

Free DVD
inside

Black and White • Texture Blending • Focus Stacking • DIY Studio

ct Digital Photography

The in-depth quarterly for the photo enthusiast

Better Photos

Macro Focus Stacking

Extreme close-up depth of field

digiKam Does it All

Open source photo management

In-depth Workshops

Black and White

Composing, Shooting, Processing

Texture Blending

Give your photos an extra dimension

Free DVD

eBook, Full Version Software
Videos, Sample Images

Creative Corner

Build Your Own Studio Gear

Custom home-made equipment

Fun with Oddball Lenses

Fisheyes, Plastic Optics, Lensbabys

Time travel made simple!

Steam Punk Photo Shoot

Styling, Location, Creating a Retro Look



www.ct-digiphoto.com

6 (2012) • \$14.99
Winter Edition

\$14.99US / CAN



DISPLAY UNTIL FEBRUARY 29

SIGMA

Katlin Van Rossmann | CAMERA: SIGMA SD14 | ISO: 50, F2.8, 1/60sec | LENS: SIGMA 85mm F1.4 EX DG HSM | Copyright © 2010 Paul Thacker

SIGMA LENS for DIGITAL
NEW RELEASE

SIGMA
85mm
F1.4
EX DG HSM

Lens Case, Petal type Hood & Hood Adapter supplied



Offering superb optical performance, this lens is among the finest in its class. A medium telephoto lens with a large maximum aperture of F1.4 and compatible with full frame SLR cameras.

The latest optical technology, such as SLD glass elements, ensures high image quality throughout the entire shooting range. This medium telephoto lens is equipped with a large maximum aperture of F1.4 and is compatible with full frame SLR cameras. Delivering beautiful bokeh, this lens is perfect for portraits and shots at twilight.

www.sigma50th.com

50
YEARS
EXPLORING THE POSSIBILITIES

SIGMA

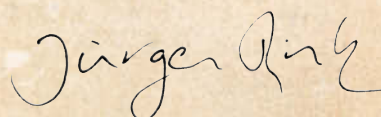
We hope you like our steam punk cover shot – it’s our take on a fictional past created using very real, high-end digital technology. In fact, what started out as a simple cover shoot turned into a full-blown multimedia project with a life of its own, and the article on page 86 tells you all about how it took shape.

Back in the present, our piece on home-build studio gear gives you practical tips on how to make your own bespoke equipment – and the results are just as good as expensive pro gear at a fraction of the cost.

Have you ever found yourself frustrated by the lack of depth of field in your macro shots? Lens experts tell us that there is no way around the laws of optics, but focus stacking gives you an alternative option and enables you to photograph even the smallest insect in perfect focus from wingtip to wingtip. Check out the article on page 76 for details on how.

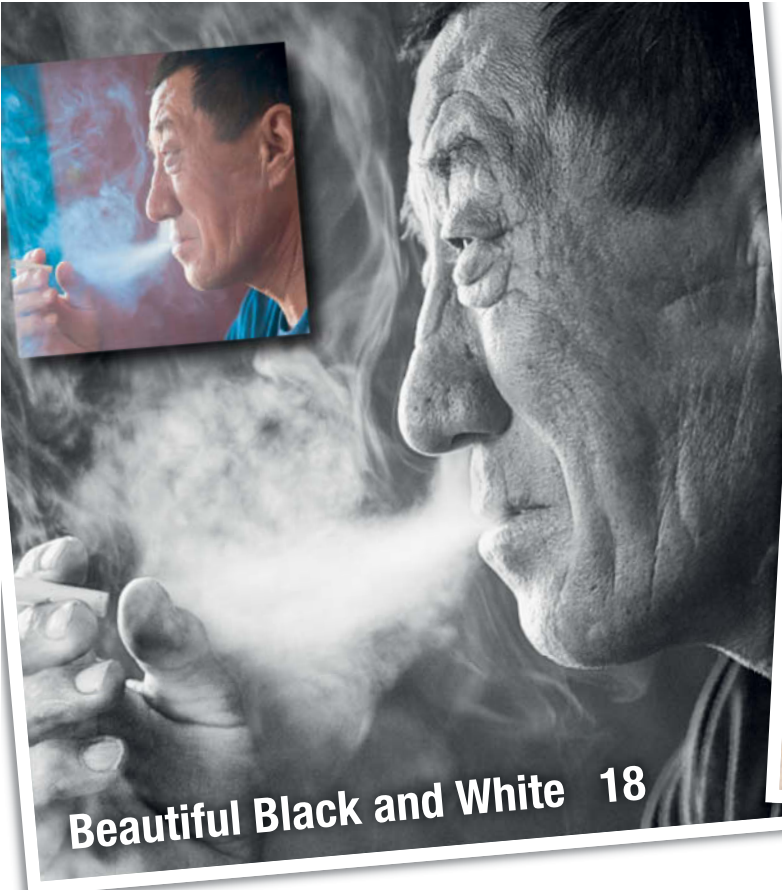
And for those of you who long for a little discreet light and shade amongst today’s intense, all-pervasive colors, our black and white workshop is right up your street. We show you how to find and shoot great monochrome subjects and how to use digital camera and processing technology to get the most out of your digital darkroom.

Have fun exploring our corner of the wonderful world of digital imaging!



Juergen Rink





Beautiful Black and White 18

Portfolio

André Wagner's fresh take on landscape photography has brought him worldwide recognition. He finds most of his subjects at night and photographs them using very long exposures.

10 André Wagner Portfolio

Beautiful Black and White

An in-depth workshop that explains how to create fascinating monochrome images from your color photos and how to hone your instinct for finding great black-and-white subjects.

- 18 Learning to See
- 23 Converting Color Images
- 28 Image Optimization
- 36 Special Effects

Camera Test

This issue's hands-on camera test covers two 30x optical wide zoom bridge cameras and a ruggedized all-weather ultra-compact.

- 42 Bridge and All-weather Camera Test
- 49 Test Camera Overview



Build Your Own Studio Gear 50

Build Your Own Studio Gear

This multi-part article shows you how to build studio accessories that are just as effective as high-end pro equipment and gives tips on using them to get great results.

- 50 Introduction
- 55 Beanbag Camera Support
- 56 Light Tents and Infinity Coves
- 60 Reflectors and Diffusers
- 65 Flash Bounce Card
- 67 Mirrors and Highlighters
- 69 Light Brush

Macro Focus Stacking

In macro situations, even small apertures seldom provide sufficient depth of field – the solution is to shoot multiple images at varying focal distances and merge the results into a single, extended depth-of-field image.

- 78 About Depth of Field
- 79 Shooting Technique
- 81 Stacking Software Review

Steam Punk Photo Shoot

The story behind our cover photo and the multimedia project it turned into. This article includes a behind-the-scenes look at the shoot and gives you tips on how to produce and process retro-look photos.

- 86 The Time Travelers' Diary
- 88 All About the Shoot
- 91 Retro-look Photo Processing
- 92 Steam Punk Photos



Macro Focus Stacking 76



Steam Punk Photo Shoot 86

Texture Blending

This workshop demonstrates the diversity of texture blending techniques and gives you some ideas for applying the technique to your own photos.

- 98 What is Texture Blending?
- 102 Sample Blends

Fun Photos with Oddball Lenses

We delve into the wonderful world of shift lenses, Lensbabys and fisheyes, and take an excursion into the outer reaches of pinhole and plastic lens photography.

- 108 Tilt/Shift Lenses
- 115 Lensbabys
- 118 Plastic Optics
- 120 Portrait Lenses
- 122 Fisheye Views
- 125 Pinholes

digiKam Does it All

We review the key features of the open source digiKam image management tool and show you how to use it to set up your own photo workflow.

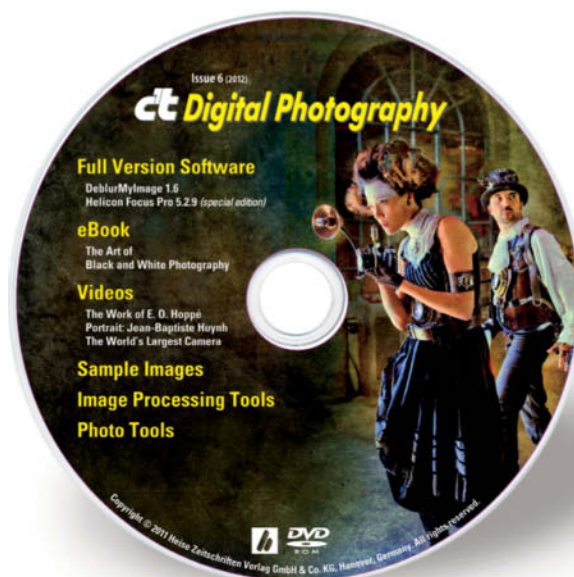
- 128 Overview
- 130 Installation and Configuration
- 132 Searching and Filtering
- 133 Working with RAW Files

Abouts Us

- 3 Editorial
- 6 Reader Forum
- 138 Coming Up in Issue 7
- 138 Contact Info

Free DVD

- 8 Highlights
- 75 Contents and DVD



Readers' Letters

Informative and beautifully made

Thank you for your speedy mailing of issue 4 of your excellent magazine. I discovered it through Ken Rockwell's site. I received today issue 1 of your publication; it is also very informative and beautifully made (pity the manual lens article was only Canon centered – I'm a Nikon user).

At last, I can't resist asking you for a re-edition of issue 2, it must be a killer – I would love to get one.

José R. Carneiro

Sorry, but issue #2 is completely sold out.

... and what people are saying about us on the Web:

A photo magazine worth reading

Let me be blunt: Most photography magazines on the newstands these days suck. Fortunately there are exceptions, one of the most noteworthy of which is c't Digital Photography. The "c't" is an abbreviation of "computertechnik" and is pronounced "C.T." c't is the largest selling tech magazine in Europe and is based in Hannover, Germany. c't Digital Photography magazine is an English translation of computertechnik's quarterly digital photography specials.

Here, in no particular order, is what I like about this magazine:

- Top-quality photos and reproductions
- Plentiful illustrations, many of which cover a full page or two-page spread
- Well-conducted and documented tests of photo equipment and software
- In-depth tutorials on useful techniques and software
- A free DVD that provides additional tutorials and applications

In short, these are photo magazines you could actually learn something from and be inspired by – assuming you're into that sort of thing. I wouldn't wait too long though – Issue 2 has already sold out of its print run.

<http://shutterfinger.typepad.com/shutterfinger/2011/09/a-photo-magazine-worth-reading.html>

Shutterfinger

Congratulations and thank you

For a great many years now I have been purchasing photographic magazines and books... And then came c't Digital Photography.

To say I was impacted by this magazine, is a tremendous understatement. \$14.95 is a lot to pay for a magazine normally, but this one was such a breath of fresh air, that I didn't take long to convince myself it was worth it (keep in mind I am Scottish, and spending money is anathema to me).

Not only did I decide to purchase the mag at the store, I logged on to my laptop and ordered all the back issues available, which excluded issue 2 as they were out of stock on that.

So what makes this magazine worth all that effort? One, the magazine is physically bigger. The articles are in-depth, technically complete and entertaining. The use of charts, tables and photographs help to illustrate the information being offered. Perhaps the reason the articles and tests are so in-depth and detailed is, this magazine is a quarterly issue. Perhaps because they are not rushing to meet weekly or monthly deadlines, the editorial staff and contributors can take some pride in producing a magazine unlike any other available in quality and content, in today's over populated photographic media circus.

I say Congratulations and THANK YOU c't for fulfilling my expectations every issue.

www.clivewatsonphotography.com/?p=69

Clive Watson's Photography Blog



Tell us what you think:

We are always happy to receive your comments and suggestions in a letter, an e-mail to 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.

A great magazine for photographers

What I really liked is that every article is deep and detailed. You know how technically oriented I am, and I was pleased to find that magazine editors think the same.

There is plenty of room for long reviews, gear tests and other interesting stuff. HDR, lens reviews (with image examples and 100% crops), HD/SLR, etc. What I also like is that they are oriented toward enthusiast and professional photographers, not just a beginners. Truly, I've enjoyed it. As a bonus, every issue comes with a DVD full of images from the tests, software, plugins for Photoshop and other useful stuff.

www.akelstudio.com/blog/the-great-magazine-for-a-photographer-meet-ct-digital-photography/

AKELstudio, Alex Koloskov



"I took this photo using my charismatic Cambo Ultima view camera, and I hope you've noticed unusual focus in the image: the spread of magazines all in focus, while any other non-flat objects are blurred. This is what happens when you tilt the lens."

Alex Koloskov

When everything feels right



When your gear feels right, your work goes more smoothly. This idea inspired the design of our **Pro Messenger AW series**. Its durable, yet soft exterior is reminiscent of classic canvas, but it's actually a modern performance fabric. It's built to fit pro-sized camera gear in configurations you've told us work best. And it has an innovative flap that effortlessly folds in half to quiet your moves and quicken your pace.

Pro Messenger AW series available in three sizes.

www.lowepro.com

© 2011 DayMen Canada Acquisition ULC



DVD Highlights

Highlights of this issue's free DVD include a complete eBook, sample images from the articles and tests in the magazine and a special offer discount for a full license of the *Helicon Focus* software introduced in our focus stacking article. Our additional free software includes a series of FotoTV.com videos on black and white photography from the early 20th century right up to today.



Black-and-white Photography Videos

Videos: This set of three videos complements this issue's black-and-white workshop in a number of fascinating ways.

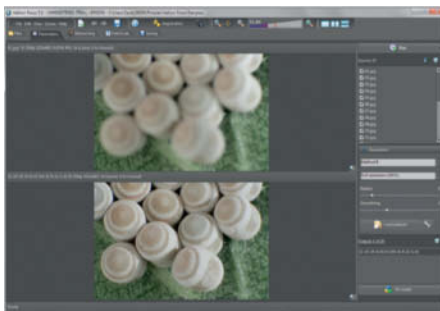
Sometimes pictures tell great stories and sometimes there are stories to tell about great pictures.

In video #1 Graham Howe introduces the fascinating story of E.O. Hoppé, an often neglected photographer who nevertheless achieved worldwide fame at the height of his success in the 1920s. Was he actually the best photographer of the early 20th century? And what happened to his fantastic work? This video provides the answers to these and other fascinating questions.

Our second video describes how a crazy, beer-fuelled idea led to the creation of the largest camera in the world and the correspondingly huge images it captures. Just to give you an idea how crazy the plan was – the camera itself used to be an airplane hangar!

Video #3 gives you a look behind the scenes at the work of Jean-Baptiste Huynh – a photographer who says that digital technology doesn't interest him, but who nevertheless creates highly contemporary monochrome images.

All video material is provided courtesy of FotoTV.com and is part of the site's comprehensive subscriber video library. (jub)



Helicon Focus

Full version: This powerful program creates one completely focused image from several partially focused images by combining the correctly focused areas from each.

As introduced in our article on Macro Focus Stacking, *Helicon Focus* merges multiple images shot with varying planes of focus to produce a single image with increased depth of field. The software is multi-processor-compatible, automatically adjusts and resizes source images and ensures high-quality results through its use of advanced interpolation techniques. It supports a wide range of graphic file formats as well as direct RAW input. The Pro and X64 windows versions of the program also include the Helicon Remote tool, which automates focus and exposure bracketing using a direct tether for all live view DSLRs from Canon and Nikon.

This issue's DVD includes a trial version of the program that you can convert into a fully licensed version (valid until July 1st 2012) by following the link in the Focus Stacking Sample Images section of the DVD. *c't Digital Photography* readers are also entitled to an exclusive US\$40 discount on an upgrade to a one-year license or a 20 percent discount on an unlimited Pro license (offer valid until December 31st 2012). (jub)



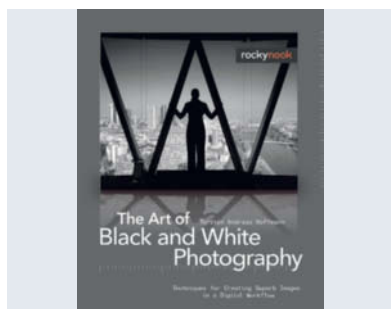
DeblurMyImage

Full version: A great little tool for adding that extra dose of sharpness to nearly perfect photos.

Whether they are painstakingly composed or just simple snapshots, some photos simply aren't sufficiently sharp. This is usually either because the subject moved unexpectedly or because the focus setting used was incorrect. As a result, we decided to include a full version of the small but perfectly formed *DeblurMyImage 1.6* on this issue's free DVD. This tool has just two functions that are both based on the same four algorithms. These are designed to deblur without amplifying image noise, deblur quickly without using much memory, deblur aggressively and to perform stable, moderate deblurring.

The level of detail, the deblurring method and the strength of the effect can be individually set for both the "out of focus correction" and "motion correction" tools, and both functions include live preview functionality to help you test the effect of different settings.

The software provided on our DVD is a full standalone version that normally retails for €14.99 (about US\$20). A *Photoshop* plug-in version of the program is available from www.adptools.com for the same price. (jub)



The Art of Black and White Photography

eBook: In contrast to many similar publications, this book by Torsten Andreas Hoffmann emphasizes the *whys and wherefores* of image composition rather than concentrating on digital image adjustment and enhancement.

The rapid development that digital photography has seen in recent years has spawned many books that describe image processing and digital workflow techniques in detail. Often, the real aim of photography – i.e., to create images that tell stories – gets lost along the way.

In this beautifully illustrated book, Hoffmann gives us an alternative view of the subject of black-and-white photography, dedicating a large part of these 272 pages to describing how to find fascinating photographic subjects and how to compose successful monochrome images around them. He covers various sub-themes, including street and abstract photography, portraiture and architecture, as well as giving us insights into the basic rules of composition, such as the golden ratio and the use of shape.

Additional chapters on choosing the right gear and advanced, *Photoshop*-based digital darkroom technique round out this excellent and thought-provoking work.

The complete current version of the book is included here on DVD. The new, revised print edition is scheduled for release through www.rockynook.com in January 2012. (jub)



Photo Tools

AmoK Exif Sorter 2.56
 AutoStitch 2.2
 CombineZP 1.0
 digiKam 2.2.0
 Enblend/Enfuse 4.0
 EnfuseGUI 2.1
 ExifTool 8.66
 HD View SL 1.2
 Hugin
 Image Composite Editor 1.4.4
 MacPorts
 Panorama Perfect Lite 1.6.2
 PhotoRec 6.12
 Picolay 2011-10-06
 RawTherapee
 Sofortbild 1.2.2
 Xee 2.2

Full Version Software

DeblurMyImage 1.6
 Helicon Focus Pro 5.2.9
 (special edition)

eBook

The Art of Black and White Photography

Image Processing Tools

FDRTools Basic 2.4.0
 GIMP
 GIMP Portable 2.6.11
 GREYC's Magic
 Image Converter (G'MIC)
 Inkscape
 Inkscape Portable 0.48.2
 PSPI 1.0.7
 ShiftN 3.6
 SmartCurve 2.2
 StylePix 1.8.6.0
 StylePix Portable 1.8.6.0

Videos

The Work of E. O. Hoppé
 Portrait: Jean-Baptiste Huynh
 The World's Largest Camera

Sample Images

Black-and-white Sample Images
 Camera Test Sample Images
 Focus Stacking Sample Images



Portfolio

André Wagner

André Wagner's fresh take on landscape photography has brought him a long way. From his modest beginnings in the graffiti scene, he is now based in Berlin and has a reputation that nets him invitations from galleries around the world. We spoke to this single-minded 30-year-old professional about his art, his craft and his business.

André Wagner finds most of his subjects outdoors at night and photographs them using very long exposures. He is a master at taking his time, waiting until the light, the subject and the overall feel of a situation are just right. The results are fascinating photos of windblown trees in New Zealand or mysteriously glowing woods on the Mediterranean island of Majorca.

He consciously resists the urge to take photos all the time, wherever he is, and prefers to concentrate his thoughts on philosophy or mythology and engage with ideas about the elements and terms like fire, wind and creation. The next photographic project emerges when the time is right, be it in India, New Zealand or somewhere closer to home.

These images are a long time in the making, and the processes involved elicit more than just a nod of recognition from viewers. They run counter to the way we are used to seeing things and, if it were not for

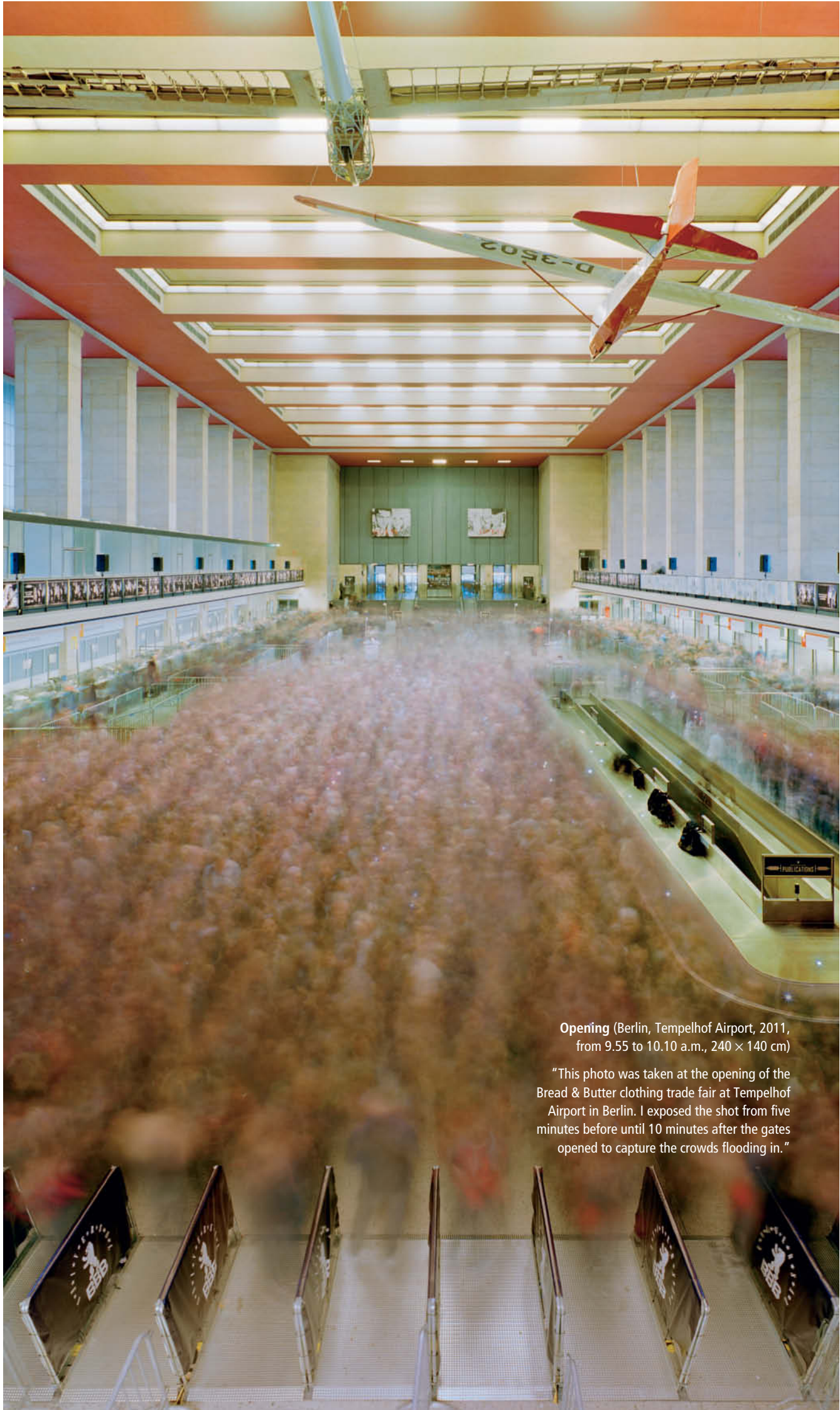
their enigmatic twilight feel, the nighttime long exposures could almost be taken for daylight shots. Another factor that makes it impossible to overlook these photos is their format: ranging from one to three meters square, these huge LightJet and Dodeka prints really stand out, even in the largest museums or galleries.

Acclaimed by critics and well received by galleries and collectors, Wagner's art scratches a very contemporary itch. The man himself is unwaveringly professional, releasing his large-format works in limited editions of between three and seven prints and often mounting exhibitions that show just a single series or one particular project. The exact subject matter is decided in close consultation with galleries, and always with potential collectors in mind: What's popular at the moment? What will demand be like in 10, or even 20 years? Many projects are simply shelved until the time is right.

Photographers typically clam up when asked about their photographic tricks and techniques. Wagner made an exception for *c't Digital Photography* and gave us a glimpse behind the scenes with the details revealed in his commentary on the images shown on the following pages.

He uses both digital and film cameras – digital for commissioned work and daylight photography and medium-format cameras such as the Mamiya 7 II or 645 Pro for nighttime photography and most of his large-format pieces.

Analog technology is far superior to digital when it comes to making exposures that can last several hours – and these are not the only extreme lighting situations in which Wagner prefers celluloid to chip. The choice between analog and digital is not a matter of faith, but simply a matter of selecting the method that best allows him to visualize what he has in mind. (jr)



Opening (Berlin, Tempelhof Airport, 2011,
from 9.55 to 10.10 a.m., 240 × 140 cm)

"This photo was taken at the opening of the Bread & Butter clothing trade fair at Tempelhof Airport in Berlin. I exposed the shot from five minutes before until 10 minutes after the gates opened to capture the crowds flooding in."



Govardhan (India, 2008,
100 × 150 cm)

"During my travels in India I saw a pilgrim embracing a holy tree on Govardhan Hill. Holy places interest me greatly because they make a special atmosphere visible, like in this photo."





On the Left Side

(Majorca, 2009, from 10.39 to 10.44 p.m., 140 × 180 cm)

"I find natural scenery in artificial light fascinating. This scene was illuminated by light coming from a tennis court."

Dimension Door (India, 2004, from 4.15 to 4.21 a.m., 135 × 200 cm)

"I wanted to portray fire spreading outwards, like the ripples produced by a stone when it is dropped into water. This location is a dangerous place for tourists after dark, which added to the challenge. We travelled 40 kilometers by motor rickshaw from Vrindavan to Kusum Sarovar. I had been suffering from stomach pains for the previous four weeks and the potholes made the trip almost unbearable. Two friends helped me, with one acting as a security guard and the other, photographer Jens Hoher, helping me to set up the fire effect. Suddenly I realized that there were about 30 locals sitting behind me, watching me very intently – all at four o'clock in the morning."



Golden Bridge

(Lithuania, 2007,
from 10.16 to 10.53 p.m.,
110 × 150 cm)

"In 2007 I accepted an invitation to go to Kaunas, Lithuania, to receive a prize at the *Kaunas Photo 07* show. I was very inspired by this bridge and used it to make this image for my 'Romance of Elements' series. I wanted to present fire so that it looked like water, and it took six people to help me turn my idea of fiery rain into reality."



