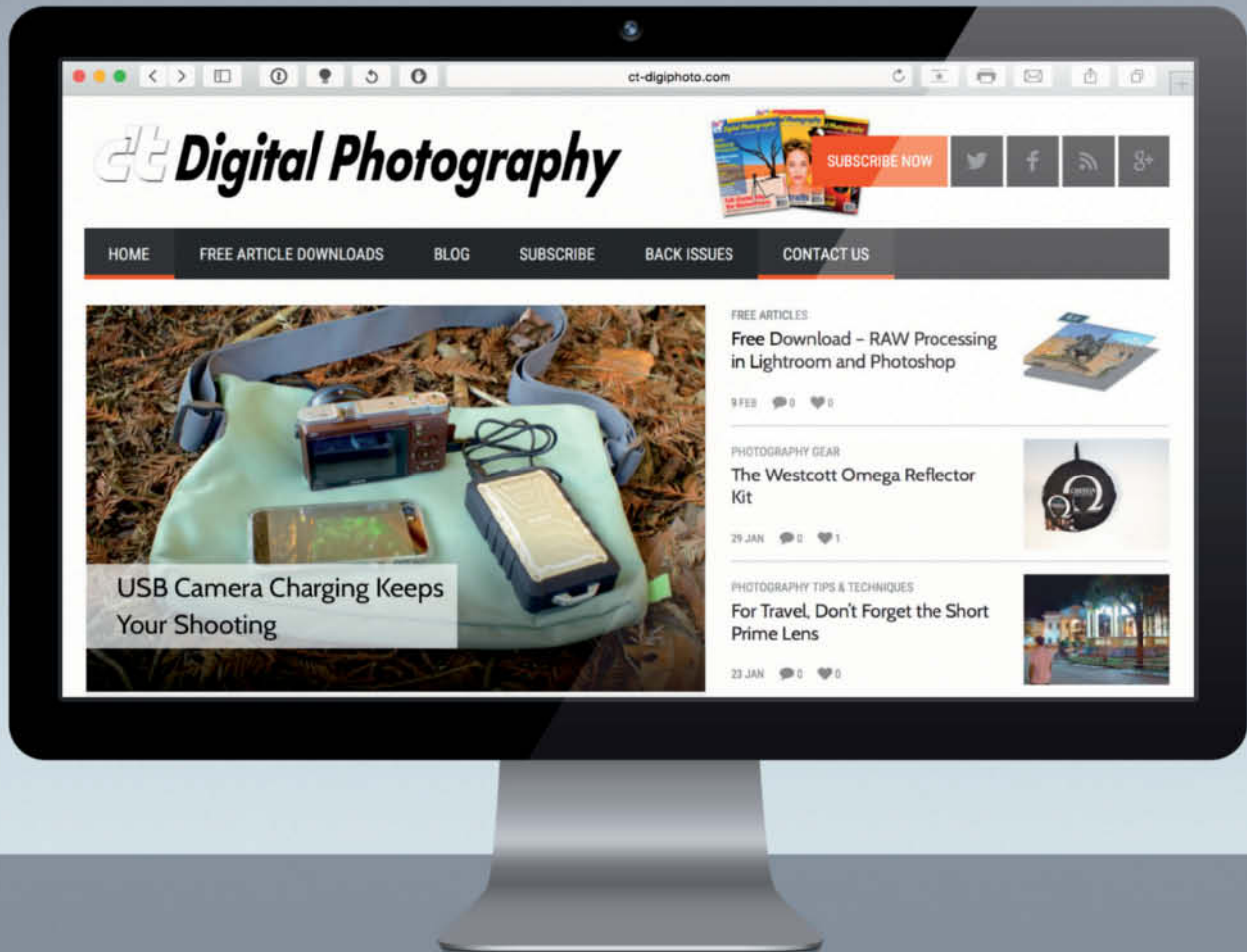
Extensive sequences are best suited to a photo book, although great photos always look good on a wall. However, presenting and hanging images is a huge topic that we can only touch on here. There are so many details that have to be taken into account in order to find the best way to present your finished work: framed or unframed, with or without mounts, glued to card or laminated, or maybe even just pinned directly to a wall.

The way a photograph is displayed can significantly increase its effect on the viewer, so it is worth putting plenty of thought and effort into your presentation. Hours perusing books, browsing the Web, and visiting galleries and museums are time well spent. Not only will you find ideas for new themes, you will discover many different ways of presenting your work and develop your ability to spot better ways to present your own projects. (ann)



When photos from a sequence are harmonized at the post-processing stage, they take on a strong formal cohesion that helps them look as if they belong together

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



ct-digiphoto.com



Sophia Zimmermann

Mirrorless or DSLR?

Samsung NX1 vs. Canon EOS 7D Mark II

For this issue's comparison test, we lined up the Canon EOS 7D Mark II with the new Samsung NX1. Read on to find out how these two very different high-end, high-speed APS-C models fared.



Photokina 2014 would probably have been completely forgotten by now if it hadn't been for Samsung's new NX1 mirrorless system camera which, with its astonishing 15 fps burst shooting rate, was the only true highlight of the show. This kind of speed throws down the gauntlet to all of the other major manufacturers and offers stiff competition to Canon's new EOS 7D Mark II, with its much-hyped 10 fps burst rate.

But spectacular specifications alone don't make a great camera, so we decided to take a look at the EOS 7D Mark II and the NX1 in the flesh and compare what these two very different beasts have to offer.

Grown-up Cameras

These two cameras represent the top end of the current crop of APS-C devices and are aimed at the kind of ambitious amateur photographers who demand high-quality tools for capturing high-end sports photos or every important moment of their children's development.

Both our test cameras underscore their high-end ambitions with their large, hefty bodies. The 7D Mark II is wider, longer and deeper than its predecessor, even though the original 7D was almost as large as some pro-grade DSLRs.

Although it is a mirrorless system model, the Samsung NX1 doesn't display any of the compactness that usually characterizes this type of camera and it is only its relatively low weight of 550 g (19.4 oz) that belies its lack of a mirror. In contrast, the 7D Mark II weighs in at 910 g (2 lb).

Alongside its speed and its pro-style design, the NX1 also has one of the highest resolutions currently available in the APS-C segment. Its 23.5×15.7mm sensor resolves 28 megapixels, compared with the 20 megapixels offered by Canon's 22.4×15 mm sensor, which lies toward the lower end of the range offered by current APS-C models.





FEATURES AND PERFORMANCE

	Samsung NX1	Canon EOS 7D Mark II
Technical Data		
Sensor resolution	6480 × 4320	5472 × 3648
Sensor size	23.5 × 15.7 mm	22.4 × 15.0 mm
Megapixels	28	20
Crop factor	1.5	1.6
Autofocus system	Hybrid	Phase detection
Focus areas	205 phase-detection, 209 contrast-based	65
Cross sensors	153	65
Shortest / Longest exposure time	1/8000 s / 30 s (Bulb)	1/8000 s / 30 s (Bulb)
ISO sensitivity	100-51 200	100-16 000 (25 600/51 200 in extended mode)
Viewfinder type / resolution	OLED / 2.36 million dots	Pentaprism / –
Monitor type / size / resolution	AMOLED / 3-inch / 1.04 million dots	LCD / 3-inch / 1.04 million dots
Monitor tiltable	yes	no
Dimensions (W/H/D)	139 × 102 × 66 mm	149 × 112 × 78 mm
Weight (incl. battery and mem. card)	550 g (19.4 oz)	910 g (2 lb)
Memory card types	SDHC, SDXC	CF Type 1, SDHC, SDXC, Eye-Fi
Connectors	WLAN, NFC, Micro USB 3.0, Mini HDMI, Bluetooth	Micro USB 3.0, Mini HDMI, PictBridge
RSP (body only)	\$1,500	\$1,800
Test Results		
	better ▶	better ▶
Sensor resolution (line pairs)	2160	1824
Center resolution (ISO 200)	1959	1567
Center resolution (ISO 400)	1914	1544
Center resolution (ISO 1600)	1780	1500
Center resolution (ISO 6400)	1625	1381
Dynamic range ¹ (ISO 200)	9.33	9.51
Dynamic range ¹ (ISO 400)	9.9	9.86
Dynamic range ¹ (ISO 1600)	9.25	9.8
Dynamic range ¹ (ISO 6400)	9.27	9.47
	◀ better	◀ better
Visual Noise (ISO 200)	0.7	1.0
Visual Noise (ISO 400)	0.8	1.2
Visual Noise (ISO 1600)	1.2	1.7
Visual Noise (ISO 6400)	1.5	3.6
AF lag at 1000 lux (using kit lens)	0.2 s	0.4 s
¹ in f-stops — not applicable		

The status display window on the top plate is an unusual feature in a mirrorless system camera and underscores the NX1's high-end ambitions. Visually, there is little difference between this and a traditionally designed DSLR like the EOS 7D Mark II.

Handling

Samsung's touch control enhances the user experience

The NX1 looks a lot like a DSLR and handles like one too. Most of the major controls are arranged like those of a DSLR, with a mode dial and the drive dial with its buttons for controlling ISO and AF mode settings taking prime position on the top plate. The twin command dials can be used to set the aperture, the exposure time, the size of the focus area and a number of other parameters depending on which mode you are shooting in. The status display window on the top plate helps to navigate the various menus quickly and reliably. In its default configuration, the Fn button reveals the 'Smart Panel' that gives you direct access to a range of major settings, including AF area adjustments.

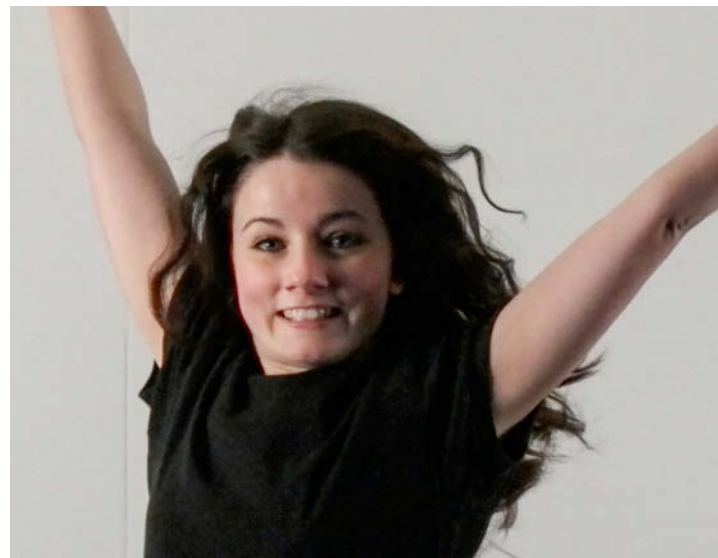
In spite of its more than 200 phase-detection AF points, AF control is not as flexible as the Canon system, and Samsung has neglected to give the AF system a menu of its own. You can choose between variable-size Selection, Multi, Face Detection and Self-portrait AF areas, with the latter squarely aimed at selfie fans. The NX1 underscores its cutting edge status with its built-in touch screen control with which you can select the area of the subject you wish to

focus on and start AF tracking. This function is highly reliable, even though you can't adjust its sensitivity. You can also use the touch screen to separate the focusing and exposure areas within the frame, which saves a lot of fumbling around in the camera's menu system when exposing high-contrast subjects.

In spite of all its high-end features, using the NX1 isn't entirely intuitive and we recommend that you take a look at the comprehensive user manual before you start shooting.

Some of the camera's functions are slightly puzzling. For example, we couldn't adjust the image quality setting in Auto mode and had to switch to A, S or M to make a change. The NX1 can only capture JPEG images in Auto and P modes.

We were also surprised to find that our test camera didn't include a battery charger – an accessory that should be mandatory for a camera in this price range. This might, however, be an anomaly and not applicable for cameras purchased in your region.



The high-speed NX1 can capture movements more precisely than the EOS 7D Mark II. The Samsung's autofocus system proved to be extremely reliable and we liked the easy-to-use Tracking AF function a lot. These photos were captured at ISO 1600.

Samsung NX1 | ISO 1600 | 35 mm | f4 | 1/1000s | 15 fps | Crop magnified to 200%

The EOS 7D Mark II offers a mature, high-end interface

The EOS 7D Mark II continues the Canon tradition of maximum ease of use, and provides controls that enable you to adjust all major camera functions without taking your eye away from the viewfinder. There are, however, some major differences between the Mark II and its predecessor. The changes are particularly evident in the way the camera's complex AF system is controlled. The new camera has its own dedicated AF operation button that enables you to select both the AF area and the focus points you wish to use. Focus settings even have their own tab within the menu system, where you can adjust AI Servo AF settings to suit various types of situations.

The menu itself offers settings for six different 'cases'. Case 1 is a versatile setting that can be used to capture a variety of moving subjects, while the others are tuned to more specific scenarios, such as subjects that suddenly enter the selected focus area, accelerate or decelerate quickly, or change speed and move erratically. Tracking sensitivity and the frame rate can be fine-tuned to your particular requirements in all six cases. Lower frame rates are suitable for subjects that move in a predictable fashion (a ballet dancer, for example), whereas

higher rates are more suitable if you want to be sure of capturing entire fast-moving sequences (such as a motocross motorcycle in mid-jump). The 7D Mark II offers an extremely comprehensive range of user-controllable settings but the system nevertheless remains fairly intuitive, making it easy for newcomers to the Canon fold to find their way around.

Only very bright lenses are able to make the most of the 65-point AF system, and other smaller details differentiate the new camera from its predecessor. For example, the Q (Quick Control) button has been shifted to the

right-hand side of the camera's back and there is now a multi-function lock switch that can be used to lock the main and quick control dials as well as the multi-controller and the AF area selection lever. The 'Creative Photo' button has been added to the top left of the camera back, offering access to picture style, HDR and multiple exposure functionality.

Creative Auto mode is no longer individually selectable via the mode dial and is now part of the Scene Intelligent Auto option, which automatically optimizes all camera settings for the scene at hand.



The EOS 7D Mark II is one of the fastest cameras in its class. We shot some burst sequences to test its AF mettle, and the results we achieved using the 24-70 mm f/2.8L II USM lens were very good indeed. Our sample photos were captured at ISO 1600.

Canon EOS 7D Mark II | ISO 1600 | 35mm | f4 | 1/1000s | 7fps | Crop magnified to 250%



At low ISO values (in this case ISO 100), the NX1 produces natural-looking images with great contrast and plasticity

Test Results and Image Quality

Noise Characteristics

The Canon recorded a signal-to-noise ratio of below 60 at minimum ISO sensitivity and visual noise that came in at a highly respectable value of 1. Both values increased slightly with every increase in ISO sensitivity. The camera offers an overall dynamic range of about 10 f-stops, which is normal for this class of camera. The NX1 recorded a signal-to-noise ratio of 85 at ISO 100 and a better visual noise reading of just 0.7. The Samsung, too, shows deteriorating values at higher ISO settings and an overall dynamic range of just below 10 stops.

Resolution

Tested with the 24-70mm f/2.8L II USM lens, the Canon recorded center resolution of 1567 line pairs at f5.6, falling to 1543 at ISO 400 and 1381 at ISO 1600. Loss of edge detail remained moderate even at high ISO settings.

Due to its lower resolution, the Canon cannot compete with the Samsung in the technical resolution stakes. Used with our

16-50mm f/2-2.8 test lens set to a medium focal length, the NX1 produced center resolution of 1959 line pairs (i.e., almost 90 per cent of its potential maximum). This value was reduced to 1914 at ISO 400 and fell off significantly to 1625 at ISO 1600.

Our test images (included on this issue's free DVD) accurately reflect our lab test results and reveal both cameras' strengths and weaknesses. At low sensitivity settings, both cameras deliver high-contrast images with great detail rendition and a natural, highly three-dimensional look. Viewed purely subjectively, the Samsung produces slightly more realistic-looking images at low sensitivities but produces obviously softer details at higher ISO settings. In contrast, the 7D Mark II performs almost as well at ISO 800 as it does at ISO 100 and the difference between the two cameras' performance becomes even more obvious at ISO 3200, where the NX1 simply fails to reproduce many fine details and produces obvious sharpening artifacts at high-contrast edges. Textures such as those in the jute fibers in our lab test scene ended up quite poorly defined. In comparison, the 7D Mark II

produces more grain at high ISO levels but reproduces fine details much more accurately.

Autofocus Speed

The NX1 was twice as fast in daylight, recording an AF lag value of 0.2s compared with the Canon's 0.4s.

Conclusions

These two models belong to the same basic class of camera but play in two different leagues. The Canon, with its complex but intuitive handling and robust body, is aimed squarely at pro-level photographers who need tough, reliable tools that stand up to use in all types of situations. The Samsung NX1 offers high build quality and great handling, while features such as touch control, Wi-Fi, NFC and a tiltable display put it firmly in the 'lifestyle camera' camp. It nevertheless has pro-grade ambitions and proves just how keen the major manufacturers are to produce mirrorless cameras that can gain acceptance in pro circles. (ssi)

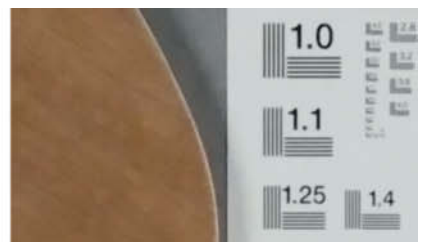
ISO Bracketing with the Samsung NX 1



ISO 100



ISO 1600

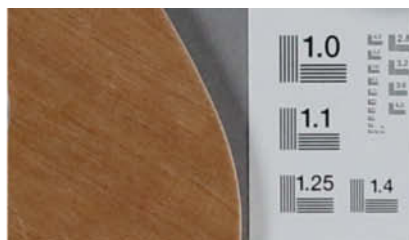


ISO 6400

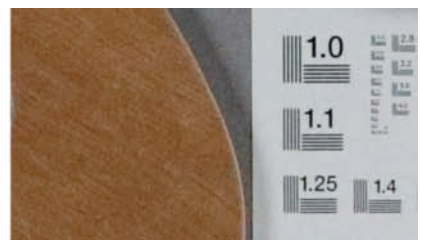
ISO Bracketing with the Canon EOS 7D Mark II



ISO 100



ISO 1600



ISO 6400

In our controlled lab test, the Samsung lost resolution in fine details at much lower sensitivity levels than the Canon.

ct



Jobst-H. Kehrhahn

Pentax 645Z

A New Alternative to Full-frame

Although they are generally considered to provide unbeatable image quality, medium format cameras are usually bulky, complex and expensive, and are only really suitable for studio use. With the new 645Z, Pentax aims to change all that. This camera offers innovative features at a competitive price, so we decided to check it out and see whether it might end up competing for the minds and wallets of digital photographers on the lookout for unusually high image quality.

A medium format camera body for \$8,500? For anyone familiar with this segment of the market, it came as a big surprise when Pentax announced the price and feature list of its latest medium format contender. The camera offers a 51.4-megapixel CMOS sensor, maximum ISO sensitivity of 204,800, live view, a tiltable LCD monitor, Full HD and 4K video capture, and a burst shooting rate of 3 fps, making it a real option for many pro photographers on the lookout for high-end image quality.

But the competition is fierce. Ultra-high resolution coupled with excellent image quality is no longer a unique selling point for the medium format market – cameras that offer resolution beyond the 35-megapixel mark, such as the Nikon D800(E) and D810 or the Sony a7R, have already gained acceptance as pro-grade photographic tools and, when used with appropriately high-end lenses, offer image quality to match.

Although we have yet to see any official announcements, the rumor mill is awash with reports of upcoming large-sensor and/or high-resolution models from Canon. The sensor used in the 645Z is manufactured by Sony (see page 78), making an entry into the medium format market a possibility on Sony's part too.

However, Pentax is the only major manufacturer that already produces an established range of medium format lenses. Anyone wanting to compete with Pentax will first have to go through the expensive and time-consuming process of developing its own lenses. Pentax is also way ahead in the medium format manufacturing game and has been gathering experience in this market segment since the introduction of the first analog 645 back in 1984. The only drawback of legacy 645 lenses is that they are not moisture and dust-proof like the newer models introduced with the digital

645D in 2010, but they are still compatible with both newer cameras. The 645D is still being produced and currently costs around \$4,800 for the body only.

The Pentax website lists 18 medium format lenses, ranging from a 28-45mm wide-angle zoom all the way up to a 400mm prime. The new 645AF2 bayonet is backwards compatible with the older 645AF and 645A models, so all DA645, DFA645, FA645 and A645 lenses will fit the 645Z. There are also various third-party adapters available for using Pentax 67 lenses with the 645 cameras. Other combinations are possible too, and we found a no-name adapter on the Web that mates Hasselblad lenses with Pentax 645 bodies.

Officially, Pentax sells 12 prime and six zoom lenses for the 645 cameras, although as we went to press, the Pentax/Ricoh online shop was selling only 12 of these and the new body was not yet available.

Camera Technology and Test Results

The heart of the 645Z is a new, high-resolution Sony sensor that delivers 51.4 megapixels of resolution and appears to be the same model that is built into the Hasselblad H5D-50C and the Phase One IQ250 digital back.

The sensor is in fact smaller than the name of the camera suggests, measuring just 43.8×32.8 mm rather than the traditional 60×45 mm size of its analog film equivalent. This equates to a crop factor of 0.62 and pixels that measure 5.3 μm across. In comparison, the individual pixels in the Nikon D800's sensor measure 4.6 μm, while those in the 16-megapixel D4 measure 7.3 μm.

Light sensitivity: The larger a pixel, the more photons it can capture, leading to greater sensitivity and dynamic range. For the Pentax, we measured a very good dynamic range of 12.3 f-stops at ISO 100, 10.38 stops at ISO 800 and about 8 stops at ISO 12 800.

The 645Z has a spectacular sensitivity range that goes way beyond the 645D's limit of ISO 1600 and extends all the way up to ISO 204 800. That is about one stop less than the Nikon D4S and the Sony a7S but still gives you plenty of potential for reducing noise, especially if you are prepared to digitally reduce the high resolution of the 645Z's native images.

Like the 645D (and the Nikon D800E), the 645Z has no built-in anti-aliasing filter – a design decision that benefits the reproduction of fine textures but increases the risk of producing moirés. However, our test images prove that this is largely a non-issue.

The processor: The large sensor's high resolution means that the camera's processor has to handle enormous amounts of image data. A single DNG-format image can be as large as 65 megapixels, while JPGs come in at between 30 and 50 megapixels. The 645Z uses the same PRIME III processor built into the K-3 DSLR which, according to Pentax, is five times faster than the previous PRIME II version.

PENTAX 645Z	
Technical Data	
Sensor resolution	8265 × 6192
Effective megapixels	51.4
Sensor size	43.8 × 32.8 mm
Crop factor	0.62
RAW shooting	yes
Autofocus system	Phase-detection/Contrast-based
Shortest / Longest exposure time	1/4000 / 30s
Sensitivity range	ISO 100-204 800
Viewfinder	Trapezoidal prism with Keplerian magnifying eyepiece
Viewfinder coverage	approx. 98%
Monitor	TFT color LCD
Monitor size	3.2"
Monitor resolution	1.04 million dots
Monitor tiltable	yes
Dimensions (W/H/D)	156 × 117 × 123 mm
Weight (incl. battery and mem. card)	1550 g (54.7 oz)
Supported memory formats	SD, SDHC (UHS), SDXC (UHS), Eye-Fi / Flucard
Connectors	USB 3.0 (micro B) / X-sync / HDMI / Stereo microphone / DC power / Cable remote
Current price (body only)	\$8,500
Test Results	
	better ▶
Center resolution (ISO 100)	2669
Center resolution (ISO 200)	2651
Center resolution (ISO 400)	2595
Center resolution (ISO 1600)	2514
Center resolution (ISO 6400)	2439
Signal-to-noise ratio (ISO 100)	63.5
Signal-to-noise ratio (ISO 200)	53.7
Signal-to-noise ratio (ISO 400)	47.6
Signal-to-noise ratio (ISO 1600)	34.5
Signal-to-noise ratio (ISO 6400)	22.3
	◀ better
Visual Noise (ISO 100)	1
Visual Noise (ISO 200)	1.1
Visual Noise (ISO 400)	1.3
Visual Noise (ISO 1600)	1.9
Visual Noise (ISO 6400)	3



Side Tripod Mount
The Pentax 645Z has two tripod mounts, enabling you to switch easily between landscape and portrait shooting formats



Monitor and Back
The Pentax 645Z has a tiltable display. The rest of the controls to its right are well arranged and intuitive to use.



This comparison shot shows how much bigger the 645Z is than a conventional full-frame DSLR. The additional bulk makes handling in everyday photographic situations trickier.

This makes the 645Z capable of shooting up to 10 full-resolution RAW or JPG images at 3 fps (compared to the 1.1 fps specified for the 645D). Our tests achieved a maximum of 2.9fps and, even if this is a lot less than the 11 fps that the Nikon D4S can shoot, it is still an enormous step forward for a medium format camera. However, the competition has once again been quick to catch up, and the medium-format Leica S (Typ 007) introduced at the 2014 Photokina show is capable of capturing 37.5-megapixel images at 3.5 fps.

Autofocus: The 645Z shares its SAFOX II autofocus unit with the K-3, although Pentax

has adjusted its functionality to focus at exposure values between -3 and $+18$ EV and meter exposure between -1 and $+21$ EV (in comparison, the 645D focuses at -1 to $+16$ EV and meters exposure at $+2$ to $+21$ EV). In SLR mode, the the AF module uses 27 phase-detection sensors (25 of which are cross sensors) but switches to center-weighted, contrast-based AF in live view mode.

The system is fairly slow and, used with our 90mm test lens, took 1.3s to track from infinity to our subject in live view (focus priority) mode. Switching to exposure priority reduced

this value to 0.43 s, which is a lot better but still slow. Our real-world tests backed up our lab measurements, and we found that we missed a couple of faster-moving subjects because autofocus was too sluggish.

Additionally, the large sensor makes the available depth of field relatively shallow, making precise focusing essential if you want to get the best out of the camera's tremendous capabilities. The built-in focus peaking feature that displays subject details at up to $16\times$ magnification is a great aid to doing just that, especially if you are working at wide apertures.

Additional Controls

The 645Z's body includes four new buttons that can be customized to provide fast access to functions that are otherwise buried deep in the camera's menu system



Image Quality and Test Results

We tested the 645Z in the the lab and in the studio using a Pentax 90mm f/2.8 D FA 645 Macro lens. This lens has an equivalent 35mm full-frame focal length of 71mm, making it ideal for portrait use (see pages 76, 81 and 82). The large maximum aperture made it possible to limit the depth of field to a very small range, which in turn made it necessary to focus very carefully using the live view magnifier. This way, we were able to keep our model's eyelashes pin sharp while the softer focus in the foreground and background provided a suitable framework for the overall shot.

As expected, our test camera/lens combo produced images with excellent noise characteristics. At ISO 100, our (subjective) visual noise test produced an excellent value of 1 and, at ISO 1600, we recorded a value of less than 2, which is still near the limit of visible noise artifacts. In comparison, the Hasselblad H4D-40 used with an HC 80mm f/2.8 lens produced a value of 6.3 at ISO 1600, which equates to obvious, disruptive noise (see the

bracketing sequences on page 83 for more comparisons).

In the resolution stakes, the Pentax surprised us by producing poorer results than our Hasselblad test combo. We measured 3285 line pairs of center resolution at ISO 100 for the Hasselblad but 'only' 2654 line pairs for the Pentax. This may seem like nit-picking, but such discrepancies can make a big difference if you are planning to make large-scale prints from your images. Rest assured, however, that the values we measured are equivalent to those produced by the Nikon D800E used with an AF-S Micro-Nikkor 105mm f/2.8G VR lens at ISO 100, so – especially in view of the 645Z's excellent noise characteristics – there is still plenty of processing headroom available in these high-quality image files.

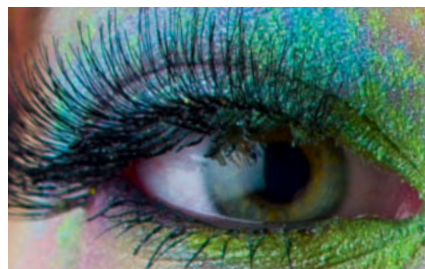
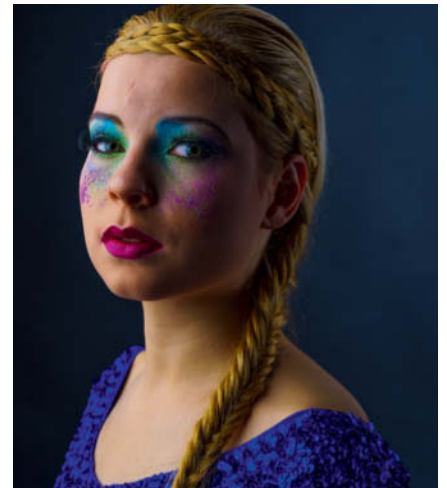
Edge softness is tolerable too, although you should note that we used camera JPGs to judge our results and that the 645Z is designed to compensate automatically for the distortion, vignetting and diffraction blur caused by specific lenses from the Pentax

range. Using this option, we measured sharpness fall-off of just 4 percent from the center of the frame to the lower left-hand corner, which is negligible.

With respect to dynamic range, the Pentax beat our Hasselblad and Nikon D800E test cameras, capturing 12.3 stops of contrast at ISO 100 compared to the 10 stops captured by the Hasselblad and 11 stops by the Nikon. This is a significant difference that gives the Pentax a serious edge over the competition.

However, test results are not the only yardstick for camera quality, so we captured a range of studio and real-world sample images for you to compare at home (these JPG and DNG files are included, along with our ISO bracketing images, on this issue's free DVD).

Viewed subjectively, the 645Z produced well balanced colors that are not as highly saturated as those produced by our Hasselblad test camera. For RAW shooting, the 645Z can output universal DNG-format or proprietary PEF-format images that can be processed using the software provided with the camera.



Photos: Thomas Saur

Three test images and corresponding details shown in a 100% view.

From left to right, these were captured using a Sony a7R with a Zeiss Otus 85mm F/1.4, a Hasselblad H4D-40 with an HC 80mm f/2.8 lens, and the Pentax 645Z with a Pentax 90mm f/2.8 macro lens.



Photo: Thomas Saur

Used with the 90mm f/2.8 D FA Macro lens, the Pentax 645Z delivers images with natural-looking colors and extremely good detail rendition.

The main image here is a 100% view of a selected image detail, while the smaller image shows the entire frame.





Photo: Thomas Saur

The 645Z displays excellent noise characteristics at high ISO values, as shown in this image, which we captured at ISO 1600


Conclusions

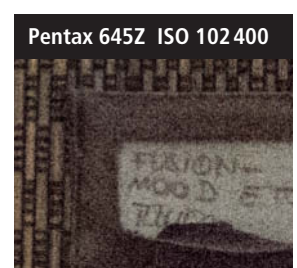
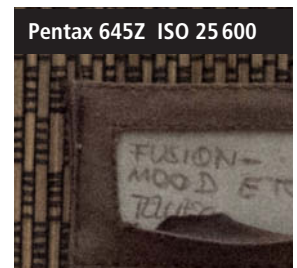
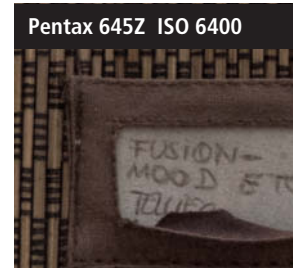
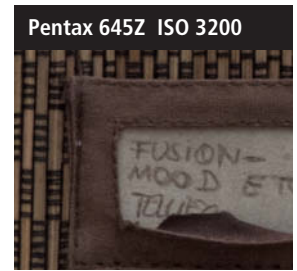
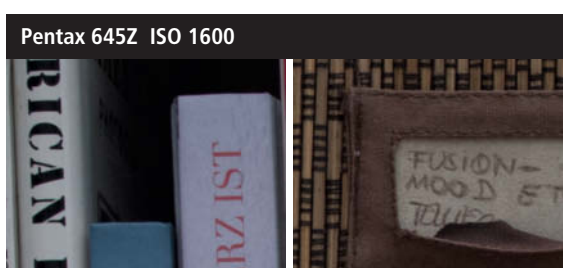
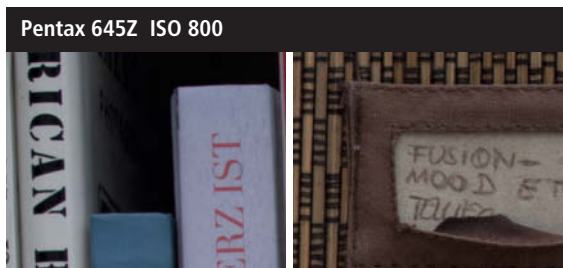
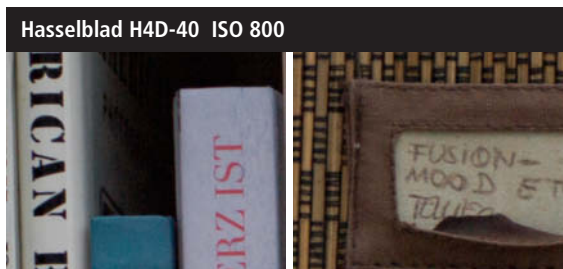
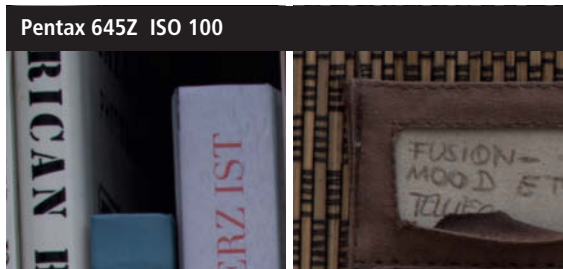
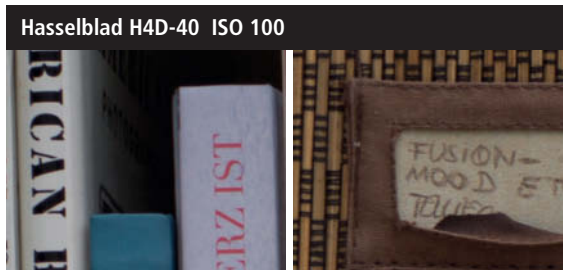
The Pentax 645Z goes a long way toward bringing medium format photography into the mainstream. The camera is affordable and includes many features – such as live view, an articulated monitor, and dust and moisture resistance – that were hitherto only available in smaller cameras. Even consumer-level features such as HDR creation are included and are well implemented into the bargain. This is the camera that many medium format fans have been waiting for and, with its high-quality, user-tweakable JPG images, doesn't even have to rely on RAW capture to provide excellent results.

The resolution values were the biggest surprise revealed by our tests, but these are more than compensated for by the 645Z's excellent high-ISO noise performance and broad dynamic range. The latter is an important factor in many everyday situations and three stops of additional exposure leeway can make the difference between a mediocre image and one with plenty of reserve shadow detail.


The 645Z is still too bulky and expensive to be considered a real alternative to today's full-frame DSLRs, but is still a remarkable device that will find many buyers (and renters) among fans of high quality imaging who know what they are letting themselves in for. Advertising photographers with their own studio space and pro landscape photographers who produce large prints are sure to be among them.

Our only real gripe is the autofocus system, which, although faster than its predecessor and all other currently available medium format cameras, still has plenty of room for improvement.

Our ISO bracketing sequences show that the Pentax 645Z produces results at ISO 6400 that are comparable with those produced by the Hasselblad H4D-40 at ISO 1600 



Photos: Stefan Arand

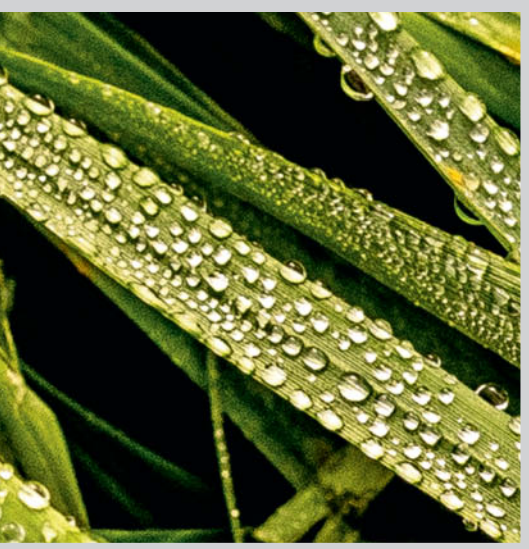


Sophia Zimmermann

Zeiss Otus 85mm f/1.4

A short telephoto prime with
medium-format qualities

The portrait-length 85mm f/1.4 is the second in the Zeiss range of Otus lenses and delivers medium-format image quality at a premium price. We took the new lens to the lab, out into the country and off to the flea market – but not with a view to selling it!



Ultimate sharpness, high detail contrast and finely tuned focus gradients make images captured using the Otus extremely three-dimensional and lifelike. This lens transforms the simplest of objects into spectacular photographic subjects.

Sony a7R with Zeiss Otus 85mm f/1.4 | ISO 400 | f5.6 | 1/640 s

With the 55mm f/1.4 Otus, Zeiss set new standards in normal lens quality, and the new 85mm model aims to do the same in the portrait lens segment.

Like its little sister, the 85mm Otus looks more like it was forged than manufactured. Its silky matte finish is accented by subtle yellow lettering and its clean lines make it clear from the start that this is a high-quality lens.

These first impressions are confirmed the moment you pick the Otus up. It is heavy and cool to touch, and its 2.51 lb weight make it a challenge to use, even with 'grown-up' cameras like the Nikon D800E. We almost found ourselves wishing that it had a built-in tripod mount. Used with the diminutive Sony a7R, the Zeiss appears almost obscenely large.

Precise Focusing

As we expected, Zeiss build quality is faultless, although the doubts we had about the robustness of the rubberized focus ring on the 55mm Otus are just as relevant for the new lens. Both quickly develop a worn-out look and feel, and our overriding feeling is that Zeiss ought to employ a more solid solution for lenses in this price range. This may sound like nit-picking, but we know from past experience that Zeiss is capable of manufacturing high-quality ribbed metal focus rings that definitely wouldn't look out of place in new lenses.

On the other hand, the focus ring's mechanics are a dream to use, and its 260-degree range of travel ensures precise focusing at all points, just like it does in the 55mm Otus.

The Nikon version of the lens has its own aperture ring, allowing you to decide whether to set the aperture via the camera's controls

ZEISS OTUS 85MM F/1.4 LENS DATA

Focal Length	85 mm
Aperture range	f/1.4 – f/16
Close focus limit	80 cm (2.62 feet)
Length / Diameter (Nikon version)	122 × 101 mm (3.98 × 4.8")
Weight (Nikon version)	1.14 kg (2.51 lb)
Supported lens mounts	Nikon F, Canon EF
Price	\$4,500
Test Results	
Center resolution (wide open / f4 / f8)	2230 / 2374 / 2306 line pairs
Edge resolution (wide open / f4 / f8)	1818 / 1948 / 2152 line pairs
Chromatic aberration (wide open / f4)	0.14 / 0.11
Distortion	+0.1 per cent

(depending, of course, on the camera model) or directly in the lens. Because Canon cameras no longer support direct aperture settings, the Canon version has no dedicated aperture ring. Both versions include a metal lens hood with a silky matte inner finish.

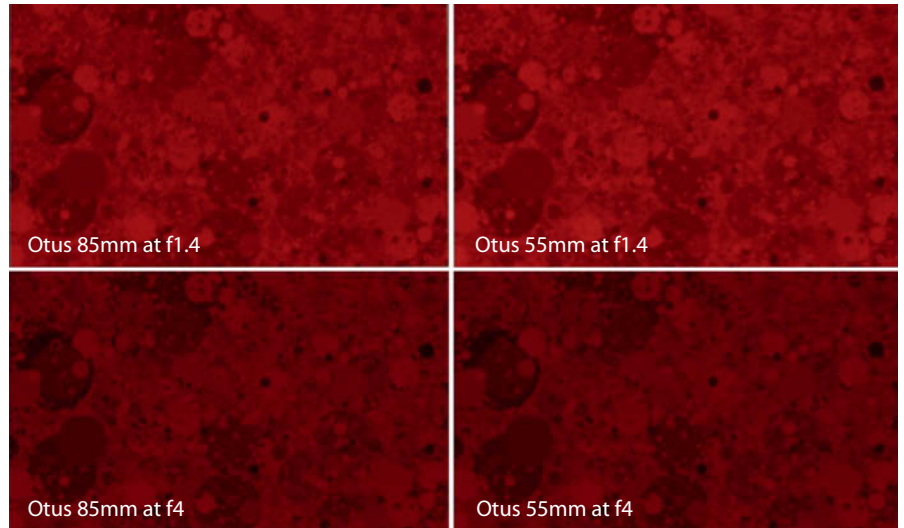
We tested the lens on a Nikon D800E and a Sony a7R using the III and IV versions of the Metabones Smart Adapter, kindly loaned to us by BPM Media. Our lab tests were performed exclusively using a Nikon D800E.

Test Results and Image Quality

Following our test of the 55mm Otus (see page 20 in Issue 18), we had high expectations for the new lens – and we weren't disappointed. In fact, the 85mm model exceeded the quality of the 55mm in some respects.

Wide open, the Otus delivered 2230 line pairs of resolution, which equates to over 90 percent of the potential maximum resolution offered by the Nikon D800E's 36-megapixel sensor, while edge resolution (1820 line pairs)

Lab-based line pair measurements are not the only way to judge lens resolution. These random circular patterns are great for judging color rendition and micro-contrast.



was not quite so stellar. Center resolution climbs even further at smaller apertures, recording 2374 line pairs between f4 and f8. Edge resolution, too, improves at smaller apertures, delivering 2152 line pairs at f8.

The 55mm Otus is of a similar quality, although the 85mm model provides slightly better center resolution at medium apertures, while image quality falls off faster beyond f11.

Like the 55mm, the 85mm Otus produces virtually no visible lens errors. Distortion of 0.1 per cent is negligible and chromatic aberration of just 0.14 pixels at f1.4 is an extremely good score that even improves slightly stopped down. Vignetting effects at maximum aperture, too, have no real bearing

on the quality of the images the lens produces.

Supreme Sharpness

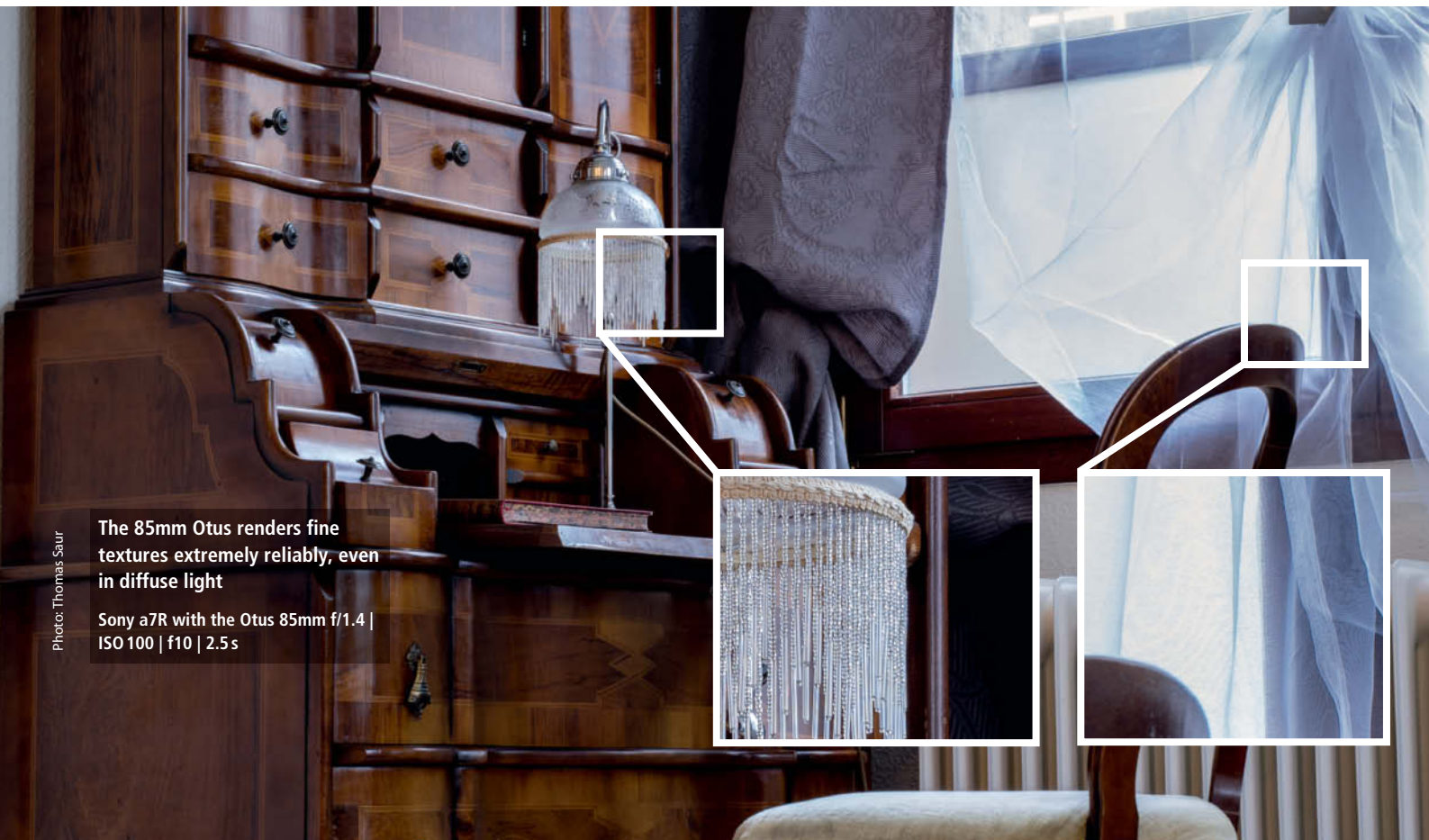
Our lab-based and real-world sample images closely mirror our test results. The most obvious characteristic of this lens is its amazing, almost pedantic sharpness that reveals the tiniest details in a portrait subject's face, even at maximum aperture. Such accuracy could almost be too much for some subjects to bear!

Images produced by the Otus are ultra-sharp and extremely lifelike, with clean focus gradients and clear color definition. The lens is equal to diffusely lit and backlit

situations too, as you can see in the curtain in the image reproduced below. As expected, the bokeh effects produced by the lens are smooth and creamy.

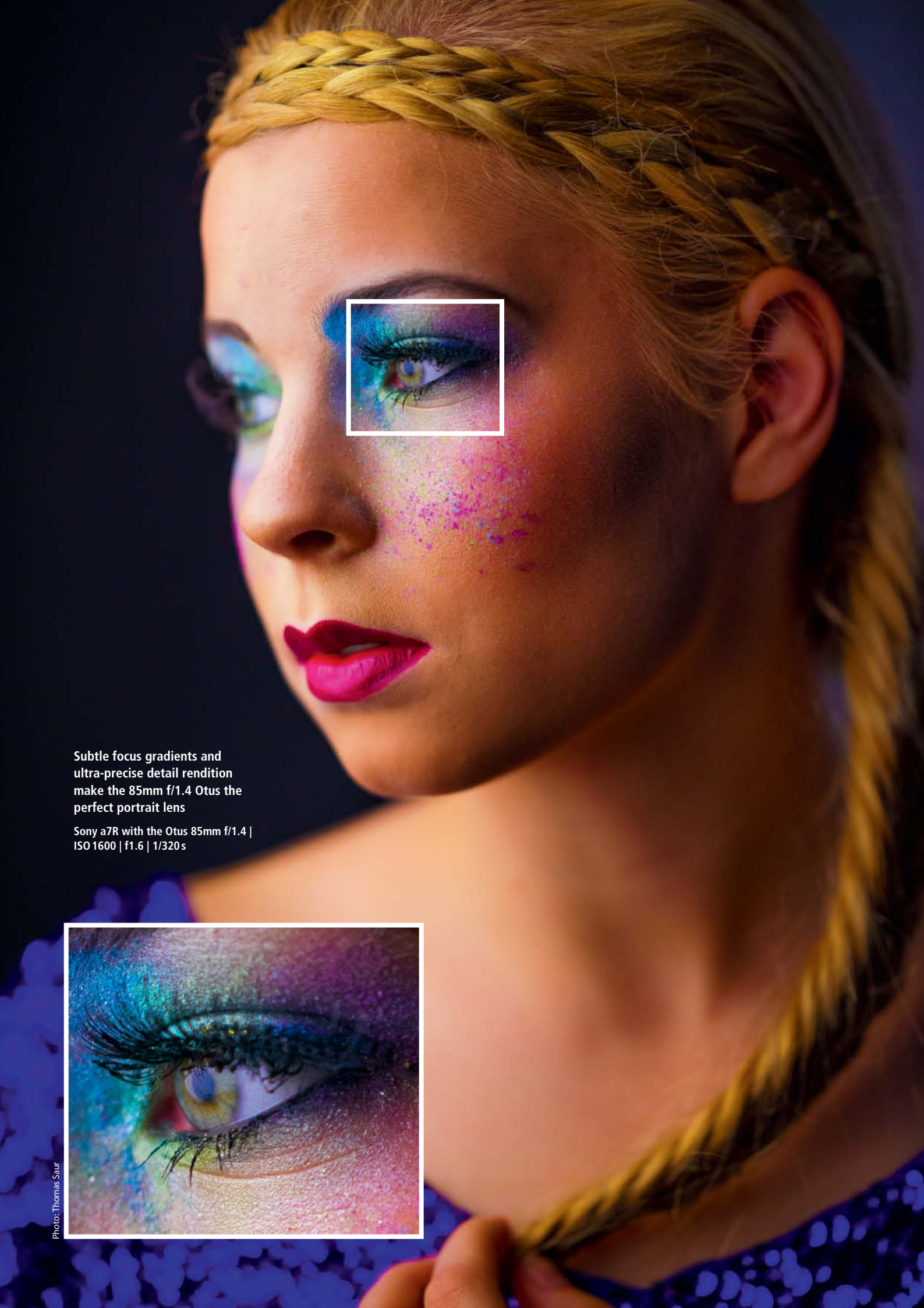
Conclusions

The 85mm model is a great addition to the Otus range, offering image quality that is at least as good as that of its 55mm cousin. These lenses are high-quality, durable tools that will save a lot of photographers the effort of taking medium-format gear with them on some shoots. We are looking forward to finding out which new Otus models Zeiss will introduce next and whether future models include a metal focus ring. (ssi)



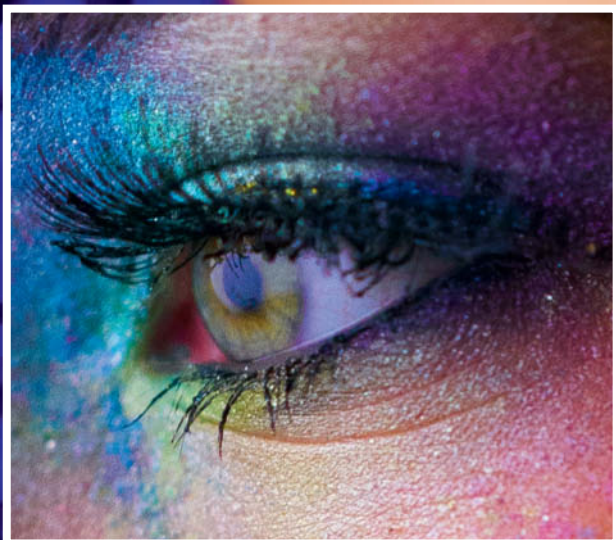
The 85mm Otus renders fine textures extremely reliably, even in diffuse light

Sony a7R with the Otus 85mm f/1.4 | ISO 100 | f10 | 2.5s



Subtle focus gradients and ultra-precise detail rendition make the 85mm f/1.4 Otus the perfect portrait lens

Sony a7R with the Otus 85mm f/1.4 | ISO 1600 | f1.6 | 1/320s





Florian Mihaljevic, Joachim Sauer

Shoe-Mount Flash Test

Photography is all about conjuring with light. When the amount of ambient light available isn't sufficient to realize a photographic concept, the simplest way to brighten a scene is to use a shoe-mount system flash. We test 10 flashes, from high-end to cheap and cheerful.



On-camera flash provides powerful, controllable light that you can use to illuminate simple subjects or construct complex lighting setups in the studio or when you are out and about. This article looks at the types of shoe-mounted flash units available and our tests (see page 92) reveal whether the more expensive camera manufacturer's own-brand flashes stand up to comparison with the performance offered by cheaper third-party models.

Alongside the obvious flash (the power of which is denoted by the guide number, or GN), the models we tested offer a range of

additional functions that might just tip the balance in favor of the more expensive flashes offered by Nikon, Canon, Panasonic and other major brands.

Flash manufacturers introduce new top-of-the-range models every year which – theoretically, at least – offer ever-increasing guide numbers and more flash power. However, some increases in power are really only due to an increase in zoom range – the more narrowly focused the light from a flash, the greater the flash-to-subject distance it can cover at a specific output setting, and these are the values manufacturers like to quote. To

produce genuinely comparable results, we measured the flash power of all our test flashes at an everyday focal length of 50mm. Not all on-camera flash units have zoomable heads anyway, and those that don't are usually built to illuminate an angle of view similar to that covered by a moderate wide-angle lens, which makes them less powerful when used with standard or telephoto lenses.

Sources of Power

In addition to its raw power, the time a flash unit takes to charge between flashes is



Pro-grade flash units have a built-in (usually proprietary) connector for an external battery pack



'Bouncing' flash off a ceiling or wall provides more diffuse light and softer shadows. To be effective, a flash head should be capable of rotating at least 90 degrees upward as well as to the right and left.

another important performance metric. Lithium batteries have greater capacities but take longest to recycle, whereas modern rechargeable NiMH (Nickel Metal Hydride) batteries are almost twice as fast. Normal alkaline batteries lie somewhere between these two extremes, as our tests confirmed: a Nikon SB-910 used at full power in manual mode took 2.4 seconds to recycle with rechargeable NiMH batteries, 3.8 seconds with alkaline batteries and 4.8 seconds with lithium batteries. Other models behaved similarly, leading us to the inevitable conclusion that normal (i.e., non-rechargeable) batteries should only be used in a flash in emergencies when other more powerful batteries are not available.

Pro-grade flashes are usually equipped with a connector for external battery packs. These are more powerful than conventional batteries and help to reduce flash recycle times even further, often by as much as half. They also have greater absolute capacities

and often last much longer than a set of normal rechargeable batteries (see page 101 for more details).

Zoom and Articulation

To be really useful, the head of a flash gun has to be articulated and should be capable of rotating at least 90 degrees to the right and left as well as tilting upward. This enables you to 'bounce' the light from your flash off walls, ceilings and other objects to produce softer shadows and more balanced lighting effects. Downward tilt can also be useful for ensuring that the lower parts of a nearby subject (such as a someone's feet) are fully illuminated. Most on-camera flashes have a built-in bounce card that directs some of the light from a bounced flash directly toward the subject. This helps to soften some of the shadows produced by the bounced flash and produces effective accents in a subject's eyes.

Many system flashes have built-in functionality that uses lens data from the camera to automatically zoom the flash head to the appropriate focal length. Top-of-the-range flashes have zoom ranges that cover equivalent focal lengths of 17-200mm. A built-in 'wide panel' can be used to broaden the angle of coverage at the wide end of the range, which is useful in indoor situations and for ensuring even lighting in group photos. The wide panel built into the Nikon SB-910, for example, increases coverage from 17 to 14mm.