Slope Point (The southernmost point of New Zealand's South Island, 2006, 108 × 162 cm)

"I discovered these trees on a photo tour through New Zealand. I bought a 20-year-old van for NZ\$1,000 and traveled 14,000 km in four months. The out-of-the-way places were the most interesting. In my mind, I'd been searching for these trees for years."





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80 DB
594 9 756-6
Eas-x[®]

22050kg
20.0t

25.0m
12.8m
72.0m³

14.0cm

20211



Express (Berlin, Germany, 2003, from 0.18 to 1.02 a.m., 80 × 120 cm)

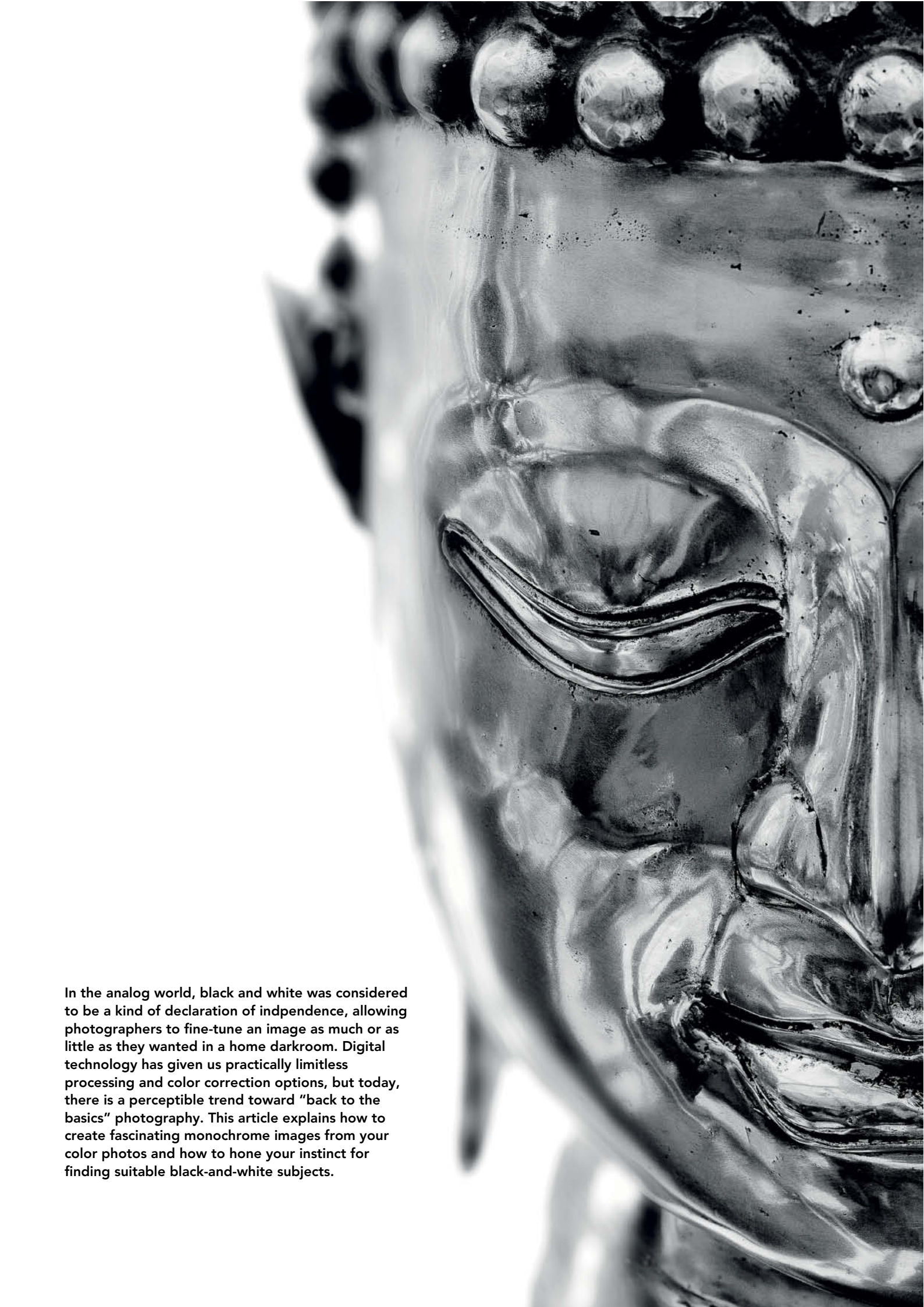
"My 'Romance of Elements' series is all about the elements – earth, air, fire and water. We worked with sparklers behind the train and then threw them between the freight cars. Because I wanted to produce just one single image, I had to coordinate the ambient light with the bright sparkler trajectories by using different aperture settings. The fragmented star trajectories are a result of the breaks in the exposure."



Reinhard Merz, Erich Baier



Digital
Black-and-white
Photography



In the analog world, black and white was considered to be a kind of declaration of independence, allowing photographers to fine-tune an image as much or as little as they wanted in a home darkroom. Digital technology has given us practically limitless processing and color correction options, but today, there is a perceptible trend toward “back to the basics” photography. This article explains how to create fascinating monochrome images from your color photos and how to hone your instinct for finding suitable black-and-white subjects.

For more than 150 years, black-and-white photography meant spending hours in a darkroom, with the enlarger as the center of the vital second stage in the creative process. And remember – back then, you had to choose whether you wanted to shoot in black and white or color before starting a shoot, and you had to know how to use specific film types and filters to produce the best possible exposure. Not only that, but you also had to tolerate the acid smells of developer and fixer to produce your finished image. Nowadays, computers have taken over the lab work and make black-and-white photography a whole lot easier. The digital workflow provides us with consistently excellent raw material that we can tweak and fine-tune to our hearts' content.

But why shoot in black and white at all? Is it simply because many of us grew up with black-and-white images and subconsciously stick to tradition? More importantly, a great photo is always a subjective interpretation of a scene that “freezes” a moving, three-dimensional moment into two stationary dimensions. The lack of color produces a strong feeling of abstraction that doesn't necessarily make an image better or worse, but certainly makes it different – perhaps in the same way that a piece of music sounds different performed by a big band than it does as a piano solo.

If we analyze the differences between great color and black-and-white images, we quickly recognize that black-and-white photos live from the interplay between light and shade or patterns and symmetry. If these are the major characteristics of an image, it will often look better in monochrome than in color. Other subjects, such as a sunset or a forest in fall, are characterized by the interplay of color and are not nearly as effective if captured in black and white

Seeing in Black and White

Today, shooting FOR black and white no longer means shooting IN black and white. Even if your camera has one, don't use black-and-white mode – you are shooting not just for the moment, but rather to process your images later, and color images contain a great deal more image data than monochrome images produced in-camera. Black-and-white images owe their effectiveness to details to a much greater extent than color images do, so always shoot in RAW format if you can. In contrast to JPEG image files, which can only be saved with 8-bit color depth, RAW images can be saved



Photo: Scott Prokop, shutterstock.com



Color or black and white? Which is more effective depends on the subject.

with 12, 14 or even 14 data bits per color channel and allow you to produce a much broader tonal range.

In spite of today's virtually limitless processing options, the depth of field, amount of blur and point of view captured in an image are still determined at the moment you release the shutter. If you are in any doubt, always shoot multiple versions of an image to give yourself the greatest possible range of processing options later. The original photo delivers the raw material, and any mistakes you make at the shooting stage can only be rectified with a disproportionate amount of effort, if at all.

Graphic Elements: Light and Texture

A common feature of all great black-and-white photos is their use of contrast as a means of expression. Skilled use of contrast – whether technically or artistically – often makes the difference between an acceptable photo and a great one. This is why shots that contain a high degree of optical and graphical contrast often look better when converted to black-and-white. Light and shade, shapes and lines, or rounded and square are all contrasts that attract a viewer's attention. It is also important to consider the composition of the individual elements while shooting, as their relative positions cannot be altered later, even if you reframe the entire image.

It is more important to make sure that your image doesn't contain any unnecessary elements than it is to use every last square millimeter of space within the frame. You will most likely perform your final framing on a computer anyway, and you are sure to make your final choice of tonal values during processing. The most important thing to remember while shooting is to give yourself enough room for maneuver later on.

Repeat patterns are an effective element in many black-and-white images, whether deliberately arranged – like shoes on a rack or roof tiles – or in a natural form like the patterns left by waves on a beach or a flock of birds in flight. Every subject also confronts the photographer with the question of whether the photo should tell a story and bring a mood to life or simply document an object. And if the mood is important, what is it telling us? What do we need to accentuate to convey its meaning? If you imagine different black-and-white versions of your image while you are shooting, you are sure to end up taking better pictures.

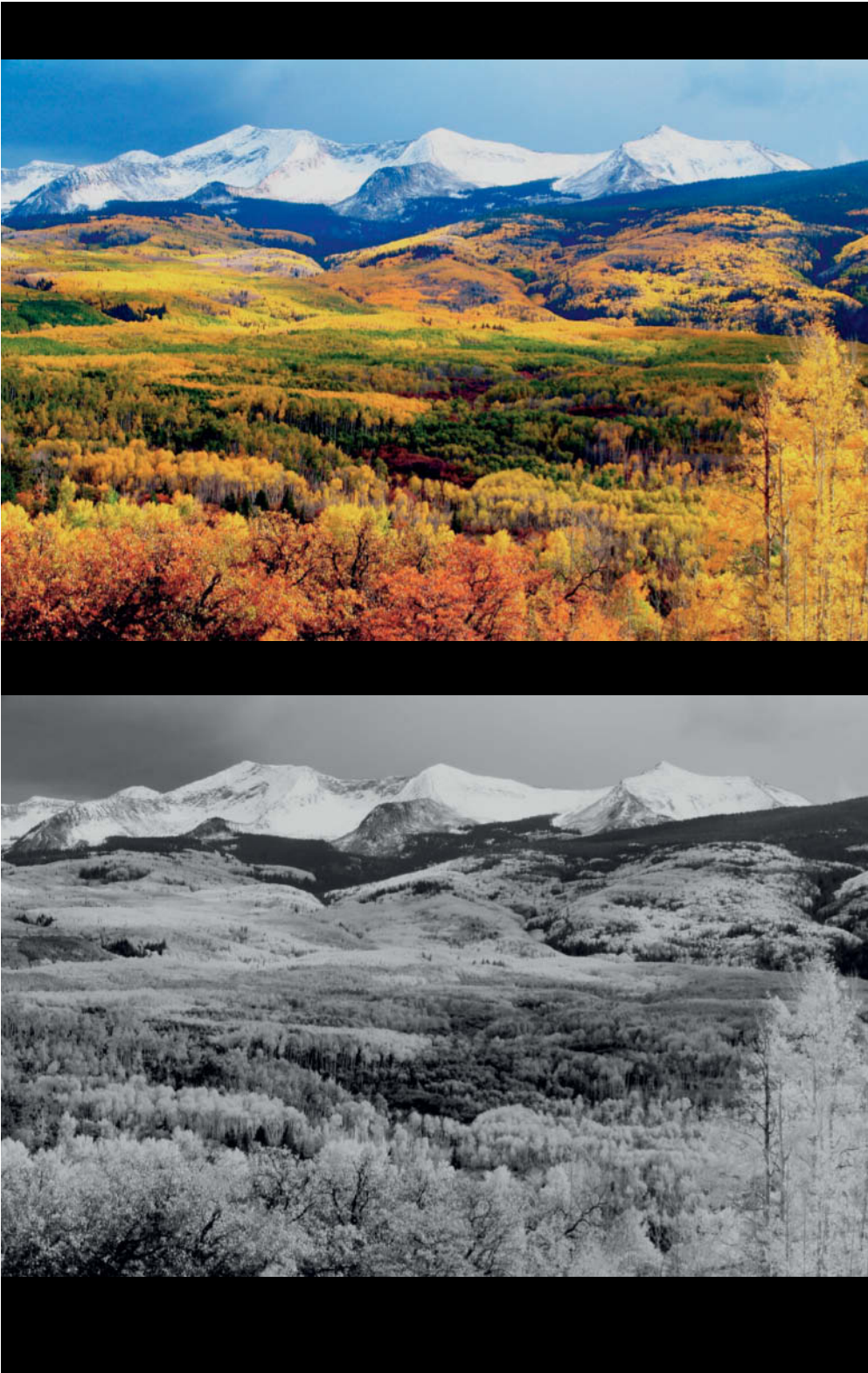


Photo: Mellow, fotolia.com



Shapes and lines.
The basic patterns in a
subject attract the
viewer's attention.



Light and shade. A wide-angle viewpoint, a panorama format and the low sun transform an everyday subject into a real eye-catcher.

How to Create Black-and-white Images

If we compare analog and digital photographic technology, it quickly becomes apparent just how much more flexible digital processing techniques are. An analog black-and-white negative has already converted all of the colors present in the original scene into blacks and grays – in other words, the entire process takes place without the presence of color at all. Overall brightness can be influenced by altering the exposure, contrast can be influenced to some degree by using different grades of paper and individual elements of an image can be accented using dodging and burning techniques, but that's all. In contrast, today's image processing software, with its layers, tools and filters, gives us endless ways to completely "reinvent" an image.

Colors and Tonal Values

The black-and-white technique you choose will depend on a number of factors. If you want to process multiple images, the structured interface of a RAW converter and batch processing functionality will help you to achieve your goals. However, if you tend more toward spending hours fine-tuning a single image, you are probably better off converting it later using *Photoshop*. Whatever you do, don't use your program's built-in grayscale mode, as this will simply rob you of valuable image data.

It is impossible to overestimate the usefulness of the ability to use the original colors to emphasize particular grayscale values. The soft drink still life on the right demonstrates this principle very nicely. Converting the original image using grayscale mode produces a result in which the green, blue and red cans are almost indistinguishable, while the real differences between the tones are immediately apparent in the individual color channels.

The green channel version is most similar to the grayscale image, with green and blue reproduced slightly lighter and red darker. The red channel reproduces blue almost as black and red so brightly that it is almost indistinguishable from the white background. The most obvious color shifts are in the blue channel. The blue can in our still life is very bright, while the label on the bottle has become so dark that the yellow lettering is no longer legible. You can achieve these same effects with black-and-white film using different colored filters. Red filters are very popular with analog photographers because

they darken skies and give clouds a dramatic appearance.

Conversion Using a RAW Converter

The earliest sensible time to begin thinking about converting images to black and white is while you are viewing and rating your photos in a RAW converter. The current market leader in the field of all-in-one photo workflow tools is *Adobe Photoshop Lightroom*, which covers all aspects of image processing from viewing, rating and sorting images through processing, output and online publication. *Lightroom* also includes a number of useful tools for creating and processing black-and-white images.

Simply select the B&W option in the program's HSL/Color/B&W panel, which can be found in the Develop module. The tool contains sliders labeled Red, Orange, Yellow, Green, Aqua, Blue, Purple and Magenta, all of which can be adjusted independently, giving you a powerful way to alter the relative strengths of the grayscale values in your image. The preview window displays a grayscale image, but this is actually based on the original RGB image data, which can be further processed in ways we will describe later on. *Lightroom* cannot process black-and-white images that have been converted using another program's grayscale mode.

Photoshop's own built-in RAW converter is called *Adobe Camera Raw (ACR)* and supports non-destructive processing for a wide range of RAW formats. *ACR's* own Grayscale tool offers the same eight sliders as the *Lightroom* version and works in exactly the same way.

Conversion During Image Processing

Most digital photographers use their favorite image processing program to convert images to black and white. The following sections detail the conversion process using *Photoshop*, although the steps involved can be duplicated in just about any other similar program. The Channel Mixer was the conversion tool of

All colors look almost identical in grayscale mode, but the tonal values shift dramatically in the individual color channels



Grayscale



Red channel



Green channel



Blue channel





Lightroom's grayscale tool offers sliders for adjusting eight different ranges of tonal values

The preview image will now be displayed in black and white, although the original RGB image still forms the background layer. This allows you to selectively and subtly access and alter the individual colors in the original image using the tool's sliders. The effect will be the same as the one produced by the non-layer-based Channel Mixer tool.

Photoshop Elements includes its own Enhance > Convert to Black and White tool, which offers a range of preset effects (Infrared, Newspaper, Portrait, Scenic Landscape etc.) and sliders for adjusting overall contrast and the intensity of the red, green and blue channels.

choice in CS2 and earlier versions of *Photoshop*, but has now been replaced by the dedicated Black & White dialog. *Photoshop Elements* has no similar tool built in, but can be upgraded using the powerful *Elements+* plug-in, which is described in detail in Issue 1 of *c't Digital Photography*.

If you still want to use the Channel Mixer (Image > Adjustments > Channel Mixer), click through the three color channel images first to give yourself an idea of how best to adjust your image. The tool itself allows you to weight the color channels individually and also offers a range of presets that simulate popular black-and-white filter effects, including blue, green,

orange, red, yellow and infrared, which brightens green tones to produce the well-known dream-like "wood effect".

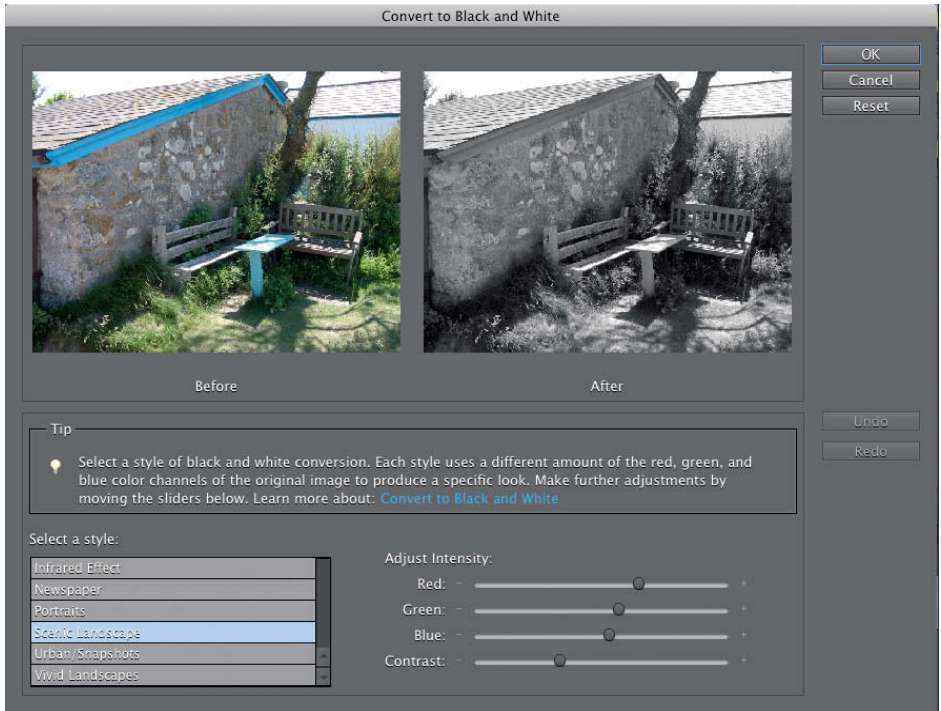
The dedicated black-and-white tool (Image > Adjustments > Black & White) works in a similar but more subtle way. To convert an image using this tool, first create a new adjustment layer (Layer > New Adjustment Layer > Black & White). Adjustment layers allow you to apply effects that you can readjust or undo at any time without affecting the original image data. In fact, the effect is similar to positioning a filter in front of the camera's lens – the immediate view looks different in spite of the fact that the original image hasn't changed.

Dedicated Software

If you are serious about black-and-white photography, you will sooner or later come across specialist software like *Silver Efex* by Nik Software or *LightZone* by Light Crafts, which is also available for Linux.

LightZone uses the same basic principle of weighting the different color channels to produce a pleasing black-and-white image, but also has other tools up its sleeve, such as the *ZoneMapper*, which offers a very intuitive alternative method for adjusting tonal values. The program is capable of simultaneously addressing and adjusting multiple image parameters without having to confirm each step individually, and allows you to apply effects to selected image areas. It also includes a range of preset Styles that automatically apply a series of processing steps to produce a particular result.

Silver Efex is a *Photoshop/Lightroom* plug-in designed expressly for converting color images to black and white, which it happens to do better than any other software we know. Once installed, the plug-in is available in the host application's filter menu. The tool emulates various black-and-white development methods, filters and paper grades and is so intuitive to use that it has helped many a dyed-in-the-wool analog photographer to make the transition to digital. It includes more than two dozen really useful preset effects and a range of color filters and sliders for fine-tuning tonal values, making it quick and easy to produce great basic monochrome images.



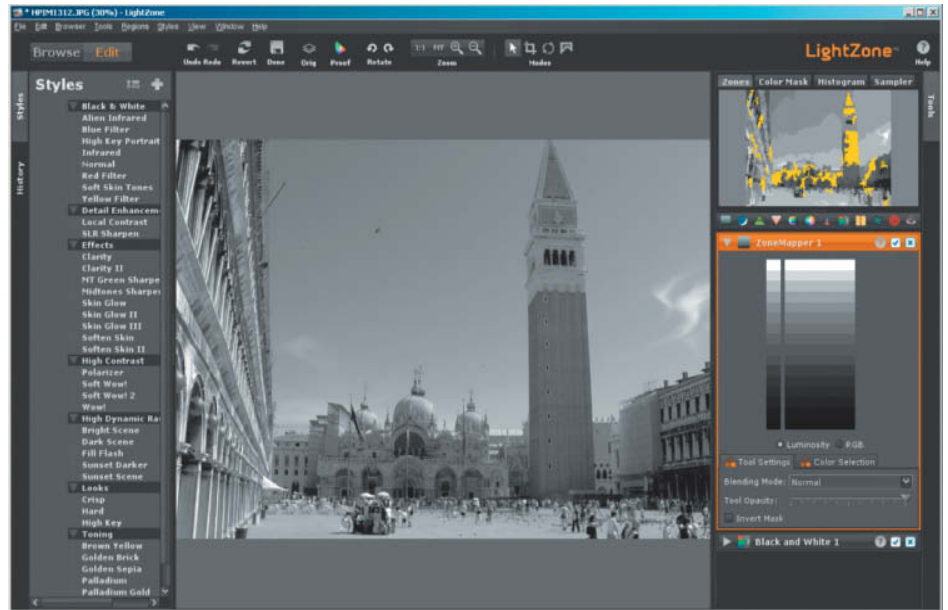
Adobe Photoshop Elements includes an intuitive black-and-white conversion tool

LightZone is capable of simultaneously addressing multiple image parameters, such as Color Balance and the ZoneMapper

Using Local Contrast to Create Tension

Fine-tuning an image often involves processing individual image areas separately. If you select a detail before you have created a new adjustment layer, *Photoshop* automatically creates a layer mask of the selection. Layer masks are separate grayscale images and are a boon to the black-and-white workflow. The currently active effect is applied at full strength in the white areas of the mask, while the black areas remain transparent and produce no effect at all.

The really clever thing about masks is that you can apply any filters or effects that you want to them, and you can create additional transparent or opaque areas at any time using black and white brushes. Not only that, but a layer mask is in fact a full 8-bit grayscale image with 256 different tonal values, which means you can apply different levels of opacity to produce soft transitions between various image areas.



Our Golden Gate Bridge example shows just how simple it is to use layer masks to produce cool effects. In the red channel, the sky is well defined, while the sea and the seashore disappear into detail-free shadow. The other two channels show the opposite effect, with good foreground detail and a pale, uninteresting sky. The solution is to use two

layer masks. In the first, select the sky and the bridge (using either the Magic Wand or the Polygon Lasso) and increase the effect of the red channel in the selections to 100% and in the rest of the frame to 0%. Now simply invert the selection in the second mask to accentuate the midtones in the foreground. The result is an image with great overall contrast.

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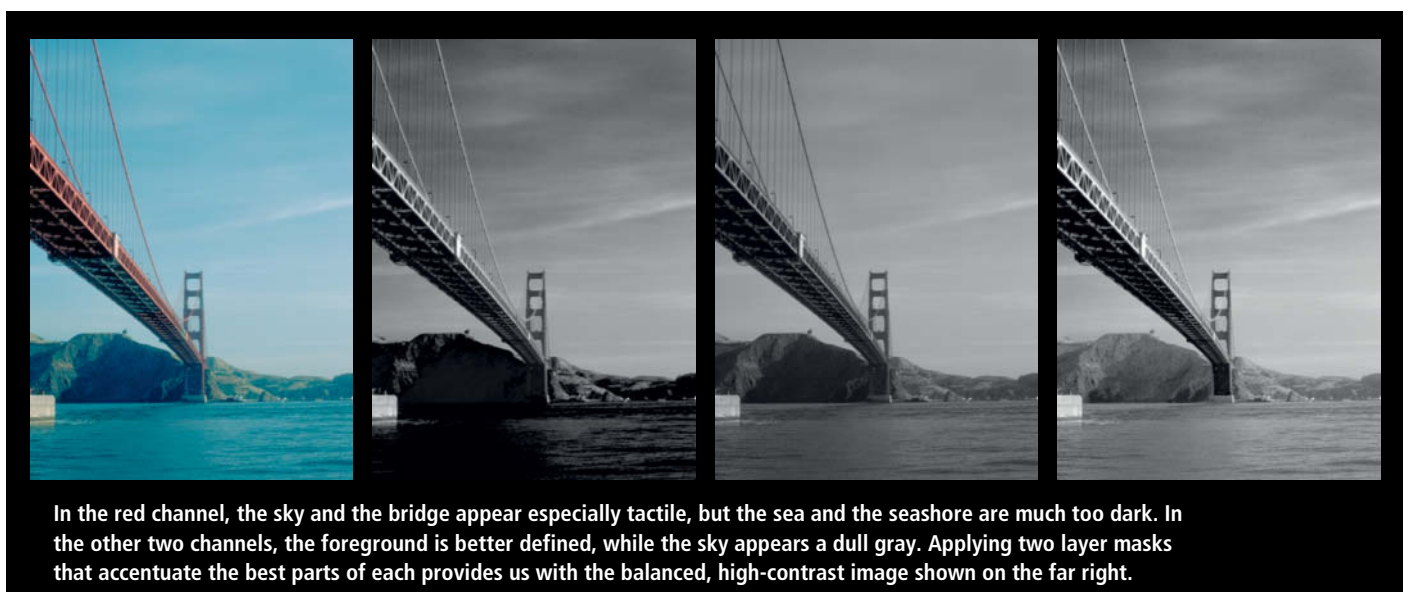
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Silver Efex works on the same principles as a traditional black-and-white darkroom, offering various processing and paper grade effects, as well as emulating optical filters. The major difference is that the software is much more powerful than a darkroom ever was.



Different Versions of a Single Photo

Conversion to black-and-white is the first and most important step in our workflow. This is the stage at which the image is given the basic mood that determines the effect it will have on the viewer, and you will need some practice until you become accomplished at performing the steps involved. Take a look at our sample images of Venice and try to work out the time of day and what the weather was doing when they were shot. These images contain everything from a diffusely lit, cloudy view to bright midday sun or a dramatic stormy sky. It is tempting to go for a dramatic look when you are making your

first attempts at black-and-white conversion, but our “red filter” image with its black sky soon becomes tiresome to look at. Use effects carefully and make sure that you end up with a good balance of gray tones in your converted image. There are, of course, no hard and fast rules for this type of work – just as you capture a specific moment and detach it from time when you release the shutter, you can add a further level of abstraction during processing that creates a completely new image. Try converting some of your favorite color images and see what you end up with.