Nissin, Nikon and some other manufacturers also provide clip-on diffusers that soften the effects of direct flash. The top-of-the-range Canon and Nikon models also include color filters for altering the color temperature of flash light from its normal value of between 5000 and 6000K (Kelvin) to a much 'warmer' value of around 2700K, which is more like that of a conventional light bulb.



A built-in bounce card steers some of the light produced by bounced flash directly toward the subject, softening shadows and creating attractive accents in a subject's eyes



A built-in diffuser (or 'wide panel') broadens the angle covered by the flash and is a great aid to producing evenly lit group portraits



A clip-on diffuser can be attached to the flash head and produces a similar effect to a built-in wide panel. More importantly, it softens the edges of the shadows produced by a conventional flash.

Handling and Flash Modes

Flash units are often used in the dark, so illuminated controls are a standard feature of many models. LCD panels (if present) are usually illuminated too. The setup of the various controls and warning lights varies from manufacturer to manufacturer. Simple flash units have just a couple of buttons and status LEDs, and most functions are controlled via the camera's menu system. This quickly becomes annoying if you need to adjust your flash settings quite frequently.

The most widely used controls are buttons and a display. A well-thought-out system makes it easy to find and select the right settings. Contemporary systems with a d-pad and a color LCD (possibly with touch control) are easy to understand and relatively simple to use but still cannot beat buttons and switches for ease of use.

Most on-camera flashes offer a range of shooting modes, usually with TTL (Through The Lens) flash metering set as default. This mode uses light readings made by the camera to select the appropriate flash output setting automatically. Most flashes also have a flash compensation (\pm) button that allows you to



With its illuminated LCD panel and illuminated buttons, the Canon Speedlite 600 is really easy to use in the dark

adjust automatic settings by up to three stops in either direction. Many flashes also have a TTL-based fill flash mode for brightening subject details when using flash in daylight. Flash manufacturers have their own names for this mode, so you will have to refer to your unit's manual to find out how to access it. In TTL fill-flash mode, the camera sets the aperture and exposure time automatically to ensure that both the flash-lit foreground and the bright background are evenly illuminated.

Many flashes also offer a fully automatic mode in which the flash itself meters the ambient light and selects an appropriate output setting, thus enabling you to use third-party flash units with a variety of camera models. If you take this approach, you have to take care to set the same ISO and aperture settings in the camera and the flash.

In 'GN' mode, you have to set the subject distance in the flash. This enables the flash to select an output setting that is independent of the reflectivity of the subject's surface, ensuring that black objects remain black and white objects white when illuminated with flash.

Stroboscopic or 'repeat' flash mode enables you to set the individual power, frequency and duration of a series of flashes and capture fluid movements in a sequence of 'frozen' images.

Off-camera Flash

Most shoe-mounted flashes can be used off-camera too, by means of a cable or a dedicated wireless control system. Early control systems allowed off-camera flash to work only in a simple 'slave' mode that triggered the remote flash when the main on-camera flash fired. Newer proprietary wireless TTL systems precisely control the behavior of remote flashes via a 'master' unit (either the main flash or the camera itself), which transmits a sequence of control flashes that are received and interpreted by the slave module. A master unit can control up to three separate groups of slave flashes, each with its own settings.

Using flash sequences to control slave units produces visible signals that can distract the subject during a portrait session, so some manufacturers use invisible infrared pulses instead.

Additional Functionality

One of the most interesting and versatile applications for modern flash units is high speed sync (often called 'HSS' or 'FP' mode). Its very short flash sync speeds of up to 1/4000 or 1/8000 sec, depending on the model,



If you want to use flash at dusk, a clip-on filter can be used to adjust its color temperature accordingly

enable you to use very wide apertures with daylight fill flash and precisely control background blur. The settings for this mode usually have to be made in the camera.

Slow sync can be used to capture the mood of low light situations such as dusk or theater scenes with flash. In normal flash situations, the flash fires as soon as the camera's shutter curtain is fully open. If you are capturing a moving subject, 'second-curtain' or 'rear-curtain' sync is the better option, as it fires the flash just before the rear shutter curtain closes, producing motion blur with the subject in sharp (flash) focus at the end of the movement.

A built-in AF-assist illuminator lights up to help the camera focus, and a modeling light (if available) helps you to judge the effect your flash settings will have before you make an exposure. Flash units that use the built-in flash tube as a modeling light depend on a sequence of high-frequency stroboscopic flashes to create the appropriate effect, which uses a lot of battery power. A more economical approach is to use the continuous LED light that some flashes provide for shooting video clips.

Flashes with built-in remote control systems are affordable enough to offer a real alternative to studio flash systems. If your flash doesn't have all the necessary functionality built in, you can probably upgrade it using some of the accessories described in our guide on page 101.

How we tested

We tested flash units from major manufacturers including Canon, Nikon, Panasonic and Sony, as well as a selection of third-party models that are available for a wide range of cameras. Although they are equipped with the same hot shoe, some units from Nissin, Sigma, Metz and Yongnuo are not

compatible with all types of camera. In other words, a Nissin flash built for use with Nikon cameras is not compatible with Canon cameras, and vice versa. Third-party remote control systems aren't always universally compatible either, although the Yongnuo flash we tested worked perfectly with both Canon and Nikon master units.

As previously mentioned, it is difficult to compare manufacturers' own guide number figures directly, and a quoted guide number of 64 at a focal length setting of 200 mm can

easily shrink to as little as 40 at 50 mm. Instead, we used a reproducible scenario to provide reliable test data. We performed all our tests at ISO 100, a (flash) zoom setting of 50 mm and at a fixed distance of 2 m to the subject. We conducted our tests in a normally furnished room with a floor space of about 270 square feet, whereas flash manufacturers often measure their specified GN figures in smaller, white-painted spaces.

We measured recycle times at full and half power and judged the overall quality of each

unit's feature set using a standardized list of desirable features and functions (see page 106). The differences in the quality and range of the supplied accessories also formed part of our overall assessment.

Simple handling is essential in flash photography situations, so we awarded extra points for intuitive controls. Some of our test candidates proved tricky to master, so we thoroughly checked how easy it was to set a range of standard settings and which interface system was simplest to use.

System Flash Test

Canon Speedlite 600EX-RT

The Speedlite 600EX-RT is Canon's top-of-the-range model and, at around \$500, is one of the more expensive models we tested. Compared with its predecessor, the zoom range has been extended to 20-200 mm and a built-in radio control module added that allows remote flash firing at distances of up to 40 m – performance that has hitherto been reserved for studio flash or flash equipped with extra radio control transmitters and receivers. As is to be expected, the radio control functionality only works with other Canon RT-compatible units. The ST-E3-RT Speedlite shoe-mounted transmitter costs \$270, although the equivalent Yongnuo YN-E3-RT model costs just \$130 and is compatible with other makes of camera.

Used as a master unit, the 600EX-RT can control up to three groups of flashes via radio or infrared control, and can be set up to operate in one of up to five slave groups. As Canon flashes only work with the proprietary Wireless TTL transmission protocol, they do not have a 'dumb' slave mode or a camera-independent Auto mode.

Build quality is excellent and, unusually, the unit is dust and moisture resistant, right down to the rubberized hot shoe mount. The flash head can be rotated a full 360 degrees and tilted 90 degrees upward as well as 7 degrees downward. It has built-in catchlight (bounce) and wide panels and is mounted using a quick-release lock system – now a standard feature in camera manufacturers' own-brand flash units.

Canon uses its tried-and-trusted user interface for its latest flash, relying on a large, illuminated LCD panel, a rotating selector dial and a selection of dedicated and programmable function buttons. The most widely used functions are immediately accessible, while other, less common functions are accessed via sub-menus. We found handling intuitive and only had to refer to the manual a couple of times.

The RT's specifications leave little to be desired and include remote release, external power source and PC sync connectors. The unit is delivered with a printed user manual, a padded case, a stand with a built-in tripod thread and a color filter holder. The latter is equipped with a standard filter set for altering flash color temperature to match artificial lighting conditions.

We measured a guide number of 40 at a 50mm zoom setting and the unit recycled within a respectable 2.8 sec at full power and 0.7 sec at half power.



The interface of the Canon Speedlite 600EX-RT is based on a tried-and-trusted formula. It uses a combination of a large display and multiple dedicated buttons that make it simple to select your desired settings. This is one of the most powerful flashes currently available and has a built-in radio control module.

- ⬆ Power
- ⬆ Recycle time
- ⬆ Features
- ⬆ Included accessories

Canon Speedlite 320EX

Priced at \$200, the Speedlite 320EX belongs at the lower end of the mid-range bracket. The unit is well built but lacks automatic zoom functionality. Its two manual zoom settings of 24mm and 50mm are not particularly useful if you are shooting using anything longer than the shortest of telephoto lenses.

The head rotates through 270 degrees and tilts upward by up to 90 degrees. There is no downward tilt feature and no catchlight or wide panel. The 320EX has a built-in video light that provides 75 lux at a subject distance of 1 m, which is not as powerful as that offered by most of the competition. However, the video light is still useful as a modeling light.

The rudimentary controls and the need to use the camera menus to access most major functions make this unit quite difficult and slow to operate. The controls are not illuminated, so it is tricky to operate in low light, too.

The unit has no master functionality and only operates as a slave in conjunction with other Canon Wireless TTL-based devices (i.e., there is no optically controlled standard slave

mode). It also has no flash-based Auto and stroboscopic modes. On the plus side, high speed and second-curtain sync functionality are both on board.

A printed manual and a stand with a built-in tripod thread are included. Set to 50 mm, the 320EX has a guide number of 30, which places it in the middle of our test field. Its recycle times of 2.6sec (full power) and 0.6sec (half power) were among the better values we recorded.

The Canon Speedlite 320EX is powerful enough for its size and has a built-in video light. Its short recycle times are an added bonus.



The rudimentary built-in controls are the 'baby' Canon's weakest suit. Most functions are only accessible via the camera menus, so handling can be difficult and slow.

- ⬆️ Recycle time
- ⬆️ Manual
- ⬆️ Features
- ⬆️ Handling

Metz Mecablitz 64 AF-1 digital

The German-built, pro-grade Metz 64 AF-1 digital costs \$450 and is available for Canon, Nikon, Sony, Pentax and a range of Micro Four Thirds cameras. It comes with a comprehensive manual, a padded case and a stand with a built-in tripod thread. Compared with its predecessor, the 64 AF-1's zoom capability has been extended to 200mm.

The large flash head rotates through 300 degrees and tilts 90 degrees upward and 9 degrees downward. A reflector card and a wide-angle diffuser are built in, as is a really useful secondary reflector that can be used to soften shadows produced by bounce flash. PC sync, USB and external power connectors underscore the Metz' pro-grade intentions, and the P76 power pack (available separately) provides plenty of juice.

Instead of the usual switches and buttons combined with an LCD display, the Metz user interface consist of a large color touchscreen. Using the 64 AF-1 therefore feels entirely intuitive, even if it sometimes responds quite slowly. The touchscreen also uses more battery power than conventional solutions.

The Metz has all the high-end features you would expect in a pro-grade flash, including TTL, manual and auto modes. It also offers

master control of up to three groups of slave flashes, wireless TTL control, distance-based manual control ('GN' mode) and the clever 'SERVO' slave mode, which 'learns' to use various pre-flash sequences to ensure that it only fires in sync with your main flash.

With a guide number of 39 at 50 mm, the Metz is one of the more powerful units we tested. Its fast recycle times came in at 2.6 sec at full power and 0.8 sec at half power.

The Metz Mecablitz 64 AF-1 plays in the same league as Canon and Nikon's high-end models and offers only slightly less power



The unusual touchscreen-based interface is intuitive and surprisingly easy to use, even if it is sometimes quite slow to respond

- ⬆️ Handling
- ⬆️ Features
- ⬆️ Recycle time
- ⬆️ Power

Nikon SB-910

The latest version of the \$550 Nikon SB-910 is an incremental update and the only major change is the elimination of the overheating problems that occasionally affected its predecessor. Its focal length range remains the same ample 17-200mm and the unit is supplied with a printed manual, a padded case, a stand with a built-in tripod thread, a clip-on diffuser and color filters. PC Sync and external power connectors round out the specifications, which are among best available in a pro-grade system flash.

The flash head can be rotated through 360 degrees and tilted 90 degrees upward and 7 degrees downward. A wide panel and a bounce card are built in and the quick release lock on the hot shoe is really simple to operate, even one-handed in the dark!

All the major controls are illuminated and operation is surprisingly intuitive, in spite of the enormous range of features and functions available. Less common functions are tucked away within the comprehensive menu system and it is obvious that Nikon has put a lot of effort into constructing the user interface. Of all the systems we tested, this is the easiest to use.

Master and slave modes are selected using the main selector dial, although optical slave

mode has to be selected via the menu. In master mode, the unit can control up to three slave groups.

Nikon quotes a guide number of 34 at 35mm, which equates to 40 at 50mm and makes the SB-910 the most powerful flash in our test field. Recycle times are 2.4sec at full power and 0.6sec at half power – again, some of the best we tested.

The SB-910 is an iterative release of Nikon's top-of-the-range model and provides fast recycle times as well as top-notch flash power

- ➡ Handling
- ➡ Features
- ➡ Recycle Time
- ➡ Power



The latest high-end Nikon flash relies on its familiar interface. Although it has an enormous range of features, the large LCD panel and illuminated buttons make it simple and quick to operate.

Nikon SB-500

At \$250 and 226 grams (8oz) without batteries, the Nikon SB-500 is the lightest flash we tested. The basic feature set is enclosed in a high-quality body that enables 360 degrees of horizontal and 90 degrees of upward movement in the flash head.

The unit's mid-range features include a modeling light and high-speed and rear-curtain sync. Unfortunately, the unit forces you to use the camera menu to set it up and its master mode only works with the D810 and D750 camera models. Nikon camera menu systems only support slave control in the D60, D90, D300 and later models. The built-in LED video light has three output levels that provide up to 100 lux.

The SB-500 comes with a stand with a built-in tripod thread and a soft case.

The 24mm fixed-focal-length reflector has a guide number of 26 at 50mm, making it one of the weaker flashes we tested, and the recycle time of 4.4sec at full power is almost twice as long as that of the SB-910. Even its half-power recycle time is 1.9sec, so this particular model is no use if you are in a hurry.

- ➡ Light weight
- ➡ Handling
- ➡ Power
- ➡ Recycle time

The Nikon SB-500 is compact and light, but its two-battery setup makes it slow and not particularly powerful. The built-in LED video light is a big plus.



Built-in controls are kept to a minimum in this model, and most settings have to be made via the camera menu

Nissin MG8000 Extreme

The Nissin MG8000 Extreme is available for Canon and Nikon for around \$560. Its name refers to its high performance and heat resistance. Instead of the usual built-in wide-angle reflector and diffuser panels, the Nissin's head is equipped with metal cooling fins. According to the manufacturer, this makes it possible to shoot up to 1,000 full-power flashes without the risk of overheating, although this kind of performance is only possible if you use the PS8 battery pack, available separately for around \$200.

Used more conventionally, the MG8000 Extreme is a solid performer. The flash head has 270 degrees of rotation and 90 degrees of upward tilt. Its focal length range of 28-105mm puts it firmly in the mid- to high-end range. It has PC sync, USB and external power connectors and is supplied with a clip-on diffuser, a user manual, a soft case and a stand.

The user interface is based around a color LCD panel and a d-pad and is highly intuitive to use. Feature-wise, the MG8000 is up there with the best, providing master control for up to three slave groups as well as smart (wireless TTL) and 'dumb' slave modes. It has a second built-in reflector for filling in shadows in bounce flash mode.

We measured a guide number of 40 at 50 mm, making this one of the more powerful units in our test field. All this power has its downside, and we measured a full-power recycle time of 4.6 sec – one of the slowest we tested. The half-power recycle time came in at 1.3 sec, making this unit less fun to use without the additional battery pack.

The Nissin MG8000 Extreme is one of the best flashes we tested. It is powerful and well protected against overheating. A separate power pack is required to maximize performance and minimize recycle time.

- ➕ Feature set
- ➕ Handling
- ➕ Power
- ➖ Recycle time



The Nissin has a color LCD display and controls based on a conventional d-pad. The menu system is easy to understand, so operation is mostly intuitive and we only had to refer to the manual occasionally.

Panasonic DMW-FL360L

This mid-range flash from Panasonic costs around \$230 and is compatible with Micro Four Thirds cameras from Olympus, Panasonic and Leica. It covers a zoom range of 24-85 mm and offers both 360-degree horizontal and 90-degree upward and 7-degree downward movements. The built-in video light has a maximum output of 100 lux.

Handling is well thought out, with an illuminated LCD display, a main selector dial and an 'OK' button covering most settings. The major settings are easy to select, while additional functionality is governed by a separate menu. The supplied manual is useful but not usually necessary.

There is no master or stroboscopic flash functionality but the unit offers TTL and optically controlled remote flash control, the latter with its own Auto setting that also works when the flash is mounted on the camera. This makes it possible to use this unit with cameras from other manufacturers (albeit without TTL, high-speed sync or other proprietary functionality).

The unit is supplied with a soft case and a stand. It has a mid-range guide number of 28 at 50 mm and relatively short recycle times of 2.2 and 0.8 sec at full and half power.

The DMW-FL360L is a solid mid-range performer with fast recycle times and a useful built-in video light

- ➕ Handling
- ➕ Speed
- ➕ Features
- ➖ Power



Panasonic sticks to a tried-and-trusted selector dial/LCD interface with no master functionality

Sigma EF-610 DG Super

The EF-610 DG Super – Sigma’s top-of-the-range flash – is available for Canon, Nikon, Pentax, Sigma and Sony cameras and costs around \$220. It offers a useful zoom range of 24-105 mm and, although its build quality doesn’t match that of its more expensive competitors, it is still perfectly adequate for hobby photographers. The flash head rotates through 270 degrees and tilts 90 degrees upward and 7 degrees downward. It has built-in wide and catchlight panels.

The unit is controlled using non-illuminated buttons and an illuminated LCD display and most settings, apart from TTL and manual modes, are rather complex to select. Using the unit without referring to the manual is virtually impossible, and some functions remain vague even when you do.

On the upside, its feature set is comprehensive and includes master mode, FP (high-speed) sync, second-curtain sync, strobe mode and modeling flash. The only other feature we would have liked to see is a ‘ready’ sound in wireless mode.

The ‘Super’ is supplied with a padded case but no stand. The manual is printed in several

languages but is poorly illustrated and not at all clearly written.

Our lab tests resulted in a highly respectable guide number of 36 at 50 mm, but its slow recycle times of 5 and 1.4 sec at full and half power make it more of a candidate for light everyday use.

Adequate power and a high-end feature set for half the price of the pro-grade competition make the Sigma an interesting prospect. Its only drawback is its long recycle times.

- ➕ Feature set
- ➕ Price
- ➖ Handling
- ➖ Recycle time



The Sigma LCD/button-based interface is anything but easy to use, making it essential to refer to the manual in most situations

Sony HVL-F43M

The HVL-F43M costs around \$400 and is available for the older Minolta-style flash shoe or Sony’s newer MI (Multi Interface) Shoe, which is built into the Alpha 99, NEX-VG 90 and later cameras. All models have a zoom range of 24-105 mm and are supplied with a manual, a padded case and a flip-out stand with a built-in tripod thread.

The unit has an unusual design that allows you to rotate the entire head/control unit sideways to place the flash head beside the optical axis of the camera. Rotating the head upward then enables you to point it at walls to perform bounce flash. In its normal position, the head can be tilted by as much as 8 degrees downward to fully illuminate close-up subjects. The quick-release mount is solid and reliable. There are no connectors for external power sources or a PC sync cable but there is a built-in LED video light rated at 100 lux.

The unit is controlled via a large LCD panel, a circular d-pad and a selection of non-illuminated buttons. As with the Sigma, setting up anything except TTL or manual mode can be quite complicated, and setting up slave mode, even with the help of the user manual, is a cumbersome task.

The HVD-F43M’s features place it firmly in the mid-range category. It lacks master

functionality and only works as a slave in wireless TTL mode. On the upside, it offers high-speed sync, stroboscopic flash, modeling flash and rear-curtain sync.

The HVL-F43M has a guide number of 32 at 50 mm, which is fine for this class of device, while its recycle times of 2.6 and 0.3 sec are very good indeed compared with most of the other flashes we tested.

Sony markets the HVL-F43 as a mid-range device, with performance and features to match. The unit also has a built-in video light and an unusual tilt mechanism (see the small photo on the right).

- ➕ Recycle time
- ➖ Handling
- ➕ Adequate feature set
- ➕ Acceptable power



In spite of the supplied manual and LCD/button-based interface, the Sony is often difficult to operate. The unit’s body is moisture protected but the buttons are not illuminated.

Yongnuo YN-568 EX (II)

This is the cheapest flash in our test and, even if its build quality isn't quite up to that of the more expensive competition, it offers unbeatable value for money.

The YN-568 EX tested here is designed for use with Nikon cameras, while the more recent EX II model is compatible with Canon cameras. The unit is available for around \$150 in the USA or less if purchased elsewhere. When ordering from outside your home country, beware of additional import duties and the validity of any warranty terms.

The 24-105mm zoom range is comparable with that of the high-end competition, as are the 360-degree horizontal and 90/7-degree head movements. A wide-angle diffuser and a catchlight 'reflection board' are built in, and the unit is supplied with a padded case, a printed manual and a stand with a built-in tripod thread.

All settings are handled using a d-pad, five buttons and a large, illuminated LCD. The menus are mostly self-explanatory and we only had to refer briefly to the manual when setting up slave mode (which you select by keeping the

'Zoom' button pressed). The Nikon-compatible EX model does not offer master mode, and the newer EX II model (which does) is only available for Canon at this stage.

Used off-camera, the YN-568 EX is compatible with both the Canon and Nikon Wireless TTL systems and, with high-speed and rear-curtain sync and a stroboscopic mode, it offers a good range of pro-grade features. We would have liked to see a TTL-independent auto mode and modeling flash functionality, but the feature list is still exceptional for the price.

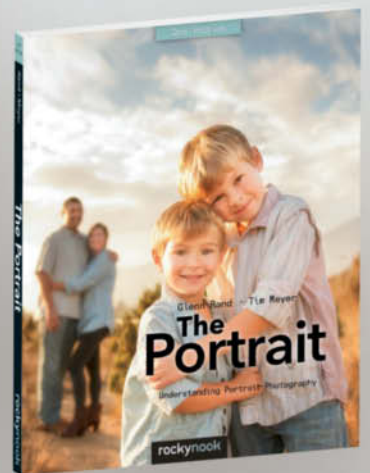
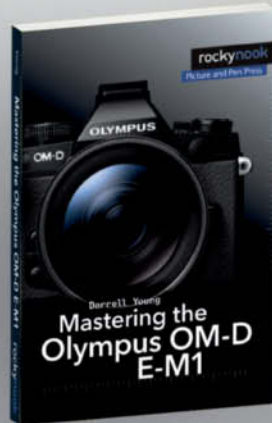
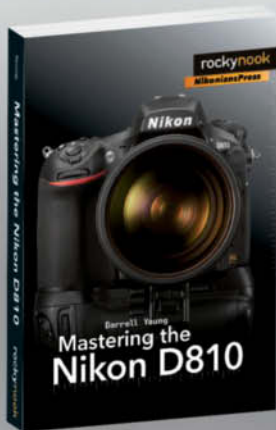
Performance-wise, the Yongnuo kept up with the more expensive competition, and we measured a guide number of 38 at its 50 mm zoom setting. Its 2.1 sec recycle time at full power is the fastest we tested and it proved to be no slouch at half power too, recording a great time of just 0.8 sec.

- ⬆️ Speed
- ⬆️ Power
- ⬆️ Price
- ⬆️ Handling



Handling-wise, Yongnuo has done a great job, providing a simple and intuitive LCD and button-based interface. The unit provides high-end power and speed combined with a pro-grade feature set for an unbeatable price of around \$150. The only drawback of the Nikon version is its lack of a master mode.

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Conclusions

Our tests prove conclusively that high prices don't always guarantee great performance. Nevertheless, the top-of-the-range models from Canon and Nikon have the edge over most of the competition in many respects, and Canon is the only manufacturer to offer built-in radio-based remote flash control in a shoe-mount device, even if you have to acquire other, quite expensive RT-based gear to use it. Overall, we preferred the Nikon system of dials and buttons to the Canon approach.

At the low end of the price range, the Yongnuo YN-568 EX goes a long way toward dispelling our skepticism concerning Chinese camera gear by offering great performance in an easy-to-use and reliable package. The Canon-compatible EX-II model even includes master control functionality. In fact, the Yongnuo provided the fastest recycle times we tested, making it a no-brainer if you are considering purchasing your first high-end flash. The color LCDs in the Metz and Nissin units make operation highly intuitive and the user manual less of a necessity, although we often found conventional buttons and switches faster to use.

The Nissin MG8000 Extreme specializes in long sequences of high-power flashes without the risk of overheating but relies on an external power source to produce its best performance. Without a battery pack, it has some of the slowest recycle times in our test. The Metz is cheaper than the equivalent models from Canon and Nikon but its performance is comparable in every respect. Its slightly lower guide number made no difference to its effectiveness in everyday use. The Sony HVL-F43M and Sigma EF-610 DG Super models appear somewhat outdated and don't even provide manuals. While the Sigma does include master control functionality, it is one of the slowest flashes in our test field.