Depending on how they were converted, the various versions of this image convey completely different moods

Optimizing Black-and-white Images

In view of the amazing tools available for processing digital images, you could be forgiven for thinking that it is nowadays impossible to produce a poor print. The fact that many images still have no soul is often due to a lack of balanced tonal values or poor framing. Once an image has been converted, the next step is to straighten and crop it, and remove any unwanted distortion. We assume that you usually apply these steps to your color images anyway, so we won't go into any further detail here. The exposure corrections that we do describe are, however, much more monochrome-specific.

You should immediately discard any seriously under- or overexposed images, but any well exposed image can benefit from the adjustments we will be discussing. The necessary tools can all be found in the

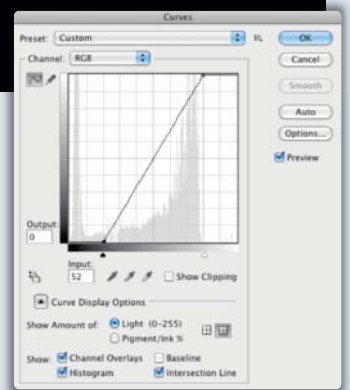
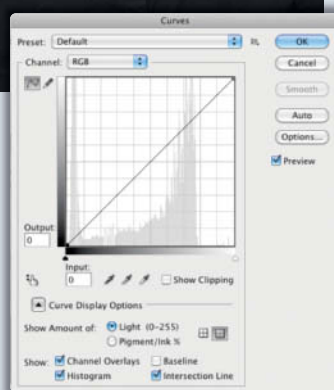
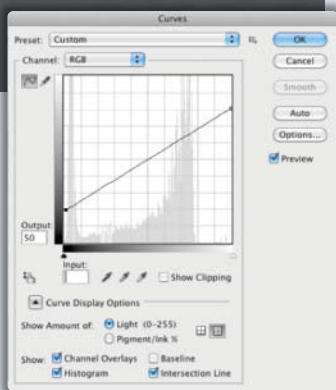
Photoshop Image > Adjustments menu. Always create a new adjustment layer to apply an effect. Our aim while shooting was to capture as much image data as possible, and we now want to distribute that data to perfectly fill the entire spectrum between black and white. Any data that a scan or exposure didn't capture in the first place is, of course, lost forever.

The simplest way to adjust exposure is to use the Brightness/Contrast tool to make the entire image brighter or darker, although this rarely actually improves a photo. If you adjust brightness globally you will also have to adjust contrast (i.e., the difference in brightness between the brightest and darkest point in your image). You can often achieve acceptable results by adjusting these two settings together, but the

simplicity of the algorithms involved means that the results are not particularly spectacular.

Before we go into detail on the more complex tools available, let's look at an example of how under- and overexposure or changes in contrast can affect the look of an image. The relationship between the two ideas is simple, but true understanding often makes the difference between an acceptable photo produced by trial and error and a well thought-out black-and-white image.

Adjusting contrast produces "high-key" or "low-key" images, while adjusting global brightness alters highlights and shadows to the same degree. Some tools allow selective adjustments to specific image areas without affecting the rest of the frame.



Each of these three versions of a single image has the same brightness but a different level of contrast. All three tone curves intersect with the center point of the graph, but each has a different gradient.

The Levels Tool

The Levels tool is much more efficient than the Brightness and Contrast sliders and includes a histogram that displays the distribution of tonal values in your image. The histogram consists of 256 points on a scale that corresponds to black on the left and white on the right. The height of each “peak” is proportional to the number of times that particular grayscale value occurs in the image.

The shape of the histogram curve shows where and how you need to adjust your image using the White Point, Black Point and Gamma pointers. An underexposed image shows more pixels grouped toward the left-hand end of the scale and virtually no pixels toward the right-hand (white) end. The range of tonal values in the image increases if you move the white point slider toward the center of the scale. This spreads the available tonal values more evenly throughout the image. If an image is overexposed, you will need to move the black point to the right to balance its tones.

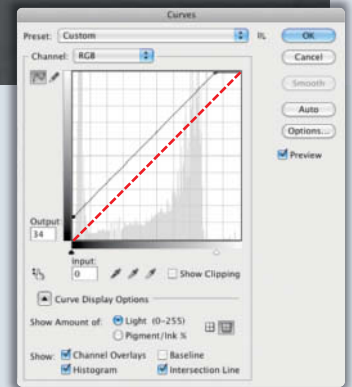
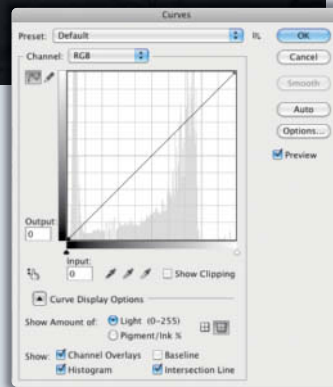
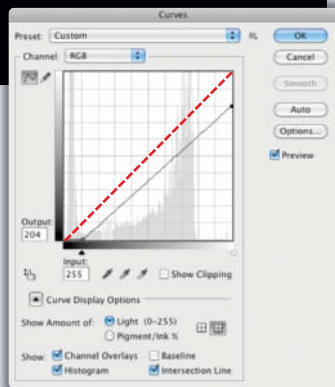
Low-contrast images lack punch, and the tonal values are grouped in a narrow range in the center of the scale. In this case, it is best to shift both pointers toward the center. This makes the curve flatter and wider and gives the image more verve. The center pointer in the Levels dialog adjusts gray balance – i.e., midtones only. A shift to the left brightens the midtones while moving the pointer to the right darkens them. The adjustments you need to make will also depend on the type of output medium you plan to use.

Make sure that you don’t delete any tonal values while you are making your adjustments. There are often areas with very few visible pixels to the right and left of the main hump in the curve, and it is these that contain the important highlight and shadow details that breathe life into a black-and-white image. If you press the Alt key while shifting the black and white point markers, *Photoshop* displays the parts of the image that your adjustment will clip in real time – a really helpful feature.

Tone Curves

The Curves tool allows you to delve even deeper into the tonal values that make up your image, but requires you to take more care while doing so. The tone curve shows the relationship between input and output values and forms a straight 45-degree line at its default setting. The input value corresponds to the current brightness setting and is shown on the X axis, while the corresponding output value (i.e., the effect of the adjustment) is shown on the Y axis. Here too, the darker values are located on the left and the brighter ones on the right. *Photoshop Elements* does not have a built-in Curves feature, but can be upgraded using plug-ins such as *SmartCurve* or *Elements+*.

To understand how curves work, take a close look at how adjustments to the brightness and contrast sliders affect the shape of the curve. The curve for a bright image is positioned toward the top of the graph, while a darker image has a curve that



In these three images, we altered the brightness without changing the contrast. In this case, the tone curve is shifted up or down parallel to the original curve while the gradient remains the same.

is positioned lower down. In this case, the gradient of the curve remains the same. In other words, the Contrast slider moves the line on the graph and alters its gradient but doesn't change its shape, which is why adjustments to brightness and contrast are known as linear adjustments.

Things get more exciting when we move away from linear adjustments and begin to selectively adjust specific tonal values. A high-contrast image with only a narrow range of midtones looks more harmonious if we brighten the shadows and darken the highlights. This involves spreading the existing tonal values to cover a broader range of output values and unavoidably "squeezes" the midtones together. Darkening the shadows and brightening the highlights produces an S-shaped curve, which helps to breathe life into low-contrast images by accentuating the details in the midtones. An S-curve compresses but preserves highlight and shadow detail.

Adjusting the shape of the tone curve is a simple matter of grabbing and moving the point you wish to adjust with your mouse.

Photoshop allows you to draw tone curves freehand, but care is required, as it is difficult to tell what the results will look like. You can also save a curve, which saves you having to perform the same curve manipulations multiple times if you are processing a series of images taken under the same lighting conditions.

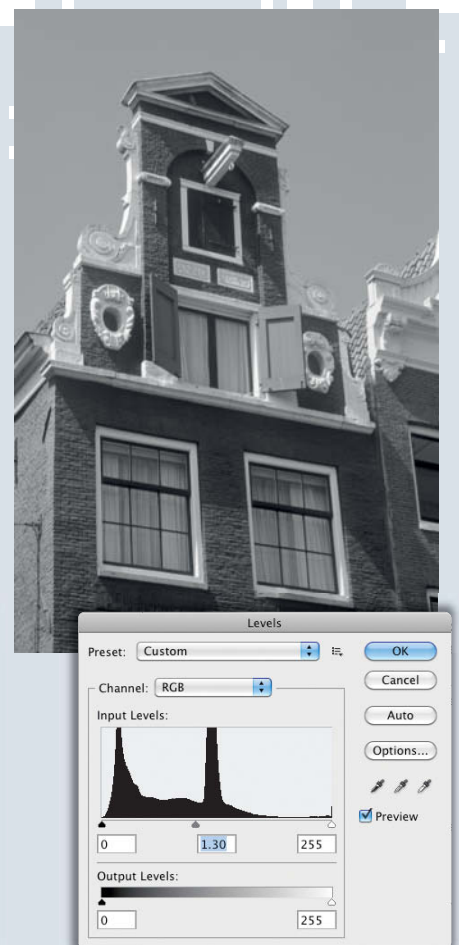
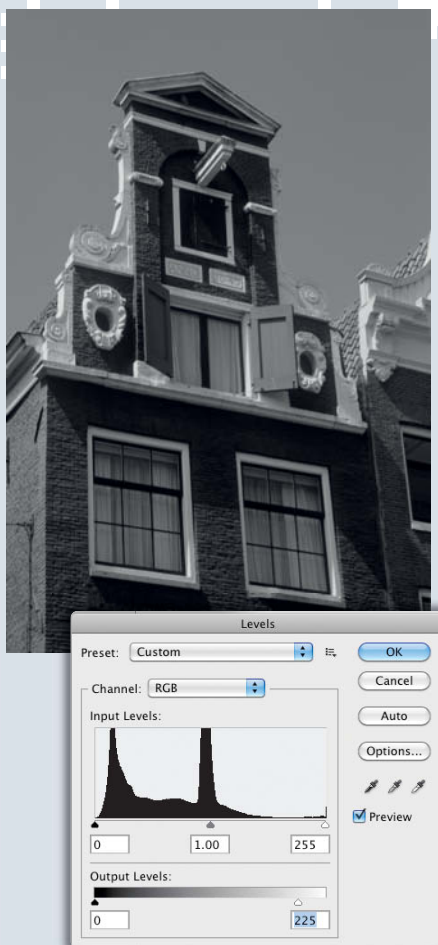
Shadows/Highlights

The Shadows/Highlights tool (in the Image > Adjustments menu) is another great *Photoshop* tool for adjusting tonal values. The tool adjusts the tonal values of individual pixels relative to their surroundings and, in its Show More Options view, offers a wide range of adjustment options. Amount is the most important Shadows slider, but take care when adjusting the value, as the effects it produces can quickly get out of hand. Start at a value of about 10% and increase its value slowly in 5% steps. There is usually no visible improvement in detail contrast above about 20%. The Tonal Width setting determines which differences in tonal values are addressed, and the Radius

setting defines the area the effect is applied to. If you want to stick to adjusting only the darker pixels, you need to use Radius values of 30 or less.

The settings in the Highlights section work in the same way, but darken the affected pixels instead of brightening them. There is also a dedicated Midtone Contrast slider that really does only affect midtones and effectively prevents burned-out highlights or swamped shadows. Analog darkroom technicians always longed for such a tool, and were only ever able to produce this type of effect by performing extremely complex dodging and burning procedures.

Not all images require tonal values to be distributed evenly – dark details in a photo shot in fog, for example, simply spoil the mood of the shot. However, it is still important to ensure that detail doesn't simply disappear into the mist, and the solution is to perform selective darkening. Again, the trick here is to apply the effect subtly and keep your images realistic-looking. Images in which bright tones dominate are described as "high key", while the term "low key" is used to describe images



in which darker tones determine the overall mood. Spreading all the available tonal values to distribute them more evenly is an easy approach to take but seldom produces results with an effective range of contrast. Even the darkest low-key image contains a wealth of interesting detail, and trying to “optimize” tonal values in such an image is often a mistake.

Zone Mapping

The most complex way to adjust tonal values is using “zone mapping”, which is based on a system developed by Ansel Adams. Generations of photographers have admired Adams’ fantastic landscape photographs and his theories regarding complete control of photographic contrast – even if no-one has ever really understood them! His system involved dividing an image into eleven zones labeled using Roman numerals from zero (indicating black) to X (indicating white), but only worked if each negative was individually developed in a way that corresponded to the exposure parameters used to shoot it. It is also

easy to forget that the quality of Adams’ images stemmed from his use of large-format film. High-resolution medium-format digital camera backs or 8×10-inch negatives inevitably record more detail than a full-frame sensor or film. It is only recently that digital processing techniques have enabled us to reproduce a level of detail and expression that approaches that of large-format images.

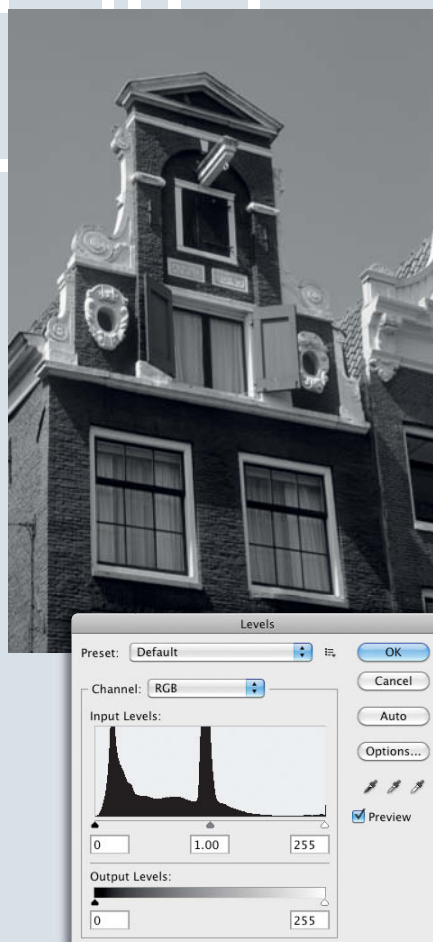
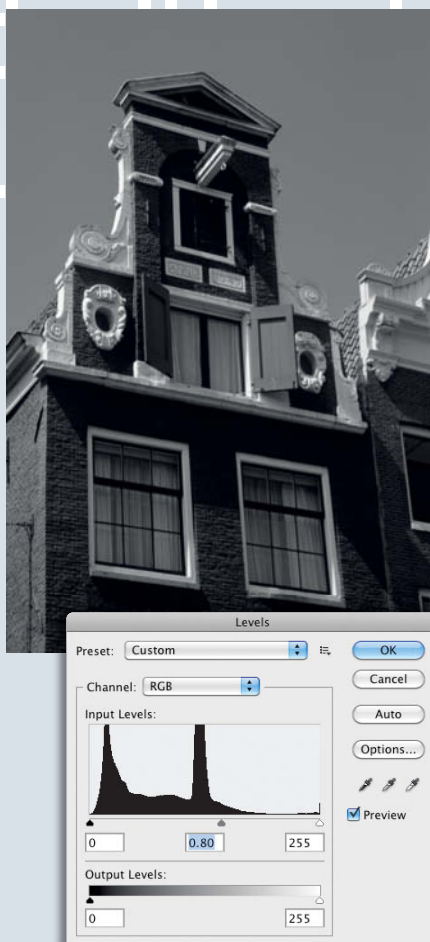
The zone mapping functionality built into programs like *LightZone* and *Silver Efex* makes it possible to select a specific grayscale value and apply it to selected target zones. It sounds complicated, but is, in fact, a very intuitive way to make adjustments, especially in view of the real-time preview image, which immediately shows you the effects of your alterations. The Zone Finder tool uses colored markings in its own preview window to highlight all the areas in your image that belong to the currently selected zone.

Dodging and Burning

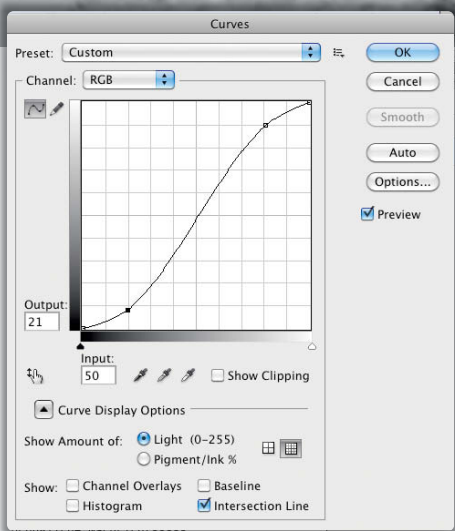
All of the adjustment techniques we have discussed so far are applied either to the

entire image or to areas of the image that you have selected in advance. The manual dodge and burn tools that are part of just about every image processing program are designed for making fine adjustments to extremely localized image areas. The names of these tools are the same as their equivalent analog darkroom techniques, and *Photoshop* users who have darkroom experience often find it easier to get to grips with them. Some black-and-white photographers process their images using just the Dodge and Burn tools and without using selections, layers or masks – and the results speak for themselves.

To underscore what all this means, let’s take a quick look at how analog darkroom techniques actually work. Analog images are printed using an appropriate combination of exposure time and paper grade, which often produces images with areas that lie between the resulting gradations and are either too bright or too dark in the final print. Dodging (i.e., brightening) part of an image is achieved by holding either your hand or a piece of opaque card between the light path from the enlarger lamp and the area you want to



The Levels tool has three sliders with which you can expand or contract the overall distribution of tonal values or adjust color balance by selectively adjusting the intensity of shadows, highlights and midtones. The original image is shown on the right and the adjustments in the others are highlighted in blue.



The Curves tool is a sensitive instrument for adjusting tonal values. Low-contrast images often benefit from the application of an S-curve.

brighten. The parts of the image thus shaded will be brighter in the finished print. Burning has the opposite effect and is used to give areas that are too bright an extra dose of light during the exposure. Gently "fanning" your hand or the mask while dodging or burning ensures that the transitions between manipulated and non-manipulated areas remain invisible.

Compared with analog techniques, dodging in *Photoshop* is child's play – and you only have to apply the effect once to produce whole sequences of identically altered images. The Dodge and Burn tools work on a destructive basis, so it is safer to apply them to a separate layer. Select Overlay blend mode

and activate the *Fill with Overlay-neutral Color* option.

You can now brighten or darken your targeted areas using the Dodge and Burn tools. The effects of each tool are controlled using the settings in the toolbar, which allows you to apply them to shadows, highlights or midtones. You can also adjust the size and hardness of the brush tip. We recommend that you start using low values and work slowly up to the values that produce the effect you are looking for.

The best way to see the effects of your adjustments is to hide all the other layers. Burned areas will appear darker and dodged areas brighter on the adjustment layer.

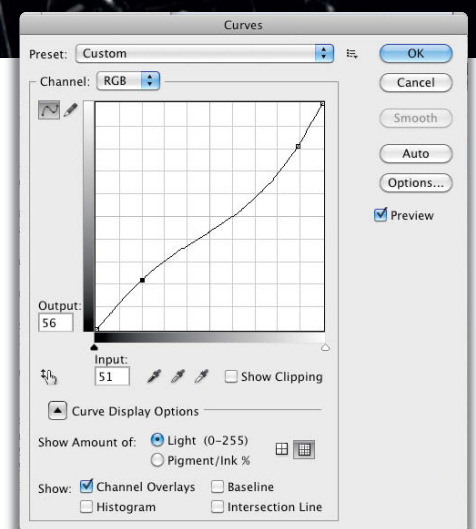


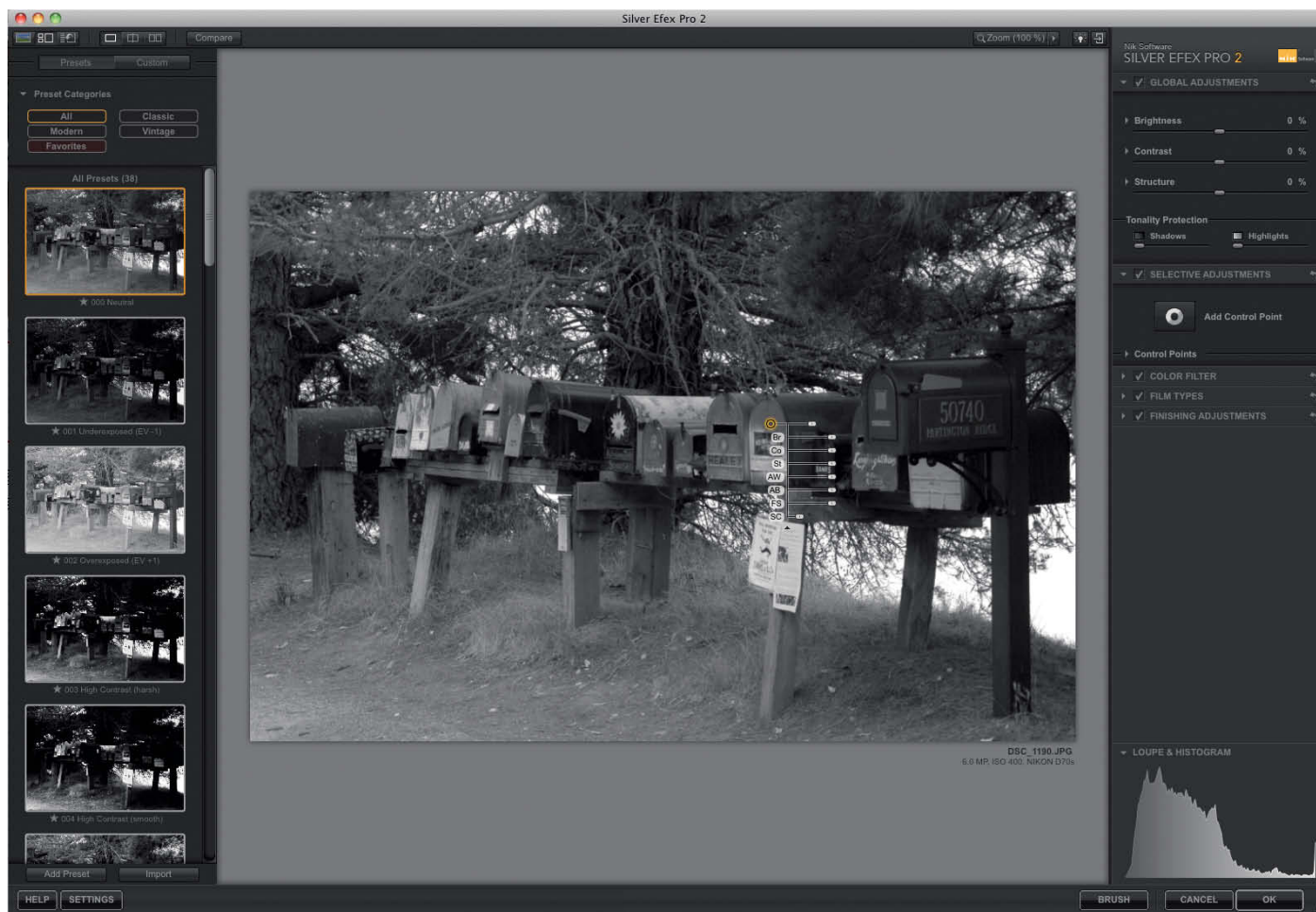
High-contrast images, such as night-time street scenes, look more balanced if you brighten the shadows and darken the highlights

Because the 50-percent gray color of a layer in Overlay mode has no effect on the image, we can precisely target the details and textures that we want to manipulate. It is a good idea to create a new layer for each step in the process, as you can then use the opacity slider to fine-tune your adjustments and alter each effect individually later if you need to.

If you want to dodge or burn very fine textures, we recommend that you make a selection first and then use it to work in a new layer. Use a soft edge for selections in broad-based patterns to keep the transitions between manipulated and non-manipulated areas invisible.

These tools enable you to selectively manipulate the tonal values anywhere in your image. The control point functionality built into *Silver Efex* works in a similar way and, once you have performed your basic processing, you can use it to fine-tune the details to your heart's desire. Control points can be placed individually or grouped, and you can selectively adjust brightness, contrast and structure for both. There are additional contrast sliders for amplifying blacks and whites, as well as for manipulating the fine structure of your selected detail. Using control points requires a little practice, but the results are more than worth the effort.





Fantastic black-and-white effects: the control point functionality built into *Silver Efex* is perfect for giving your monochrome images real polish



Applying the Burn tool gives the reeds in the foreground much better detail definition

Black-and-white Portraits

Not every photo of a person is a portrait. The art of portrait photography involves capturing and accentuating a person's character. Traditional portrait photos are shot using a short to medium telephoto lens, a three-quarter view of the subject (i.e., with the subject looking diagonally out of the frame) and a neutral background that doesn't draw the viewer's attention away from the subject. But these are merely guidelines, and you can set up your own portrait shoots however you like.

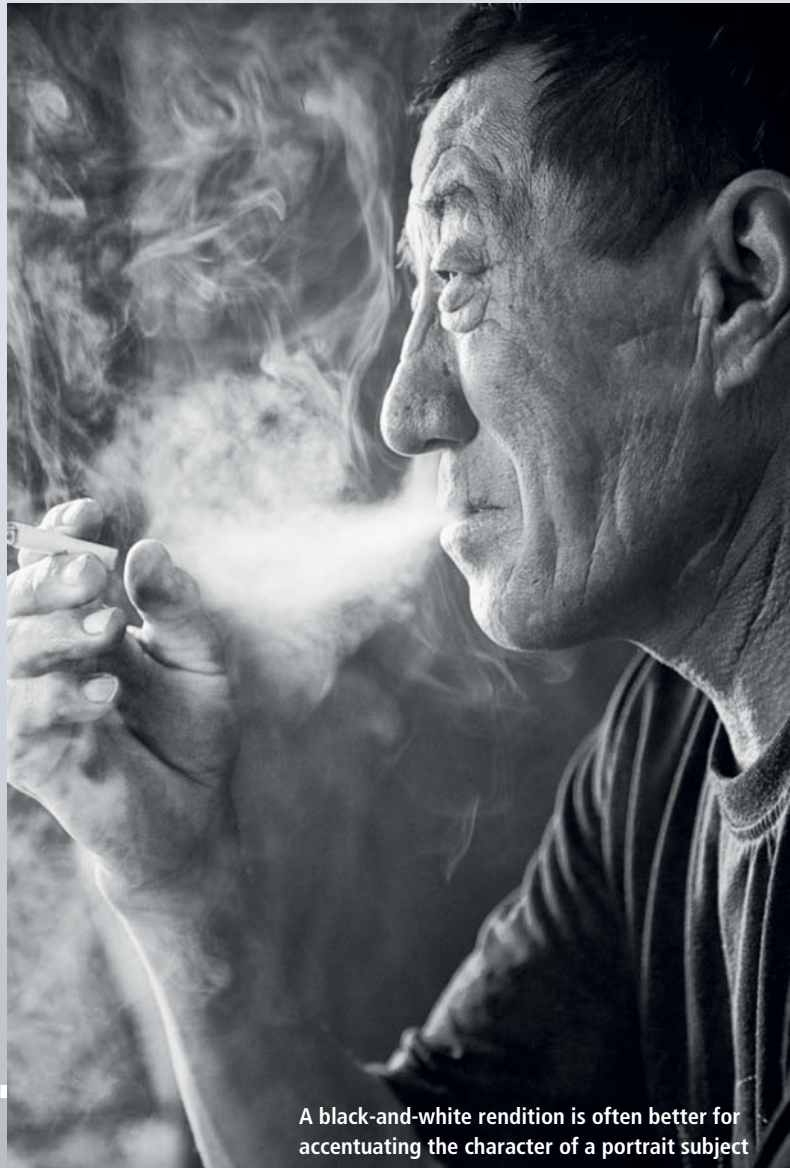
A well-lit studio portrait looks calm and dignified, but often posed as well. In contrast, photos shot on location are seldom perfectly lit, but usually create a much more lively image of the person being portrayed. It is often preferable to use and

enhance natural light than it is to attempt perfection in a controlled studio environment. The photo shown below is an extremely successful location shot.

The lack of color in a monochrome portrait often helps to accentuate the subject's own physical characteristics, whether these are the folds in an older person's skin, the glint in a winning athlete's eyes or the soft expression on a child's face. Pay special attention to the skin tones when converting portraits to black-and-white – a relatively large red component in the channel mix gives them a softer, more even look. In contrast, increasing the blue component can make even the palest of faces look freshly tanned.



Photo: hunta, shutterstock.com



A black-and-white rendition is often better for accentuating the character of a portrait subject

Black-and-white Effects

If you want to make your black-and-white images even more striking, you can try applying some special effects. Since the invention of the medium, photographers have been looking for ways to alter or manipulate their results, and some of today's techniques are as old as photography itself. Once the principle of silver halide-based development had been established, there was no looking back. In addition to these older techniques, a number of processes that were developed in analog darkrooms can now be simulated digitally. The following sections describe some of the best.

Antique Effects

If you look closely at prints from the 1920s and 1930s, you will see that they often contain neither black nor white, and more often than

not show a dark brown image printed on a light brown background. Ultraviolet radiation and sulfuric gases gnaw at the blacks over time and the white background simply yellows with age. Generations of photographers used sepia toning and tea-based solutions to deliberately give their images an antique look, but the 21st century photographer only has to activate the *Tint* option in *Photoshop's* Black & White dialog to adjust the hue and saturation of a tint using the tool's built-in sliders. If you are tinting particularly sharp images, applying a blur filter first helps to accentuate the effect.

Once you have found the right tint color, you can simulate the effects of years of UV radiation. First, set the foreground and background colors to black and white in the toolbox and then navigate to the Render > Clouds command in the Filter menu. This

creates a new layer filled with a random pattern. Set the new layer's opacity to 10% and observe the effect this has in the preview window. You can also simulate film grain by applying a Noise filter to the image layer. Make sure that images you process this way are suited to the look of a bygone age.

Colorization

Before the invention of color photography, hand colorizing black-and-white photos was a widespread art form. People used albumen-based paints and brushes or cotton swabs to apply layers of transparent color that were absorbed into the photo paper. Although they weren't particularly realistic, the resulting colors nevertheless had a certain romantic charm.



Photo: Jeffrey Kaufmann, fotolia.com

The mystical effect in this image was produced by applying the right combination of digital effects

There are various ways to simulate this type of effect digitally. If you want to color an entire image, first create a copy of the background layer and convert the original background layer to black and white. Reducing the opacity of the copied layer then simulates the effect of applying a transparent color to the image – 30% opacity is a good starting point for most subjects. The dreamy look in many hand-colored photos is a result of the paint reducing image sharpness. This effect can also be simulated by applying the Gaussian Blur filter to the color layer. The overall effect is more realistic if produced by superimposing a transparent color layer on an opaque image layer, rather than the other way around. Once you have found the right basic effect, you can fine-tune the individual colors.

You can then optimize your results by adjusting opacity and blend mode for one or other (or both) layers. Using the Soft Light blend mode for the upper, color layer adds a feeling of depth, and brightening the background layer a little while preserving

contrast enhances the overall mood. It is worth making the extra effort to manually color your black-and-white images, as no filter or plug-in can automatically generate such convincing effects.

Another effective and eye-catching technique involves coloring selected details in a black-and-white image. The more striking the image detail, the more effective a dab of color will be.

You can colorize details either by coloring a selection in an image that has already been converted or by masking a detail before performing the conversion. Try it out – it's amazing how you can use color to steer the viewer's eye toward a particular detail. This technique is especially effective in busy images in which many details compete for your attention. If you mask a single-colored detail during conversion, you can adjust the tonal values and framing in the finished image around it. If you compose your images with this kind of technique in mind, your photos will provide you with perfect material to experiment with.

Further Reading

If you want to delve deeper into the fascinating world of black-and-white photography, these two books are well worth a closer look:

Black-and-white composition

Torsten Andreas Hoffmann,
The Art of Black and White Photography,
ISBN-13 978-1-93395-227-7

Fine art black-and-white photography

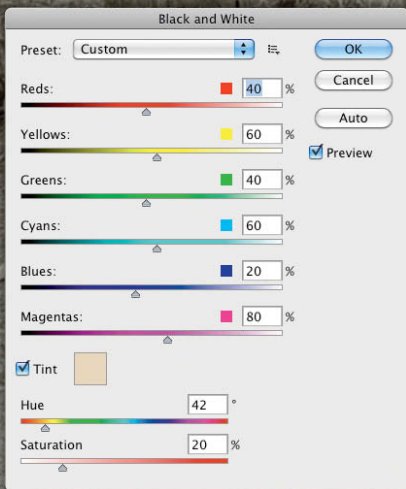
Ralph Lambrecht/Chris Woodhouse,
Way Beyond Monochrome,
ISBN-13 978-0-240-81625-8

Graphic Techniques

There are various ways to create graphic black-and-white images. For example, lith



Color details can be widely spread within the frame as long as the overall mood is consistent



The Tint tool is part of the Black and White dialog and includes sliders for adjusting Hue and Saturation



prints use a combination of standard black-and-white paper and lithographic developer to produce prints with fine, bright highlights, unusually dark shadows and virtually no midtones. If all the development parameters have been well coordinated, the paper will display a coarse grain structure and a subtle colored luster. Such effects involve complex tinkering in the darkroom, but can be reproduced reliably and effectively using *Photoshop*.

The process begins with a black-and-white image in RGB mode. Make two copies of the background layer and name the lower one "highlights" and the upper one "shadows". Now switch the blend mode of the highlights layer to Multiply to allow the shadows layer to show through. Use the Curves tool to drag the lower end of the shadows tone curve upward until the darker

tones disappear (equivalent to an output value of about 100). Now move the upper end of the tone curve in the highlights layer to the left until all tonal values above 100 are white (i.e., with an output value of 255).

Our Lith print now receives its final polish in the form of grain and tonal fine-tuning. Use the Hue/Saturation tool's *Colorize* option to apply a sepia tint to the highlights layer with a Hue value of about 30 and a Saturation value around 20. You can now add grain to the shadows layer using the Artistic > Film Grain filter – and that's it.

Solarization is another popular graphic approach to developing black-and-white images. *Photoshop* offers various approaches to this technique, the simplest of which is to use the eponymous Stylize > Solarize filter. The filter itself has no adjustment options, but you can alter the effect manually using the

opacity slider in the Edit > Fade Solarize dialog.

You can gain better control over the process if you first create a new Curves layer and move the left-hand end of the curve upward until all the pixels are displayed in black. The effect can then be modulated by adjusting the shape of the curve. A U-shaped curve is equivalent to the standard filter effect, and various tweaks to the overall shape produce different effects. Try it out and see what you come up with.

Infrared

Infrared analog film has a sensitivity range that extends to 900nm at the long-wave end of the scale. In other words, it is sensitive to near infrared (NIR) frequencies that the human eye cannot see. Because the visible

Photo: wajan, fotolia.com



A typical infrared look. The green of the leaves tends toward white and the sky appears almost black.

spectral region makes up more than 80 percent of the total luminance, it is necessary to use an appropriate filter to block these wavelengths if we want to be able to see the infrared effect. The result is a photo with a unique look that cannot be simulated using any other tools or techniques. Green foliage is reproduced in bright white and the blue of the sky appears very dark in contrast, producing wonderfully dramatic landscape images. Portrait photographers like the soft skin tones that infrared effects produce.

The only way to produce “real” infrared images with a digital camera is to use an optical infrared filter attached to the lens, although it is possible to produce similar effects digitally for suitable subjects. CS3 and later versions of *Photoshop* have a dedicated *Black & White Infrared* option in the Image > Adjustments > Channel Mixer dialog. Older

versions of *Photoshop* (and other programs) require a little more effort to achieve the same effect: first make a copy of your image and activate the Channel Mixer dialog. In order to simulate bright green tones against a very dark sky, you then need to set a high Green channel value and a negative Blue value in Monochrome mode. Red +20, Green +150 and Blue -100 are good values to start out with, but vary widely from subject to subject.

The next step is to apply the Gaussian Blur filter. A Radius setting of 0.5 pixels produces subtle halos without reducing visible sharpness too much. As a final touch, create a new layer in Overlay mode and activate the *Fill with Overlay neutral color (50% gray)* option. Applying the Film Grain filter to this layer gives your image an authentic “grainy” infrared look.

Conclusions

Digital technology gives us endless ways to manipulate and enhance images after shooting. Black-and-white conversion is one of the more significant ones because the additional degree of visual abstraction it provides makes it easier to control the effects your images have on the viewer. The importance of black-and-white functionality is documented by the fact that every image processing program, from entry level upward, has its own monochrome conversion tool. If this article and your own experiments have awakened your curiosity, it is definitely worth taking a closer look at *Silver Efex*. Whichever tool you choose, a good photographic eye and a little practice are all you need to start producing your own impressive black-and-white images. (pen) **ct**





Dr. Klaus Peeck

Bridge and All-weather Camera Test

This issue's camera test covers two 30× optical wide zoom bridge cameras and a ruggedized all-weather ultra-compact. Sensor resolution continues to increase in these classes of camera and none of the models we tested has less than 14 megapixels under the hood.

The Tough TG-810 from Olympus is a weatherproof compact with relatively dark 5× zoom with an equivalent focal length range of 28-14 mm. The camera is waterproof to a depth of 10 meters and resistant to falls of up to two meters. The robust all-metal body is capable of withstanding pressure of up to 100 kilograms, which is handy if you like carrying your camera in your hip pocket. When switched off, the TG-810 covers the lens with a metal lens cover which, thanks to the periscope-type lens, is the camera's only external moving part.

Our other two test candidates belong to the superzoom category and both offer DSLR-type bridge bodies with 30×, f/2.8-5.6 zoom lenses. The Fujifilm FinePix HS20 EXR offers a particularly impressive manually zoomable 24-720 mm (equivalent) lens, while the Sony Cyber-shot DSC-HX100V zooms "by wire" using the lens ring or the standard zoom lever. The Sony's 27-810 mm zoom range extends slightly further than the Fujifilm model, but has a slightly narrower widest-angle setting as a result.

Even More Megapixels

We were pleased to see Canon's recent release of the Powershot SX230 with "only" 12 megapixels of sensor resolution and commensurately improved high-ISO performance. Unfortunately, pixelmania continues to dominate the market and all of our current test candidates are equipped with sensors that capture 14 megapixels or more. Both bridge cameras have 16-megapixel back-illuminated CMOS sensors. With the exception of the Fujifilm, with its slightly larger 1/2" sensor, all of our test cameras have to make do with tiny 1/2.3" sensors. The combination of a large number of pixels with such a tiny surface area reduces the light sensitivity of each individual receptor and delivers a relatively weak optical signal that is sometimes barely distinguishable from the sensor's own background noise (see the Signal-to-noise ratio column in the table). The camera's firmware therefore has to strongly

Our test shot contains some serious technical challenges as well as some random objects that were selected for their high recognition value. The details mentioned in the test results are outlined in red.

amplify the signals produced by the sensor, and this inevitably produces more noise which then has to be digitally removed – again reducing overall image quality.

All this is nowadays dealt with by specially developed noise reduction algorithms that are ably supported by today's increasingly powerful processors. But no matter how powerful your camera's processor is, it still cannot work magic! Even the most sophisticated algorithm cannot reconstruct details that are simply missing in a noisy image with poor detail definition. Camera firmware is instead programmed to selectively sharpen high-contrast image areas and equalize the effects of low-contrast areas and monotone shapes. The theory is that the detail that is probably present in high-contrast areas is automatically enhanced while simultaneously softening potentially irritating noise artifacts in detail-free, low-contrast areas.

The result is a soft, almost mushy look that is typical of images produced by today's highly integrated do-it-all digital wonders. In extreme cases, these effects take on an almost water color-esque character, which can lead to very disappointing results when it comes to capturing fine details such as grass, leaves or the crevices in a brick wall. The alternative would be to use less aggressive noise reduction algorithms and to risk producing images with slightly more noise but markedly better detail definition.

Viewed in the cold light of day, all of our test cameras have poor noise handling characteristics, which is no surprise in view of the huge resolution packed into such tiny sensors. ISO 400 is the maximum tolerable setting for making small prints or viewing

images in full-screen mode for all of these cameras. Ironically, the enlargements that the manufacturers advertise as the main advantage of their high pixel counts are unusable at ISO values above 200. At higher values, all of our test cameras battle with more or less heavy-duty noise modulation artifacts. This situation is often exacerbated by cameras that have no Auto ISO feature and that simply crank up the ISO value (and with it the level of image noise) even further in low light instead of setting a limit.

Features

The weatherproof Olympus offers a typical feature set for a camera of its class, with the emphasis on automation. Semi-automatic and manual exposure settings are not part of the deal and there are no user-controllable settings for sharpness, contrast or the degree of noise reduction. This camera doesn't even have center-weighted metering functionality or manual white balance settings, and only just missed a "poor" rating in the features category. Continuous shooting mode wheezes in at a meagre 0.6 frames per second (fps) burst rate.

Our two bridge cameras don't demand as many compromises, and both offer a full set of manual and semi-automatic exposure and image parameter settings, including variable noise reduction, flash compensation, white balance fine-tuning and, in the case of the Sony, white balance bracketing and shift. The HS20EXR offers its own film simulation bracketing mode that reproduces the look of old-school Fuji slide films and also includes a dynamic range bracketing mode. Both cameras offer fast continuous shooting. The



Bridge and All-weather Cameras: Test Results, Part 1

	Relative center resolution (ISO 100, wide-angle) [lp/h] better ▶	Diagonal resolution (ISO 100, wide-angle) [lp/h] better ▶	Center resolution (ISO 400, wide-angle) [lp/h] better ▶	Diagonal resolution (ISO 400, wide-angle) [lp/h] better ▶	Center resolution (ISO 800, wide-angle) [lp/h] better ▶	Diagonal resolution (ISO 800, wide-angle) [lp/h] better ▶	Center resolution (ISO 1600, wide-angle) [lp/h] better ▶	Diagonal resolution (ISO 1600, wide-angle) [lp/h] better ▶
Fujifilm FinePix HS20EXR	1480	976	1440	985	1396	952	1045	606
Olympus Tough TG-810	1300	1099	1117	909	883	732	758	637
Sony Cyber-shot DSC-HX100V	1470	1247	1412	1157	1322	1033	1080	858

Resolution was determined visually in units of vertical line pairs [lp/h]. The larger the value, the sharper the image.

Bridge and All-weather Cameras: Test Results, Part 2

	Contrast range/subject range, ISO 100 [in f-stops] better ▶	Contrast range/subject range, ISO 400 [in f-stops] better ▶	Contrast range/subject range, ISO 800 [in f-stops] better ▶	Contrast range/subject range, ISO 1600 [in f-stops] better ▶	Contrast range/subject range, ISO 3200 [in f-stops] better ▶	White balance in daylight [Digital values] ◀ better	Color Checker SG ΔE ◀ better	Signal-to-noise ratio [S/Nx] ISO 100 better ▶
Fujifilm FinePix HS20EXR	9.0	7.0	6.0	6.0	5.3	4	9.2	35
Olympus Tough TG-810	10.0	7.7	7.3	6.3	–	5	9.3	34
Sony Cyber-shot DSC-HX100V	9.7	8.7	7.7	7.3	6.0	3	9.0	47

Larger signal-to-noise ratio values indicate better image reproduction with less unwanted noise. Visual noise is a physiologically-based judgement of how "irritating" certain image noise artifacts appear to the viewer. The values are calculated based on the intensity, frequency, and color of the perceived noise artifacts. Values below 0.8 represent virtually noise-free images, values below 2 low-noise reproduction, while values between 2 and 3 represent visible but acceptable noise levels. Values above 3 represent disruptive noise levels. Values of 5 and above represent extreme, unacceptable noise.

HS20 can shoot up to 32 JPEG frames at between 3 and 11 fps, while the Sony offers between 2 and 10 fps or up to 10 shots. As usual in burst mode, you have to wait a while at the end of a burst while the camera saves the captured data, and the Fujifilm was particularly slow in this respect.

Camera monitors are getting better all the time. The HS20EXR has a 460,000-dot, 3-inch screen that is more than adequate for judging overall image sharpness, but the Sony takes the prize with its ultra-sharp 921,000-dot monitor. Both bridge cameras' displays are tiltable, which makes overhead or low-level shooting much easier. They both also have electronic viewfinders, but with such low resolution that they are only really any use in an emergency – for example, if the ambient light is too strong to use the monitor effectively.

The HS20EXR has a 58mm filter thread and a TTL flash shoe and, to our surprise, the Olympus is capable of wirelessly controlling Olympus system flash units. Its already commendable underwater capabilities can also be extended to a depth of 40 meters using the PT-051 accessory underwater housing.

Follow-on Costs

Not surprisingly, the Olympus' 925 mAh, 3.7-volt battery is not very long-lasting, especially in view of the large, energy-hungry monitor. If you plan to use it for long trips, it is a good idea to acquire an additional battery or two. Third-party batteries are fairly cheap these days and Olympus hasn't built original equipment recognition circuitry into this particular model. The Sony only recognizes original Sony batteries, but the 6.8-volt model used in the HX100V provides twice as much power as the Olympus and even displays the remaining power in terms of minutes. The Fujifilm runs on four AA-size rechargeable cells, and offers the most potential battery power of our test models – provided, that is, that you use batteries with a flat discharge curve like Sanyo's *eneloop* range. This type of battery also has a long shelf life and loses virtually no charge when not in use. Fujifilm supplies only standard, non-rechargeable batteries with the camera, so users who don't already own them will have to purchase rechargeable batteries and a charger.

Battery chargers are provided with digital cameras much less frequently than they used to be, and most models that use Li-ion batteries force their owners to charge the batteries in-camera or using a computer by way of a USB cable or mains adapter. This is a practical solution with regard to the compatibility of USB chargers with car electrics, but means that you cannot use the camera away from your power source while the battery is charging. Camera manufacturers sell separate (often expensive) dedicated chargers, although universal chargers can be found that have either variable pin configurations or replaceable battery compartments for specific battery models. If you do decide to use a universal charger, please make sure that you purchase one made by a reputable manufacturer and not a cheap Chinese model with dubious electrical safety standards.

The memory built into most cameras is negligibly small, but SD cards have recently become virtually standard, making memory a relatively cheap factor in the cost of running a digital camera. All of our test models are compatible with SDHC memory cards and the

Bridge and All-weather Cameras: Test Results, Part 3

	Wide-angle distortion [%] ◀ better	Telephoto distortion [%] ◀ better	Wide-angle vignetting [in f-stops] ◀ better	Telephoto vignetting [in f-stops] ◀ better	Wide-angle chromatic aberration ◀ better	Telephoto chromatic aberration ◀ better	Startup time [seconds] ◀ better	Shutter lag (wide-angle) [seconds] ◀ better	Shutter lag (telephoto) [seconds] ◀ better
Fujifilm FinePix HS20EXR	0.9	0.3	0.4	0.4	1.5	2.6	4.3	0.36	1.96
Olympus Tough TG-810	0.0	0.2	0.4	0.7	0.4	0.8	1.7	0.82	0.86
Sony Cyber-shot DSC-HX100V	0.1	0.1	0.4	0.5	0.6	0.7	3.1	0.18	0.65

Center resolution (ISO 3200, wide-angle) [lp/h] better ▶	Diagonal resolution (ISO 3200, wide-angle) [lp/h] better ▶	Center resolution (ISO 100, Teleposition) [lp/h] better ▶	Diagonal resolution (ISO 100, Teleposition) [lp/h] better ▶	CCD resolution (not measured) [lp/h] better ▶	Relative center resolution (ISO 100, w-a) / sensor resolution [%] better ▶	Relative diagonal resolution (ISO 100, w-a) / sensor resolution [%] better ▶	Resolution dropoff center / diagonal (ISO 100, w-a) [%] ◀ better
1025	706	993	845	1728	86 %	56 %	34 %
–	–	934	937	1608	81 %	68 %	15 %
999	820	1122	1111	1728	85 %	72 %	15 %

The logarithmic density, D, represents the camera's dynamic range in terms of the ratio between the brightness of the subject and the corresponding recorded tonal values. Higher values are better. Real subject range represents the range of tonal values contained in an 8-bit rendition of a test image.

Signal-to-noise ratio [S/Nx] ISO 400 better ▶	Signal-to-noise ratio [S/Nx] ISO 800 better ▶	Signal-to-noise ratio [S/Nx] ISO 1600 better ▶	Signal-to-noise ratio [S/Nx] ISO 3200 better ▶	Visual noise OECF20 ISO 100 ◀ better	Visual noise OECF20 ISO 400 ◀ better	Visual noise OECF20 ISO 800 ◀ better	Visual noise OECF20 ISO 1600 ◀ better	Visual noise OECF20 ISO 3200 ◀ better
14	10	12	8	1.8	3.9	6.0	5.3	7.4
26	21	14	–	2.0	2.9	4.0	5.1	–
26	17	14	13	1.5	2.6	3.6	4.1	5.2

Sony's slot is also compatible with the proprietary Memory Stick Duo format.

All of our test cameras have USB 2.0 connectors. Commendably, the Fujifilm has separate mini USB and A/V sockets, while the other two have combined USB and A/V multi-connectors. Sony doesn't even provide the required proprietary A/V cable. All three have built-in HDMI connectors, the Olympus using the smallest D type and the other two the slightly larger C type. None of our test models included an HDMI cable, but these are cheaply available at any photo or video accessory store.

Video Capability

The days of the traditional consumer camcorder are numbered, and the competition in today's casual video sector is really between smartphones and digital stills cameras.

Having said that, most camcorder manufacturers can breathe a sigh of relief when faced with this issue's test candidates. Only the Sony produces video footage that is comparable in quality to that of a camcorder. Its 50fps Full HD mode provides excellent quality clips with virtually no visible rolling shutter effect, although it does appear more strongly at 25fps. Resolution is great, focus tracking is reliable, the stereo sound is very good and image stabilization works very well, even at telephoto settings. Only the slightly pale color rendition and the audible zoom motor noises spoil an otherwise excellent video performance. We would, however, have liked to see a connector for an external microphone.

The Fujifilm does offer Full HD video while Olympus owners have to make do with 720p footage. The HS20EXR's clips are only averagely sharp and suffer from slow focus and exposure tracking as well as poor image stabilization that produces serious wobbles at telephoto settings. Sound is rather muffled and is marred by the continual audible adjustments made by the camera's aperture control system.

The Olympus produces clips with rather pale colors, heavy contrast and slightly artificial looking sharpness. Its image stabilization works acceptably well but the relatively fast autofocus system tends to search vaguely for the right setting. The sound of the zoom motor is unavoidably captured for posterity in the somewhat muffled and flat-sounding mono soundtrack.

Our views on each camera's photographic strengths and weaknesses are detailed in the individual camera sections below and all other details regarding features and handling can be found in the table at the end of this article.

Conclusions

This diverse set of cameras produced surprisingly similar image quality, and we were able to give all three satisfactory or good ratings for color reproduction, exposure sharpness and detail rendition. Unfortunately, all three have poor noise characteristics in common, making crops and enlargements practical only at ISO speeds of 200 or less – at higher levels, the noise reduction algorithms simply spoil the overall image quality.

All of these effects are a result of the manufacturers' own decision to squeeze too many megapixels onto tiny image sensors which, in addition to the drawbacks already mentioned, also makes it difficult to stop the aperture down to usable levels.

These cameras are nonetheless all great photographic tools if used with these limitations in mind. Ruggedness, a bright display and simple handling make the Olympus a good choice if you are prepared to accept a slight lack of shooting flexibility. The motorized metal lens cover is a big plus.

The Fujifilm's highlights include its wonderful 30x manually-adjustable 24-720mm (equivalent) zoom and the EXR sensor technology that enables the user to extend the camera's effective dynamic range. The TTL flash shoe and the on-lens filter thread also add to the camera's plus points. On the downside, the HS20EXR's Full HD video mode is only good on paper, and delivers only average results with poor image stabilization.

The Sony is the exact opposite and delivers excellent 50fps Full HD video courtesy of, amongst other things, a great two-stage anti-shake system. Apart from its mediocre noise handling characteristics, the camera also delivers in the photo arena and ended up at the top of the class in our test. Sony also include GPS, a virtual compass and various 3D and sweep panorama modes for the price. The only real annoyance in our test model was the shutter button, which was much too easy to release and had a virtually imperceptible halfway point that resulted in many an unintentional or prematurely shot photo. (pen)



Fujifilm FinePix HS20EXR

Large SLR-format bridge camera with compact 30x zoom, 24mm wide-angle setting and tiny 16-megapixel CMOS sensor.

Good: Robust, rubberized body. EXR sensor with pushable dynamic range. Precise controls, including large mode dial, thumb wheel and 4-way selector with RAW shortcut button. Quick setting buttons for major functions. Vertically tiltable 3-inch monitor with good resolution and wide viewing angle. Automatic infrared monitor/viewfinder switch. Fast autofocus in good light up to medium focal lengths and in macro mode. Face (re)recognition with personal info database. Manual focus using lens ring, and Focus Check monitor magnifier and focus scale. 1cm super macro mode. 58mm filter thread. Fast continuous shooting at 8fps. Motion panorama (sweep) mode. Selectable automatic upper ISO limit. Built-in flash with well-balanced close-up mode. TTLflash shoe. SDXC-compatible card slot on camera side. Power from AA batteries or mains adapter.