The mid-range Canon and Nikon models both take the unusual step of transferring most major settings to the camera menu, making them tricky and slow to use in anything but TTL mode. Due to its two-battery construction, the Nikon SB-500 is lighter than most other flashes but takes almost twice as long to recycle. The Canon Speedlite 320 EX performs better overall than its Nikon counterpart and has a higher guide number too. The Panasonic DMW-FL360L is a little on the weak side but offers great features, handling and speed and is a better bet than the smaller Canon and Nikon devices in most respects, even if it is limited to use with Micro Four Thirds cameras. (pen)

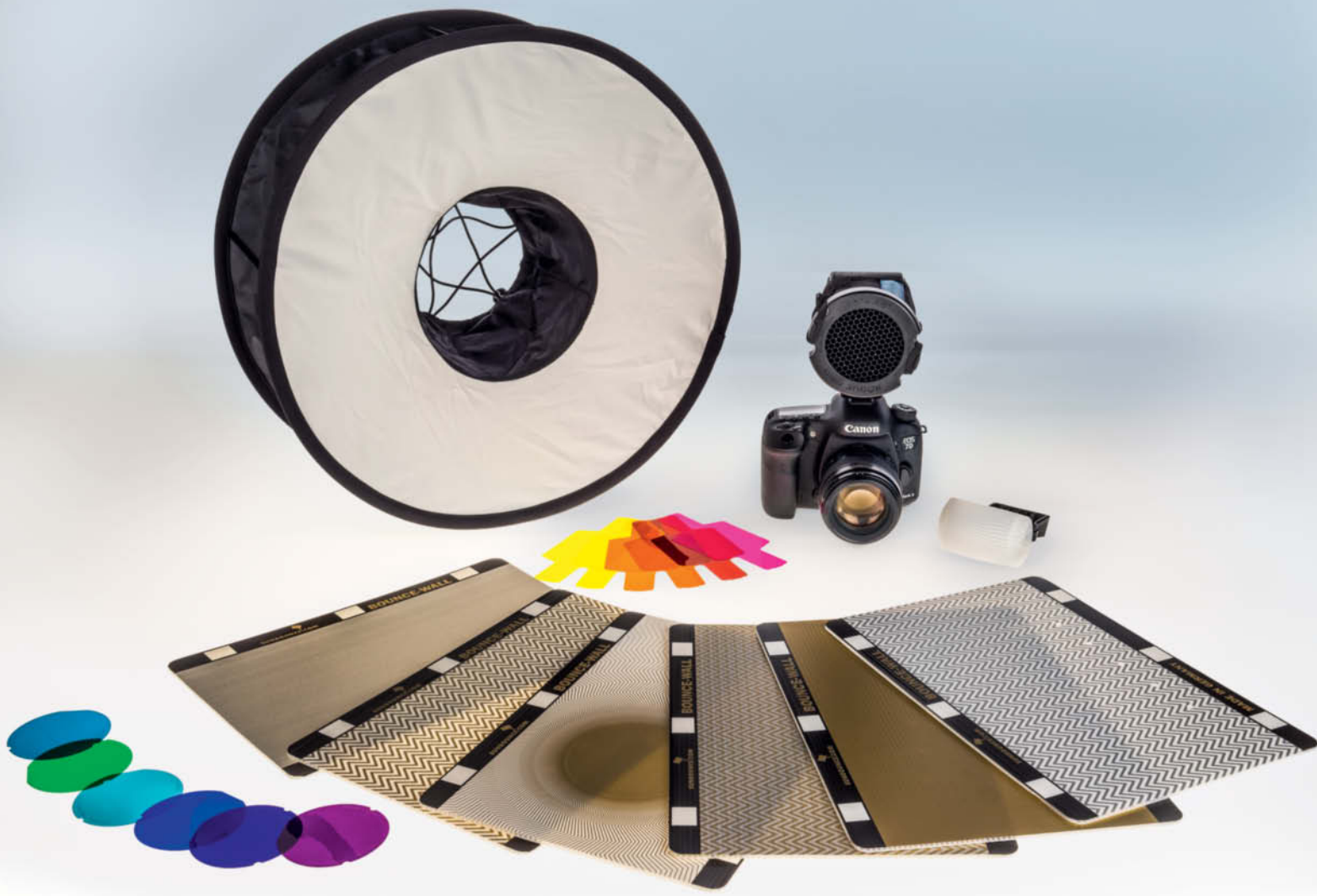
SHOE-MOUNT FLASH TEST OVERVIEW

Model	Speedlite 600EX-RT	Speedlite 320EX	Mecablitz 64 AF-1
Manufacturer	Canon	Canon	Metz
URL	www.canon.com	www.canon.com	www.metz.de/en/home
Weight (without batteries)	428 g (15 oz)	271 g (9.6 oz)	429 g (15.1 oz)
Available for	Canon	Canon	Canon, Nikon, Olympus, Panasonic, Leica, Pentax, Sony
Features			
Tilt (up/down)	90°/7°	90°/–	90°/9°
Rotation (left/right)	180°/180°	180°/90°	180°/120°
Wide-angle diffuser	✓	–	✓
Catchlight panel	✓	–	✓
Status display	LCD	LED	Touch-LCD
Controls illuminated	✓	–	✓
Mount type	Quick release	Quick release	Screw
Firmware updates possible	✓	–	✓
'Ready' sound	✓	–	✓
Standard power source	4 × AA	4 × AA	4 × AA
Compatible battery types	Lithium, alkaline, NiMH batteries	Lithium, alkaline, NiMH batteries	Lithium, alkaline, NiMH batteries
Connector for AC/battery pack	✓	–	✓
PC sync connector	✓	–	✓
Functionality			
Flash mode	E-TTL	E-TTL	ADI, E-TTL, Four Thirds TTL, I-TTL, P-TTL
Zoom range (35mm equivalent)	20-200 mm	24 mm, 50 mm	24-200 mm
Auto zoom	✓	–	✓
Master/Groups	✓/5	–	✓/3
Off-camera TTL/Optical slave mode	✓/– ²	✓/– ²	✓/✓
Wireless compatibility	E-TTL	E-TTL	ADI/E-TTL/Four Thirds TTL/I-TTL/P-TTL
Infrared/Radio control	✓/✓	✓/–	✓/–
AF assist lamp	✓	✓ ⁴	✓
Output levels	8	7	9
f-stop increment	1/3	1/3	1/3
High-speed sync	✓	✓	✓
Approx. flash duration	1/1000-1/35 000 s	n/a	1/750-1/40 000 s
Stroboscopic mode	✓	–	✓
Modeling flash	✓	✓	✓
Additional reflector	–	–	✓
Rear-curtain sync	✓	✓	✓
LED video light	–	✓	–
Video light power (in lux at 1 m)	–	75	–
What's in the Box			
Clip-on diffuser	– ³	–	–
Color filters	–	–	–
Stand/Tripod thread	✓/✓	✓/✓	✓/✓
Case	✓	✓	✓
Manual	✓	✓	✓
Test Results			
Guide number (ISO 100, 50mm)	40	30	39
Color temperature (K)	5700	5800	5400
Recycle time full/half power	2.8/0.7	2.6/0.6	2.6/0.8
Ratings			
Handling	⊕	⊖	⊕⊕
Features	⊕⊕	⊖	⊕⊕
Power	⊕⊕	○	⊕⊕
Recycle time	⊕⊕	⊕⊕	⊕⊕
Supplied accessories	⊕⊕	○	○
Manual	⊕⊕	⊕⊕	⊕⊕
RSP	\$500	\$200	\$450
¹ YN-568 EX II now available for Canon, incl. master control ² Slave mode only works with manufacturer's proprietary wireless TTL (i.e., no 'dumb' mode) ³ Clip-on filter holder ⁴ Modeling light possible using LED video light ⁵ Import can be cheaper ⁶ Only with Nikon D810 or D750			
⊕⊕ Excellent ⊕ Good ○ Satisfactory ⊖ Poor ⊖⊖ Inadequate			

SB-910	SB-500	MG 8000 Extreme	DWL-FL360L	EF-610 DG Super	HVL-F43M	YN-568EX ¹
Nikon	Nikon	Nissin	Panasonic	Sigma	Sony	Yongnuo
www.nikon.com	www.nikon.com	www.nissindigital.com	www.panasonic.com	www.sigmaphoto.com	www.sony.com	www.hkyongnuo.com
422 g (15 oz)	227 g (8 oz)	426 g (15 oz)	258 g (9.1 oz)	330 g (11.6 oz)	348 g (12.3 oz)	381 g (13.4 oz)
Nikon	Nikon	Canon, Nikon	Olympus, Panasonic, Leica	Canon, Nikon, Pentax, Sigma, Sony	Sony	Canon, Nikon
90°/7°	90°/–	90°/–	90°/7°	90°/7°	150°/8°	90°/7°
180°/180°	180°/180°	90°/180°	180°/180°	90°/180°	150°/150°	180°/180°
✓	–	–	✓	✓	✓	✓
✓	–	–	✓	✓	✓	✓
LCD	LED	LCD	LCD	LCD	LCD	LCD
✓	–	✓	✓	✓	✓	✓
Quick release	Quick release	Screw	Quick release	Screw	Quick release	Screw
✓	✓	✓	–	–	–	✓
✓	–	✓	–	–	–	✓
4 × AA	2 × AA	4 × AA	4 × AA	4 × AA	4 × AA	4 × AA
Lithium, alkaline, NiMH batteries	alkaline, NiMH batteries	Lithium, alkaline, NiMH batteries	Lithium, alkaline, NiMH batteries	alkaline, NiMH batteries	Lithium, alkaline, NiMH batteries	alkaline, NiMH batteries
✓	–	✓	✓	–	–	–
✓	–	✓	✓	–	–	✓
I-TTL	I-TTL	E-TTL, I-TTL	Four Thirds TTL	ADI, E-TTL, I-TTL, P-TTL, S-TTL	ADI	E-TTL, I-TTL
17-200 mm	24 mm	28-105 mm	24-85 mm	24-105 mm	24-105 mm	24-105 mm
✓	–	✓	✓	✓	✓	✓
✓/3	–	✓/3	–	✓/3	–/– ²	– ¹ /✓
✓/✓	– ⁶ /✓	✓/✓	✓/✓	✓/✓	✓/– ²	✓/✓
I-TTL	I-TTL	E-TTL/I-TTL	Four Thirds-TTL	ADI/E-TTL/I-TTL/P-TTL/S-TTL	ADI	E-TTL, I-TTL
✓/–	✓/–	✓/–	✓/–	✓/–	✓/–	✓/–
✓	–	✓	✓ ⁴	✓	✓	✓
8	8	8	8	7	8	8
1/3	1/3	1/3	1/3	1/3	1/3	1/4
✓	✓	✓	✓	✓	✓	✓
1/880-1/38 500 s	1/1100 s	1/300-1/30 000 s	1/500-1/20 000 s	1/700 s	k. A.	1/200-1/20 000 s
✓	–	✓	–	✓	✓	✓
✓	✓	✓	✓	✓	✓	–
–	–	✓	–	–	–	–
✓	✓	✓	✓	✓	✓	✓
–	✓	–	✓	–	✓	–
–	100	–	100	–	100	–
✓	–	✓	–	–	–	–
✓	–	–	–	–	–	–
✓/✓	✓/✓	✓/✓	✓/✓	–	✓/✓	✓/✓
✓	✓	✓	✓	✓	✓	✓
✓	–	✓	✓	✓	✓	✓
40	26	40	28	36	32	38
5350	5600	5700	5500	5300	5600	5950
2.4/0.6	4.4/1.9	4.6/1.3	2.2/0.8	5.1/1.4	2.6/0.3	2.1/0.8
⊕⊕	⊖	⊕⊕	⊕⊕	⊖	⊖	⊕⊕
⊕⊕	○	⊕	⊕	⊕⊕	○	⊕
⊕⊕	⊖	⊕⊕	⊖	⊕	○	⊕
⊕⊕	⊖	⊖	⊕⊕	⊖⊖	⊕⊕	⊕⊕
⊕⊕	○	⊕	○	⊖	○	○
⊕⊕	⊖	○	⊕	⊖	○	⊕
\$550	\$250	\$560	\$230	\$220	\$400	\$150 ⁵

✓ Included – Not included n/a Not applicable





Thomas Hoffmann, Florian Mihaljevic, Joachim Sauer

Accessories

for system flash

Once you have learned to use your system flash to achieve better photographic results, you are sure to want to try out some of the many accessories available for fine-tuning your flash photos. This article introduces some of the more interesting accessories out there and tells you how to get started with your own creative flash photography experiments.

System flash is often supplied with a couple of useful accessories, such as color filters for adjusting the color temperature of the light from the flash or fine-tuning skin tones. Most flashes also include a stand for off-camera use – and this is where after-market accessories start to become interesting. If the supplied stand is too low, or you want to use a diffuser or some other light shaper, or if you are planning a long session and aren't sure whether a single set of batteries will suffice, or you want to fire a remote flash wirelessly, there are accessories available for all these scenarios and more. The following pages look at some of the add-ons available and some of the situations in which you can use them.

Power Sources

Normal rechargeable batteries severely limit the length of a flash photo session. Batteries that run out of juice at the wrong moment can spoil a whole shoot, and the speed at which your flash recycles can be the key to getting the perfect shot. Lithium-ion batteries recycle the slowest and modern NiMH (Nickel Metal Hydride) batteries can recycle up to twice as fast. Performance-wise, (non-rechargeable) alkaline batteries lie somewhere between these two extremes. Sanyo's 'eneloop' brand rechargeable NiMH AA batteries have a nominal capacity of 1900mAh and an extremely long shelf life. They also hold their charge for longer than any other currently available batteries and cost around \$14 for a pack of four. Batteries with higher capacities run down faster and have shorter life spans. Tests have shown that eneloop batteries stored in a cool place retain up to 80 per cent of their charge after a year of non-use, and



The smart technology built into the Ansmann Powerline 4 Pro charger includes auto cut-off functionality and individual supervision of each cell. Only use the 'fast charge' setting in emergencies, as this shortens the life span of your batteries.

A separate battery pack such as this Pro Powerblock II from Walimex (available in the US under the Godox brand) offers fast flash recycle times and up to 500 flashes from a single charge – in some situations, enough for a complete session



they don't suffer from 'memory' or deep discharge issues.

It is nevertheless a good idea to carry a set of normal alkaline batteries with you for use in emergencies, although you will find that recycle times become unbearably slow when they begin to run down.

If you take proper care of rechargeable batteries, they will reward you with years of use. A charger with an automatic cut-off feature is essential. Models like the Ansmann Powerline 4 Pro or the Technoline BC 700 (both around \$40 at amazon.com) can charge up to four batteries and offer auto cut-off functionality. Both also have quick charge circuitry, although you should only use this in emergencies, as it shortens the life of your batteries.

Most pro-grade flash units have connectors for separate battery packs, which are available from all the major flash brands as well as from specialized third-party manufacturers. Battery packs like the Yongnuo SF-18 (around \$40) use off-the-shelf

Eneloop rechargeable batteries have a reputation for extremely long life and fast charge times

batteries, while others (such as the Walimex Powerblock shown above or Bolt Cyclone products) have non-removable rechargeable cells. These kinds of battery packs significantly reduce flash recycle times and help you to keep shooting for longer.

Mounting and Firing

The small stands supplied with most flashes quickly reach the limits of their usefulness, and dedicated light stands are often necessary whether you are shooting at home or on the go. We recommend using robust, air-cushioned stands, which start at around \$30 for models from Impact or Westcott. Stands available on the Web for \$10 or less may be cheap but simply won't stand up to any kind of rough use.

The 'master' functionality built into many cameras is often sufficient for controlling off-camera flash. To prevent built-in flash from affecting your lighting, you can affix an appropriate cover over the camera's flash so that only the invisible infrared control signals reach your off-camera flash. The Nikon SG-3IR, for example, costs \$11.95 and fixes directly to the camera's flash shoe. With a little help from a modeling knife, it can be modified to fit Canon cameras too.

If you need to trigger off-camera flashes that are positioned a long way from the camera or have no clear line of sight to the master flash, you will need to use some kind of remote release system. This can be cable-based via the camera's flash sync terminal or using an extension that attaches to the flash shoe. A 5-meter extension cable costs about \$30.

However, if it is possible, using radio control is a much more elegant solution. Wireless flash transceivers such as the those in the Yongnuo TTL YN-622 range start at about \$80 and work as master and slave controllers. More complex models that include control functionality for multiple groups of flashes and support multiple transmission channels start at about \$140. Such devices have a working range of up to 100 m and can be used to control up to five separate groups of slave flashes, each with its own settings.



Radio-controlled wireless flash controllers eliminate the need for yards of cables in a flash setup. These Yongnuo TTL YN-622 units work as masters when attached to the camera and as slaves when attached to an off-camera flash. Both can control multiple flash groups.

A simple clip-on diffuser makes a big improvement to any built-in flash, but to get really creative you need to use off-camera 'system' flash



Diffusers and Other Light Shapers

Used with appropriate accessories, system flash units can be used as a full-fledged alternative to conventional studio flash. To produce useful effects, you need to be able to direct and shape the light your flash produces. Most system flashes have built-in diffusers and can be kitted out with filters to adjust their color temperature, but neither of these accessories enable you to really shape the light you use.

One way to increase the versatility of your flash setup is to attach multiple flashes to a single light stand using an appropriate adapter, such as the Impact multi-shoe bracket or the Jinbei ET-3 (both around \$30 at ebay.com). This way, you can combine up to four flashes with light shapers such as a beauty dish, a softbox or a reflector. Most photo dealers offer a range of flash accessory bundles at price levels that are usually cheaper than purchasing each item separately.

If you shoot more outdoors than in the studio, brackets and adapters that attach directly to the camera make a useful addition to your kit. These are available in a broad range of shapes and sizes and include colored filters, various types of reflectors and, in the case of the Rogue system, even allow the use of a portable honeycomb grid for precisely controllable spot lighting. The Rogue Master Lighting Kit costs \$180 and includes large and small 'Flashbender' reflectors, a bounce



This IR Panel from Nikon only allows infrared control signals through, thus preventing the camera's built-in flash from spoiling the mood of flash shots



Three-section air-cushioned light stands (from Impact or Westcott, for example) start at about \$35

card/flag, a diffuser, a honeycomb grid and universal and color filter sets. All the components are available separately if you don't want to purchase the whole kit.

Cheap and simple add-on diffusers such as the Neewer Pro start at less than \$5, while larger, more flexible models such as the Walimex Universal Octagon Softbox shown on page 105 or the Alien Bees Octagon Softbox cost around \$30 at amazon.com. Such diffusers can be a little tricky to attach to your flash but are nevertheless cheap and effective. Some can even be used as spot shapers if you remove the diffuser attachment.

Other, more exotic options include the Vello 'Ringbox', which diffuses flash into an even, ring-shaped light that is particularly useful in macro and close-up situations. Ring light also produces attractive ring-shaped reflections in a portrait subject's eyes. The Vello device is attached to the lens and surrounds the camera's controls, making it quite tricky to make camera settings or focus effectively, so you will have to use a tripod with this kind of device.

A completely different, fun accessory is the Spiffy Gear Light Blaster, which attaches

to your flash and uses a lens to project slides or purpose-built gobos (available separately) onto a wall to create a custom background. The Light Blaster reminded us of artist Julius von Bismarck's 'Fulgurator', which he used to project a crucifix onto Barack Obama's lectern during a speech and a dove of peace onto the portrait of Mao Tse-Tung at Tiananmen Square, causing quite a lot of confusion among photographers who captured photos of both.

Reflectors

To ensure ideal lighting, you need to retain complete control over the light sources you use, and reflecting light is one of the most effective ways to fine-tune the look of a photo. Reflected light is much 'softer' than direct light and produces shadows that are less harsh and more controllable. Studio reflectors are usually large and cumbersome, but portable reflectors are available in a range of shapes and sizes for the flash photographer on the go. Portable reflectors usually have spring-loaded metal frames that make it possible to pack them down really small, and



A ring diffuser (or 'ringbox') produces extremely even lighting but makes it difficult to operate the camera effectively

Colored filter gels like these from Rogue can be used to alter the color of the flash and produce all manner of creative effects





they usually have interchangeable surfaces, which makes them extremely versatile. Alongside standard white, popular variations include gold-toned surfaces that prevent a subject from squinting in sunlight and combined gold/silver surfaces that produce authentic-looking skin tones. A black-covered

The Sunbounce BOUNCE-WALL enables you to produce sophisticated bounce flash effects without an assistant. Make sure you have enough space to move freely when the adjustable arm is fully extended.



reflector can be used to produce targeted shadows. Larger reflectors such as those made by Sunbounce (starting at around \$100) can be bent into concave or convex forms to provide spot-style or diffuse reflected light.

Great products for your first experiments with reflectors are the Photoflex 22" or 42" Multidisc 7-in-1 reflector sets (\$90-190), which come complete with a set of seven zip-on 'skins'. Similar products are available at budget prices with fewer surfaces, so it pays to shop around to find the model that best covers your particular needs.

If you are shooting on your own, there are many systems available for affixing reflectors to the camera itself. One of the better solutions for this type of work is the Sunbounce BOUNCE-WALL, which attaches to an adjustable bracket that screws onto your camera's tripod socket, enabling you to enhance the throw and style of the light produced by your on-camera flash. The interchangeable reflectors measure 8×11" and are available with a range of surfaces similar to those provided with conventional multi-use reflectors. Portrait shots always benefit from indirect 'bounced' light, and the only limitation of the Sunbounce solution is its relatively long arm, which can be tricky to use in crowds. The basic BOUNCE-WALL kit (with just a silver reflector) costs around \$100, and additional reflectors cost \$30-40 each.

Conclusions

Purchasing a powerful system flash is a big step on the way to creating better flash photos, but additional accessories are essential if you want to get really creative. As this article shows, you don't have to spend much on flash add-ons, and you can always expand your collection as your needs grow.

A system flash and a bunch of accessories often end up forming the foundation of a fledgling home studio and, once you have acquired a flash, you don't have to spend more than a couple hundred dollars to get a basic light stand/remote release/softbox system up and running. If you find that a value setup spurs you on to greater things, you can always invest in high-end gear later on. (tho) **ct**

A flash-mounted diffuser like this collapsible Octagon Softbox (available from Walimex, Neewer, etc.) provides soft light for close-ups and portraits



Lighting kits such as the one from Rogue pictured here offer endless ways to extend the functionality of an on-camera system flash





Thomas Gade, Sascha Steinhoff

How to Digitize **Slides**

While film and slide scanner technology has been stagnating for the last 10 years, digital cameras have steadily improved and have become a popular tool for digitizing analog photo archives. However, there are no out-of-the-box digitizing solutions available, so you have to be prepared to improvise when copying your analog treasures. Read on to find out how.

For most of the second half of the 20th century, slides were probably the favorite imaging medium of amateur and pro photographers. Now they are valuable originals that store memories of the past. Unlike negatives, which use inverted colors and masks to store image data, slides make ideal raw material for digitizing experiments. Although the 35mm format was the standard for many photographic applications from the 1930s onward, 6×6cm, 9×12cm and some even larger formats were used too, so today's archives are full of slides in a wide variety of shapes and sizes.

Slides are either framed individually or stored in strips like negatives. Docotoral these have probably been written about the multitude of slide frame types that have existed over the years, and the standard 2×2-inch frames can be made of cardboard, paper, plastic, glass or metal. However, the major difference among all these lay in whether the slide itself was mounted between two sheets of glass, behind a single sheet of glass or with no glass at all. Some slides that have spent their lives mounted between two sheets of glass look as fresh and vivid today as they did when they were first processed, while others have suffered all sorts of damage or have simply been destroyed. The downside of double glass mounts is that they sometimes create their own internal microclimate in which destructive microbes thrive. Unfortunately, it is virtually impossible to tell in advance if and when this will happen.

Keep or Discard Glass Frames?

Whether glass mounts are better than glassless ones for long-term archiving is a matter of intense debate. If the paper strips used to glue the glass sheets together haven't become porous or crumbly and if there is no visible fogging on the inside of the frame, there is no real reason to change anything. However, glass frames can have all sorts of adverse effects on the quality of copied slides, so glassless frames are the better option when it comes to digitizing your archives.

Always plan in advance what you want to do with your originals once you have finished digitizing them. We recommend that you keep them rather than throwing them away, especially if you earn your living from your photos and occasionally need proof of ownership for a particular original. One side effect of digitizing an archive is that you are bound to end up sorting your images and rejecting the ones you really don't want to keep. As a bonus, your slides will take up much less space if you store them in piles or in boxes (instead of in projector magazines)



Photos: Dieter Hoppe

Archives that have grown over the years often contain slides in many different formats

once you are finished. Replacing heavy glass or metal frames with thin plastic ones saves space and weight too. If you want to keep your projector magazines, you can fit up to 100 slides in thin plastic frames in a magazine originally made for 36 glass-framed slides.

Photos vs. Scans

Desktop film scanners were first introduced to the consumer market in the mid-1990s, and many of these were built specifically for scanning 35mm negatives and slides. A

high-quality film scanner produces scans with a high degree of detail and should be able to automatically detect and remove dust and scratch-based artifacts. If the scanner itself is well calibrated, dust and scratch detection usually works well for color negatives developed using the C41 process and slides developed in E6 chemicals, but there are only a few scanners that support it for Kodachrome slides. Hardware-based artifact detection doesn't work at all for black-and-white negatives because they contain reflective silver halide particles. Nevertheless, the



Standard 2" slide frames are used to hold various slide formats. From left to right, these are: 28×28mm (126), 24×36mm (35mm) and 40×40mm (127/Super Slide).



35mm slides are usually mounted in standard 2x2-inch frames, while 6x6cm medium-format slides are usually mounted in significantly larger 70x70mm frames

automatic dust and scratch detection offered by desktop scanners is a real bonus that has no equivalent if you use a camera to copy your slides. The only way to reduce the effects of permanent artifacts when using a camera is to use indirect rather than direct lighting.

35mm slide scanner technology reached its peak in 2003 with the introduction of the Nikon COOLSCAN 5000. This desktop machine offered scan quality that hasn't been equaled since and is still the reference against which all similar devices are measured. It is no longer in production and new or little-used examples change hands for several times the original purchase price. Flatbed scanners can be fitted with a variety of negative and slide scan units and are thus more flexible than desktop devices designed for scanning one particular format, but usually produce scans of a quality that is inferior to that produced by dedicated film scanners.

The major drawback of scanning rather than photographing slides is that the capture process takes place line for line and takes a lot longer. The COOLSCAN 5000 is considered to be quite fast but still takes about a minute to scan a single 35mm slide, while most other scanners of this type take even longer. You

then have to add extra time for loading originals and making pre-scans, so it only really makes sense to digitize a large archive this way if you have access to multiple scanners that you can use in parallel, which is an unrealistic scenario for most individuals.

All in all, it is not really worth investing in a flatbed or film scanner to digitize slides. See our slide scanner test in issue 17 of *c't Digital Photography* for more details.

Copying Slides with a Digital Camera

Using a digital camera to copy slides is much faster than using a scanner. The basic things you need to photograph slides are a camera, a lens and a light source. Other accessories that make the job easier can then be added as necessary.

Back in analog times, various manufacturers marketed purpose-built slide duplicators that consisted of a copy stand, a bellows unit, a lens and some kind of copy holder located above a light source. Unfortunately, these types of device are no longer in production and are very hard to find.

There are no all-in-one solutions available, so if you want to use your digital camera to copy slides you will have to improvise and cobble your own gear together using the gear and accessories available. In many cases, it makes sense to combine modern digital technology with old-school analog equipment. Read on to find out how to make your own super-efficient slide copier.



A slide duplicator made in the 1990s, showing the modeling light, flash unit, bellows and copy stand



This 1995 image shows a camera with a built-in line scanner and bellows unit being used to digitize microfilm

Slide Copying Gear

In principle, you can use any digital camera to copy slides, although higher-quality cameras give better results. The best camera to use is either a DSLR or a system camera with interchangeable lenses. These have high-quality sensors and, with resolutions between 16 and 36 megapixels, can effectively digitize analog film material. Generally, the larger the sensor and the greater its resolution, the better it is suited to the digitization process. Large, high-resolution sensors make greater demands on the quality of the lens, but you don't have to use the latest 36-megapixel full-frame DSLR to produce high-quality copies – an APS-C camera with 10 megapixels or more is perfectly adequate.

The Dynamic Range of Slides and Cameras

Dynamic range plays a significant role in slide copying, as it denotes the brightest and darkest tonal values that a camera can capture in a single image. For analog film and digital camera sensors, this value is quoted in terms of f-stops. In scanners, however, the cornerstone value on which copy quality is based is density range, and since there are no accepted standards for expressing it, there is no way to compare the values quoted by different manufacturers.

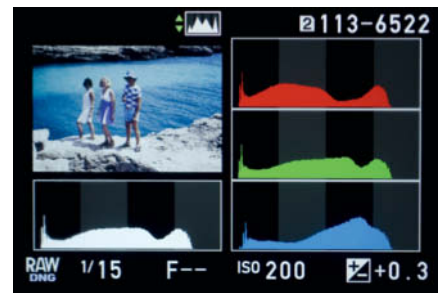
To produce sufficient quality, the dynamic range of the camera has to be at least as wide

as that of the slide you are copying. Otherwise, you will end up producing copies that contain color errors or posterization effects. Different slide films have different dynamic ranges, but it is generally assumed that negatives cover a range of about 12 f-stops, while slides cover about eight.

High-end drum scanners have density ranges in the region of 4.8, which is equivalent to about 16 f-stops and enables them to scan virtually any original. Most consumer-grade film and flatbed scanners have lower density ranges that make them less suitable for copying high-contrast originals.

Early digital camera sensors were said to have less dynamic range than slide films, but modern sensors usually have a dynamic range of 10 f-stops or more. Of course, these values vary from camera to camera and, if you shoot in RAW, you will capture images with the maximum dynamic range your camera allows. The settings you use to process JPEG images will determine whether you end up with images that cover the entire dynamic range that the camera's sensor can capture.

If you take care setting your exposure parameters, most currently available digital cameras are fine for copying slides. Use the histogram to check whether you are working within the camera's range. Shadow or highlight clipping is usually due to incorrect exposure rather than to insufficient sensor sensitivity, and exposure compensation usually solves any such issues.



The Pentax K-3 can digitize a high-contrast slide without clipping shadows or highlights

Shake-free Shutter Release

It is essential to avoid any kind of camera shake or vibration when copying slides, so a wireless remote release is the best solution. If you are using a DSLR, use mirror lock-up too. Focus with the aperture wide open using the live view magnifier function on your camera's monitor. Purpose-built focusing screens are available for copy work, but using them is rarely worth the cost and effort involved. Always shutter-priority (S) exposure mode. If you follow these guidelines, you will rarely have to make any manual corrections to your exposure parameters.

Choosing a Lens

The lens you use is the most critical factor influencing the quality of your results.



A zoom lens with a slide duplicator attached



① Rodagon enlarger lenses ② Extension tubes ③ Camera adapters ④ Zoerk Mini Makro close-up mount with a ⑤ Rodenstock APO-Rodagon 75mm D enlarging lens

Copying 35mm slides involves reproduction ratios of 1:1.6 in an APS-C camera and 1:1 in a full-frame camera, so you will need to use a lens that is designed for high-quality close-up work. Macro lenses are ideal. Zooms and prime lenses are designed for capturing distant objects, and the closest focus distance for a conventional 50mm lens is around 50 cm (20 inches), which is equivalent to a reproduction ratio of 1:10. Using such a lens would reduce the size of a 24×36mm original to 2.4×3.6 mm on the camera sensor, which is obviously useless for copying slides.

Any lens can be converted for macro use using add-on close-up or 'achromat' lenses, extension tubes and reversing rings. Screw-in close-up lenses start at around \$20 and can greatly improve the quality of a copy. An achromat is a better, if more expensive, option than most close-up lenses, because it consists of two or more optical elements. This type of lens starts at around \$50. Reversing rings and extension tubes have no built-in optical elements but complicate the camera's handling. A reversing ring does exactly what the name suggests and enables you to mount a lens back to front. Mounted this way, the electrical contacts in a modern autofocus lens can only be used in conjunction with a complex reversing ring such as the Novoflex AF Retroadapter (\$350). Higher-quality extension tubes often have contacts for transmitting control signals between the camera and the lens and cost around \$150,

while basic extension tubes cost from around \$20 but have no built-in electrical contacts.

Macro Lenses

Macro lenses have more complex geometries than standard lenses and can be focused from infinity right down to magnifications of 1:1. They generally produce extremely sharp, distortion-free images of normal and close-up subjects. There is a wide range of macro lenses available with mounts compatible with most major camera manufacturers' bayonets, so they can use all the usual camera functions such as autofocus and automatic aperture control. Apart from their much longer focus travel, they work in just the same way as conventional lenses. Camera manufacturers' own-brand macro lenses are available for APS-C and full-frame cameras and start at around \$400, while third-party lenses from Tamron and Sigma cost quite a lot less.

Enlarging Lenses

Enlarging lenses are an interesting alternative to macro lenses, although they have very basic designs that cannot even be focused without the use of additional accessories. They are most often used for photo lab, repro and macro work and produce extremely sharp, virtually distortion-free images at close focus distances. Rodenstock Rodagon and Schneider-Kreuznach Componon enlarging lenses are well known for their extremely

good reproduction characteristics. Focal lengths between 50 and 105 mm are ideal for copying 35mm slides and can be used equally well with APS-C and full-frame sensors. Prices are similar to those of macro lenses – the basic non-APO version of the Rodenstock 80mm f/4 Rodagon costs around \$420, while a focusing unit and adapter rings cost extra.

Specialists for 1:1 Reproduction

The Rodenstock 75mm f/4 APO-Rodagon D (\$660) was specially developed for the 1:1 reproduction of slides and negatives. It has a very limited range of uses but a well-deserved reputation for excellent reproduction characteristics. Unlike macro lenses and other enlarging lenses, it can only focus at close distances, but it is perfect for copying slides using a full-frame camera. Used on an APS-C camera (i.e., at 1:1.6 magnification), it shows signs of sharpness fall-off at the edges of the frame.

Brand new enlarging lenses tend to be quite expensive but, because so many analog photo labs are being dismantled, there are plenty of used models in good condition to be found at reasonable prices on the second-hand market.

All macro and enlarging lenses produce their best results at apertures between f5.6 and f11, while diffraction blur sets in at smaller apertures. You may need to use a small aperture to extend the depth of field when compensating for curvature in an original. In most cases, you simply have to experiment to find the optimum aperture for each copy or set of copies.

Focusing with Enlarging Lenses

Enlarging lenses have no built-in focusing mechanism and are focused using either a



The Kaiser Slimlite LED lightbox

bellows or a helicoid focusing unit, often with additional extension tubes. A bellows unit with an M42 bayonet and a built-in macro focusing rail is a good choice and can be used with a wide variety of cameras and lenses. M42 adapters are available for most popular system cameras and M39 or M42 adapter rings can be used to attach the lens to the bellows.

Locking the front and rear standards on a focusing rail can cause inconsistencies in the orientation of the lens axis to the focal plane, while helicoid focusing adapters are less prone to this kind of error and offer extremely precise focusing capabilities. Zoerk Film & Fototechnik (www.zoerk.com) manufactures a wide range of high-quality helicoid focusing units and adapters. The 'Mini Makro' close-up mount enables you to focus enlarging lenses at macro and greater distances. Together with an adapter and a set of extension tubes, it costs around \$450.

Light Sources and Other Accessories

Legacy slide duplicators use hot, power-hungry halogen lamps or flash with an additional modeling light as a light source, whereas cheap modern LED lightboxes provide even, diffuse light with a continuous spectrum, stay cool in operation and consume much less electricity. They start at around \$40 and run on rechargeable batteries or AC power.

It takes a while to line up the individual elements of a setup and find the right distance settings, so it makes sense to fix everything in place or mark your settings once you have built a workable system. This is easiest to achieve using a bellows unit or a purpose-built slide copier, but you can always use double-sided tape and magnets to make sure your originals and copyholder stay put. Make sure that your workspace is free of dust and always handle your originals using lint-free cotton gloves.

Slide Duplicators

A simple solution is to use a duplicator that screws into the filter thread on your camera's lens. These usually have 52mm threads and are supplied with a 58mm adapter.

The duplicator itself consists of a metal tube with a built-in close-up lens, negative and slide carriers and a diffuser. This a cheap, simple way to get started copying slides. The reproduction ratio of your setup depends on the focal length of the lens you use – around



A DSLR with an enlarging lens mounted on a bellows unit. An LED lightbox placed behind the slide carrier acts as the light source.



65mm is sufficient to fill an APS-C frame with a 35mm slide, whereas you will need a 100mm lens to produce the same effect using a full-frame camera.

If you use autofocus, make sure that your lens doesn't have a rotating front element, otherwise the entire duplicator will rotate when the camera focuses.

We tested the Kaiser Digital Slide Duplicator, a compact unit that costs about \$190, is five inches long and weighs 290g (10.2 oz). Film originals are positioned by moving them to and fro in the slot in the end of the device and we have our doubts about whether most cameras' zoom and focusing motors are sufficiently robust to remain

accurate while supporting the weight of the device.

Many zoom lenses have a 65mm setting but in our tests, results varied greatly depending on the lens. Our 55-300mm Pentax lens produced results that were very sharp in the center but showed significant blur at the edges of the frame, which is useless for copying of slides. Our 35-70mm Pentax zoom performed better, but the best results of all came from our old metal-bodied 55mm standard lens, which is robust enough to stand up to the mechanical loads that continual use of a slide duplicator brings to bear. Copying slides with an APS-C camera meant that we



The result of using a Pentax K-3 with a 55-300mm zoom and a Kaiser slide duplicator (1) is unacceptable. Using a 35-70mm zoom instead (2) produced an adequate copy.

were unable to produce frame-filling results and had to crop our copies accordingly. There are no rules regarding which lens works with a duplicator, so you will simply have to experiment to see which of your lenses works best.

Inserting originals into the sliding carrier requires a fair degree of dexterity. In this respect, cropping proved to be a boon, as it is simpler to remove unwanted edges from a copy than it is to precisely position each original.

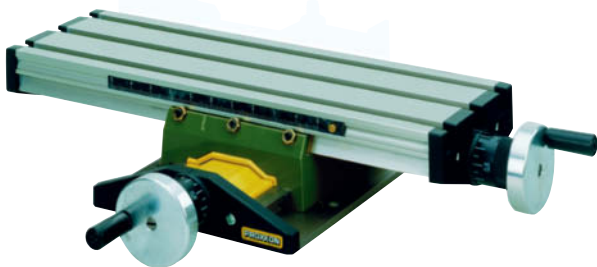
Take care with your choice of lens and don't expect to produce anything better than satisfactory copies using a simple duplicator.

Bellows Are Hard to Beat for Close-ups

Some photographic tools reached the peak of their development decades ago and still work perfectly today. Bellows units are one of these and are a standard feature of many macro shoots, as they enable you to focus more closely than you can using a lens mounted directly on the camera.

A bellows unit consists of an extendable tube with a camera mount at one end and a lens mount at the other. Lenses can also be mounted using additional adapters if necessary. In some units, both mounts are mobile, while in others only the lens mount can be moved back and forth to vary the distance between the lens and the camera body.

Holders for negatives and framed slides are available separately and include a diffuser made of glass or plastic to keep the light illuminating the original even. Take care to remove any dust or other specks from the diffuser, as these may show in the copy. If you want to be sure of avoiding these types of artifacts, you can either fold the diffuser out of the way or remove it completely and use a separate diffuse light source such as an LED lightbox.



A compound drilling table from a DIY store makes an effective alternative to a four-way focusing rail



The slide carrier attached to the bellows with the diffuser folded down

Many bellows units with built-in slide carriers were built for making 1:1 copies of slides using a full-frame camera fitted with a 50mm lens. If you use an APS-C camera, the lens has to be mounted closer to the sensor to achieve appropriate magnification, although the geometry of the bellows and the camera and lens mounts doesn't always allow the bellows to be compressed enough to achieve this. In the course of our test, we found our 60mm enlarging lens to be the best option. Many bellows units cannot be extended far enough for use with 80mm or longer lenses.

Most bellows units have a focus scale engraved on one of the rails. Once you have found the most effective settings for the camera, slide carrier and lens, be sure to note them along with the focus setting you use to help you set up your gear next time. Until a few years ago, most major camera makers manufactured their own high-quality bellows units, but these are now quite difficult to find. This is most likely because bellows units last for years if properly looked after and also because they require the use of lenses with built-in aperture rings, which have become extremely rare.

The bellows unit shown above has a macro rail and a stop-lock for the slide carrier. In this case, the geared macro rail serves to

adjust the distance between the slide carrier and the lens.

Bellows units can be quite expensive and are often quite tricky to use. Most have manual M42 screw-thread mounts but can be used with most other lens types with the help of appropriate adapters. The Novoflex BALCAN-AF bellows unit is compatible with Canon EOS cameras and transmits lens data and other electronic signals between the camera and the lens. However, at \$950, this clever piece of gear costs more than a high-quality macro lens.

In spite of their shortcomings, bellows units with a built-in slide carrier are effective tools for copying slides. They enable precise lens control and, because they have no built-in optical elements, the quality of the results is determined by the quality of the lens alone. For photographers on a budget, the second-hand market is full of bellows units in good condition.

Our Tip:

A second bellows, folded down to its shortest setting and placed between the lens and the slide carrier, makes an effective improvised lens hood and helps prevent unwanted reflections on the surface of the original

Using a Modified Slide Projector

Most slide projectors have a projection lens, a light source and a mechanism for automatically swapping slides, making them prime candidates for modification as slide duplicators. Most projectors use optical elements to focus light from a halogen bulb so that its rays are parallel when they hit the slide being projected. This is an extremely effective way to illuminate originals but makes scratches and other artifacts highly visible in a copy.

Swapping Out the Light Source

A standard projector lamp is also too hot and too bright for normal copying work, so you need to swap the light source for one that is dimmer and more diffuse. The light bulb and glass elements in a slide projector are normally located in slots beneath a flap in the projector housing and can usually be removed by hand. Once you have removed them, insert a diffuser into the slot nearest the slide. If you don't have an appropriate diffuser to hand, you can always use a piece of 40-50% translucent opalized acrylic or a piece of frosted glass from a hardware store or a glazier.

Replace the halogen bulb with an LED panel and line the light chamber with silver foil, offcuts from a camping mat, Styrofoam or some other reflective material to maximize the LED's output. Place one piece of reflective material at 45 degrees to the light source to reflect any extraneous overhead light toward your original.

LED video lights start at around \$30 and are ideal for this kind of modification. Individual LEDs with GY6.35-type pins are also available for use with 24-volt devices and can be inserted directly into the original halogen bulb socket.

Removing the Lens

To facilitate copying your originals, you have to remove the projection lens and photograph through the resulting tubular space, which is usually wide enough to produce full 1:1 copies. If this is not the case, you will simply have to cut away the parts of the projector housing that are in the way – which of course means that you will no longer be able to use your projector normally. We found that lenses with focal lengths between 80 and 100mm worked best, and a purpose-built, modern macro lens is ideal if you have access to one, as autofocus

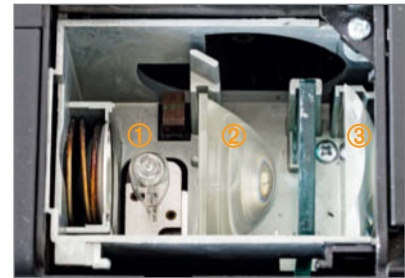
Modified Slide Projector



Virtually any slide projector with automatic magazine transport can be modified for use as a slide duplicator.

Begin by removing the lamp cover.

Remove ① the halogen lamp, ② the lens and ③ any remaining glass elements



Line the light chamber with reflective foil.

An LED movie light provides bright, cool light.

Position the light above the projector's lightwell



The rest of the projector works exactly as it did before the light source was customized

Remove the projection lens



The resulting tubular space is usually wide enough to shoot through

The complete setup showing the camera mounted in front of the modified projector



automatically compensates for the slight changes in subject distance that inevitably result when swapping originals.

Rotate any portrait-format slides through 90 degrees before you begin copying to save you having to switch the camera position while you work.

Use a stable tripod with a geared center column to position the camera and, if possible, mount it on a four-way focusing rail to help you make precise forward, backward and sideways adjustments. The Novoflex CROSS-Q is perfect for this kind of work but costs \$650. Value models from Neewer start at around \$25 at amazon.com. As an alternative, you can also use a compound drilling table from a DIY store and a conventional tripod mounting screw to affix and adjust your camera.



A Sony SLT α99 with a 105mm Sigma macro lens mounted on a Novoflex four-way focusing rail

Using a Copy Stand

A copy stand consists of a baseboard and a column with an adjustable-height mount for a camera and can be used to copy various sizes of original. A high-quality copy stand like the Kaiser RS 1 includes a baseboard and a counterbalanced column and costs about \$600. If the column on your copy stand doesn't have a rack-and-pinion or friction-based adjuster for the camera mount, you will have to use a separate macro rail for focusing.

You can copy slides simply by placing them on a lightbox and photographing them, but it is better if you fix your light source in place and affix your original so that it doesn't accidentally shift while you work. If you fix your light source in place, you won't have to readjust it every time you swap out the original.

We couldn't find any ready-made products that fit the bill, so we built our own from a small wooden box lined with Styrofoam. We drilled a hole for a power cable and inserted an LED lightbox to create a chamber in which light is reflected in multiple directions, providing even, diffuse light from below that minimizes the visibility of dust and scratches in the original. We used carpet tape to fix a thin metal plate to the baseboard of the copy stand and strips of magnetic tape to attach our lightbox to it. This gave it a firm hold while enabling us to easily fine-tune its position.

We then glued strip magnets to the top of the lightbox and got a local metalworking shop to make us a 2mm metal plate with a 9×9cm hole in it (for originals up to 6×9 cm), which we mounted on the magnets. We used more magnets attached to the metal plate to help us position our film and negative carriers.

It doesn't matter whether you use a bellows unit, a macro rail or a macro lens on a copy stand – you can copy anything from Minox 'spy' film to 18×24 sheet film negatives



Strip magnets are great for holding a variety of film carriers in place

Re-use the Film Carrier from Your Scanner

The best negative and slide carriers are ones that were built for use in analog enlargers, but the rise of digital photo technology has made it increasingly difficult to find new and used analog darkroom gear. Kaiser is the only major manufacturer still making quality negative carriers, although these are made of plastic. High-quality metal negative carriers are only available second hand. The negative carriers often provided with scanners make a good value alternative, especially if you are copying strips of negatives or slides.



A Kaiser negative carrier with removable masks for strips of film and framed slides



A DSLR fitted with a macro lens being used to copy a slide

and slides as long as your light source is large enough. The flexibility and robust design of a copy stand make it ideal for copying all kinds of film originals.

How to Adjust a Copy Stand

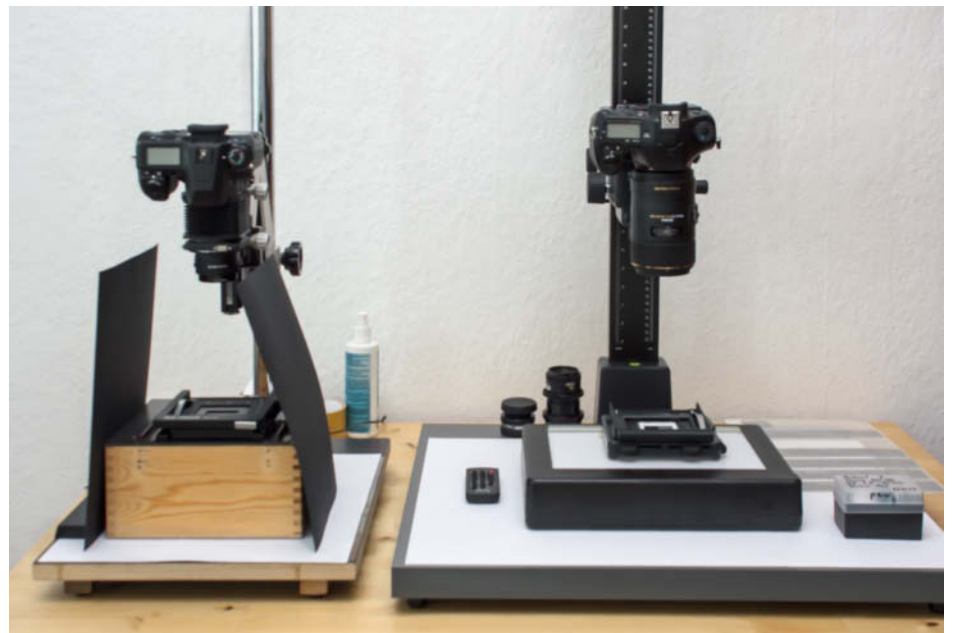
The shallow depth of field available at reproduction ratios of 1:1 makes it essential to precisely position the camera, the original and the lens. The simplest way to do this is to place a mirror on the baseboard and adjust the camera position until the mark in the center of the viewfinder is lined up with the center of the reflection of the lens. If the column isn't mounted at precisely 90 degrees to the baseboard or, if the camera is not mounted perfectly parallel to the column, the best way to ensure correct focus is to use paper or card to raise the corresponding edge of the lightbox.

How to Align the Camera with a Modified Slide Projector

You can use a similar method to line up your camera with the modified slide projector



Adjusting the camera position using a mirror



Left: Our home-made lightbox in use with a camera fitted with a bellows unit
Right: An LED lightbox and a camera fitted with a macro lens

described on page 113. We found a small mirror at a drugstore that we fitted into a slide frame. If you can't find a suitable ready-made mirror, a glazier will cut one to size for a few dollars.

Draw diagonals using a ruler to find the center of the mirror and mark its position using a permanent marker. You can then move the mirror into the light path and focus so that the center of the mirror is aligned with the center of the viewfinder and the center of the reflected lens. If you move the projector or adjust the position of any of the other elements of your setup, you will have to perform the focusing process again.

Check for Unwanted Cropping

It is difficult to tell where the slide frame meets the edge of the viewfinder image, making it tricky to judge whether you have truly filled the frame with a 100% view of the original. An effective way to make sure you align the camera correctly is to mount a piece of black card in a slide frame and make holes at the corners and in the center using a needle. The resulting bright points are easy to see in the camera viewfinder and it is obvious if one of your adjustments makes one or other of them disappear beyond the edge of the viewfinder frame.



Check your settings in the camera viewfinder



A piece of black card with pinholes mounted in a slide frame can be used to check for unwanted cropping

Comparing the Quality of Scans and Copies

Digitizing analog originals always involves a reduction in image quality. We copied our originals using a Sony α 99 (24 MP full-frame), a Pentax K-3 (24 MP APS-C) and a Pentax K-r (12 MP APS-C) with macro and enlarging lenses and compared the results with those produced by scanning the same originals.

Copy Resolution

A good scan should have sufficient resolution to reproduce all the significant details contained in the original. Optimum scan resolution depends on a range of factors (see our scan workshop on page 72 of Issue 17 for more details). This article concentrates on the factors affecting the quality of photographically created digital copies. The nominal resolution of modern DSLRs has long since caught up with that of film scanners: using the 36-megapixel Sony a7R to copy a slide is equivalent to a film scan with a resolution of more than 5000 spi (samples per inch), while a 12-megapixel camera produces the equivalent of 3000 spi. However, nominal resolution is not a reliable indicator for the real-world quality and detail rendition in a copy.

Scan Resolution

There are various ways to measure effective resolution. In the past, we have measured effective resolution of 3872 spi for the high-end Nikon COOLSCAN 5000 (with its nominal resolution of 4000 spi), and 2314 spi (compared with a nominal value of 6400) for the Epson V750 flatbed scanner. To ascertain scanner resolution, we use values measured using a USAF (US Air Force) resolution test target. This technique uses values obtained in the center of the frame but, because flatbed scanners scan line by line (i.e., sharpness is always the same in the center and at the edges of the frame), this is a non-critical issue when analyzing scanners. However, when analyzing photographed copies, center resolution is only part of the picture. The USAF method is also subjective and therefore includes a margin for discretion on the part of the viewer.

How We Determine Lens Resolution

At *c't Digital Photography*, we use target subjects mounted on a wall to test lens resolution and analyze the results using

custom software. We use lens-to-subject distances that fill the frame with the test subject – in other words, the subject distance depends on the focal length of the lens we are testing. This means that our test shots are always the same size, regardless of whether we are testing a wide-angle, normal or telephoto lens. This way, we can precisely evaluate the resolution at the center and the edges of the frame. However, because the reproduction characteristics of lenses used at close range are different from those at normal distances, these results are not always meaningful. Because there is no ready-made target for shooting at 1:1, our normal test procedure doesn't cover shots taken at macro magnifications.

USAF Methods for Digital Cameras

As an alternative to our usual methods we used the USAF methodology to measure center resolution for a variety of camera/lens combinations (see the table opposite). As expected, we achieved our best results (2896 spi) using a full-frame camera and the purpose-built 1:1 Rodenstock APO-Rodagon



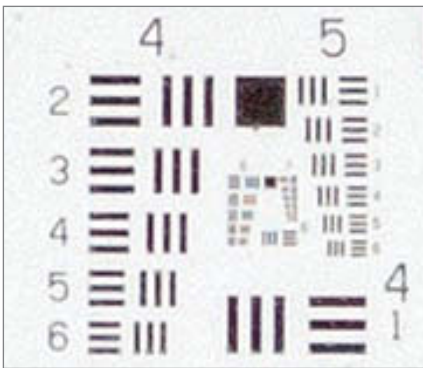
Used with a Sony α 99, the Rodagon D is sharp all the way to the edges of the frame



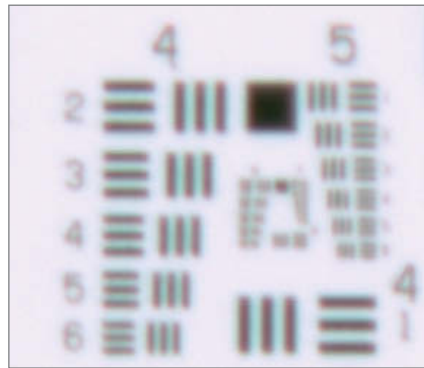
The Epson V750 shows an obvious lack of sharpness in the center and at the edges of the frame



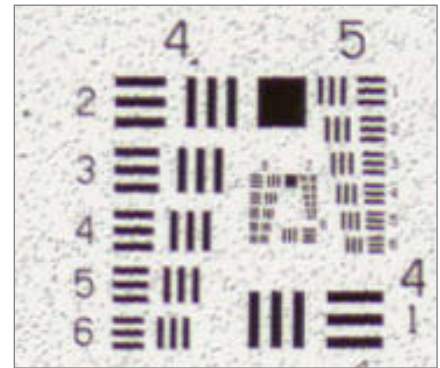
The 105mm Sigma macro lens shows obvious sharpness fall-off toward the edges of the frame



We achieved our best sharpness using the full-frame Sony and a purpose-built apochromatic enlarging lens



The limiting factor for the Epson V750 flatbed scanner is its poor optical quality



The Nikon COOLSCAN 5000 produces extremely sharp results but also captures dust and other artifacts in great detail

enlarging lens. The difference in quality between this and the other lenses we tested is obvious to the naked eye even in an unmagnified image but cannot compare with the quality produced by a high-end film scanner such as the Nikon COOLSCAN 5000. These values are, however, much better than those we achieved using our flatbed test scanner and are on a par with the results produced by our mid-range Reflecta ProScan 7200. Even our legacy APS-C Pentax K-r, with its 12-megapixel sensor, managed to produce effective resolution of 2048 spi.

Comparison Images on DVD

In spite of all this technical finesse, lab-based figures don't always provide an accurate indication of how an image looks when viewed subjectively. We have included TIFF files digitized using the methods described on this issue's free DVD. Each method is saved on a separate layer to help you compare them objectively. The original slide was captured in 1998 on Fuji Sensia 100 using a high-quality SLR. We scanned it using Epson V750 and Plustek Optic Film 7200 scanners and copied it using a variety of camera/lens combos. The

shots we took with the Sony α 99 and the Pentax K-3 are saved at their native resolution, whereas the ones from the Pentax K-r and the scanners are scaled to 24 megapixels for ease of comparison.

Macro and Enlarging Lenses

The Rodenstock 75mm APO-Rodagon D is designed for use at a reproduction ratio of 1:1 and delivered consistently excellent results throughout the frame when used with the full-frame Sony SLT α 99. The normal and apochromatic versions of the 80mm Rodagon produced virtually identical results when used with the Sony and are every bit as good as the 75mm 'D' lens. In contrast, the 60mm Rodagon wasn't as sharp at the edges of the frame, producing similar results to the Sigma 105mm macro lens. Because it is designed for full-frame use, the 75mm Rodagon produced disappointing results with the APS-C Pentax K-3, although the differences are hard to spot when viewed at normal size. Our test macro and enlarging lenses all delivered great absolute performance, and you can compare them by way of the test copies we made using a slide

duplicator (also on the DVD). The close-up lens built into the duplicator didn't work well with every lens we tested, but did produce results of acceptable quality with some of them. The poorest of the bunch produced consistently blurred, almost psychedelic-looking results.

Color, Dust and Scratches

Used with any of our test lenses, the α 99 and the K-3 produced results that were at least as good as our scans, while the lower nominal resolution of the K-r limited its usefulness. We found some minimal fringing in the corners of some of our test images, while our Epson scanner even managed to produce fringing artifacts in the middle of the frame – a kind of artifact that is usually caused by a poorly corrected lens. Our camera-based copies have better and more natural-looking colors and color gradients too. The only real drawback of photographing rather than scanning slides is that scratches and dust particles generally become more obvious, whereas scan software usually has built-in automatic scratch and dust removal functionality.