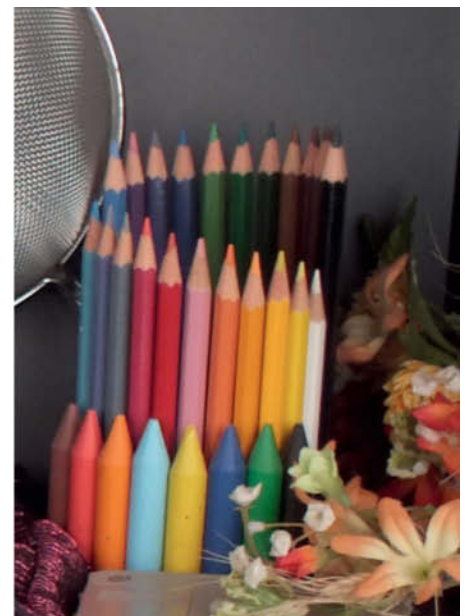
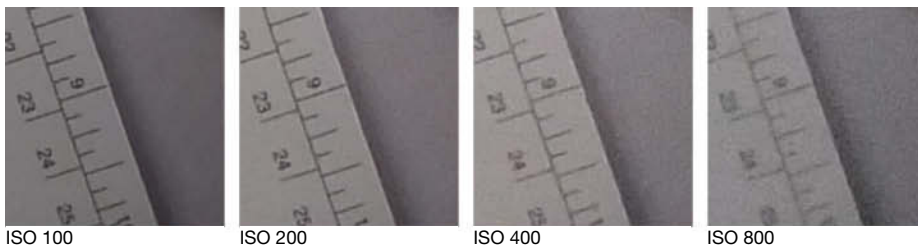
Not so good: 16 megapixels squeezed into a 1/2" sensor. Sensor shift image stabilization not very efficient, especially in video mode. Flash housing gets in the way of the zoom ring, which doesn't rotate smoothly enough. Macro vignetting. Low-resolution electronic viewfinder. Menus have too many entries. Autofocus in low light and at long focal lengths slow and "searches" for subject. Autofocus sometimes inaccurate, even with confirm lamp. Manual focus ring too sensitive. No flash in continuous shooting mode. Data saving slow. Low-power batteries supplied, remaining power only displayed near the end of battery life.

Test results: Good maximum contrast at ISO 100, strong drop-off thereafter. Noise characteristics acceptable below ISO 400, much more obvious thereafter. Only slight vignetting at wide-angle and telephoto settings, obvious wide-angle distortion. Clear color fringing at telephoto focal lengths. Center resolution OK at ISO 100 for a 16-megapixel sensor, slight drop-off toward ISO 800. Strong edge resolution drop-off and weak center resolution at telephoto settings. Long startup

time for a camera with manual zoom. Slow focusing at telephoto settings.

Image quality: Warm test-shot tones in daylight with our test sticker positively orange. Inconsistent exposure. Sharpness not really balanced with interference artifacts at diagonal edges. Detail not really good enough for a 16-megapixel camera. Moirés on our Siemens star, the line chart and the sieve. Clean monotones at ISO 100. Reduced sharpness at ISO 200 with some ragged edges. Grainy monotones and smudged edges at ISO 400. Some artifacts above ISO 800, yellow/green color blots beyond ISO 1600. Full-screen view OK at ISO 400. Fringing on the "Imperial" sticker, the text chart and the corner markers.

Outdoor colors realistic and sharpness good except at extreme wide-angle settings. Exposure fairly consistent. Edge artifacts and noise handling as for our indoor test shot, with paler colors beyond ISO 400. Considerable loss of detail and sharpness above ISO 800.





Olympus Tough TG-810

Extremely robust, waterproof and pressure resistant 14-megapixel ultra-compact with 5x periscope zoom and built-in GPS.

Good: Slightly blocky but easy-to-handle metal body, water resistant to 10m, shockproof for falls of up to 2m and resistant to 100 kg of pressure. No external moving parts except for the metal lens cover. Finely adjustable motorized zoom. Very bright 920,000-dot monitor that is still usable in bright sunshine. Precise buttons and useful mini joystick. Clear menu system with one screen per tab, additional major function icons at the edge of the monitor. Fast, precise autofocus, except in very low light. Two separate Auto ISO settings. Fast flash recycle time and wireless flash control for other Olympus flash units. Fast data save times. Battery/memory card slot on camera's side. SDXC and Eye-Fi-compatible. Built-in virtual compass and help pages.

Not so good: Too many megapixels for a small sensor. Maximum aperture too small at all focal lengths. Spongy zoom lever, zoom too

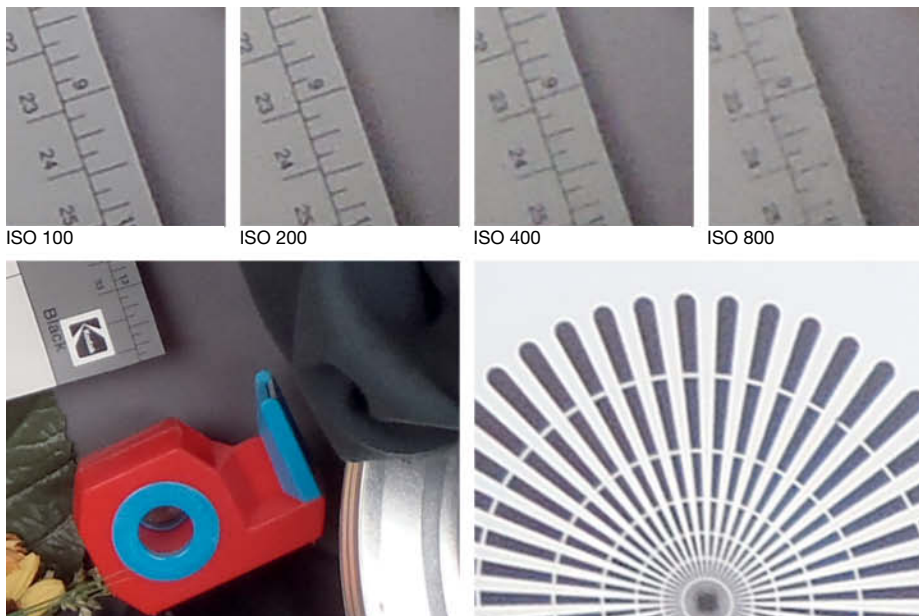
fast and zoom steps too coarse. No viewfinder. No manual focus. LED lamp only for macro or video shooting, not as AF-assist lamp. Autofocus unreliable in low light. Very slow continuous shooting. No manual white balance. Weak flash that overexposes close up. Very power-hungry. Battery can be incorrectly inserted.

Test results: Good maximum contrast at ISO 100 for this class of camera but with strong drop-off thereafter. Noise handling only acceptable at ISO 100, getting quickly worse at higher values. Slight telephoto vignetting but generally distortion-free. No obvious fringing. 81% center resolution at ISO 100 with only slight edge drop-off, declining quickly at higher values. Telephoto resolution not as good, but consistent. Fast startup, mid-range shutter lag at all focal lengths.

Image quality: Tendency to overexposure resulting in slightly pale but consistent daylight test-shot colors. Sharpness pretty good with an area of slight blur at the join with

the circuit board. Detail good for a 14-megapixel sensor. Few moirés and only very slight fringing. Clean monotones and edges with fair texture reproduction at ISO 80 – less detail and less smooth at ISO 100. Smudged edges and a loss of texture definition at ISO 200. Detail rendition obviously worse above ISO 400 with grainy monotones. Additional luminance noise above ISO 800. Full-screen view very close to unacceptable at high ISO values. Heavy artifacts above ISO 1600. Sprinklings of red and magenta-colored blots at all ISO levels.

Outdoor shots generally well exposed with good color rendition. Images flat-looking and unsharp at widest wide-angle setting, otherwise good detail rendition up to ISO 100 with obvious drop-off, frayed edges and grainy monotones above ISO 200. Water color-esque noise reduction artifacts above ISO 400 and even paler colors above ISO 800. No fringing.

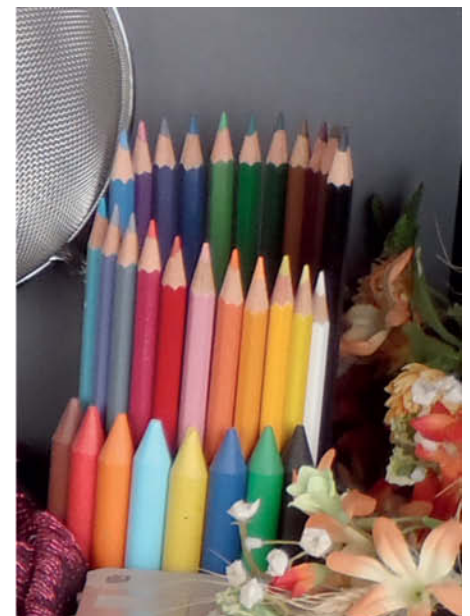


ISO 100

ISO 200

ISO 400

ISO 800





Sony Cyber-shot DSC-HX100V

Super-zoom bridge camera with a 30× zoom range starting at 27 mm (equivalent), an excellent high-resolution monitor and 50 fps Full HD video.

Good: Solid, well-built body with (mostly) well-positioned controls. Large mode dial, thumb-controlled jog dial and “zoom by wire” zoom ring. Finely adjustable two-speed zoom. High-resolution vertically tiltable monitor with large angle of view. Autofocus fast and precise in macro mode and up to medium focal lengths. 1cm macro close focus. Fast continuous shooting mode and (3D) sweep panorama functionality. Fast data write times. White balance shift and three custom memory recall settings. GPS and compass functionality. Powerful flash unit with balanced close-up flash. SDXC and Memory Stick Duo-compatible. Relatively low power requirement. Remaining battery time display.

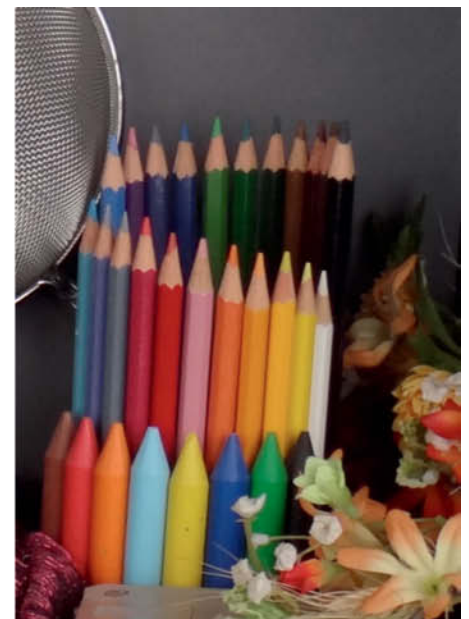
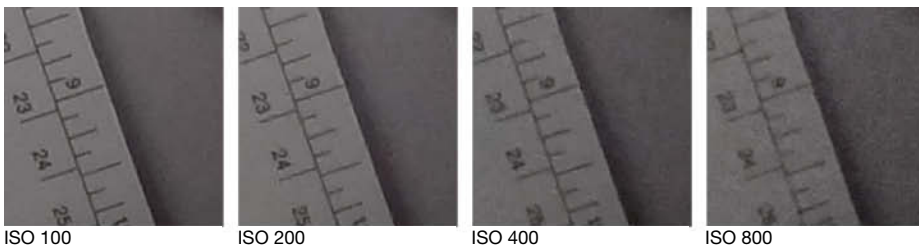
Not so good: 16-megapixel sensor too densely engineered. Shutter button much too easy to

release with barely detectable halfway point. Manual focus response sluggish. No filter thread. Minimum shooting distance 1.75 m beyond 6× zoom. Low-resolution electronic viewfinder. Icon/menu system difficult to understand. No quick menu feature. Not particularly configurable: fixed JPEG quality and playback settings, button volume not adjustable. No Auto ISO limit. Autofocus “searches” at telephoto settings and is very slow in low light. No flash in continuous shooting mode. No flash shoe and long flash recycle time. Combined battery/memory card slot. No A/V cable included.

Test results: Very good maximum contrast that only drops off by one additional stop at ISO 400 and 800. Good noise handling at ISO 100, but falling off rapidly thereafter. No vignetting problems and only slight distortion. Fringing well compensated. Good center resolution up to ISO 400 for this class of sensor with little or no edge softness, even at telephoto settings. Fast startup. Strong wide-angle shutter lag, much better at telephoto settings.

Image quality: Good daylight test-shot color rendition, although with warm tones – orange sticker salmon-colored. Balanced sharpness and good detail rendition. Tendency to slight underexposure, grayscale chart poorly differentiated above level 17. Few moirés. Clean monotonies at ISO 100 with some frayed edges and some loss of texture. Detail and texture still clean but not as good at ISO 200, with some ragged edges. Performance at ISO 400 too dark and with too much contrast and slight violet color cast – orange label with obvious color artifacts. Beyond ISO 800 unsharp and with significant luminance noise. Full-screen view only acceptable up to ISO 400. Fringing well compensated and few other artifacts.

Outdoor colors and sharpness good, but slightly underexposed. Automatic noise reduction visible but acceptable up to ISO 200 with loss of detail and edge and monotone artifacts thereafter. Overall image quality dull above ISO 800. Chromatic aberrations well handled.



All-weather and Bridge Camera Test			
Manufacturer and Model	Fujifilm FinePix HS20EXR	Olympus Tough TG-810	Sony Cyber-shot DSC-HX100V
URL	www.finepix.com	www.olympus.com	www.sony.com
Digitization			
Native resolutions (in pixels)	4608 × 3456, 4608 × 3072 (3:2), 4608 × 2592 (16:9), 3264 × 2448, 3264 × 2176 (3:2), 3264 × 1840 (16:9), 2304 × 1728, 2304 × 1536 (3:2), 1920 × 1080 (16:9)	4288 × 3216, 4288 × 2416 (16:9), 3264 × 2448, 2560 × 1920, 2048 × 1536, 1920 × 1080 (16:9), 1600 × 1200, 1280 × 960, 640 × 480	4608 × 3456, 4608 × 2592 (16:9), 3648 × 2736, 2592 × 1944, 1920 × 1080 (16:9), 640 × 480
Sensor type, effective megapixels / Size	EXR CMOS (BSI), 16 Mio / 1/2"	CCD, 14 Mio / 1/2.3"	Exmor R CMOS (BSI), 16 Mio / 1/2.3"
Image format(s) / Compression rates / Video format	RAW, JPEG / 2 / MPEG-4 H.264	JPEG / 2 / MPEG-4	JPEG / 1 / AVCHD or MPEG-4
Video: max. resolution [pixels], length, fps	Full HD 1080p, 4 GB or 29 min., 30	HD 720p, 4 GB or 29 min., 30	FullHD 1080p, 29 min., 50
Memory card type / average file size ³	SD(HC/XC) (+ 20 MB internal) / 5.7 MB	SD(HC/XC), Eye-Fi (+ 20 MB internal) / 5.8 MB	MS Duo or SD(HC/XC) (+ 19 MB internal) / 4.3 MB
Features			
ISO settings	auto (100-400/800/1600/3200), 100, 200, 400, 800, 1600, 3200, (6400, 12800)	auto (80-400) / auto HIGH (80-1600), 80, 100, 200, 400, 800, 1600	auto (100-1600), 100-3200 in 1/3 steps
Max aperture / Steps / Mechanical image stabilization	f/2.8-5.6 / 13 (wide-angle) – 7 (telephoto) / ✓ (sensor shift)	f/3.9-5.9 / 2 / ✓ (sensor shift)	f/2.8-5.6 / 10 (wide-angle) – 4 (telephoto) / ✓ (lens)
Exposure times [s]	(30) 4 – 1/4000	(4) 1/4 – 1/2000	(30) 1 – 1/2000
Zoom / Steps / Equivalent focal length range	30× / mechanical stepless / 24-720	5× / 25 / 28-140	30× / 115, 2 speeds (lever + electronic zoom ring) / 27-810
Minimum wide-angle subject distance macro / standard ⁵	1 cm / 4 cm	2 cm ("super macro"), 9 cm / 18 cm	– / 1 cm
Focusing / AF focus areas / AF-assist lamp	AF (one-shot, continuous, tracking), MF (with AF override) / Multi-area or 1 (49 positions), face (re)detection / ✓ (white)	AF (continuous, tracking) / multi-area or 1, face detection / – (LED video and macro lamp only)	AF (continuous, tracking), MF / 9 or 1 (117 positions), face detection / ✓ (orange)
Metering: Multi- / Center-weighted / Spot	✓ / ✓ / ✓	✓ / – / ✓	✓ / ✓ / ✓
Programmed auto / Scene modes / Custom Presets	✓ (EXR auto with scene recognition) / 17 / 1	✓ (with scene recognition) / 21 / –	✓ (with shift and scene recognition) / 16 / ✓ (3 memories)
Exposure: Aperture priority / Shutter priority / Manual	✓ / ✓ / ✓	– / – / –	✓ / ✓ / ✓
Exposure compensation [EV]	±2 EV in 1/3 steps	±2 EV in 1/3 steps	±2 EV in 1/3 steps
Bracketing: Exposure / WB / Focus /	✓ / – / – (film type, dynamic range bracketing)	– / – / –	✓ / ✓ / –
Self-timer / Continuous shooting speed ³	10 or 2 s or face recognition / approx. 8 fps, up to 32 shots	12 or 2 s / approx. 0.6 fps, 200 shots	10 or 2 s, 1 or 2 face or smile-controlled shutter release / 2-10 fps, 10 shots
Interval mode / Sound / Comment function	– / ✓ (16-bit, stereo, 48 kHz) / 30 s	– / ✓ (AAC, mono) / 4 s	– / ✓ (16-bit, stereo, 48 kHz) / –
White balance: Auto / Presets / Manual	✓ / 6 / ✓ (with fine-tuning)	✓ / 4 / –	✓ / 7 / ✓ (with fine-tuning)
Sharpness, Contrast, Saturation, Noise reduction adjustable	✓ / ✓ / ✓ / ✓	– / – / – / –	✓ / ✓ / ✓ / ✓
Monitor: Size / Resolution (dots) / Protective cover / Viewfinder	3.0" (vertically tiltable) / 460,000 / ✓ / ✓ (electronic, 200,000 dots)	3.0" / 920,000 / ✓ / –	3.0" / 921,600 / ✓ / ✓ (electronic, 200,000 dots)
4-way selector / Multi selector / Command dials	✓ (+ center button) / 1 / 1	✓ (Mini joystick) / – / –	✓ (+ center button) / 1 / 1
Flash compensation / Recycle time ⁵ / Connector	±2/3 EV in 1/3 steps / 5.6 s / ✓ (TTL shoe)	– / 4.3 s / – (wireless flash control with Olympus system flashes)	±2 EV in 1/3 steps / 9.8 s / –
Playback			
Multiple [# of images] / Zoom / Histogram	100, 9, 4 / ✓ / ✓ (also while shooting)	30 or 12 / ✓ (up to 10×) / ✓ (also while shooting)	25, 16 or calendar / ✓ (stepless up to 8×) / ✓ (also while shooting)
Connectors / Dimensions			
Power source	4 × AA, mains adapter	Rechargeable Li-ion	Mains adapter (proprietary), Li-ion rechargeable
Interfaces / A/V out / HDMI / Printer	USB 2.0 / ✓ / ✓ (type C) / ✓ (PictBridge)	USB 2.0 / ✓ / ✓ (type D) / ✓ (PictBridge)	USB 2.0 / ✓ / ✓ (type C) / –
Dimensions (W/H/D) / approx. weight ⁶ body, ready to shoot ²	131 mm × 91 mm × 126 mm / approx. 750 g (with 4 rechargeable NiMH batteries)	100 mm × 65 mm × 26 mm / approx. 225 g	122 mm × 87 mm × 93 mm / approx. 580 g
What's in the Box			
Manual / User guide	Quick start guide, manual (PDF only)	Quick start guide, manual (PDF only)	Quick start guide (also in-camera), manual (PDF only)
Accessories	4 AA batteries, lens cap with strap, lens hood, wrist strap, USB and A/V cables	LI-50B Li-ion battery (3.7 V, 925 mAh), USB charger (battery charges in-camera), wrist strap, USB and A/V cables	NP-FH50 Li-ion battery (6.8 V, 870 mAh), wrist strap, lens cap with strap, USB connection/charging cable, USB charger (battery charges in-camera)
Optional accessories	Mains adapter, rechargeable NiMH batteries and charger, accessory flash unit, HDMI cable	Memory cards, mains adapter, battery charger, camera bag, shoulder strap, HDMI cable, accessory flash unit, underwater housing (to 40 m)	Memory cards, mains adapter, battery charger, camera bag, HDMI cable
Software			
Standalone software (platform)	MyFinePixStudio 2.1 (Win), FinePix Viewer 3.6 (Mac), RAW File Converter (Win/Mac)	ib (Win), Olympus Viewer 2 (Win/Mac)	Picture Motion Browser 5.5 (Win)
Ratings			
Test images ¹ (c't test image shot in daylight)			
Color rendition / Exposure	⊕ / ○	⊕ / ○	⊕ / ⊕
Sharpness / Detail rendition	○ / ○	⊕ / ○	⊕ / ⊕
Image noise / Other artifacts ²	⊖ / ⊖	⊖ / ⊖	⊖ / ⊕
HD video ¹ / Sound	○ / ⊕	○ / ○	⊕⊕ / ⊕⊕
Ease of use / Printed manual	⊕ / ⊖	⊕ / ⊖	○ / ⊖
Feature set ⁴ / included accessories ⁴	⊕⊕ / ⊖	○ / ○	⊕⊕ / ○
RRP: Camera / Replacement battery (US\$)	450 / –	319 / 28	400 / 20
¹ judged by eye on a calibrated monitor (applies only to these cameras and therefore not comparable with earlier tests)			
² Sharpening and compression artifacts, noise, moirés, color fringing			
³ using largest native image size and best JPEG quality			
⁴ relative to similar class of camera			
⁵ measured values, recycle time for maximum flash power			
⊕⊕ excellent ⊕ good ○ satisfactory ⊖ poor ⊖⊖ inadequate ✓ included – not included n/a not applicable			



Cyrill Harnischmacher

Build your own

Studio Gear



If you are just starting out experimenting with studio lighting and shooting techniques, expensive new gear can quickly break the bank. But never fear – with the help of easily available materials and a little manual skill you can build studio accessories that are just as effective as high-end pro equipment. This article shows you not only how to go about building your own gear, but also how to use it to get great photographic results.

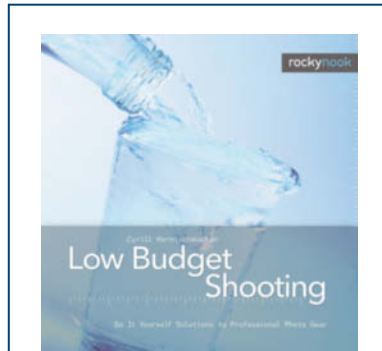
Even if you move on to using professional studio gear in the future, many of the DIY accessories we introduce here will continue to be part of your photographic life. To be successful, tabletop photography often requires spur-of-the-moment improvisation and unusual technical solutions to everyday photographic challenges.

Building new tools is part of the routine in pro photo studios too: reflectors have to be tailored to a specific shot, light shapers need to be modified, backgrounds are painted in new colors and all sorts of ornaments are produced seemingly out of thin air. This is one of the skills all photographers have to master, and homemade accessories are just as much an investment in your photographic future as expensive, commercially produced equipment.

Is building your own gear really worth it? My immediate answer is a resounding "Yes!" – otherwise, I wouldn't have taken the trouble to write this article or my book on the subject. But, aside from any financial or commercial considerations, getting to grips with light at this level is often a much more rewarding experience than simply buying and using ready-made tools.

You are sure to critically question the results of your DIY experiments, and this naturally leads to a deeper learning experience. Building your own gear also makes it possible to create tools that are simply not available anywhere else, and it's always easier to modify your own equipment than it is to revamp things that you have bought.

The following pages explain how to build a range of accessories that will simplify your photographic life in the studio and out-of-doors.



There are many more examples of great DIY studio equipment in Cyril Harnischmachers' book **Low Budget Shooting**, published by Rocky Nook (www.rockynook.com).

Backgrounds

The main focus of any photo is of course the subject. However, the background and the objects surrounding the subject also play an important role in the success of a shot. There are many ways to make your own backgrounds, and there are many everyday objects that you can kidnap and use for purposes they were never intended for.

It is a good idea to build up a stock of objects and accessories for inclusion in your photos. Hobby and model shops or DIY and building supplies stores are great places to start looking for wood surfaces, textured paper, felt, fabric and much more besides.

Wrapping paper made of unusual materials or colored plastic is perfect for creating interesting backgrounds, and a visit to a metal workshop or a local stonemason can also reap rewards. Odd pieces of exotic stone or

corrugated metal make ideal backgrounds for photographing jewelry. Last but not least, a walk in the woods often yields a variety of source of material. Fallen leaves, gnarled branches, delicate twigs, moss and grass, shells, driftwood and pebbles all make wonderful makeshift props.

Simple backgrounds are easily made by painting bold brushstrokes onto card or canvas, and you can always use a spatula or a sponge to vary the texture. Plaster of Paris is another versatile helper and can be used to imitate stucco or concrete, and you can even make casts of unusual objects in unmixed plaster powder. Impromptu rust can be created by painting vinegar onto a piece of sheet metal and waiting for a few days.



An old school atlas and shallow depth of field instantly make this tin airplane look as if it is flying high above Europe



Complex scenes can be effectively staged using simple props.
 The atmospheric background in this shot is actually a photo of a cloudy summer sky.

Your own photos, printed on a large-format printer, also make interesting backgrounds. With a little skill and the right lighting, you can include blue skies, photogenic cloud formations, sunsets or picturesque landscapes in your studio shots. And you are not restricted to using props in the background. You can use reflective surfaces to create the frame for your entire scene, like a mountain panorama reflected in mirrored ski goggles, for example.

Stage design stores sell specialist accessories such as transparent acrylic cubes, artificial snow, water-effect sheeting, stage blood, cobweb spray, fog machines and artificial turf. Once you start, you are sure to end up with quite a collection of odds and ends that you need to store somewhere and find easily when you need them. Don't underestimate the amount of space you will need, and try to keep things tidy so that you can find what you need when you need it.



You can find great backgrounds just about anywhere: here (from left to right) are corrugated card (stationery store), rusty sheet metal and satin glass (builder's supplies), flagstone (gardening store), punched aluminum sheeting and ceramic tile (builder's supplies) and various types of card (stationery store)



Where to Shop

Unusual photo accessories and materials for building your own props can be found just about anywhere. Flea markets are great places for finding used eyeglasses, antique tools, cutlery, crockery, aging wood and metal, and any number of other unusual things that can give your photos extra punch and pizzazz.

All of the materials that we used for the projects shown here are easily available at shops and stores.