Conclusions

Camera-based slide copying is a useful alternative to scanning. A camera with a 24-megapixel sensor is a good choice if you are digitizing high-quality originals, as a 12-megapixel sensor might not produce enough detail. The choice between full-frame or APS-C is less important than the quality of the lens. Enlarging lenses designed specifically for close-up use are the best option, although they are trickier to use than autofocus macro lenses, which make it much easier to successfully digitize large numbers of slides. (sts) **ct**

COMPARING RESOLUTION OF CAMERAS AND SCANNERS

	Device Type	Image Size	Nominal Resolution	USAF Resolution
Scans				
Nikon COOLSCAN 5000	Film scanner	21.4 megapixels	4000 spi	3872 spi
Reflecta 10T	Film scanner	133.9 megapixels	10000 spi	3649 spi
Reflecta ProScan 7200	Film scanner	17.3 megapixels	3600 spi	2597 spi
Epson V750	Flatbed scanner	54.8 megapixels	6400 spi	2314 spi
Copies				
Sony α 99/Sigma 105mm macro	Full-frame camera	24 megapixels	4200 spi	2580 spi
Sony α 99/75mm APO-Rodagon D	Full-frame camera	24 megapixels	4200 spi	2896 spi
Pentax K-3/75mm APO-Rodagon D	APS-C camera	24 megapixels	4200 spi	2580 spi
Pentax K-r/80mm Rodagon	APS-C camera	12.1 megapixels	3000 spi	2048 spi



Thomas Bredenfeld

How to **Mail Merge** in Photoshop and Lightroom

Turning a guest list and a photo into a series of individually-named invitations usually involves a lot of hard work adding text to multiple copies of the same image. However, help is at hand – a little known Photoshop function and Lightroom plug-ins help to automate this otherwise tedious task.

When it comes to creating invitations or a standard letter, most people immediately think of Microsoft Word's Mail Merge functionality. This popular tool enables you to merge the contents of an Excel sheet with a Word template to automatically create multiple individualized versions of a single document. It is possible to add photos to Word documents, but purpose-built image editors like Lightroom and Photoshop are much better suited to creating image-based files. What many people don't know is that Photoshop has its own built-in mail merge functionality and that Lightroom can be upgraded to do the same using plug-ins. This article demonstrates how to merge an Excel sheet with a photo to create invitations, certificates, business cards and much more besides. The process works the same with LibreOffice and OpenOffice, too.

Little-known Functionality

Photoshop has long been able to merge PSD files with text data. The only requirement is that the image file is set up with appropriately predefined layers. In our example, we show you how to build an invitation to a music festival using a multi-layer PSD file. There is a photo layer, plus two text layers (for the first and last names of each guest) and five other icon layers, one of which is inserted into each document to serve as a ticket for a raffle. In Photoshop, the visibility and contents of text and image layers can be defined using the Image>Variables>Define command. Though rather clunky, the tool's interface is quite easy to use once you have grasped the principle.

Photoshop Mail Merge

To follow the tutorial below, either set up your own file or use the multi-layer PSD file included on this issue's free DVD.

Step 1: Define your variables

Use the Image>Variables>Define command to define the type of variable for each layer.

Options include *Visibility* and *Pixel Replacement*. The tool automatically creates names for each variable, but you can change these to suit your own project. Be sure to assign unique variable names without spaces or special characters. Once a variable has been assigned to a layer, an asterisk appears next to the layer name in the 'Layer' drop-down list in the Variables dialog.

Step 2: Create Data Sets

Now create a data set for each variable. Here too, there are various configurable options. For example, the raffle icons were each given a Visibility variable that determines when and whether the icon is visible. Click the 'Prev' (preview) button to check the effect. If you check the *Preview* checkbox, the effect of changes you make will be shown in real time. Once you are done defining variables and data sets, Photoshop is primed for the rest of the mail merge process. You can apply a data set manually using the Image>Apply Data Set command, although automating the task is a much more elegant approach.

Step 3: Create an Excel File

In our example, the content for the merged files is loaded via the 'Import' button in the Variables dialog. Clicking the button opens another dialog where you can select the text file in which your merge data is saved. We used an Excel sheet that we converted to text shortly before import. Name the columns in your Excel sheet according to the variables you defined in Step 1. To keep things clear, we gave our sample Excel columns the same colors as their corresponding Photoshop layers, although this does not affect the actual merge process. Layer visibility is controlled using the attributes TRUE and FALSE, which have to be written in capitals. We then filled the text columns with the names of our guests. Using Excel makes it simple to use data from other sources to create new variants of the same basic document. The number of Excel columns has to match the number of Photoshop variables you define and their



The layer stack for our Photoshop file. The layers marked in red change their visibility and the ones marked in yellow their text depending on the content of the data sets

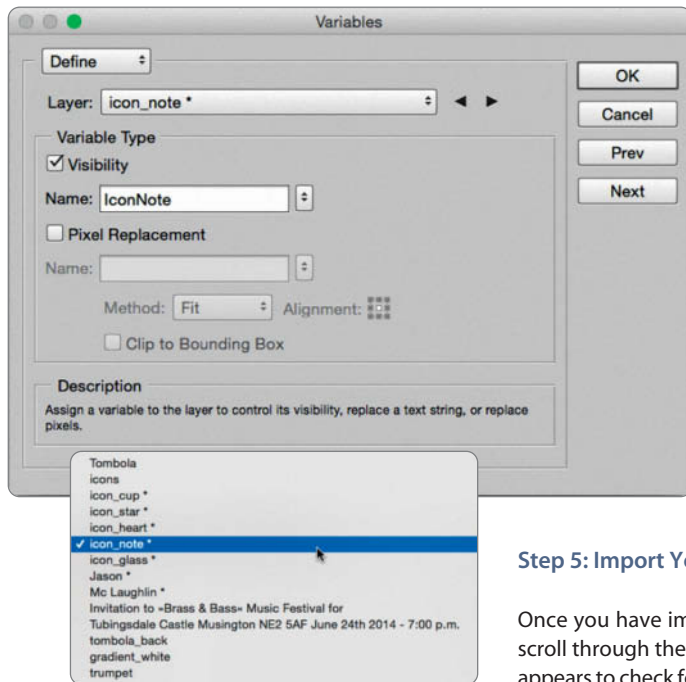
headings have to precisely match the names of the variables.

Step 4: Convert Your Excel Data to Text

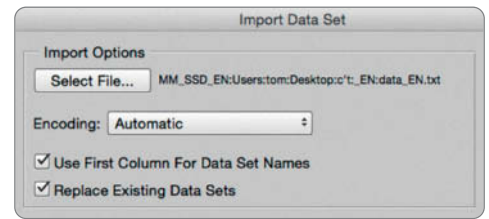
Photoshop can only interpret text files, not native Excel sheets, so you have to convert your data into text before you can proceed. The best format to use is CSV (Comma-Separated Values) or TXT (text with tab-separated values). Once you have converted your data, import it using the 'Import' button in the Variables dialog. If you check the *Use First Column For Data Set Names* option, the column heading will appear during editing but not in the final document. Setting

	A	B	C	D	E	F	G
1	IconCup	IconStar	IconHeart	IconNote	IconGlass	Text1stName	TextLastName
2	TRUE	FALSE	FALSE	FALSE	FALSE	Henry and Lisa	Miller
3	FALSE	TRUE	FALSE	FALSE	FALSE	Francis	Wayne
4	FALSE	FALSE	TRUE	FALSE	FALSE	Lord Kenneth	Wilkington
5	FALSE	TRUE	FALSE	FALSE	FALSE	John	Smith
6	FALSE	TRUE	FALSE	FALSE	FALSE	Tom	Hastings
7	FALSE	FALSE	TRUE	FALSE	FALSE	Charly	Brown
8	FALSE	FALSE	FALSE	TRUE	FALSE	Emily	Hill
9	FALSE	FALSE	FALSE	FALSE	TRUE	Joseph	King

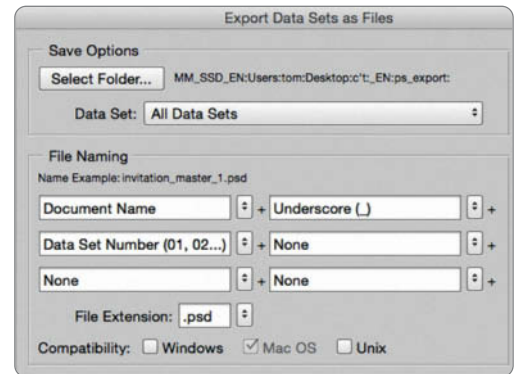
An Excel sheet based on our predefined variables



Assigning variable names to layers. Here, the 'icon_note' layer 'is named 'IconNote'.



Importing merge data into *Photoshop*



Exporting the merged data sets as files

Step 5: Import Your Data

Once you have imported your data, you can scroll through the data sets in the dialog that appears to check for errors. The imported data is now part of your PSD file and is saved with it – in other words, you have successfully merged your data with your image file.

Step 6: Outputting Your Merged Files

The File>Export>Data Sets as Files command enables you to select the location where you want to save your merged files as well as providing file naming options. These include a user-definable document name, the data set name or number and various separators. Once you have selected your naming options, clicking 'OK' saves your merged files as a

Encoding to *Automatic* usually works fine, although you may have to tweak this value depending on the *Excel* and *Photoshop* versions you use, or if you merge data from a Mac on a Windows computer (or vice versa). Some combinations work better with CSV data, while others prefer TXT. If your data includes special characters, it is usually best to select the UTF-8 encoding option.

sequence of PSD files tailored to the requirements you defined in the previous steps. Output to JPG or TIFF is unfortunately not an option.

Step 7: Convert Your Files for Output

If necessary, you can convert your PSD files to a different format for output. The simplest way to do this is using Adobe *Bridge*.



The result of the mail merge process is a sequence of individually addressed invitations with varying icons in the bottom left-hand corner

Mail Merge with Lightroom Plug-ins

Lightroom has no built-in mail merge functionality, but there are two plug-ins available that emulate it very nicely. *LR/Transporter* provides various import, export and metadata manipulation options, while *LR/Mogrify* integrates the *ImageMagick* command-line image processing module into *Lightroom's* native export functionality. The free versions of both donationware plug-ins limit the number of files you can export to 10, which is sufficient for a trial run but probably not enough for real-world use. Neither plug-in is particularly intuitive to use, so you will need to spend some time familiarizing yourself with them before you can start productive work. To perform the steps described below, you need to download, unpack and install both plug-ins using the *Lightroom Plug-in Manager*. *ImageMagick* is installed automatically with the Mac version of the plug-in, whereas Windows users have to install the .exe file separately.

Quick tip: When using plug-ins, always follow the online installation instructions to the letter.

Preparing Your Collection

If you accidentally use the wrong settings in the *LR/Transporter* plug-in, you run the risk of altering the metadata for the entire content of the catalog you are processing, so it is a good idea to export the image you want to use from your everyday catalog and create a new one for your merging activities. We have provided a sample catalog on this issue's free DVD. Once you have imported it, you may have to enter the path to your image file manually in the *Lightroom* navigator.

Step 1: Prepare the New Catalog

Import your chosen image file to the new catalog and save it to a collection with a meaningful name. Now switch to the metadata panel. Leave the filename as it is, enter the word 'Original' in the Copy Name field and enter a placeholder ('dummy' for example) in the Caption field. This is where the names of your guests will appear later on.

Step 2: Create Copies

Now use the Ctrl+' (apostrophe) shortcut to create as many virtual copies of your image as you need. *Lightroom* automatically names these copies 'Copy 1', 'Copy 2' etc., and these

filenames are the key to the metadata manipulation that we will perform later. If you are working with a large number of files, you can select them all using Ctrl+A, then use Ctrl+' to duplicate them. The number of copies is displayed in the status bar beneath the main image display area.

Step 3: Export Your Metadata

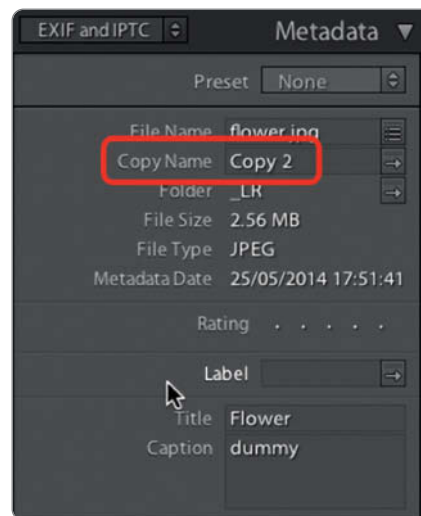
Navigate to File>Plug-in Extras> Metadata Export using *LR/Transporter* to gain access to the metadata fields you need to manipulate. Select the Summary File tab in the Export Metadata dialog. You can choose your own names for the fields you want to export, although it is simplest to stick to the names *Lightroom* provides – i.e., File Name, Copy Name and Caption. The first of the three sections in the Summary File tab (i.e., the summary file heading) should read as follows: {tab}COPYNAME{tab}FILENAME{tab}CAPTION{return}. The second section contains the variable text that we want to assign to each individual photo. Click the 'Add Token' button and select the appropriate metadata field names from the comprehensive drop-down list that appears. There are a lot of field names to choose from, so this can take a while. Start by selecting *Basic Tokens>Name associated with this copy*, which adds {copyName} to the list. Next, insert a tab and then add *Basic Tokens>Leaf name of the ORIGINAL* (which adds {fileName}), then another tab and *IPTC tokens>Caption for this photo* to add the {caption} token. Finish up by manually adding {return}. Leave the 'footer' section of the metadata export dialog empty. Select a location for the summary file and, if required, click *Save Current Setting as New Preset* in the Preset menu to save your settings for later use.

Step 4: Prepare Your Excel Data

Create a new Excel file, select the top left-hand cell and navigate to the Data>Get External Data>Import Text File command to import your metadata or address file. Now replace the 'dummy' placeholder with your guests' names. If you already have a list in *Excel* format, you can simply copy and paste the appropriate column.

Step 5: Extracting Data from Excel

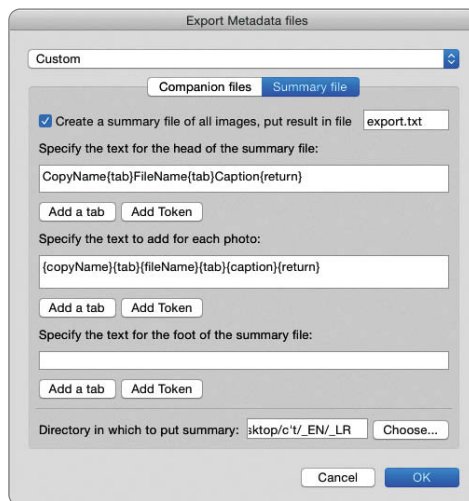
Like *Photoshop*, *Lightroom* cannot interpret *Office* file formats, so here too, you have to convert your Excel data into text. To do this click File>Save As and select the *Tab Delimited Text* option in the Format drop-down. The resulting file should look like



Preparing a virtual copy in *Lightroom*

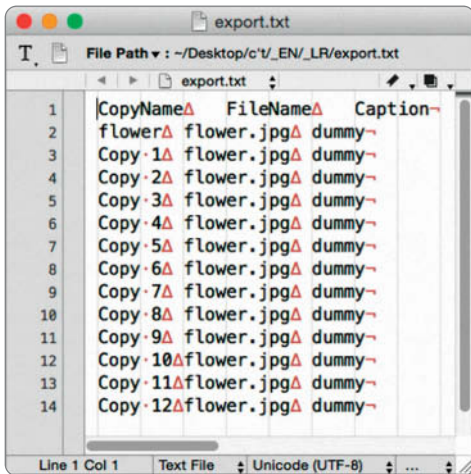


Selecting the *LR/Transporter* Export Metadata Files dialog



Using the 'Summary file' tab to select metadata fields for export

the one created earlier by *LR/Transporter*, and you can check whether this is the case by opening it in your favorite text editor. Make sure that you save your data with UTF-8 encoding. You can now reunite your manipulated data with your image file.



This is how the exported metadata fields look in text form

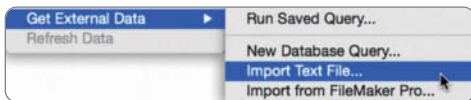
Step 6: Re-import Your Data into Lightroom

Navigate to Library>Plug-in Extras>Import Metadata using LR/Transporter and select your saved text file in the Input File box. During the process, the exported copy names ensure that each copy of your image is assigned only one name. In the Record Mapping section, you can link the *Lightroom* metadata field 'Copyname' with the appropriate source data field and replace the 'dummy' placeholder in the 'Caption' field with the content of the corresponding text cell. A confirmation dialog follows to check that you really want to overwrite the *Lightroom* database, followed by another that asks whether you want to apply your changes to the contents of the current collection or to the entire catalog. It is easy to select the wrong option here, which is why we used a separate catalog with image copies for our merge.

Now you can link the text from your metadata with your image and export the results using the *LR/Mogrify* plug-in.

	A	B	C
1	CopyName	FileName	Caption
2	flower	flower.jpg	Henry and Lisa Miller
3	Copy 1	flower.jpg	Francis Wayne
4	Copy 2	flower.jpg	Lord Kenneth Wilkington
5	Copy 3	flower.jpg	John Smith
6	Copy 4	flower.jpg	Tom Hastings
7	Copy 5	flower.jpg	Charly Brown
8	Copy 6	flower.jpg	Emily Hill
9	Copy 7	flower.jpg	Joseph King
10	Copy 8	flower.jpg	Carl Thornton
11	Copy 9	flower.jpg	Mary Douglas
12	Copy 10	flower.jpg	David Church
13	Copy 11	flower.jpg	Luisa and John Parker
14	Copy 12	flower.jpg	Grandpa...

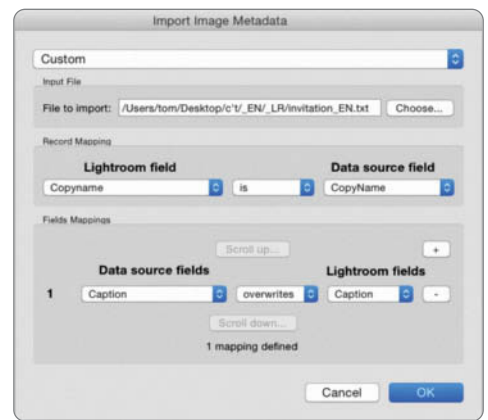
The 'dummy' placeholder is replaced with real data



Importing the metadata text file into Excel

Step 7: Writing the Text into Your Image

Select *LR/Mogrify* from the Post-Process Actions box in the bottom left-hand corner of the Export dialog. In our example, we used three different Text Annotations lines: the



Re-importing the manipulated metadata into Lightroom using LR/Transporter



The results of a *Lightroom*-based mail merge performed using free plug-ins

first contains the words “We like to Invite”, the second the {caption} placeholder (which contains the guests’ names) and the third the words “to celebrate our marriage”. Text can be positioned using either pixel or percent values but, because *ImageMagick* is a command-line program, it has no GUI to provide a preview, and you have to experiment with test exports until you get your document looking just right, which can take a while.

Quick tip: *ImageMagick* uses system fonts in Windows but requires fonts in the form of files when used on a Mac. We downloaded two free fonts from Google Fonts to build our sample merge document.

It is a good idea to save your trial export settings as a new user preset (click ‘Add’ in the Preset box in the Export dialog) and update them using a right click and the Update with Current Settings command whenever you alter your settings. Because *Lightroom* doesn’t support text layers, your merged text only becomes visible once you have exported the merged files. Click the ‘Export’ button to export your finished JPEG files to your chosen location.

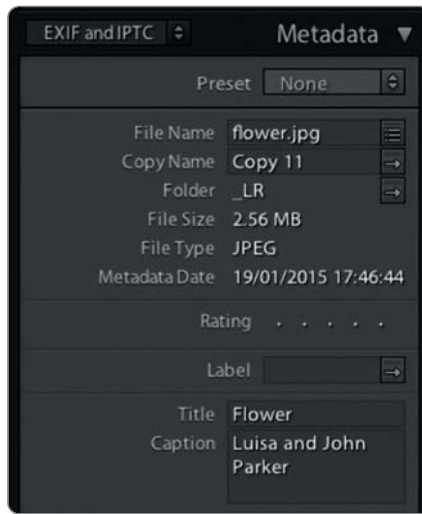
Conclusions

When you consider the degree of sophistication that *Photoshop* and *Lightroom* offer for image processing, it is perhaps surprising that the two solutions presented here are so complex and fiddly to apply. If you have experience using databases and data import/export functionality, you may find these steps easier to follow than if you have only ever used *Photoshop* and *Lightroom* for image manipulation.

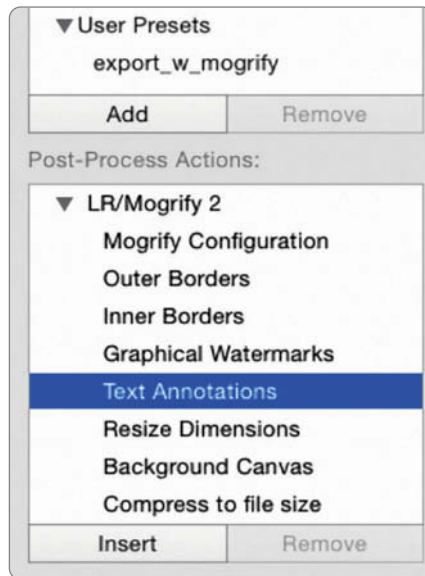
These solutions nevertheless present an interesting addition to both programs’ base functionality and could be of particular interest to professional event photographers, especially when you consider how easy it is to save projects and re-use them later.

Both solutions are relatively easy to apply for simple projects such as greetings cards or invitations, but *Photoshop* noses ahead in more complex projects with its ability to handle additional image and text/icon layers.

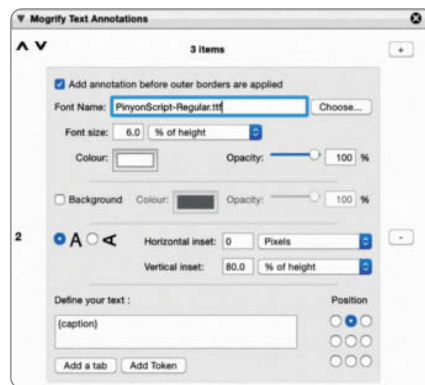
Lightroom has no native layers functionality, so the process of adding text to images is buggier and more complex than it is in *Photoshop*. Additionally, the *Lightroom* plug-ins available offer no preview functionality, so using them is sometimes a rather hit-and-miss affair. If you have the choice, *Photoshop* is the better overall option. (sts)



The altered metadata, as displayed in the *Lightroom* interface



Once installed, *LR/Mogrify* appears automatically in the *Lightroom* export dialog



Flying blind: *LR/Mogrify* forces you to format your text and metadata placeholders without a preview



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Dmitri Popov, Sascha Steinhoff

Cloud Photo Services

from Nikon, Canon and others

All roads lead to the Cloud. Now that hardware is no longer a major selling point, camera manufacturers are offering their own Cloud-based photo services with RAW support in the hope that they can grab market share from established providers.

Not long ago, Flickr was the only serious option for publishing your photos on the Web, but today's market offers everything from simple hosting solutions like Strato, through Web album services like Flickr, Flockshots and 500px, to services provided by operating system manufacturers like Microsoft and Apple. Google has become a major player in this segment too, although its Picasa Web Albums service, which used to be technically way ahead of the competition is less popular now that it is integrated with the Google+ social network. Other social media sites allow you to upload photos but limit file sizes and impose other restrictions that dedicated Web album services don't force on their users. The gallery services offered by Web hosting companies are often quite limited in functionality and don't have a built-in community. Now, Canon and Nikon have launched their own Cloud photo publishing services, Irista and Image Space, which stand out from the crowd thanks to their RAW image support.

Sony and Leica

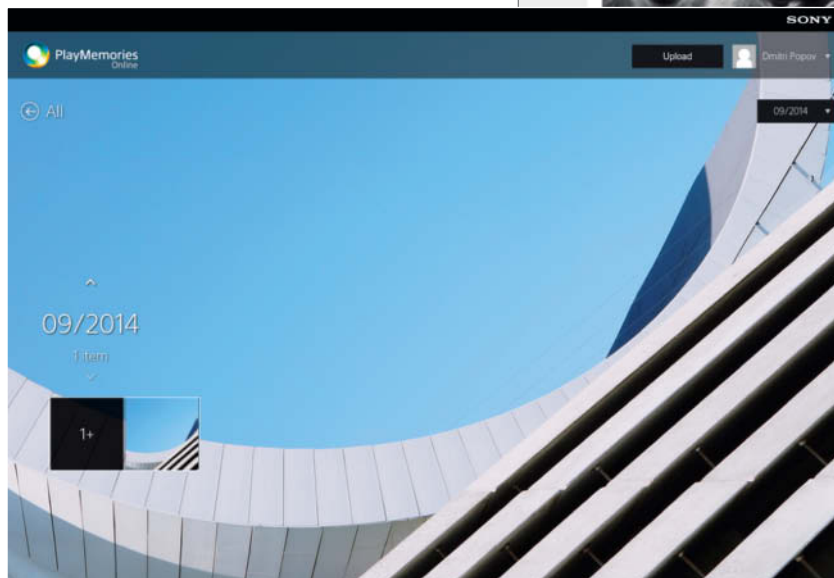
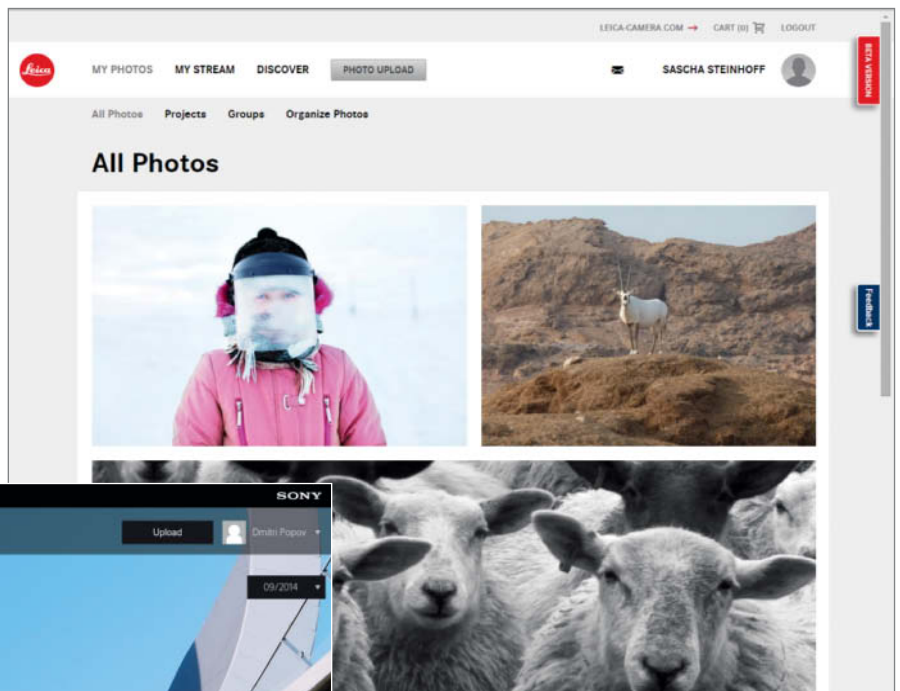
However, the 'big two' aren't the only camera manufacturers who have entered the Cloud service space. Sony launched PlayMemories Online, a free service that offers unlimited Web space, in 2012. The service supports a huge range of Sony devices, from mobile phones and computers through smart TVs to PlayStations and digital cameras, enabling you to network all your devices that can produce and/or display digital images. Of course, every Cloud service requires a corresponding app and must support at least iOS and Android if it is to have any chance of success. Most services can be accessed via the Web, but this is simply not practical with small smartphone screens. A desktop computer offers more screen space, but using a dedicated app is still the simplest and most efficient way to access a Cloud-based photo service. Even Leica – a manufacturer that

often takes its time to catch up with technical trends – started its Fotopark Cloud service in late 2014. As you might expect, Leica offers a no-frills service that is not cluttered with useless gimmicks. The free version offers 10 GB of Web space, and you can bump that up to 100 GB for 10 euros (about \$11) per month.

Fujifilm, Panasonic, Olympus

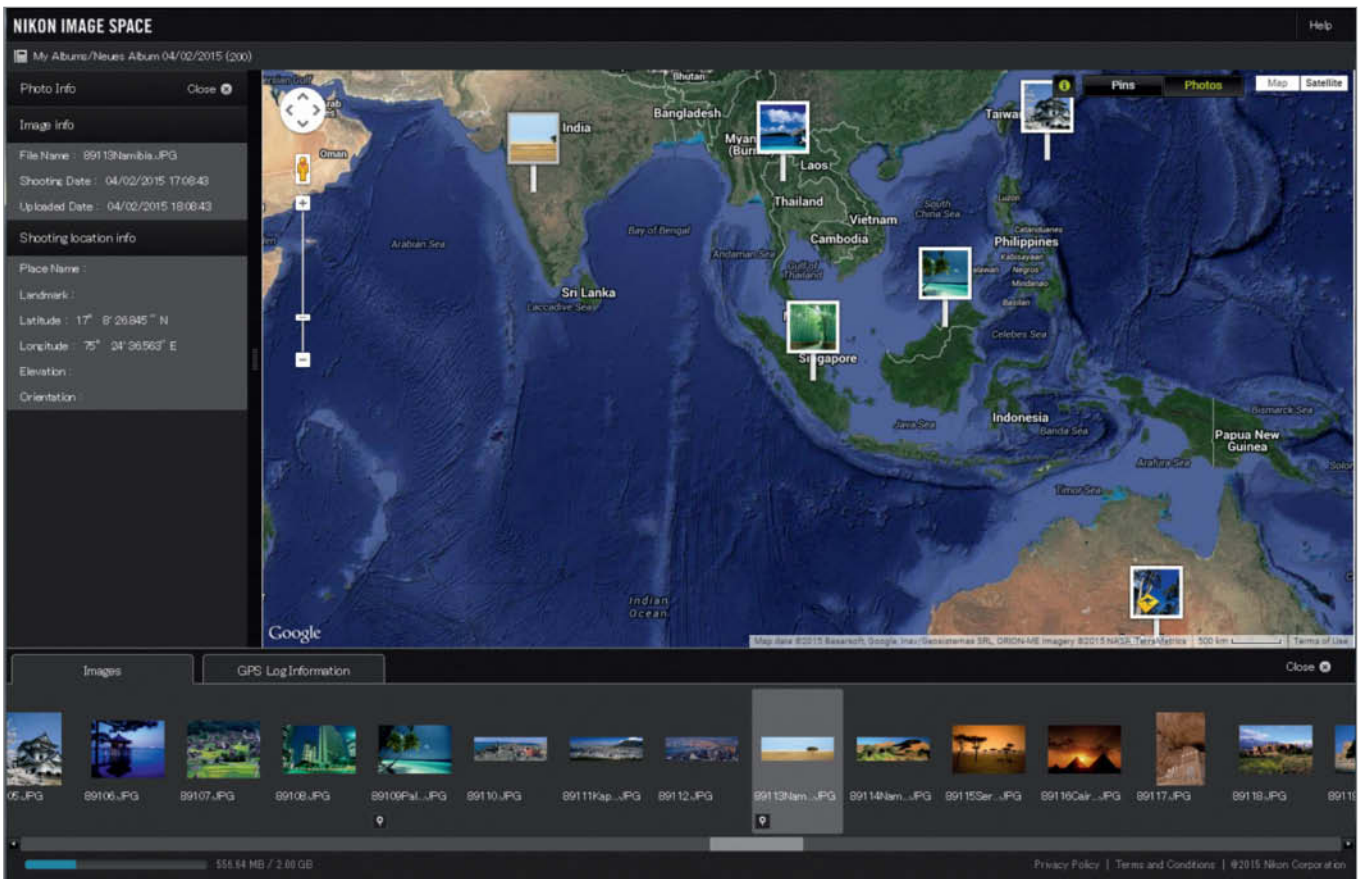
Not all camera manufacturers' Cloud-based offerings are successful: Fujifilm's ill-fated SeeHere Web album and development service closed down in 2012 and, as far as we can tell, Panasonic's Lumix Club has only a modest number of members and is only open to owners of Lumix cameras. Olympus chose not to offer its own Cloud service and instead partners with Eye-Fi – a company that manufactures memory cards with built-in Wi-Fi functionality and automatic access to its dedicated Cloud service.

Leica's Fotopark service went live at the end of 2014. Membership is free, includes 10 GB of online disk space and is open to all photographers.



Sony's PlayMemories Online is a multi-platform Cloud service that works with cameras, gaming consoles and televisions

Nikon Image Space



The NIS map view links geotagged photos to a map. You can add geotags to existing photos too, and NIS even writes newly-created geotags to RAW image files stored on its servers.

Nikon Image Space (NIS) is not the company's first attempt to get a foothold in the Cloud service space. My Picturetown, launched in 2007, offered too few features and limited Web space, and its clunky interface found few supporters. Its replacement, the all-new NIS platform, is open to everyone, although Nikon camera owners get more features and extra online storage space. The free 'basic' account includes 2 GB of online storage and allows you

to create multiple albums of up to 200 images each, but doesn't allow you to give others download access to high-resolution files. In other words, the basic account is fine for getting to know the service but doesn't offer enough features for serious use.

If you own a Nikon camera, you can open a 'special' account that includes 20 GB of storage, albums with up to 10,000 images and the ability to share original image data,

control downloadable content and share password-protected albums. To register for these privileges, you have to download Nikon's *Upgrade Utility* software and use it to identify your camera. Given the size of today's RAW image files, even 20 GB of free space is quickly used up.

The first thing we noticed when we logged into NIS was its slow response. In general, the site is pleasant to use, but its laggy



The Nikon Image Space search function looks good but lacks functionality. Although Nikon began marketing digital cameras in 1994, you can only filter dates later than May 1, 2000.

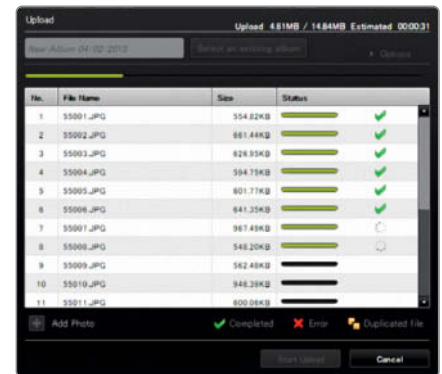
performance can be annoying during a long session. Photos are uploaded using either the site's own web-based uploader or a tool that you can download and install on your desktop. The latter is based on Adobe AIR, which is installed automatically with the tool. Both tools support batch uploads and allow you to add tags, create a new album or add the images you are uploading to an existing album. During our test, NIS incorrectly read some existing metadata, such as image titles, ratings and tags, but transferred GPS data without batting an eyelid. NIS supports Nikon RAW formats but not those from other manufacturers, so you don't have to convert NEF files before uploading them. It also allows you to download RAW files – a function not offered by most other photo sharing services. GPS tags added to RAW files stored in the Nikon cloud are written directly to the corresponding NEF file's metadata, so they are retained when you download your files. Tags, ratings and image titles that you edit online are not retained.

NIS is an album-only service that doesn't include image editing functionality but does offer quick conversion of RAW files to various sizes of JPEG during download. However, you will get better-quality images if you download

your RAW files first and convert them on your own computer using a dedicated RAW converter.

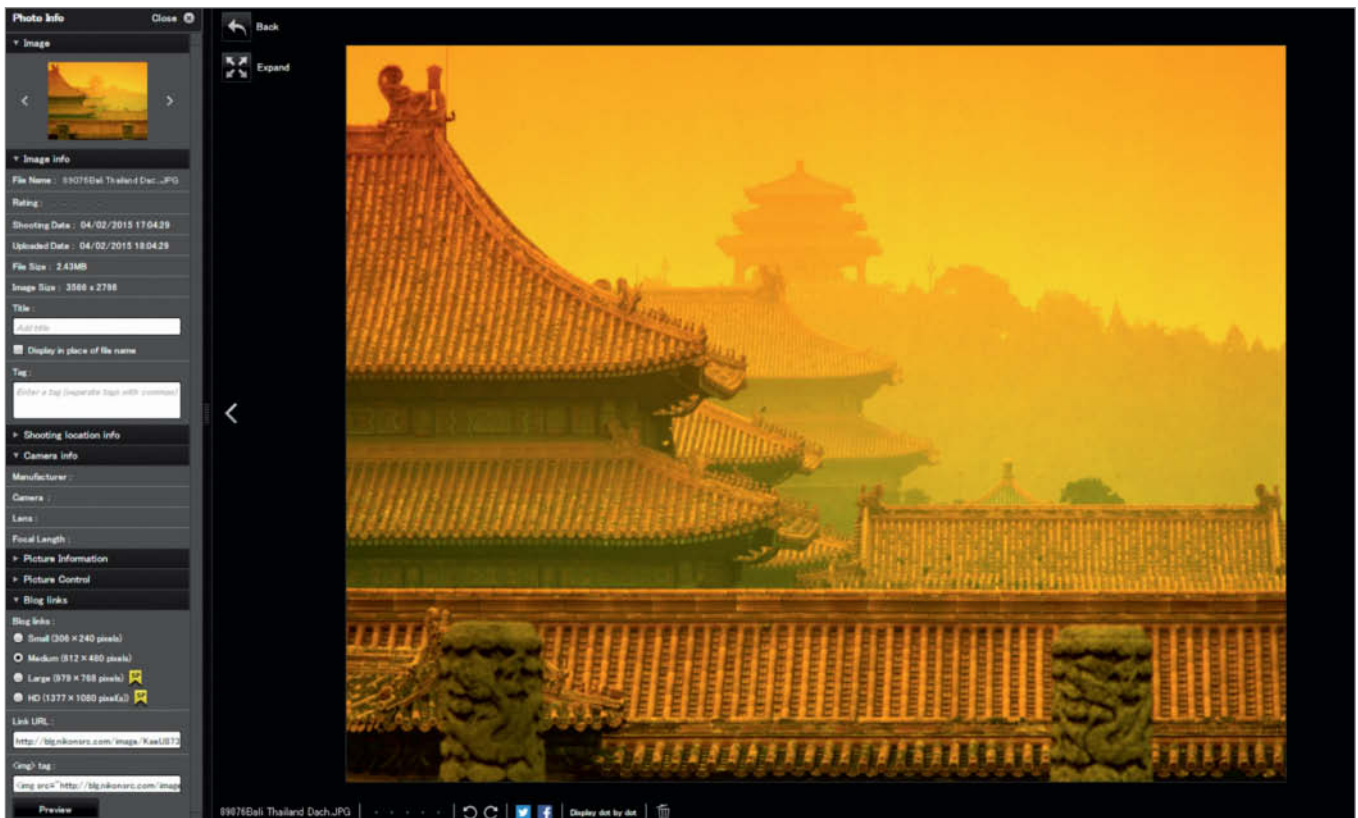
The NIS interface is clearly arranged and sorts photos according to *Categories* and *Albums*. The EXIF capture date, upload date and camera data are read during upload and can be used to filter images. File management within albums is largely intuitive and is as simple to use as most desktop tools. If you run into problems, right-clicking an object or clicking the menu items button opens a context menu with helpful options. Albums can also be grouped in logical 'boxes'.

Clicking the loupe icon in the top right-hand corner of the window reveals the clean but spartan search tool, which allows you to search for images according to shooting date, upload date or the number of ratings stars. There is also a text-based search function that searches by category (title, tags, location, camera manufacturer etc.) for the keywords you enter. The search tool is easy to use but not particularly good at finding individual images in large collections. You can search for images captured on a specific day but not within a range of dates. The most annoying aspect of the search tool is its inability to search for images captured before May 1, 2000.



The NIS Uploader supports batch uploads that you can add directly to a specified album

NIS offers various ways to share your images and albums in social networks. You can create links and post them on Twitter or Facebook or embed various sizes of images in a blog. To embed an image link, click the menu items button, select *Info* and then click 'Blog links' at the bottom of the info panel and follow the instructions that follow.



Preview mode displays a large version of your photo along with a metadata panel, where you can edit a photo's tags, title and ratings

Canon Irista

Canon spent quite a while perfecting the beta version of its Irista service under the 'Project 1709' banner before finally starting the real thing in mid-2014. Registration is simple and allows you to use an existing Facebook, Google+, Yahoo or Microsoft account or a separate Canon ID. You don't have to own a Canon camera to use Irista, so it is more flexible and appeals to a wider spectrum of users than Nikon's NIS offering. The free account offers 15 GB of online storage and doesn't limit the functionality on offer. You can expand your storage space to 500 GB for \$16 per month. As a comparison, Google currently offers 1 TB of cloud storage for \$9.99, while 1 TB at Flickr is free.

Canon's uploader is currently only available for Windows and Mac desktops but, unlike the Nikon uploader, can synchronize the contents of entire folders with the Cloud. Handling is quite complicated and forces you to switch back and forth between the Irista menu in the taskbar and the program window. For example, folder synchronization via the program window starts automatically and you can pause an upload by clicking the button in the taskbar tool, but to restart the

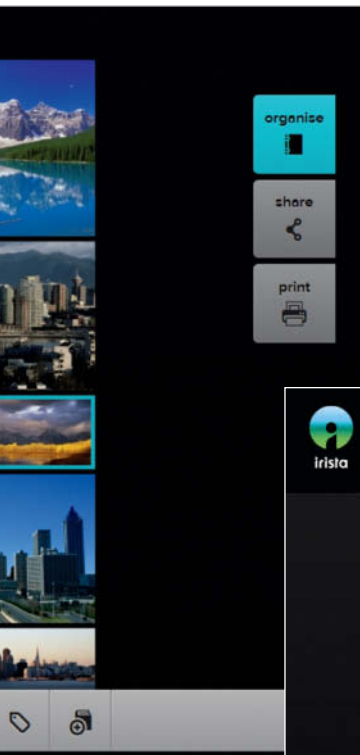


process, you have to switch back to the program window and click the appropriate button. General functionality is fairly limited, and we couldn't find a way to upload

individual images or manually selected batches of images. In other words, this is a simple folder synchronization tool, not a full-featured upload tool.

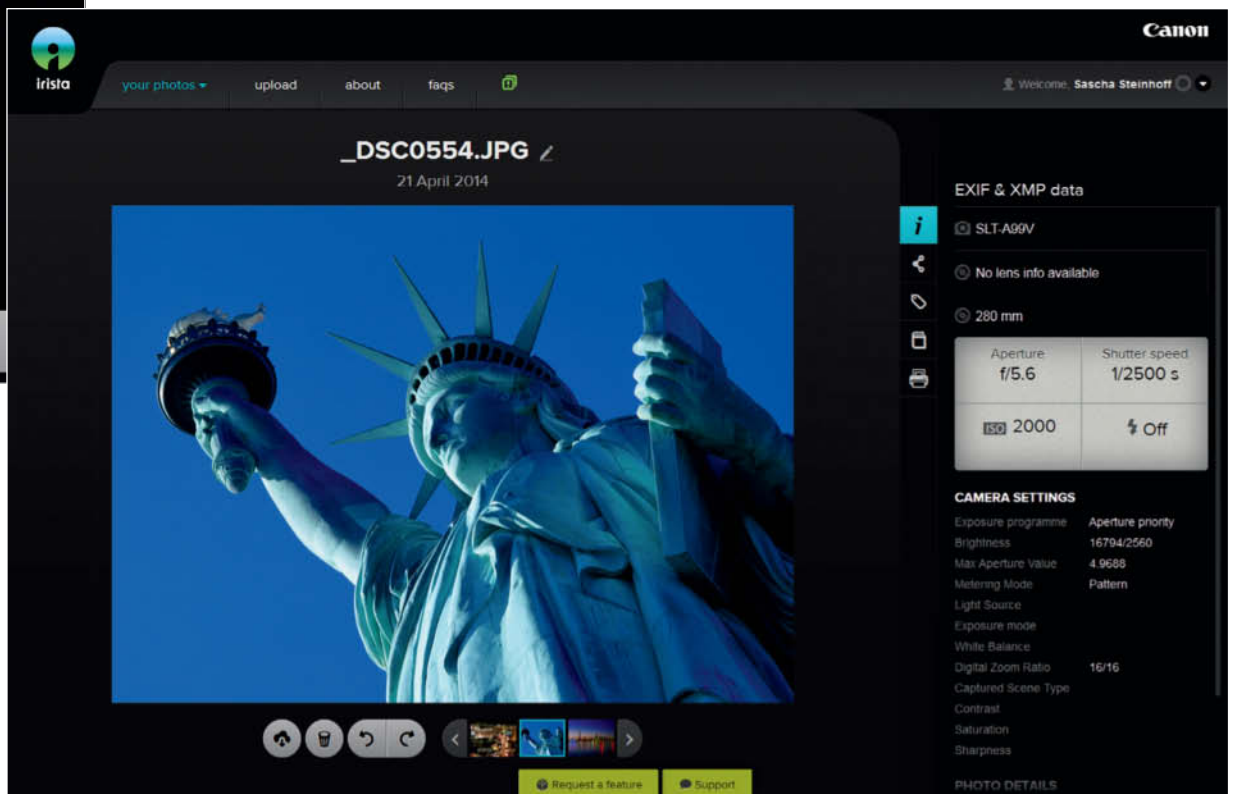


Irista uses a plug-in to synchronize *Lightroom* collections with the Irista cloud ①. The main program window shows which images have already been published ② and which are prepared for upload ③. The *Lightroom* progress bar ④ sometimes reports uploads that are not visible within Irista.



Irista offers a limited range of functions presented in a clear user interface

Irista's single image view displays EXIF metadata and enables you to add tags, rotate your image and add it to an album



With its default settings, the application is launched at system startup. It can also be used to synchronize nested folders, but is incapable of assigning the data it uploads to specified target albums. This means that however many photos you synchronize, you have to sort them manually once they are stored in the Cloud, which is time-consuming and sometimes plain annoying. Upload speeds are not particularly fast, so you need to be patient when transferring large numbers of images.

On the positive side, Irista offers much better RAW support than Nikon Image Space and can display RAW files from Nikon, Olympus, Panasonic and Samsung cameras, which are subject to a conversion process with no options for user intervention. Irista

leaves filenames and GPS data unaltered during upload but doesn't transfer metadata such as tags, titles and ratings (these do, of course, remain embedded in the original image data). Tags added from within the Irista interface are not embedded in the image data and are not transferred during subsequent downloads. Contrary to Canon's advertising claims, we found it virtually impossible to keep desktop and Cloud folders perfectly synchronized.

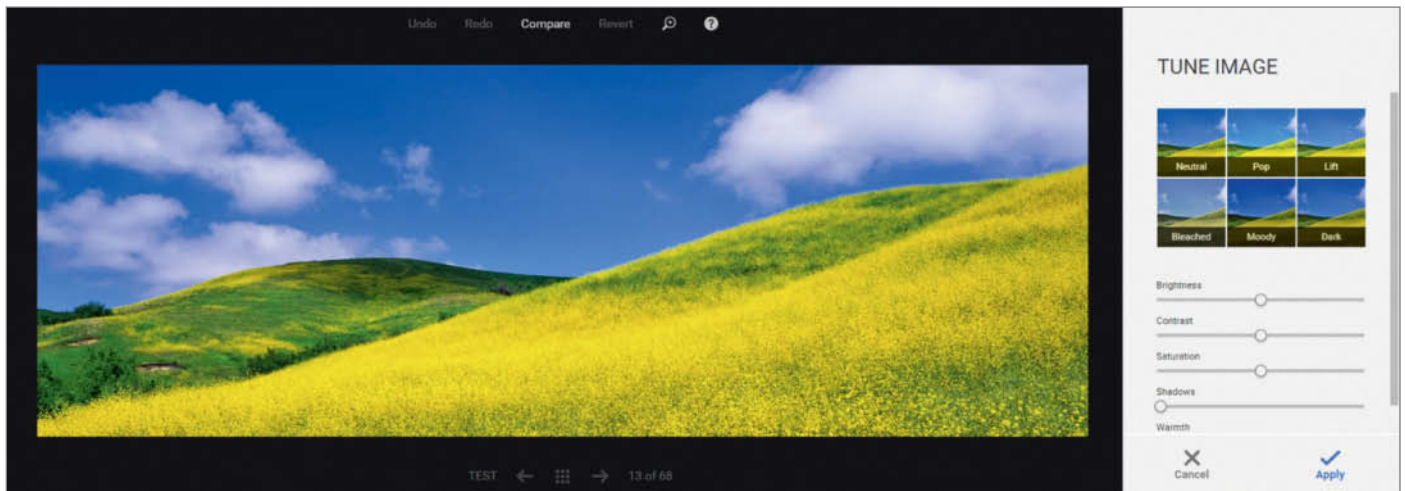
You can opt to download the original image or a smaller (approximately 3-megapixel) version but, unlike in NIS, there are no other image size options. The automated import of images from Facebook and Flickr works very smoothly and you can use Irista to post images to both platforms. If

you own a Canon camera with built-in Wi-Fi functionality, you can set it up to transfer images to the Cloud automatically. Upload speeds aren't especially fast, but the Canon site generally feels much snappier than NIS – for example, preview images load much faster on Irista than they do on NIS.

The Canon search functionality is better than Nikon's too. You can sort photos by year, month and date, although you cannot search a range of dates. You can filter images for specific cameras or lenses, but you can only search tags for keywords. Unlike NIS, Irista cannot search for a specific filename.

The *Memento* feature is a cool additional viewing option that determines which are your most important images by analyzing how often they are shared and commented.

Flickr and Other Alternatives



The Google+ image editor offers a complete, non-destructive cloud-based RAW image editing workflow, so you don't need to create duplicates before you begin processing

The new Cloud-based offerings from Canon and Nikon have to compete with a wide range of established services.

Among these, Flickr is still the biggest and most widely used. Newer services have to build up their communities from scratch and haven't yet had time to perfect their user interfaces. On the upside, Irista and NIS both offer the RAW support that is lacking in most other online services. As far as storage space is concerned, Flickr's unparalleled 1 TB of free space would easily be enough to house most archives, if only it supported genuine RAW file transfer and storage – however, the site's guidelines state that it only supports JPEG, GIF and PNG and automatically converts any other file types to JPEG. Our attempts to upload a NEF file via the Web ended with an error message. Even though the Canon and Nikon services support RAW upload and download they don't offer sufficient storage space to make this feature worthwhile. Nikon's paltry 20 GB simply aren't enough to store a comprehensive RAW archive and, although Canon now offers sufficient storage space with its subscription accounts, its desktop uploader, dedicated *Lightroom* plug-in and sharing tools aren't up to the task of utilizing it to the full. All in all, the services currently on offer from Flickr, Canon and Nikon are not technically compelling.

Google Drive

Shooting RAW has become just as important to most photographers as shooting JPEG, so Cloud-based photo services need to reflect this. Because we found weaknesses in the established photo sharing offerings as well as in the Canon and Nikon services, we decided to check out some other Cloud services that can handle a range of file types even though were not specifically designed with photographers in mind.

Google has long been a mainstay of the Cloud-based world, and Google Drive can be used to store and synchronize virtually any type of file. Its synchronization functionality is much more robust than that offered by Canon's Irista, but it lacks photo-specific features such as a date filter. It is fast and offers plenty of storage at a reasonable price (1 TB currently costs \$9.99 per month). The 1 TB offered for free by Flickr is not RAW-compatible and doesn't support upload for nested folders, so it is difficult to use the available space to its full potential. Google offers storage upgrades of up to 30 TB and a suite of apps for all major computing platforms. Our thorough test of the Windows version proved it capable of reliably synchronizing large collections of data, including automatic synchronization of folder structures. The only potentially limiting factor

here is the bandwidth of your internet connection.

Cloud-based RAW Workflow

You can use Google Drive not only to upload and download original RAW files, but also to preview and control access to your images. The relatively new RAW preview functionality replaces the older icon-based RAW storage, and the differences between Google+ and Google Drive are disappearing fast. You can now display images stored on Google Drive in Google+, while the Photos section of Google+ offers a number of photo-specific options, including the ability to search the photos stored on Google Drive. To do this, click Settings in Google+ and check the *Show Drive photos and videos in your photo library* option. Your photos will then be automatically displayed in the library view but remain private until you share them. Google+ also includes a RAW editor and, although you cannot control the conversion process, your original RAW (or JPEG) image files remain unchanged regardless of any alterations you make. The editor enables you to adjust brightness, contrast, shadows and sharpness, and offers cropping functionality and a selection of effect filters. Unfortunately, it only works in Google Chrome, but other online image editors such as Pixlr work perfectly well in other browsers.

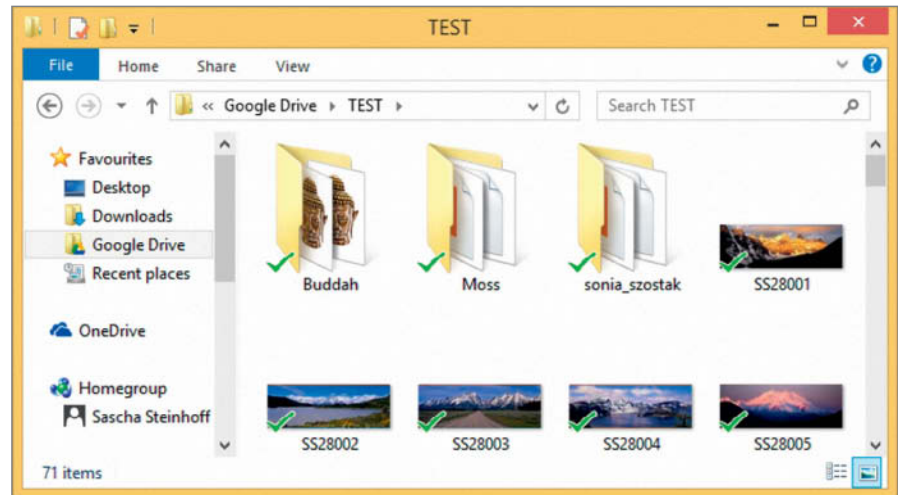
You can open Pixlr directly from Google Drive, but processed images can only be written back to the Cloud in JPEG format. If you stick to using Google’s Cloud tools, you always work on the same original file.

Unlike most conventional photo sharing services, Google’s Cloud-based apps are available for all major desktop and mobile platforms and offer a complete online RAW processing workflow. Google also attaches great importance to making its products compatible with all major browser interfaces, whereas Apple takes a completely different approach – see below for more details.

Microsoft and Apple

Reluctant to give in to Google without a fight, Microsoft has recently invested a lot of effort in developing its Cloud services. Since the early days of its Windows Live services, Microsoft has developed some really useful Cloud apps. OneDrive (formerly SkyDrive) is similar to Google Drive in many ways and can synchronize folder structures between your desktop and the Cloud. OneDrive is built into Windows 8 and can be downloaded for free for Windows 7 or Vista, making it an obvious choice for Windows users. It includes 15 GB of free storage and you can upgrade to 1 TB (including an Office 365 subscription) for \$6.99 per month. OneDrive can handle any file format and can be used to upload, download, display and share RAW image files, so the only real advantage of the Google system is its online RAW editor. There are Microsoft apps for all major desktop and mobile platforms except Linux.

Apple’s new *Photos* app (the successor to *iPhoto* and still in beta) is designed to simplify sharing photos between desktops and mobile devices in conjunction with iCloud. Apple’s *iPhoto* and *Aperture* apps can already be used



Microsoft OneDrive and Google Drive behave just like local folders

to synchronize and display RAW images stored in the iCloud using *My Photo Stream*. Apple usually uses its own fat clients to access its Cloud offerings and, even though earlier versions of its Cloud tools allowed access via non-Apple browsers and operating systems, you can only use all of the built-in features if you use an Apple device and Apple apps.

According to Apple, the new *Photos* app will make it simple to search for individual images within large Cloud-based collections. Only the future will tell how well it works, as there was no publicly available beta as we went to press and the new iCloud Photo Library was still in beta too.