Builder's Supplies:

Tools, aluminum struts and brackets, shelf brackets, emergency blanket

Kite Shops:

Nylon string, fiberglass spars, connectors and other bits and pieces for making things light but stable

Hobby Shops, Stationery Stores, Arts and Graphics Supplies:

Foam rubber, spray glue, superglue, unusual paper, card, wrapping paper, poster rails and gift boxes

Architectural Model Makers:

An endless source of varied materials, including plexiglass, plastic, metal sheeting, wire mesh, cardboard, plastic sheeting and special tools

Advertising Media:

Plexiglass, translucent diffusion foil

Photo Stores and Garage Sales:

Markets and Internet auctions are a great place to look for photo accessories with unusual thread sizes, adapters, filter gels, all sorts of remote releases and flash brackets

There's no limit to where you can look for props and supplies for your home studio

A beanbag effectively cushions camera vibrations and adapts itself to the shape of any surface



Beanbag Camera Supports

A simple beanbag is an effective way to absorb camera vibrations when you are shooting at ground level or with your camera perched on a wall. It also protects the bottom of the camera and the lens from damage and helps you to level your shot.

My 20 × 16cm (6 × 8-inch) beanbag is made of two pieces of leather with dimensions that are slightly larger than the finished beanbag and a thick zip fastener. You may need a special needle for your sewing machine if you use particularly thick leather.

Fold the short side of the leather to make a hem and sew the zip to the inner (rough) side of the leather. Now place the two pieces of leather together with their smooth sides facing each other and sew the remaining three sides together leaving about 1 cm of space at the edges.

You can now tie off the loose threads by hand, turn your finished beanbag the right way out and fill it with dried beans, lentils or styrofoam beads. As a finishing touch, you can impregnate the leather with dubbin or shoe spray to make it weatherproof.

I fill my beanbags with dried beans. If you want to make a lightweight version, you can use styrofoam beads instead.

Camera-mounted Spirit Level

If you need to make sure your camera is perfectly level, for example, when you are shooting landscapes, a spirit level attached to the camera's flash shoe is a simple and effective aid.

The one illustrated here was made by gluing a cheap level from a do-it-yourself store to the bottom foot of an old flash bracket. Before actually gluing the two parts together, use a second spirit level to make sure that they are correctly oriented using a second spirit level.



A simple builder's spirit level used as a camera leveling aid



The disused foot of an old flash bracket is fixed to the spirit level with superglue. The finished unit is a great way to ensure your camera remains level during shooting.

Portable Infinity Cove

Infinity coves are used to make the transition between the vertical and horizontal parts of a background invisible. If you don't have a lot of space for your home studio, an infinity cove that can be erected and taken down in seconds makes it easy to organize a quick shoot on the kitchen table or your desk.

The basic components of a DIY infinity cove are fiberglass rods, poster rails and thick card. The thickness of the card you use will depend on the size of the cove you want to build. If you use a piece of 30 × 42cm card, 300 g/m² will be sufficient, but you will need thicker card for the larger 50 × 70cm version – in this case, 1mm modeling card is ideal.

We glued black velvet to one side of the card to give us a choice of backgrounds.

Make holes in the corners of the card using a normal hole punch. The ends of the fiber glass rods are made from pieces of rubber tubing and prevent the card from slipping off the rods. Wrapping a normal rubber band around them achieves the same effect. Aluminum or plastic poster rails fixed to the top and bottom edges of the card provide extra stability. You can see the results in the photo of the blue car opposite. >>>>

Plastic Bowl Light Tent

A light tent is the tool of choice for photographing objects with potentially distracting reflective surfaces, such as cutlery or watches. Just about everyone has a variety of light tents at home in the form of translucent plastic bowls and storage containers.

A simple bowl with a diameter of about 30 cm is ideal for shooting macro photos. All you have to do is cut a hole with the same diameter as your lens in the side of the bowl. The easiest way to do this is to draw an outline using a felt pen and drill it out bit by bit. Any remaining joins between holes are easily removed using a modeling knife.

You can remove any remaining protrusions using a file and smooth the edges of the hole using sandpaper. Light for your light tent is provided by a flash unit. You can use holes cut in different places to vary your camera angle. Such a modified bowl is also great for taking outdoor macro shots at ground level.

Larger, rectangular plastic containers can be used too, although you will need to glue a cardboard infinity cove into the container to smooth the transition between the side and the bottom. Here too, light is provided by one or more remotely controlled flash units. <<<<



Fiberglass rods hold the cardboard infinity cove in shape, while poster rails add stability



Our infinity cove is extremely portable and quick to put up and take down



This photo, shot using our home-made infinity cove, shows just how effective a smooth, horizon-free background can be



A photo of a watch taken in our plastic bowl light tent. The lateral light source produces a soft, subtle shadow. Lighting subjects like this from both sides produces shadow-free results.



Rectangular plastic containers make great light tents too, although you will usually need to add a curved piece of card to disguise the bottom edges in the background.



Home-made light tents can help produce professional-looking results, like this product shot of an analog camera

Reflectors

Reflectors control the direction of light, while diffusers scatter it to produce softer shadows. Silver-colored diffusers produce clear “technical” looking light, while gold-colored reflectors produce light with a warmer character. White reflectors have a generally neutral effect, while colored surfaces used as reflectors can be used to produce a wide range of special effects and accents.

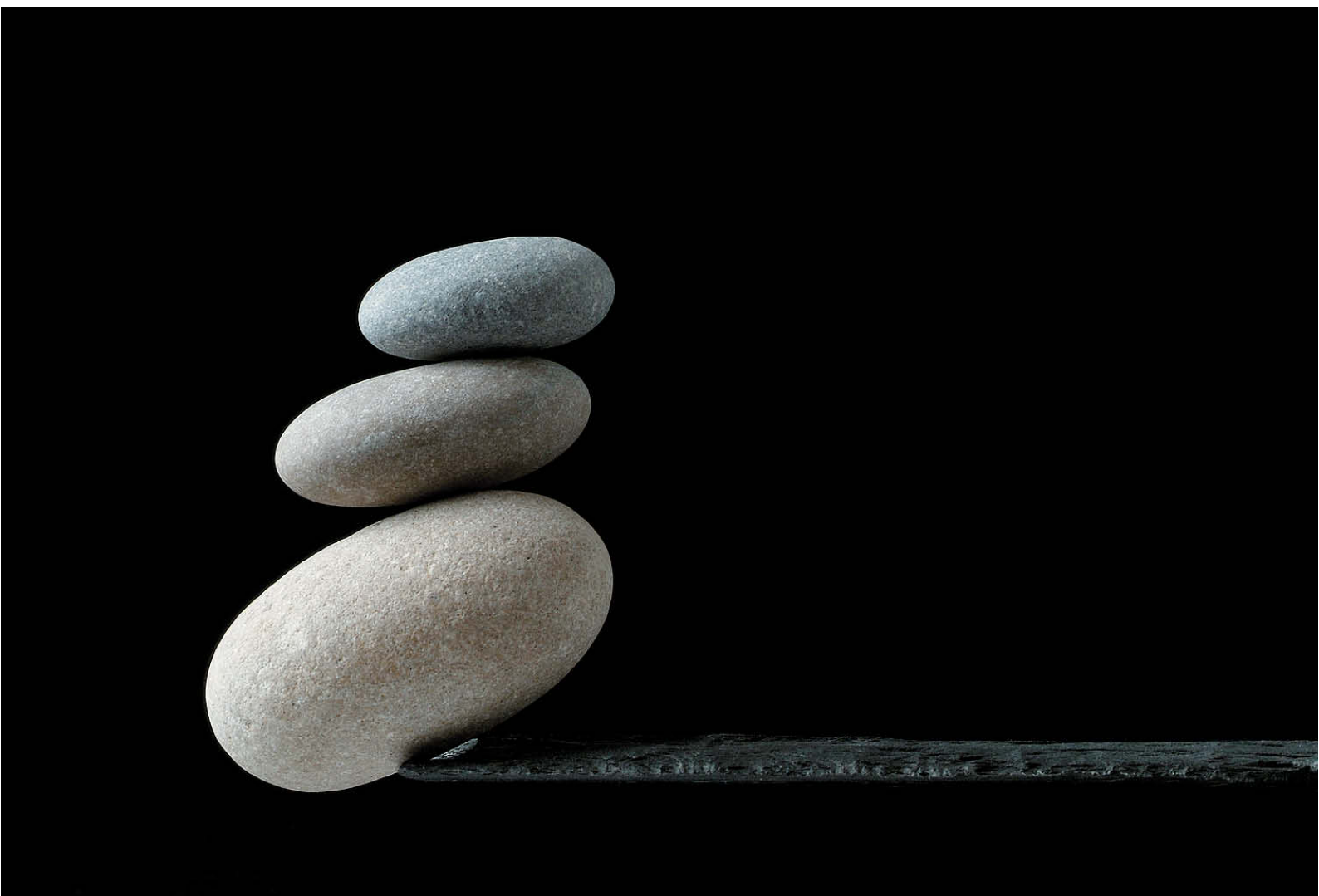
Mounting board from a graphic arts store is perfect for making reflectors. It is usually matte black on one side and white on the other, and has a foam core that makes it very light and easy to cut to size. This makes it great for making small, custom reflectors that produce highlights in metal, glass and other reflective objects.

Not only does white styrofoam make a cheap, lightweight alternative reflector, but its textured surface also diffuses light better than smooth card. You can turn styrofoam black by gluing black card to

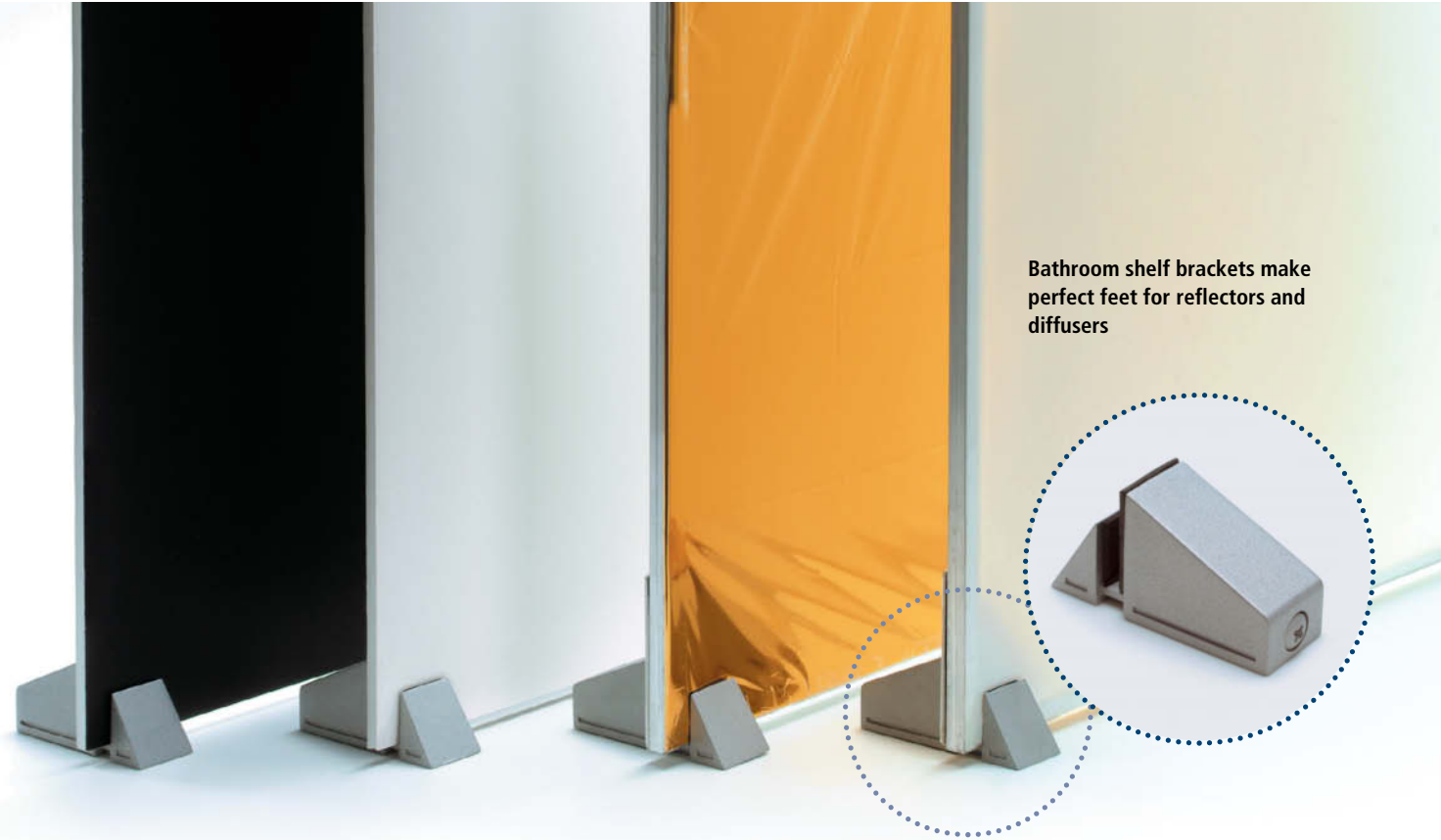
its surface or by painting it with water-based acrylic paint (available in tubes from art suppliers). This type of paint dries quickly and doesn't dissolve styrofoam like solvent-based paint.

Lightweight plywood panels are also a good base material for reflectors. You can color them using emulsion paint or glue a foil rescue blanket to the surface to make a gold-colored reflector. Crumpling the blanket before fixing it to the plywood panel increases the diffusion effect very effectively.

Metal shelf brackets of the type used to mount glass shelves in bathrooms make ideal supports for home-made reflectors. They can be adjusted to accommodate reflectors of different thicknesses using just a single screw, so you don't have to purchase a separate set of feet for every reflector you use. They also make it quick and easy to switch reflectors while you work.



Photos shot using large reflectors display wonderfully soft transitions between areas of light and shade. Here, we used this effect to turn simple pebbles into a beautiful sculpture.



Bathroom shelf brackets make perfect feet for reflectors and diffusers

An absorber made of black mounting board can be used to produce shadow effects and absorb stray light

The reverse of the same board is white and makes a great reflector for brightening shadows

A reflector made from a sheet of styrofoam and a rescue blanket produces warm, "sunny" light

This diffuser has a stable frame covered with diffusion sheeting from an advertising and signage supplier. Diffusers produce soft shadows and uniform lighting effects.



The bottle in the photo on the left looks rather two-dimensional, but adding a white reflector to the setup helps to brighten the shadows and produces a highlight on the surface of the glass, giving it more depth and definition





In this photo, white reflectors accentuate the dewdrops against the black background

Holder for a Styrofoam Reflector

A flexible way to support a styrofoam reflector is to use a home-made holder made from an aluminum bar and two carpenter's nails. A knurled-head screw with a standard tripod thread fixes the whole assembly to your light stand. Simply drill a hole at each end of the aluminum bar for the nails and a larger hole (usually 8 mm) for the fixing screw in the center. The "prongs" of the holder are made from two carpenter's nails of about 10 cm (4 inches) in length that you can hammer into the holes you have drilled. If the holes are too large to hold the nails securely, you can use two-component glue to fix them in place. For safety's sake, it is better to file down the points of the nails.

You can then fix your reflector holder to a light stand or a tripod using the fixing screw and push your styrofoam reflector onto the nails. And that's all there is to it!



A styrofoam reflector mounted on a light stand with a tiltable head makes a very flexible studio tool

An aluminum bar and two carpenter's nails are all you need to make an effective reflector holder

Diffusers

Building a diffuser is slightly more complicated than building a reflector because you need to build a frame for mounting the translucent diffusion foil. We used 8mm square-cut aluminum struts and triangular aluminum angle brackets from a builder's supplier and fixed them together using a simple hand riveter. Once you have cut your aluminum to length, use rubber cement to glue the components together to ensure that everything fits.

Now mark the location of the rivet holes on the angle brackets and drill them using an appropriately sized drill bit. You can now use the holes in the angle brackets to mark the struts for drilling.

It is always a good idea to number the individual components of your frame using a permanent marker so that you can assemble them

in the correct order. You may need to make a sketch of the parts too. Once everything is in place, it is simple to use a hand riveter to finish your frame.

Now all you have to do is fix a layer of diffusion foil (available from advertising media suppliers) to your frame using transparent adhesive tape. This type of foil produces diffuse, evenly distributed light. Here too, the shelf brackets we described above make perfect supports.



Triangular aluminum brackets and square-cut aluminum struts make a simple, stable frame for mounting diffusion foil



Using blind rivets and a hand riveter is a cheap and easy way to fix the parts of a diffuser frame together

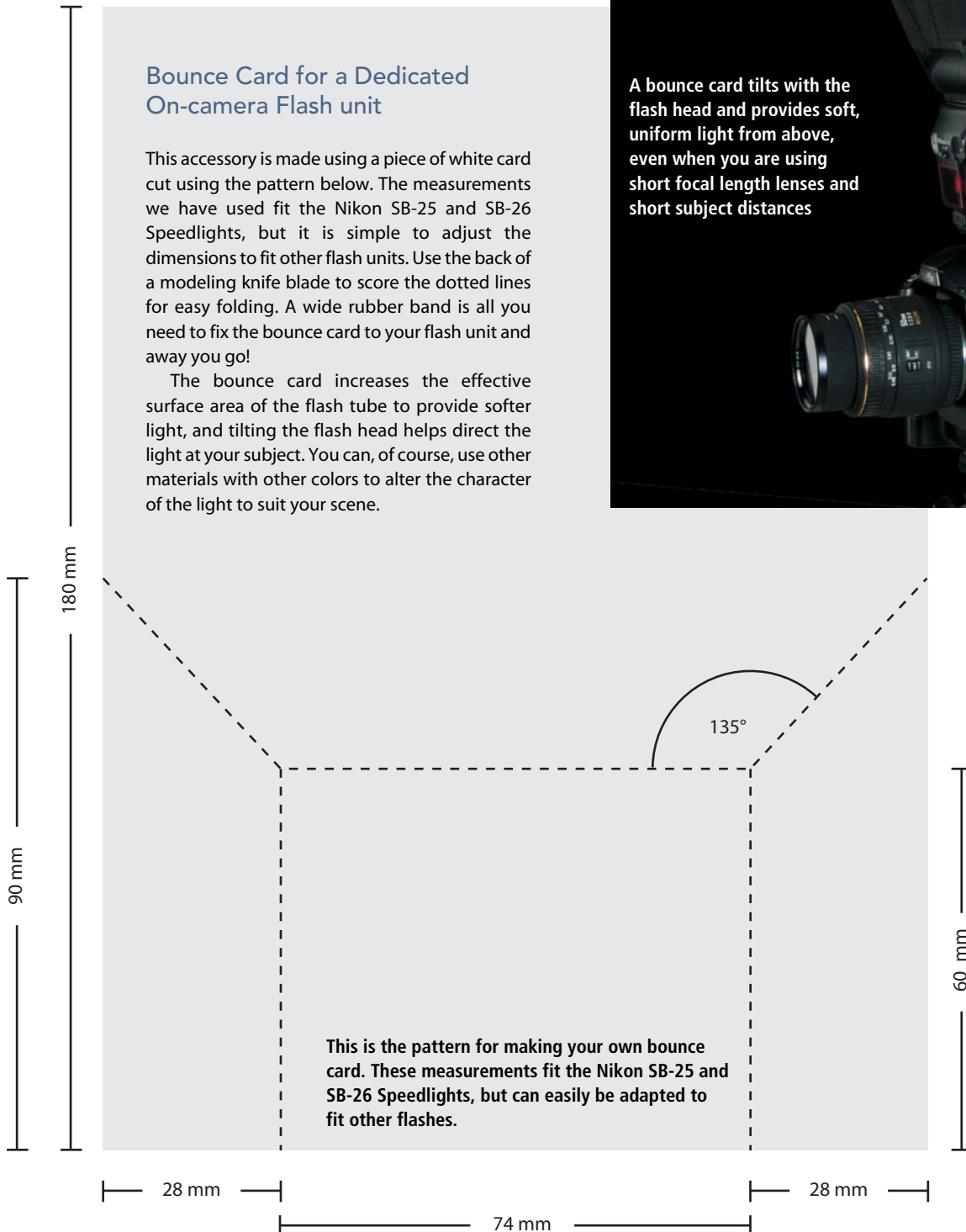
Bounce Card for a Dedicated On-camera Flash unit

This accessory is made using a piece of white card cut using the pattern below. The measurements we have used fit the Nikon SB-25 and SB-26 Speedlights, but it is simple to adjust the dimensions to fit other flash units. Use the back of a modeling knife blade to score the dotted lines for easy folding. A wide rubber band is all you need to fix the bounce card to your flash unit and away you go!

The bounce card increases the effective surface area of the flash tube to provide softer light, and tilting the flash head helps direct the light at your subject. You can, of course, use other materials with other colors to alter the character of the light to suit your scene.



A bounce card tilts with the flash head and provides soft, uniform light from above, even when you are using short focal length lenses and short subject distances





Our multi-flash mount is made from three flash shoes, an aluminum plate, a knurled screw with inner and outer threads and two 1/4-inch screws



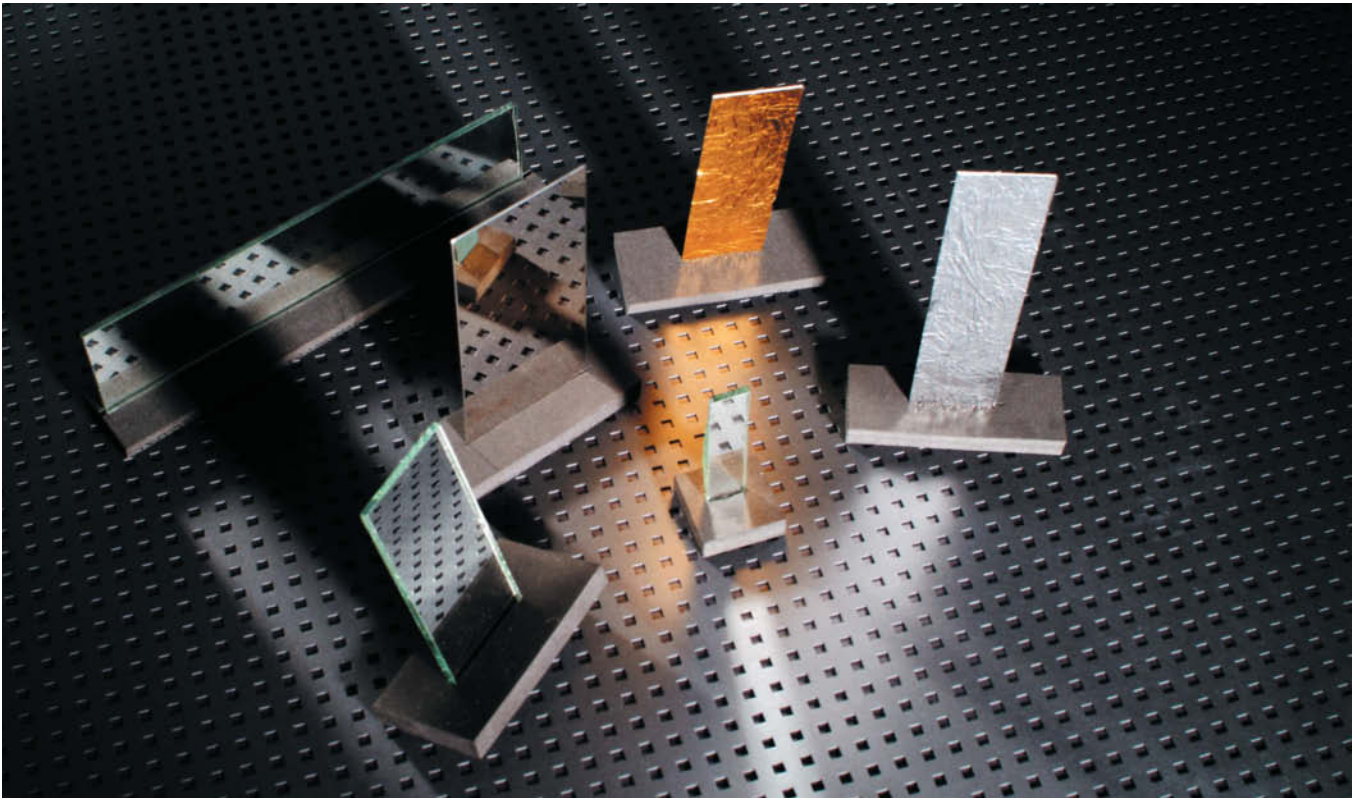
This particular plate is designed to hold up to three flash units



The flash units are fired using a remote cable and a three-way adapter



The multi-flash mount is particularly suitable for use with softboxes or reflective umbrellas



Highlight reflectors can be made from fragments of mirror, polished metal, silver and gold foil or colored card

Multi-flash Mounting Plate

If your flash doesn't have sufficient output for a particular project, you can use a multi-flash mount to increase the flash power of a softbox or reflective umbrella. The mount itself is just as simple to build as our styrofoam reflector holder. All you need is three flash shoes with tripod threads, two 1/4-inch screws and a 1/4-inch knurled knob with an inner tripod thread. The base plate is made from a piece of aluminum (about 5 mm thick) that you can purchase at a hardware store.

Saw the base plate to length (about 20 cm should do) and file the ends down to make them smooth. Drill three 8mm holes and countersink two of them (see the illustration opposite). The distance between the holes will depend on the size of the flash units you are using. Screw the individual components together, mount your flash units, and you're ready to go.

Synchronizing your flashes is easiest if they all have built-in infrared sensors that fire when they detect the light from a main flash. If this option isn't available, you can use a three-way adapter to connect the flash units together and fire them using either a single infrared or radio receiver or a simple flash sync cable. Three-way flash adapters are available from photo stores everywhere.

Mirrors and Highlight Reflectors

Some subjects require extremely targeted lighting that you can produce using mini-reflectors made from mirrors or small pieces of card covered with reflective foil. Suitable silver and gold foil can often be found in the packaging for coffee powder or potato chips.

You can cut mirror fragments to the correct size using a glass cutter, but please be sure to wear gloves and protective goggles while you are doing so to prevent injury from sharp edges or flying shards. It is a good idea to smooth the edges of cut glass using sandpaper.

The simplest way to position small reflectors is using foam rubber feet. Simply cut a slot of the same width as your reflector in a piece of foam rubber and insert your mirror or card reflector. You can then adjust the angle of reflection precisely to fit your scene. You can also use modeling clay as a base, or even a disused gooseneck reading lamp.

You will often need a modeling light to check the effects of your mirrors and highlight reflectors in advance of shooting. A normal clip spot positioned next to your flash performs this task admirably.