Conclusions

The Cloud services from Canon and Nikon have breathed new life into the online photo

sharing market and brought Cloud-based RAW image handling into the mainstream. Both technically and in terms of storage space, Irista and NIS still have a lot of ground to make up if they are to compete with established services like Flickr – however, new services always take time to develop and mature, and the Canon and Nikon offerings are sure to improve significantly as they gain acceptance.

Google Drive and OneDrive deal smoothly with JPEG and RAW image files even though they are not dedicated photo sharing services, which makes them ideal for photographers who need to store RAW files online only occasionally. If you are on the lookout for a broad-based community and a wide range of sharing options, you are still better off using an established photo sharing service such as Flickr. (sts)

CLOUD-BASED PHOTO AND FILE SHARING SERVICES					
	Canon Irista	Nikon Image Space	Flickr	Google Drive	Microsoft OneDrive
URL	www.irista.com	nikonimagespace.com	flickr.com	drive.google.com	onedrive.live.com
Free storage	15 GB	20 GB ¹	1 TB	15 GB	15 GB
Maximum storage (price per moth)	500 GB (\$16)	20 GB ¹ (free)	1 TB (free)	30 TB (\$299.99)	1 TB (\$6.99)
Sharing interfaces	Flickr, Facebook	Facebook, Twitter, blog links	Facebook, Twitter, Tumblr, Pinterest	Google+	Facebook, blog links
Platforms					
Desktop (Windows/Mac/Linux)	yes/yes/no	yes/yes/no	no	yes/yes/yes	yes/yes/no
App (Android/iOS/Windows Phone)	no/no/no	yes/yes/no	yes/yes/no	yes/yes/no	yes/yes/yes
Supported Formats					
Camera RAW	Canon, Nikon, Olympus, Sony, Panasonic, Samsung	Nikon	–	Yes (not specified)	Yes (not specified)
Others	JPEG	JPEG, TIFF (limited)	JPEG, GIF (non-animated), PNG	JPEG, GIF, WebP	Yes (not specified)
Video and audio formats	Not supported	MOV, AVI, WAV, NMS, MPO	Yes (not specified)	Yes (not specified)	Yes (not specified)
Download Options					
JPEG (original / scaled)	yes/yes	yes/yes	yes ² /yes	yes/no	yes/no
RAW (original / JPEG 1:1 / scaled)	yes/no/yes	yes/yes/yes	–/–/–	yes/no/no	yes/no/no
¹ For Nikon owners only, otherwise 2 GB ² Original size but renamed					



Peter Schuffelen

Shooting Landscapes with Brian Matiash

Brian Matiash is one of the most exciting nature photographers working today. In this article, he tells us about a perilous trip to the Oregon coast and lets us in on the secrets behind some of his favorite nature photography techniques.

Cape Perpetua, a rugged headland on the Pacific coast of Oregon: a man walks into the sea, checking his balance on the treacherous, slippery rock every step of the way. He has a camera slung around his neck and is carrying a carbon fiber tripod. It is Brian Matiash, pro photographer and devotee of long exposures. Matiash is famous for his hyper-real yet meditative landscape images and is busy getting up close to a particularly impressive subject called 'Thor's Well'. This natural sinkhole is 20 feet deep, 10 feet wide and appears to swallow the approaching Pacific waves before spewing the water out in a huge fountain.

Just before he reaches the edge of the hole, Matiash stumbles and is certain this will cost him at least his camera (a Sony a7 with a 17mm tilt/shift lens) and possibly a nasty bruise or two. However, a friend standing nearby in the ankle-deep water manages to grab hold of him and prevent him from falling.

"The trip to Thor's Well was no cakewalk," says Matiash. "The location isn't easy to find, even using GPS, and we had already got lost on the way. My friend nearly fell into a crevice and, once we finally arrived, we had to work fast to make the most of the best views, which occur in the two-hour period just before and

just after high tide. To capture the most dramatic effect, we had already decided to capture the well using the backlight provided by the sunset."

Matiash finally gets into position with his camera and tripod on a crag covered in swirling surf. He is about eight feet from the monstrous hole – close enough to fill the frame using his 17mm lens but far enough away to avoid getting caught by the explosive swell. He releases the shutter for the first time at 8pm and, as the last rays of spring sunshine peek out from behind the clouds, makes a final exposure (his 240th) at a quarter to nine.

Landscape Shoot

The Job: High-intensity landscape shoot

Dateline: May 2014

Photographer: Brian Matiash

Location: Cape Perpetua, Oregon, USA

The Filter Trick

Matiash used a half-second exposure time to capture the movement of the water and a tilt/shift lens to correct the converging lines that would otherwise have spoiled the perspective in the final shot. If you compare the overview of the shoot on the right with the final image reproduced on the left, it is obvious that it isn't just the ultra-short focal length and the long exposure that make this image so arresting. To achieve the effect he was looking for, Matiash used a graduated neutral gray filter by Formatt Hitech to darken the sky while preventing the shadowy main subject from

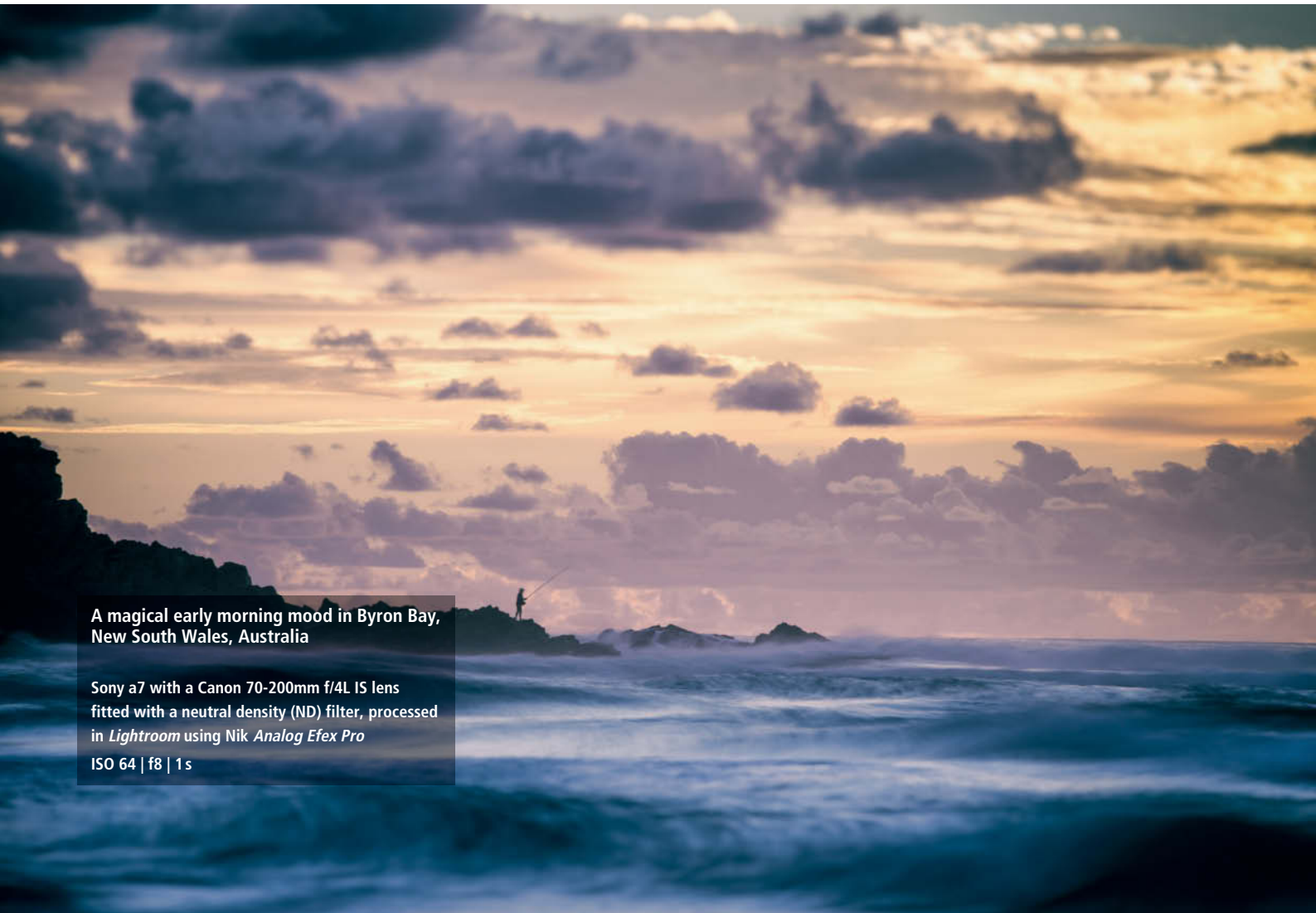
Photo: Hudson Henry



Twenty feet wide and 10 feet deep, the 'Thor's Well' sinkhole at Cape Perpetua in Oregon presented Brian Matiash with a real photographic challenge

A magical early morning mood in Byron Bay, New South Wales, Australia

Sony a7 with a Canon 70-200mm f/4L IS lens fitted with a neutral density (ND) filter, processed in *Lightroom* using *Nik Analog Efex Pro*
ISO 64 | f8 | 1s



completely disappearing into darkness. He also used the *Lightroom* Split Toning tool to lend a warmer look to the highlights and a cooler tone to the shadows. Matiash explains: "Deciding which look to apply takes much longer than the actual processing, which is usually done in about 20 minutes." He has been experimenting with image editing techniques for many years now and markets his own unique textures and *Lightroom* and *Photoshop* plug-ins via his website.

Matiash used *Lightroom* plug-ins to process both images reproduced opposite too. 'The Fingerlings' benefited from the application of a cross-processing preset, while the image of the mill was given its HDR feel using textures from OnOne's *Perfect Photo Suite*.

Both shots were taken when Matiash was still using DSLR cameras, although he

has since switched to using Sony's a7 mirrorless system. He says that the reduced weight of the Sony cameras and lenses is a huge benefit on his shoots, especially when he has to take long hikes to reach his subjects. He also likes the flexibility offered by the articulated monitor, and the electronic viewfinder makes composing images and setting focus points in low light a breeze. In spite of his move to lightweight gear, he always takes his 16-35mm, 24-70mm, 70-200mm and 16mm f/2.8 fisheye lenses along.

Matiash likes to capture natural subjects that are as untouched as possible: "I love to shoot in the back of beyond, where there are no TVs or cars and the sounds, smells and lighting are all natural. My trips help me to find peace and calm."



Brian Matiash

Brian Matiash is a pro landscape and travel photographer from Portland, Oregon. He has a distinct affinity for long exposures, graduated filters and fisheye lenses and enjoys sharing his knowledge and experience in hands-on workshops and online tutorials.




Greyhound Rock Beach,
California

Canon EOS 5D Mark III with an
EF 24-105mm f/4L IS lens

ISO 100 | f10 | 20s

Although he sells some of his images as stock photos, he makes most of his money selling his unique presets and passing on his knowledge and experience in workshops and online tutorials. He also leads landscape photography field trips on subjects as diverse as sunrises and starscapes, as well as offering image processing workshops to teach people how to fine-tune the results. He creates video tutorials on most of his shoots, and these too can be acquired online. Matiash is never short of work and, although his home state of Oregon offers a huge range of highly photogenic subjects, he is often on the road in the rest of the US and regularly travels abroad too.

Recent shoots took him to Hawai'i and Death Valley in the Californian Mojave Desert, and he will be somewhere between Norway, Iceland and Canada when this issue goes to print. There are definitely less attractive workplaces in the world! (jr) 

*In his eBook *Moving to Mirrorless* (available for download from <http://goo.gl/kaYYJS>), Brian Matiash describes his switch from using DSLRs to the exciting new world of DSLM photography. He explains why he chose the Sony a7 system and talks about which bodies and lenses he uses for which types of assignment.*



Titled 'The Fingerlings', this image was captured in Silver Falls State Park, Oregon

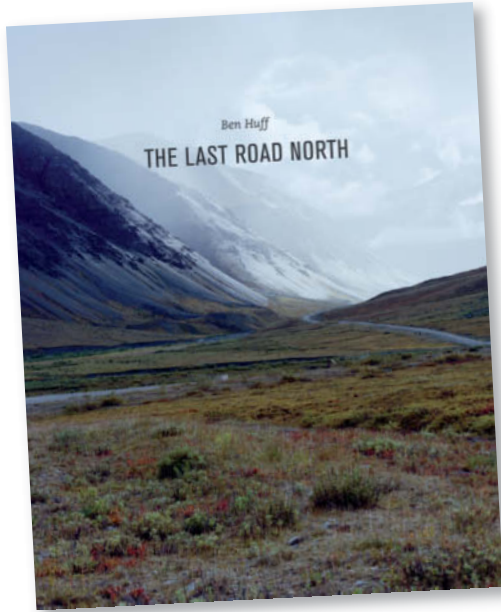
Canon EOS 5D Mark III with an EF 24-105mm f/4L IS lens, processed using a *Lightroom* Cross Process preset
ISO 100 | f11 | 2.5s



This shot of the Cedar Creek Grist Mill in Washington was fine-tuned using *OnOne's Perfect Photo Suite*

Canon EOS 5D Mark III with an EF 24-105mm f/4L IS lens
ISO 200 | f5 | 81s

Book Reviews



The Last Road North

Ben Huff

Published by Kehrer

120 pages

56 color and monochrome illustrations

9.5 × 12.1 inches, Hardcover

\$35

ISBN: 978-3-86828-574-1

The End of the Road

The *Last Road North*, a coffee-table book full of melancholy, chronicles photographer Ben Huff's multiple trips along the 800-kilometer Dalton Highway in Alaska – the northernmost highway in the United States. The road follows the Alaska Pipeline from Livengood to Deadhorse, and the names of these places hint at what awaited Huff on his travels.

On his way through the wilderness, Huff encountered countless truckers working the supply routes to the oil installations in the north and others who, like Huff, were attracted by the rugged natural surroundings. The photos are arranged to follow the author's route from south to north and, instead of numbers, the pages are adorned with compass needles showing the direction the road was headed in each picture.

Huff's photos do not document the USA or the state of Alaska as much as they do the sad consequences of global industrial interests, the ravages of the oil industry and the collective responsibility of humankind for the preservation of nature.

Many of these photos appear to illustrate downfall of people or places. Everything is shrouded in a feeling of cheerless twilight, which Huff pushes to its extremes with monochrome images of anonymous crucifixes at the side of the road. There is only one shot of the colorfully lit trucks that play such an important role in helping him reach his final destination of Deadhorse.

This is the mournful climax to the trip, and Huff says that reaching the end of the road was a real disappointment. He actually regretted being there and says he would discourage others from making the same trip. The area is completely dominated by the oil industry and only oil workers are allowed access to the Arctic Sea.

The Last Road North is a thought-provoking book. Within its pages, Huff has managed to capture the extremes of nature and human disappointment in every photo. He leaves us in no doubt about the unavoidable interdependence of human endeavor and the transience of nature. (tho)

Ben Huff captured the melancholy spirit of his trip along the Dalton highway in a series of compelling photos. Along the way, he was confronted with the wonders of nature, human fallibility and many places that have already seen better days.



Mile 333: Moonlight, Atigun River Valley, 2011, Ben Huff

A Phenomenal Bird's-eye View

In *Kopfüber* (which roughly translates as 'Head First'), Dirk Broemmel presents us with images of five types of ship portrayed from a bird's-eye view. This volume represents the culmination of 11 years' work that saw Broemmel travel from Germany via Venice to Asia and back.

Broemmel is a qualified communications designer and uses this book to live out his love of layout and composition to the full. He sees the work presented here as a reflection of the path his career has taken, with graphic design and photography taking center stage. This volume is not so much a catalog as a major retrospective. He asked friends, colleagues and design agencies he has worked with to help him define the categories and ended up producing images of freighters, passenger ships, ships from the Chinese Imperial Canal, Venetian gondolas and floating markets.

Once he had chosen his subjects, Broemmel set about photographing them in painstaking detail from directly above. Most of the images are made up of an average of 70 source photos, although the image of the Queen Mary 2 shown below comprises 370 separate images, and Broemmel spent a

whole year post-processing it until he was happy with his hyper-real merged view of the world's most famous luxury liner. The results of this meticulous work are often quite strange – in one image, the same dog appears four times on deck.

The unusual 'head first' perspective used in these images presents the viewer with a visual challenge, not least because the ships are presented against single-color artificial backgrounds rather than in their usual surroundings. The colors used for the backgrounds are all taken from elements in the images, which are so detailed that it is possible to make out warning signs, people's hair, pieces of fruit and other objects within the frames.

Kopfüber is lavishly printed on heavy-grade Swiss paper, and the 230 illustrations are a joy to browse through time and time again. As well as diving into this unique photographic treat, design fans will enjoy the layouts provided by design agencies hand-picked by the author.

This book has rightfully been awarded the 2015 German Photo Book Prize in the 'Coffee Table Books' category. (tho)



Kopfüber

Dirk Broemmel

Published by Kerber PhotoArt

166 pages

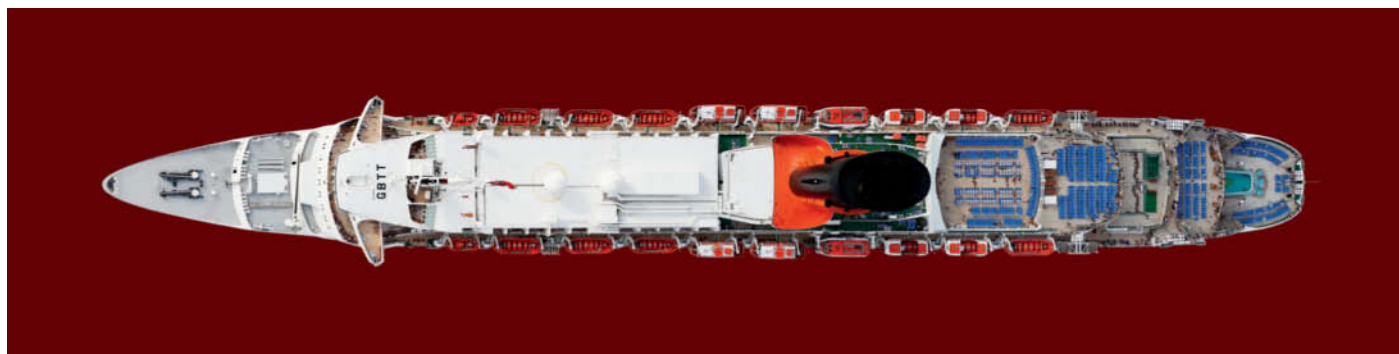
235 color and monochrome illustrations

Text in English and German

12 × 12 inches, Hardcover

\$37.50

ISBN: 978-3-86678-955-5



Queen Elizabeth 2, 2007, Dirk Broemmel

Dirk Broemmel uses as many as 370 individual source photos in his images of ships. Post-processing of these digital wonders can take as long as a year.

Coming up in Issue 20

● ● ● ● ● available from June 25

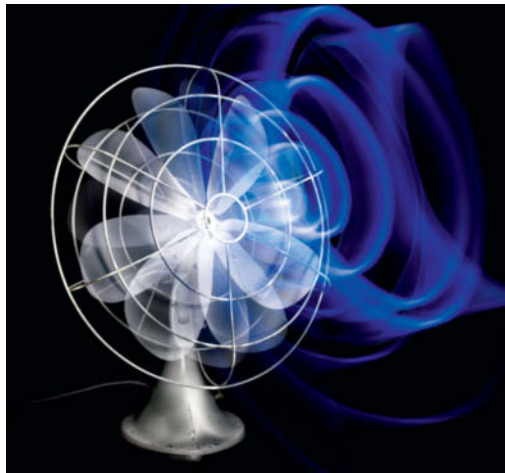


Photo: Cyrill Harnischmacher

Light Painting Workshop

Light painting is a fantastic medium that enables you to create abstract hovering drawings, ethereal messages, delicate transparent ornaments and impressive 'light sculptures' that often look as if they have floated in from another planet. Our workshop introduces this fascinating and endlessly variable form of visual expression.

Mirrorless Special

Mirrorless system cameras are still on the rise and continue to make inroads into the market traditionally dominated by conventional DSLRs. They offer compact dimensions, sophisticated handling, excellent image quality and an enormous range of additional features designed to win the hearts, minds and wallets of die-hard DSLR users. But does reality live up to the hype? We take a comprehensive look at the market and test the best mirrorless models available today.



Image: Fujifilm



Open Source RAW Converters

There are now many free alternatives to commercial RAW converters like *Lightroom* and *Capture One* available. We take a closer look at the open source alternatives (*Darktable*, *digikam*, *GTKRawGallery*, *Raw Photo Processor*, *RawTherapee*) and check how their image quality, features and handling measure up to the competition in everyday use.

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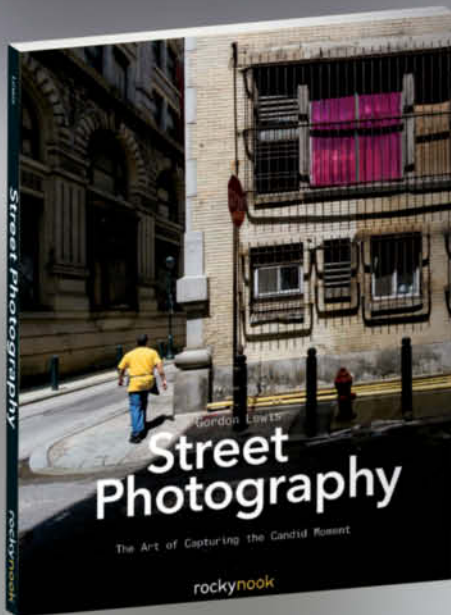
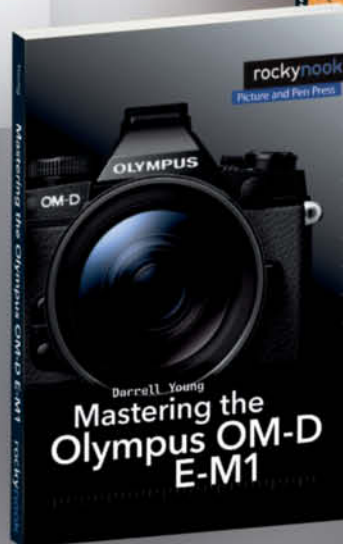
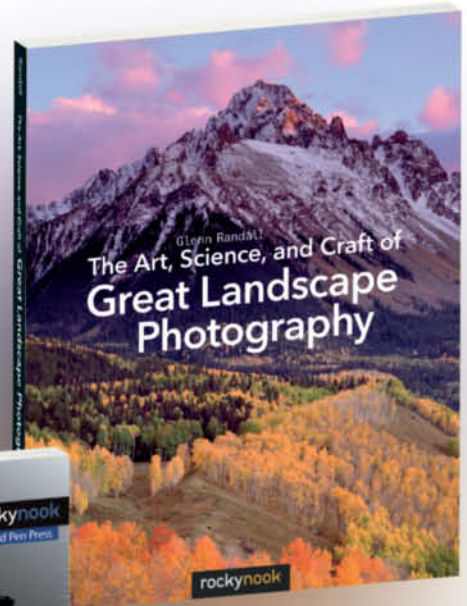
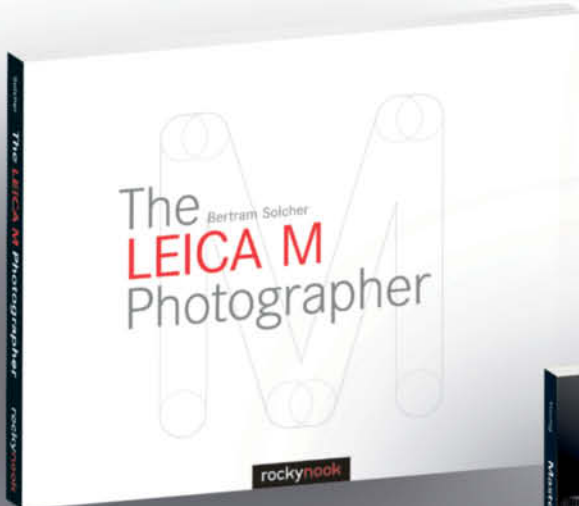
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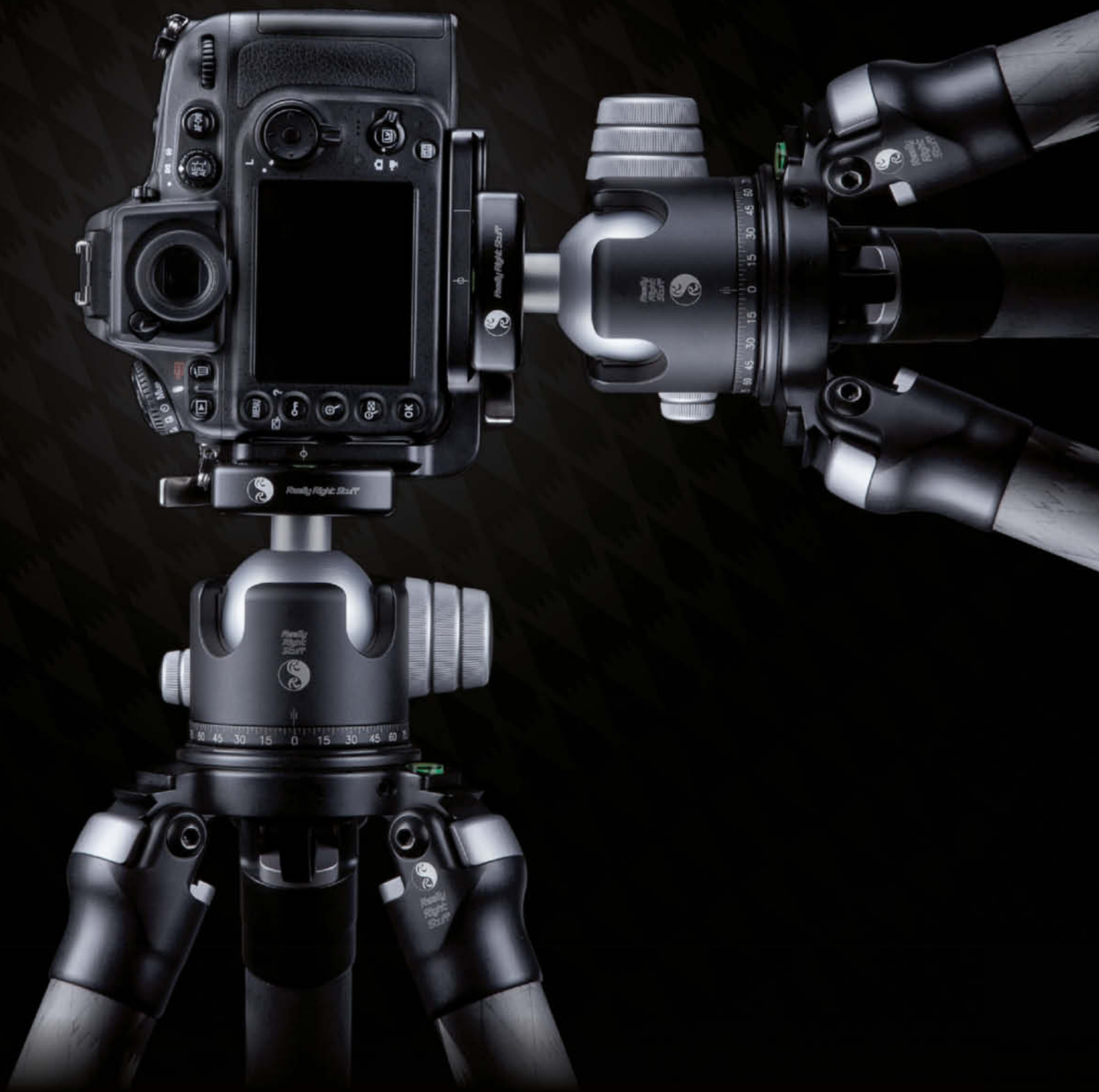


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