Foam rubber stands allow you to position your reflectors exactly the way you want

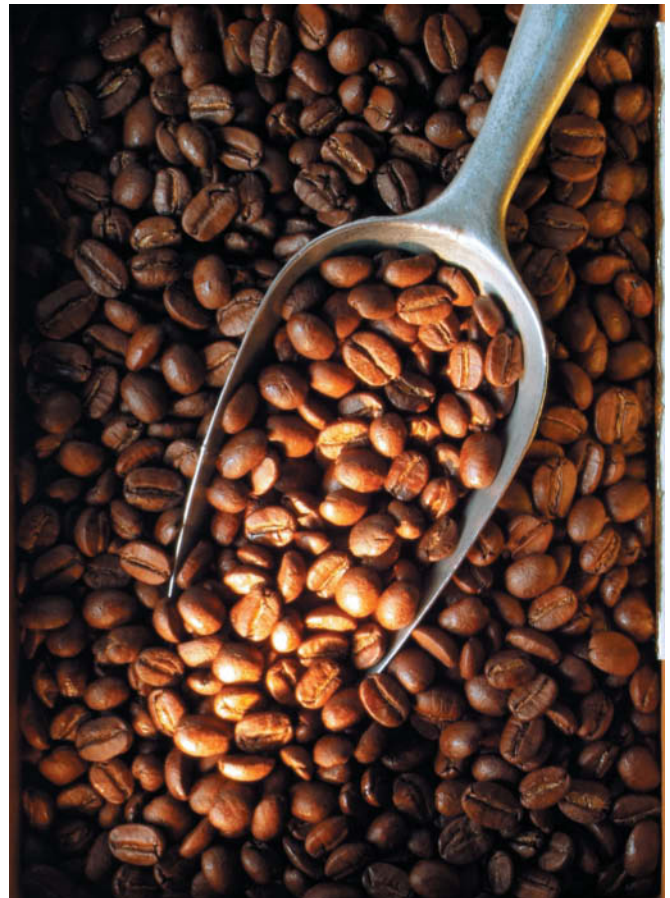


This attractive scene was created using hard lateral light and a collection of small mirrors mounted on foam rubber stands



Light Brush

Pocket flashlights and LEDs make extremely flexible accent lights and can also be used as a "light brush". Traditional, incandescent light bulbs produce a warm, sun-like light that is perfect for creating cozy moods. In contrast, LEDs produce much "cooler" light. In the following section, we'll take a quick excursion into the world of LED lighting. Issue 1 (2010) of *c't Digital Photography* includes a workshop article on using LED flashlights to make a tabletop studio in (see also the link at the end of this article). >>>>



The main light here came from a flash, while the golden beam lighting the coffee beans was produced by a pocket flashlight with an incandescent bulb



There are all sorts of pocket-sized LED lamps available at extremely reasonable prices

The “light brush” technique requires the use of a tripod and extremely long exposures during which the subject is expressively lit using brush-like movements of a lamp. Combining such “brushstrokes” with manually fired flash provides almost endless possibilities for creating unique lighting moods. However, shots like this require careful planning. Set a small aperture and a long shutter speed of several seconds, and set white balance to “flash”. Flash gives a scene a neutrally colored base light while incandescent torchlight provides an additional warm, golden glow, as shown in the photo of the coffee beans on the previous page (shot using a two-second exposure at f22).

To shoot this type of photo, set your flash to rear-curtain sync. This causes the flash to fire just before the end of the exposure, providing the scene with even, basic light. If your camera doesn’t support rear-curtain sync, you can always fire your flash manually during the exposure.

This type of lighting mood can only be produced using a light brush. Typical exposure times for this type of shot are between 10 and 20 seconds, during which the light from a pocket flashlight is used to “paint” over the subject.





The finished light tent in action



Our light tent is made from components available from any kite shop and can be set up and dismantled in seconds

Mobile Reflector/Diffuser for Outdoor Use

Some outdoor shots require the use of a light tent too: for example, to reduce the harsh contrast often caused by bright sunlight. The basic materials for this accessory are ripstop nylon, fiberglass rods and plastic T-connectors, all available from kite shops.

Wrapping adhesive tape around the fiberglass rods while you are sawing them to the right length helps to prevent them from splintering. Make sure you use the thinnest possible rods, so that the finished light tent isn't under too much tension while it is in use. We used 2mm rods in the one illustrated here.

The maximum size for such a light tent is limited only by the amount of available material, and even a large version can be packed down to

a small size once you have removed the lateral frame rods. When you are setting the light tent up, make sure the ends of the rods on one side are firmly planted in the ground before you bend the assembly over to form the final arched shape.

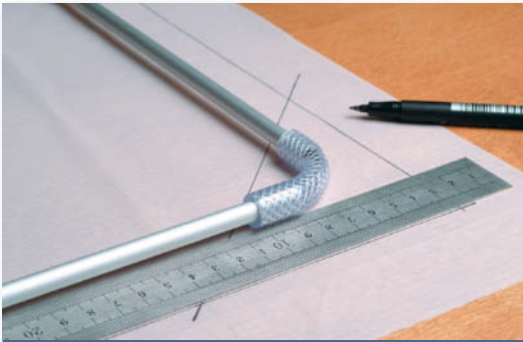
You can also use the light tent as a reflector or diffuser for larger subjects by simply sticking the lower ends of the rods into the ground and leaving the light tent standing up straight. Used with a remote flash, it provides soft, natural lighting.



Remote flash alone leaves some details insufficiently lit



The same flash used with our mobile light tent produces uniform light and a photo with a natural look and feel



Place the finished frame on the fabric and draw around it. Allow about 1 cm extra along the edges for sewing around the aluminum tubes.



Stick the fabric temporarily using adhesive tape and mark the seams



Fix the seams using double-sided adhesive tape before finally sewing them



Sew the edges together using a normal sewing machine and white thread. The double-sided tape prevents the seams from slipping out of position while you are sewing.

Outdoor Reflectors and Diffusers

Reflectors and diffusers for outdoor use need to be light and waterproof. Lengths of aluminum tube can be easily connected using reinforced rubber tubing to form a stable frame. The diameter of the aluminum tubes you use will depend on the size of the frame you want to build. We used 6mm tubes for our 45 × 65cm reflector.

It is best to try out different diameters of tubing while you are in the store to make sure you get a snug fit. Each corner piece needs to be about 8 cm long. Make sure you file down the ends of the aluminum tubes completely so that the tubing can slip over without catching.

We used white ripstop nylon from a kite shop for our reflective surface. Once you have built your frame, lay it down on your chosen fabric – the illustrations on the left show how to measure it and attach it to the frame.

Once you have finished sewing the seams, you can slot the aluminum rods into the resulting pockets and join the corners using your pieces of tubing. If the fabric has any folds or wrinkles, you can adjust the tension in the frame by moving the aluminum rods in or out of the corner pieces. Once you have finished your shoot, it is simple to take the frame apart and stow it in a bag.



Our portable diffuser (or reflector, depending on the material you use) is quick and easy to assemble. You can use fabric leftovers to make a bag for the parts.

Ultra-light Reflector

This special reflector is designed for situations in which every gram counts. Our 60 × 60cm version weighs just 80 g – in other words, less than a bar of chocolate.

The frame is made of 3mm fiberglass spars, which you can easily saw to the right length. The corner connectors are nose connectors sold by kite shops as part of the steering gear for stunt kites. The foil is actually part of a rescue blanket taken from a first-aid kit.

The edge rods are 60cm long and the diagonal rods measure 82 cm. These are necessary to keep the entire structure stable and also make it easier to hold and position the assembled reflector. Once you have put the frame together, you need to cut the foil to size, leaving a 3cm overlap at each edge. Crumpling the foil before fixing it to the frame enhances the diffusion effect it creates. Although the cross spars are visible from one side, you can still use both sides of the reflector to produce different effects. The silver side will produce cooler, more “technical” light, while the gold side produces a warmer “sunlit” tone that is particularly suitable for portrait shots. (jr)



The gold side of our ultra-light reflector can even imitate sunlight under a cloudy sky (shown on the right)



The finished two-color ultra-light reflector. The visible framework on the reverse has no effect on the results.



Constructing our ultra-light reflector. The frame also acts as the template for cutting the rescue blanket to size.



Fold over the edges and fix them using transparent adhesive tape. No further gluing or fixing is required.

c't

Get in the Picture!



„Perhaps the reason the articles and tests are so indepth and detailed is this magazine is a quarterly issue. I think because they are not rushing to meet weekly or monthly deadlines, the editorial staff and contributors can take some pride in producing a magazine unlike any other available in quality and content, in todays over populated photographic media circus.

To say I was impacted by this magazine, is a tremendous understatement. If you never buy another photo magazine in your life, **SUBSCRIBE** to this one ... you will not regret it.“ – **Clive Watson**

Source: www.clivewatsonphotography.com

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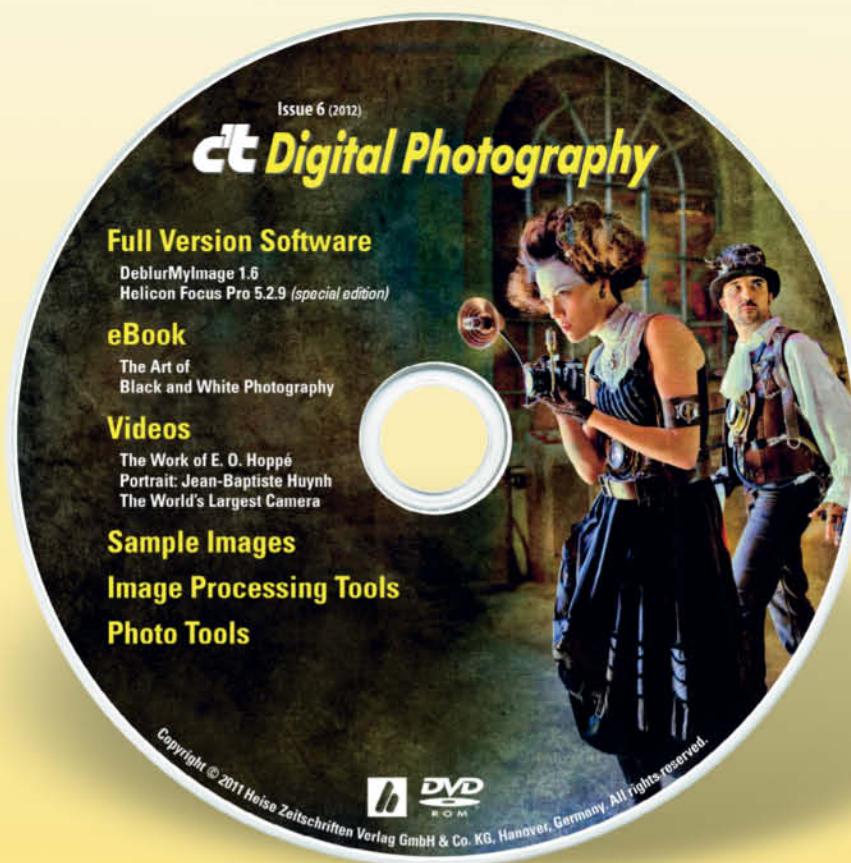
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The Art of Black and White
Photography

Videos

The Work of E. O. Hoppé
Portrait: Jean-Baptiste Huynh
The World's Largest Camera

Sample Images

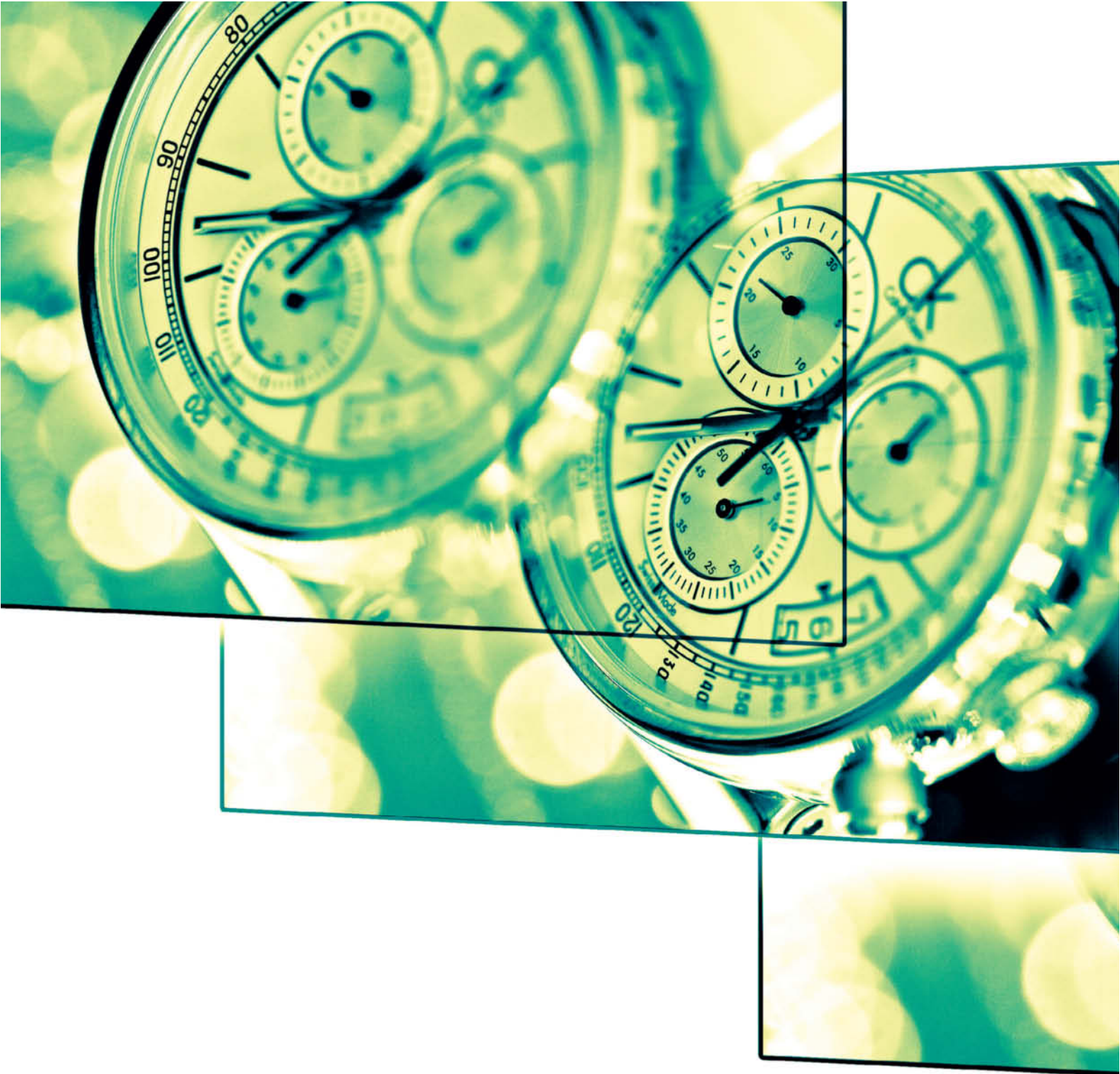
Black-and-white Sample Images
Camera Test Sample Images
Focus Stacking Sample Images

Photo Tools

AmoK Exif Sorter 2.56
AutoStitch 2.2
CombineZP 1.0
digiKam 2.2.0
Enblend/Enfuse 4.0
EnfuseGUI 2.1
ExifTool 8.66
HD View SL 1.2
Hugin
Image Composite Editor 1.4.4
MacPorts
Panorama Perfect Lite 1.6.2
PhotoRec 6.12
Picolay 2011-10-06
RawTherapee
Sofortbild 1.2.2
Xee 2.2

Image Processing Tools

FDRTools Basic 2.4.0
GIMP
GIMP Portable 2.6.11
GREYC's Magic Image Converter
(G'MIC)
Inkscape
Inkscape Portable 0.48.2
PSPI 1.0.7
ShiftN 3.6
SmartCurve 2.2
StylePix 1.8.6.0
StylePix Portable 1.8.6.0



Bjoern K. Langlotz

Increasing depth of field with **Focus Stacking**

In macro situations, even the smallest apertures often provide insufficient depth of field to portray a subject adequately. The solution to this problem is to shoot a sequence of images at varying focal distances and use a computer to merge the results into a single, extended depth-of-field image.



Macro photographers often test the limits of physics. The nearer you get to your subject, the shallower the available depth of field, and selecting ever smaller apertures either begins to produce diffraction blur or simply spoils the blurred background that gives so many close-up photos their character in the first place.

It is relatively simple to counteract these problems for stationary subjects. All you have to do is shoot a sequence of images in which you move the focal point successively further into the distance from shot to shot. You can then use one of a number of specialist software packages to merge your source images into a single image with a completely sharp subject and a pleasantly blurred background. This technique is called “focus stacking”.

This article gives you the necessary background knowledge and technical know-how to shoot your own source images for focus stacking, and introduces the

software and techniques you need to produce finished images. We also go into detail on how to use *Photoshop* to stack tricky sets of source images manually.

Depth of Field

The closer a photographic subject, the shallower the available depth of field – an effect that is particularly noticeable in close-up and macro situations. Macro photographic optics are subject to slightly different rules than photography in general. At an aperture of f8 and a reproduction ratio of 1:1, the extent of the depth of field available for a full-frame camera is just 0.89mm, and the effects of using different focal length lenses at this kind of range are negligible. This effect is often referred to as macro depth of field compression.

A further peculiarity of macro subject distances is the way that depth of field extends uniformly in front of and beyond the

plane of focus – an effect that is observable for reproduction ratios of up to 1:10. Beyond that, variations in focal length begin to have a direct effect on the depth of field characteristics of an image.

What all this means is that you will generally have to use a small aperture to produce sharp macro images. If the smallest available aperture still doesn't suffice, then focus stacking is the solution.

Shooting Source Images

It is extremely important that the subject doesn't move while you are shooting focus stacking sequences, and it is also essential to ensure that the camera only moves precisely forward or backward along its optical axis, especially if parts of the background are to be visible in the finished image. If you don't adhere to these rules, you will end up producing merged images with double edges and other unwanted artifacts. A tripod is essential.

The only way to capture this kind of image, with the subject sharp from head to wingtip in front of a homogenous, out-of-focus background, is by using focus stacking techniques



Try to keep the increments in focal distance constant between shots and make sure that the fields of focus between shots overlap slightly. It is also beneficial to the overall process if all of your source images are shot using the same exposure and white balance settings, although some stacking software is capable of compensating for slight differences in brightness.

Focusing with the lens

The simplest way to change the position of the focal plane is to rotate the focus ring on the lens. In this case, the only accessory you need is a tripod. The first step involves focusing on what you think is the edge of the zone that you wish to photograph in focus. Pressing the depth of field preview button helps you to judge the depth of focus in your shot using the viewfinder, or you can take a test shot and zoom into it on the camera monitor to see if the results look right. If your camera has live view functionality, you can also use a monitor magnifier to help you judge depth of field visually. This is especially useful if you are shooting at a high reproduction ratio.

Once you have set everything up to your satisfaction and have decided how much you want to vary focus between each image in your stack, you can vary focus simply by rotating the focus ring slightly between shots

This approach is simple, but involves some risks. It is all too easy to inadvertently alter your framing when you touch or adjust the lens. Additionally, moving the focus ring in identical increments doesn't necessarily shift the plane of focus in identically-sized steps – in fact, it moves exponentially further away the greater the distance between the subject and the focal plane. This means that you actually have to shift the focus ring by increasingly small amounts to shift the position of the plane of focus consistently – a task that is virtually impossible to perform accurately.

Focusing using a focusing rail

A different way to shift the plane of focus is to move the entire camera/lens assembly back and forth. This is achieved using a piece of equipment called a macro focusing rail mounted between the camera and the tripod head. You can then adjust the plane of focus in identical increments at a fixed reproduction ratio. Because you don't have to touch or adjust the lens, the risk of accidentally adjusting your framing disappears. If you use a focusing rail, make sure that you frame your image for the



A focusing rail like this one is not essential, but is a very useful piece of gear to have when you are shooting macro focus stacking source images. A stable tripod is indispensable no matter what other equipment you use.

subject at its furthest focus distance before you start to shoot a sequence.

A focusing rail is a reliable method, but a computer-controlled focusing rail, such as the Cognisys StackShot, is even more accurate as it automatically moves the camera between shots and releases the shutter only when it is precisely in position. The major disadvantage of the StackShot is its price, which starts at around US\$500.

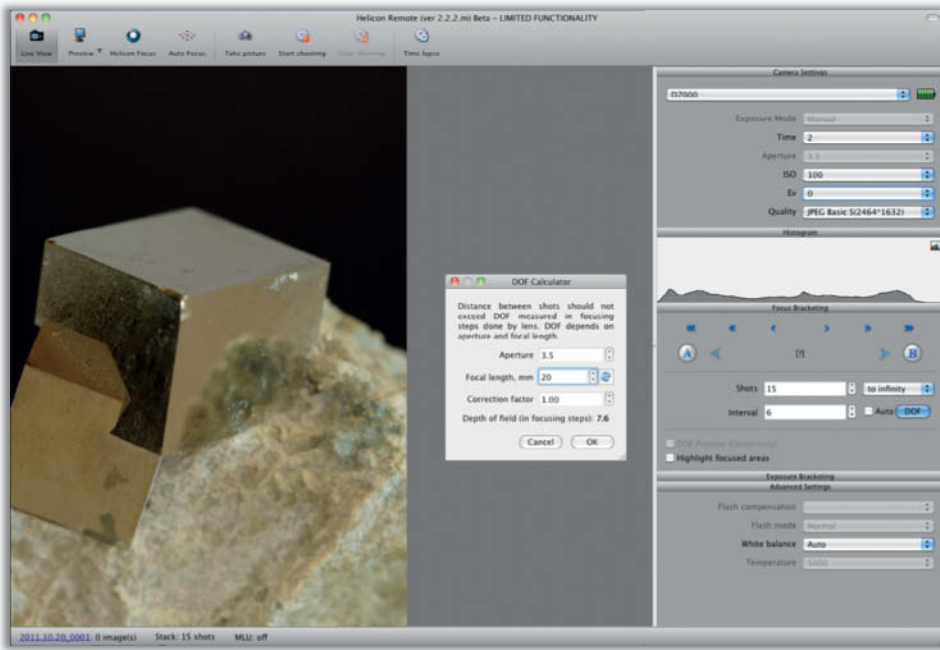
Focusing by Remote Control

Many contemporary cameras can be remotely controlled using a computer. The technology involved is often referred to as "tethered capture" and allows you not only to view the live view monitor image remotely on a computer screen, but also to control various camera functions, including the autofocus motor.



The computer-controlled StackShot macro focusing rail from Cognisys

Photos: Cognisys



The right-hand panel of the *Helicon Remote* window gives you an overview of the camera parameters controlled by the program. The built-in depth-of-field (DOF) calculator is shown in the center.

The *Helicon Remote* software package makes full use of this feature. Once you have attached your camera to your computer and started the program, *Helicon Remote* automatically activates the camera's live view mode. You can now set your exposure parameters either directly on the camera or remotely using the software. The combination

of the histogram and the preview window makes it easier to judge exposure correctly. To ensure that all photos in a sequence are shot using exactly the same exposure values, it is best to use manual metering mode. Use the Advanced Settings panel to set flash control to manual and pre-select a white balance value if you are not shooting in RAW and don't

plan to adjust WB settings and convert your source images to TIFF before handing them over to your focus stacking software. You also have to define the nearest and furthest focus distances using the arrow buttons (and confirm them by clicking the **A** and **B** buttons) before you can start to shoot a sequence. The software then automatically calculates the required number of shots. If you don't trust the program to set up the sequence correctly, there is a built-in DOF calculator for checking the settings it makes. Once you are satisfied that the settings are correct, click the Start Shooting button to get your sequence underway. The software keeps you informed of progress during shooting.

Lighting

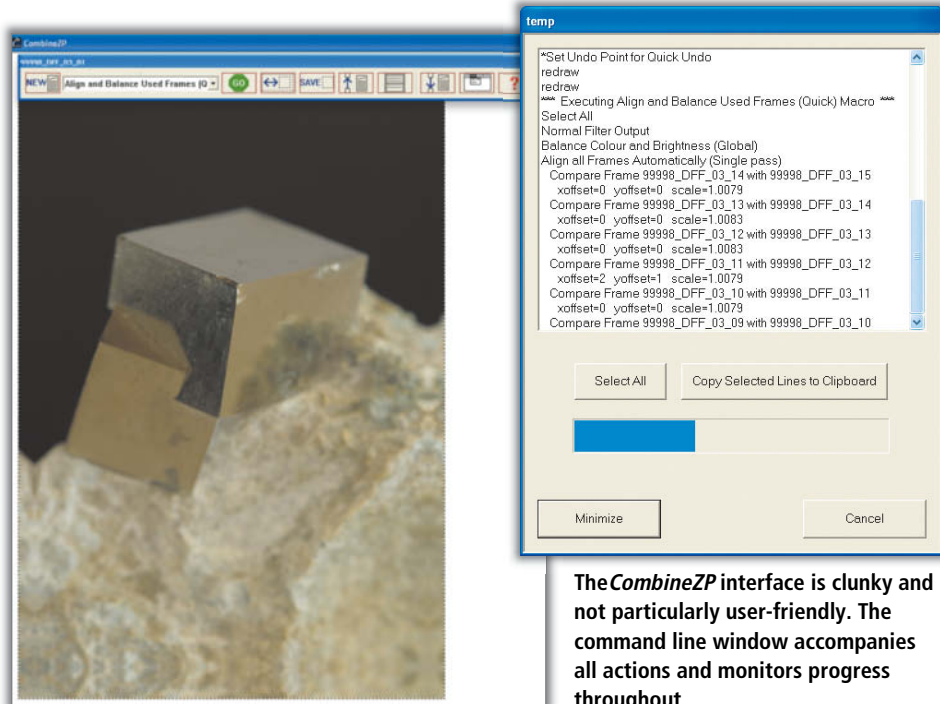
In contrast to conventional macro situations (see our Macro Photography article in Issue 4 of *c't Digital Photography*), there are no hard and fast rules for lighting a focus stacking scene, and you can use ambient light, flash or any other convenient light source. If you are using a focusing rail and flash, mount your flash independently from the camera so that it doesn't move and change the mood of the lighting during the sequence. If you are using reflectors to brighten your scene, these need to be mounted separately too. Needless to say, using your camera's built-in flash unit is taboo when you are shooting stacking sequences.

Merging Your Source Images

You can merge your source images either automatically using specialized programs such as *Helicon Focus*, *CombineZP* or *Zerene Stacker*, or stack them manually using a layers-capable image processing program like *Photoshop*. In addition to these GUI-based programs there are many command line programs and other highly specialized applications available (especially in the field of microscopy) that do a similar job. *Photoshop*, too, has included automatic stacking functionality for several releases now. All of the programs mentioned work on the same basic principles, and the only real differences are to be found in the ease of use and the range of options available.

Both approaches have advantages and disadvantages. In most cases, automatic stacking works very well, but a manual approach can be necessary if your source images are too varied in quality for the software to merge them automatically.

The following sections describe how to go about focus stacking using the programs



The *CombineZP* interface is clunky and not particularly user-friendly. The command line window accompanies all actions and monitors progress throughout.

mentioned above and describe the strengths and weaknesses of the results they produce. This issue's free DVD includes our complete stack of crystal source images for you to experiment with, as well as the stacking results we produced using *CombineZP*, *Helicon Focus* and *Zerene Stacker* for you to look at and compare.

CombineZP

Windows-based *CombineZ* has been around for several years and is widely used. The current version, *CombineZP*, is the only freeware in our test group. It can be run in Simple and Menu modes but both are somewhat clunky and not very intuitive. The Help pages open automatically with the program, but don't help very much either. The interface is easiest to operate in Simple mode.

The first step is to import your source images by clicking the New button. A window then opens showing command line instructions that follow the progress of the import process. *CombineZP* supports JPEG, 8-bit TIFF, BMP and PNG formats.

The Align and Balance used Frames command in the toolbar's drop-down menu aligns the source images and makes any necessary adjustments to their colors. Once again, the command line window appears and reports progress during the operation.

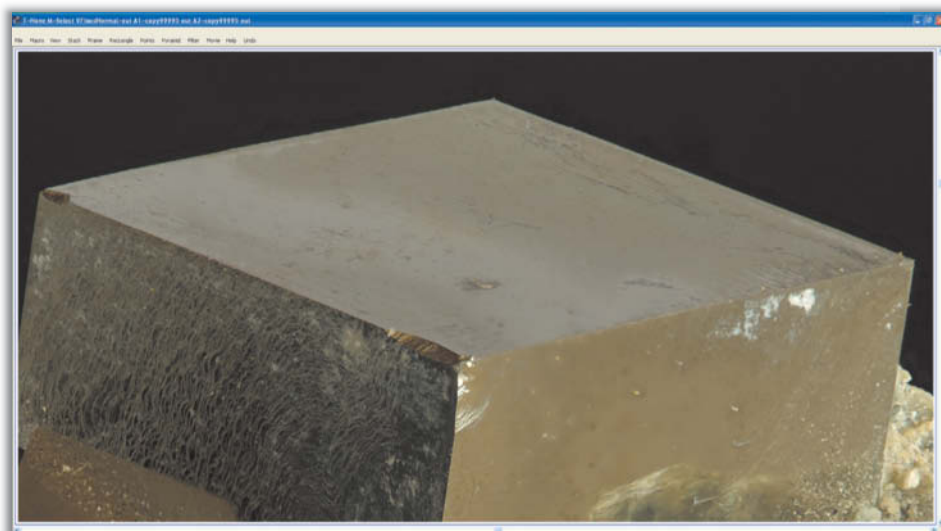
Once the source images have been prepared, you can apply the Do Stack command or one of the other stacking variations found in the drop-down menu. The results we managed to produce using the program's automatic modes were acceptable, but not as good as those produced by *Helicon Focus* or *Zerene Stacker*. However, if you are prepared to put in some work experimenting with the manual settings, you can achieve much better image quality.

The package now includes the Retouching tool, which is located in the Stack menu. The tool is not particularly well documented, but has its own dialog that displays the various settings you can make for the retouching brush. These include copying and cloning pixels from one source image to another.

Helicon Focus

Helicon Focus is one of the best-known and most widely used focus stacking programs on

You can arrange the order of your source images manually in the *Helicon Focus* Source Images pane. The settings found in the Focus Parameters pane are used to fine-tune the rendering process.



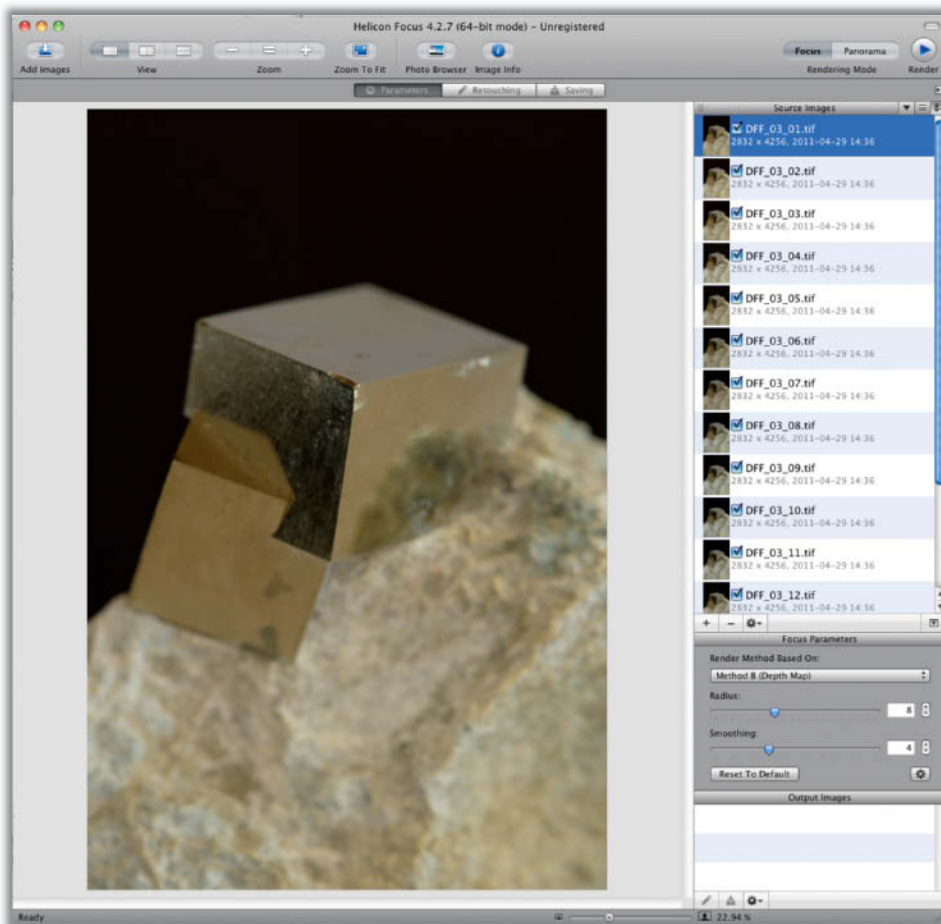
Even the best results produced by *Combine ZP's* automatic stacking functionality are not as good as those produced by the competition. Here, it produced obvious artifacts on the crystal's surface and the results were simply not sufficiently detailed.

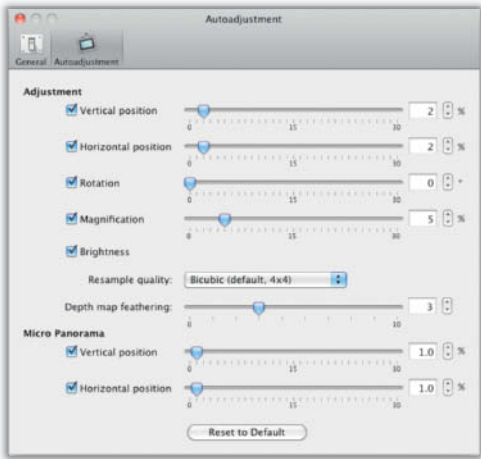
the market, and is available in 32 and 64-bit versions for Windows and Mac.

Click the + button in the program's right-hand Source Images pane to select and import your stack. Make sure that your images

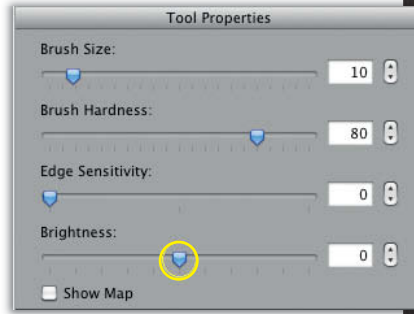
are loaded in the order in which they were focused – otherwise the program might have trouble merging them.

If necessary, you can change the order of the imported images using drag-and-drop.

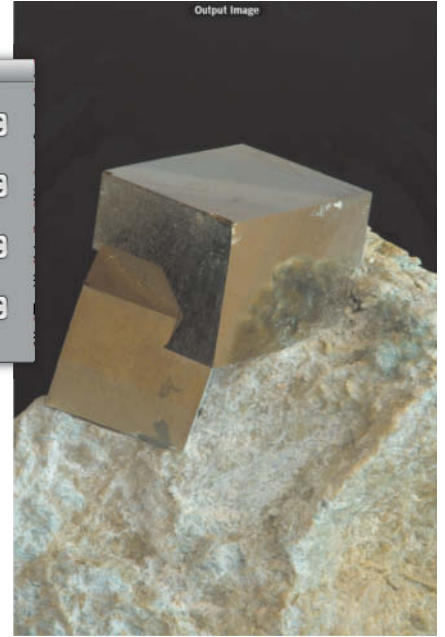




The *Helicon Focus* Autoadjustment preferences include various advanced parameters, including fine-tuning for the relative positions of the source images



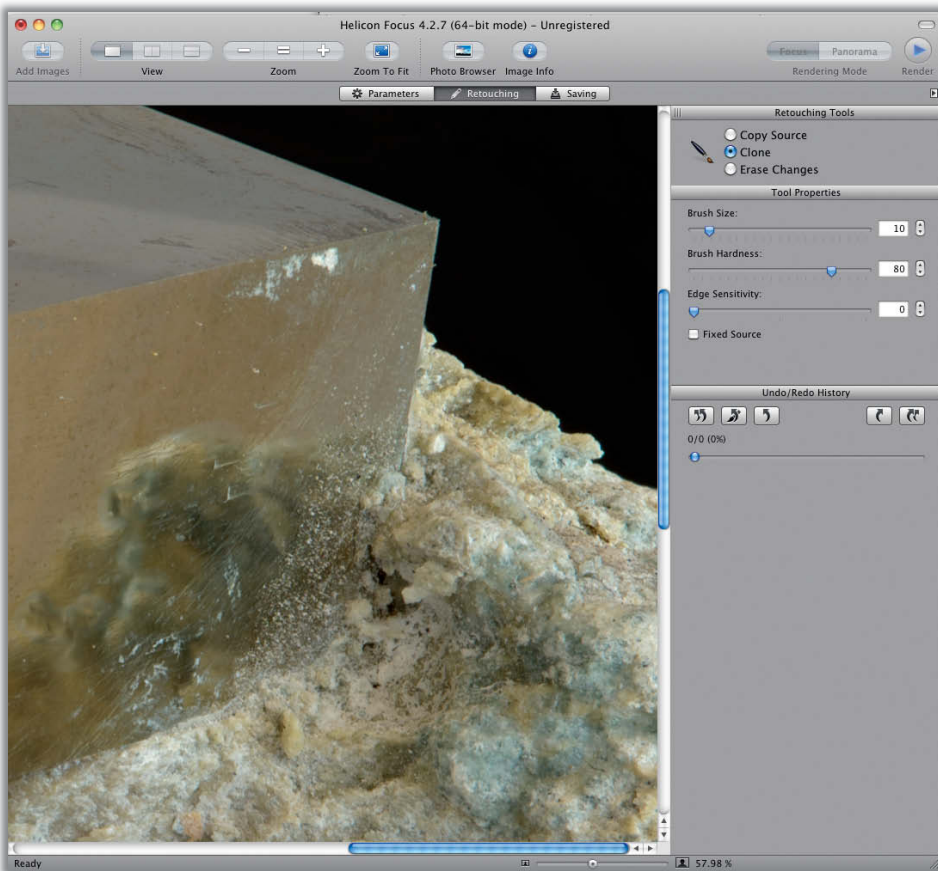
The Brightness slider is used in Retouching mode to selectively correct the brightness of individual image areas



You can then click the Render button to merge your stack. In many cases, the program's default settings produce excellent results, but you might have to make some manual adjustments for source images that are not

entirely homogenous. The Focus Parameters panel offers two different rendering algorithms. Method A weights each pixel according to its microcontrast (basic sharpness), whereas Method B selects the

source image that contains the sharpest pixel and uses this information to create an overall "depth map". This method requires the source images to be shot in consecutive order from front to back or vice versa. Method B generally produces very few halo artifacts around important image details, and is the best option in most situations. However, it still pays to try out both methods and see which produces better results for your particular stack.



The Clone tool is great for performing quick corrections to selected image areas. We used it to adjust a small area to the right of the crystal that couldn't be precisely identified in any of the source images and therefore appeared unsharp in the rendered image.

The panel also includes sliders for adjusting the Radius and Smoothing parameters. Radius is the most important rendering setting, and determines the size of the area surrounding each pixel that is assumed by the program to be sharp. Images that contain multiple fine details (such as hair or fur) generally require low Radius values between 2 and 4.

The Smoothing slider determines how the focused parts of your images are combined. Low values generally produce sharper results, but tend to produce more artifacts in transitions between areas of differing sharpness. We found that setting Smoothing to values of about half the Radius value usually produced the kind of results we were looking for.

The Autoadjustment preferences panel includes sliders for fine-tuning the relative positions and rotation of the individual source images during rendering. The Depth Map Feathering setting defines the amount of softening that is applied while merging images. We recommend using a low value that is greater than zero, which keeps the transitions between images smooth without producing too many obvious artifacts. The default value of 3 is a good choice for most standard situations.

Retouching with Helicon Focus

Every *Helicon Focus* rendering process produces a range of different results that you can select in the Output Images panel and view and compare in the preview window. It is very unusual for an automatically generated image not to require any correction before saving, and the program has built-in Clone and Copy Source tools to help smooth out any inconsistencies. The Clone tool works in a similar way to the *Photoshop* Clone Stamp and is great for repairing image areas in which none of the source images is sharp. The Copy Source tool is used to copy source pixels from source images into the rendered image.

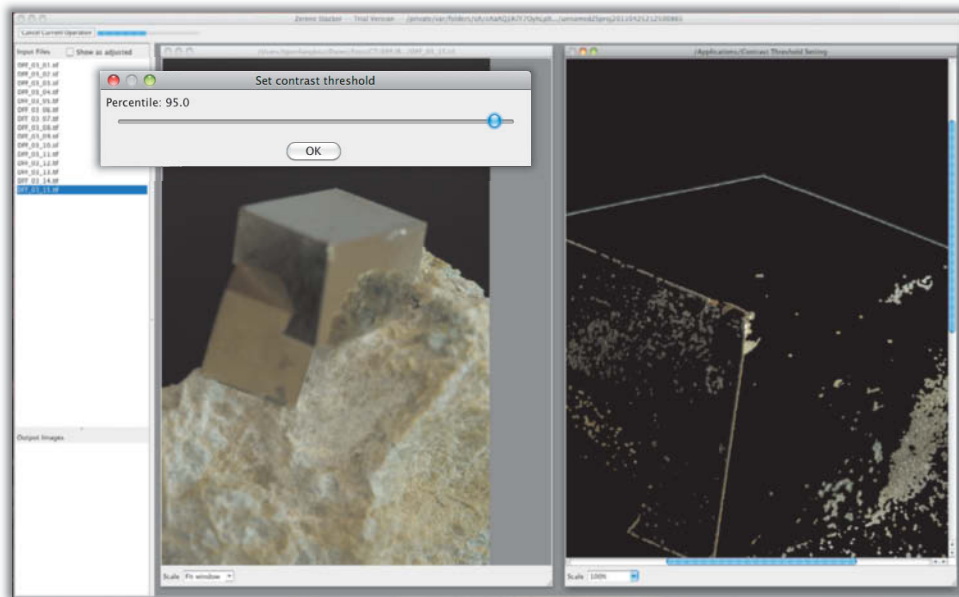
The lighting changed slightly while we were shooting our sample sequence, and the effects of this change are clearly visible on the crystal's surface in the preview image. The software couldn't quite compensate for the differences in brightness, in spite of having used the Weighted Average rendering method. This is where the Copy Source tool comes into play, as it enabled us to insert appropriately bright pixels into the relevant source images. The absolute brightness of the added pixels can be fine-tuned during the process using the Brightness slider in the Tool Properties panel.

Zerene Stacker

Zerene Stacker is not as well known as *Helicon Focus*, but is available in 32 and 64-bit versions for Windows, Mac and Linux. The interface is not quite as user-friendly as the one found in *Helicon Focus* and the program is generally slightly slower. It is capable of processing JPEGs and 8-bit or 16-bit TIFF source images.

Zerene Stacker offers two basic stacking modes called PMax and DMap. The former is a pyramid-based method that locates even the finest details and is thus eminently suitable for use with subjects that contain fine textures (such as hair) or for merging images that contain overlaps. The downside of this method is that it produces more noise and contrast in the rendered image and can cause unwanted color shifts. The program does not offer any additional fine-tuning options like those found in *Helicon Focus* and sets all internal parameters automatically on the basis of the details it finds in the selected source images.

The DMap method is based on a depth map and is best suited to merging soft transitions and in situations in which you want to preserve the original contrast and colors in your images. This method is not quite as good at detecting fine details as its counterpart. DMap initially applies standard parameters during stacking and offers a single slider



***Zerene Stacker's* DMap rendering method includes a Threshold slider for adjusting the merging parameters. A zero percentile setting produces halos at high-contrast edges, while a setting of 95.0 masks even correctly reproduced image areas in black, as shown here. Medium values of around 60 produce the best results.**

called *Set contrast threshold* for fine-tuning the results.

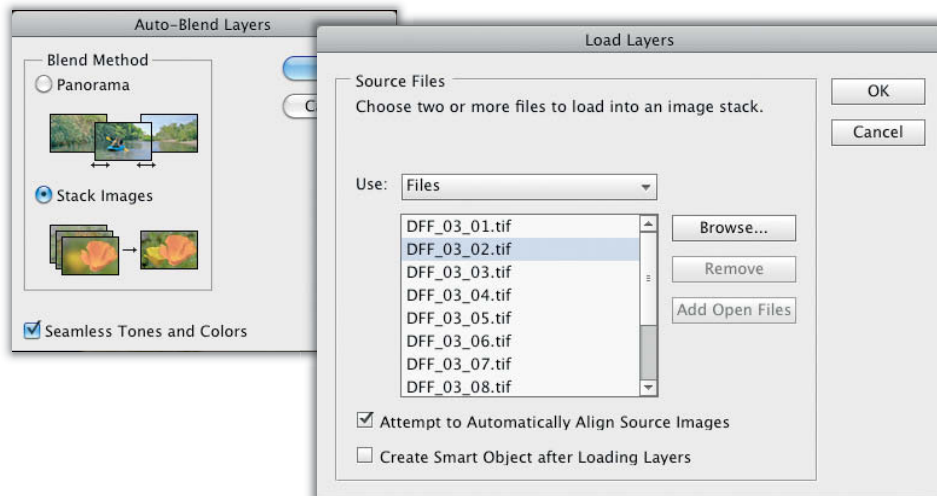
A zero percentile threshold value leads to halo effects at high-contrast edges, while a value of 95 masks even correctly reproduced areas in black. A medium value of 60 produced much better results for our sample stack, and the software applies the selected value only once you have confirmed it by clicking OK.

Zerene Stacker has its own powerful copy and clone tools for inserting pixels from

source images into your rendered results. It also allows you to copy pixels from different versions of a rendered image into the final output version, which means you can combine pixels produced by both rendering methods to give you the best of both worlds.

Photoshop CS5

It makes sense to save your source images to a separate folder and to name them sequentially so that the image with the closest



The *Photoshop* Load Files into Stack script loads and aligns selected images into a new image with a matching number of layers. You can then use the Auto-Blend Layers command to create a focus-stacked image.



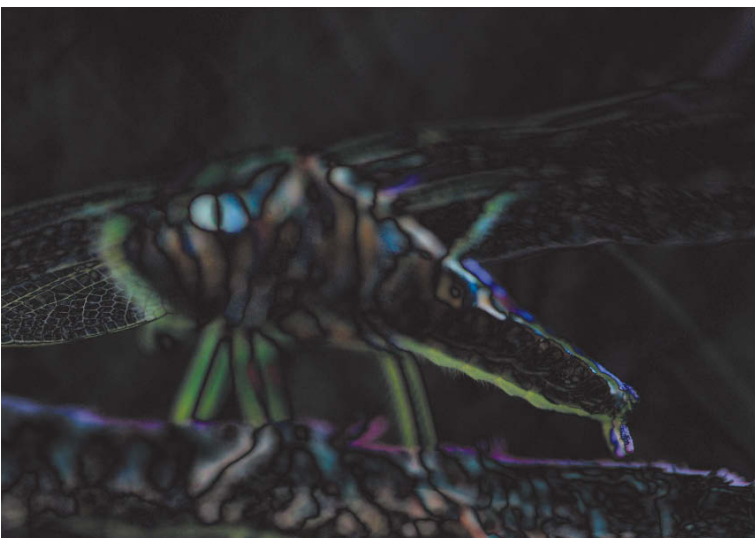
This impressive image of a lizard shows fantastic depth of field in the foreground and a pleasantly blurred background. It was merged from 78 separate source images, some of which are reproduced opposite.

focus distance has the lowest number. Now open the File > Scripts > Load Files into Stack dialog and select the images you wish to stack. Make sure you activate the *Attempt to Automatically Align Source Images* option. This is an effective tool and often saves a lot of manual tweaking. A click on OK then creates a

new file that contains a separate layer for each source image.

The aim of the exercise is to merge the sharp parts of each source image into a single, completely sharp image. The quickest way to do this in *Photoshop* is to select the layers you wish to merge, open the Edit > Auto-Blend

Layers command, activate the *Stack Images* and *Seamless Tones and Colors* options and click OK. *Photoshop* then automatically creates a new image with extended depth of field. This is quick and easy, but the results are not usually as clean as those produced by the specialist programs mentioned earlier.



The non-aligned areas in badly aligned images show up colored if you switch the layer you are viewing to Difference blend mode



The sharpest areas can be roughly selected using the Lasso tool and fine-tuned later using a layer mask

Manual stacking for tricky subjects

If your subject moves while you are shooting a sequence – as often happens with natural subjects like the fly on a branch shown on the left – the best thing to do is simply wait until things have calmed down before you carry on shooting. However, the following source images rarely overlap perfectly with the ones you shot earlier. *Helicon Focus* can compensate for slight shifts between shots, but this isn't always sufficiently accurate. In such cases, the best thing to do is to merge your images manually using *Photoshop*.

To check how well aligned the individual layers are, hide all but two layers and switch the blend mode for the upper one to Difference. The lower of the two layers serves as a reference and the upper layer will now appear black except for the areas in which the two images don't precisely coincide.

Now repeat this step for each successive layer using the same reference image. Where obvious shifts occur, select the layer concerned using Ctrl+A and move, scale, distort or skew it using the Edit > Free Transform tool until the layer appears as black as possible. Confirm your changes with the Return key. It is often simply impossible to perfectly superimpose source images of moving subjects, so try to concentrate your efforts on merging the sharpest details rather than the whole frame.

Selecting the sharpest details

The next step involves selecting the sharpest areas in each source image layer. Make an initial, rough selection using the Lasso tool with a feather setting of about 20 pixels and create a new layer mask for the active selection. You can then use the Brush tool to fine-tune the masking in the blurred areas of the image.

Repeat these steps for every layer except the one with the longest focal distance, which

serves as the background of the finished stacked image. Once you are happy with your results, you can flatten your image to a single layer.

This method gives you the most control over the individual steps in the stacking process, which is often vital to producing good results if your source images were photographed under less than perfect conditions.

Conclusions

Focus stacking is a powerful tool for working around the limitations of photographic depth of field and is a great way to produce images of sharp subjects in front of pleasantly blurred backgrounds. It is perfectly possible to shoot source material for a stack without using any special accessories at all, although, if you have access to one, a focusing rail is a boon in most situations.

Of all the stacking software we tested, *Zerene Stacker* provided the best combination of great results and user-friendliness. It isn't the fastest program we tested, but the results require less tweaking, which saves time in the long run. *Helicon Focus* is by far the fastest and most intuitive to use among our test candidates, and also offers the most individual settings and processing options. With a little practice and some retouching, *Helicon Focus* produces results that are directly comparable with those we achieved using *Zerene Stacker*. *CombineZP* is free but works only on Windows systems. It is not very intuitive to use and produces only average results, making it less interesting to experiment with. *Photoshop CS5* produces only average quality stacks automatically and offers its users no way to intervene manually in the process.

If your source images contain framing or color errors that automatic focus stacking programs cannot handle, *Photoshop* (or any other layers-capable program) can be used to manually tweak and stack effective enhanced depth-of-field images. (pen) **ct**



Focus Stacking Software

Program	Combine ZP 1.0	Helicon Focus Pro 5.1	Zerene Stacker 1.02	Photoshop CS5
Manufacturer	Alan Hadley	HeliconSoft	Zerene Systems	Adobe Systems
URL	http://hadleyweb.pwp.blueyonder.co.uk/	www.heliconsoft.com	www.zerenesystems.com	www.adobe.com
Platforms	Windows	Windows, Mac OS	Windows, Mac OS, Linux	Windows, Mac OS
Benchmark ¹	4:56 min.	1:16 min.	2:46 min.	1:43 min.
Render quality	○	⊕	⊕⊕	○
Retouching tools	⊖ ²	⊕⊕	⊕ ³	⊕⊕
Handling	⊖⊖	⊕⊕	⊕	○
Price (approx. US\$)	free	200 (Lite version 30)	90 (Student version 40)	670 (Student version 200)
¹ Measured rendering a stack with fifteen 12-megapixel images (D3s) using a 2.8 GHz Core2Duo machine with 4 GB RAM running Mac OS X (Windows XP for CombineZP)				
² Ranking due to complex handling and poor results				
³ Ranking due to limited toolset				
⊕⊕ excellent ⊕ good ○ satisfactory ⊖ poor ⊖⊖ inadequate				



The Time Trav



Travelers' Diary



How the **diary** came to be ...

The shoot for this issue's cover image has become a multimedia project with a life of its own. The original concept told the story of two Victorian time travelers, and the "diary" in which our heroes recorded their incredible adventures in words and pictures is the project's first major by-product. This article lets you in on some of the secrets surrounding its creation and explains some of the photographic and image processing work involved.

The Location

The location had to fulfill all sorts of criteria if it were to be a convincing stage for a story about time travel. Our protagonists had to find themselves in the midst of scenery that hinted at the past as well as the future. It was obviously going to be impossible to create this kind of nostalgic atmosphere in the studio, no matter how much work we put in, so we were on the lookout for historical buildings right from the start. We took test shots at a number of locations before aging them artificially on a computer to find out which would be best for our cover shoot.

The distance to the location and the challenges involved in getting permission to shoot were important factors in our considerations, and we ended up using the Landschaftspark Nord in Duisburg (a leisure park built around industrial ruins) and the Zollverein coal mine in Essen. These industrial monuments, with their enormous old machines, seemed to us to belong to some kind of parallel universe and made the perfect backdrop for our visual ideas.

Design and Styling

Our search for the right look for our planned images led us inevitably to the steam punk scene. This fantastic mix of retro and science fiction has given rise to all sorts of sub-genres and sub-sub-genres including music, clothing, role-playing games and art. The basic physical attributes of steam punk objects are a Victorian look combined with contemporary (or future) functionality.

We were very lucky to meet Alexander Schlesier, who is an extremely skilled and creative designer and set builder, and an experienced creator of steam punk ephemera. He agreed to kit out our time travelers with their exclusive, bespoke equipment – the portable time machine, the jewelry and many of the other accessories are products of Alexander's workshop. Our stylist Susanne Kutscher gave the costumes their wonderfully authentic look. Our long-time friend, makeup artist Birgt Kranzl, created the Elsa Lanchesteresque look with big, silver-streaked hair, and got our male time traveler looking like he had just leapt out of the pages of a Jules Verne novel. Photographer and project initiator Thomas Saur took the photos using his



The photographer's sketches visualized some of the initial concepts for the look of the shoot



Alexander Schlesier helping to get our time travelers' costumes just right

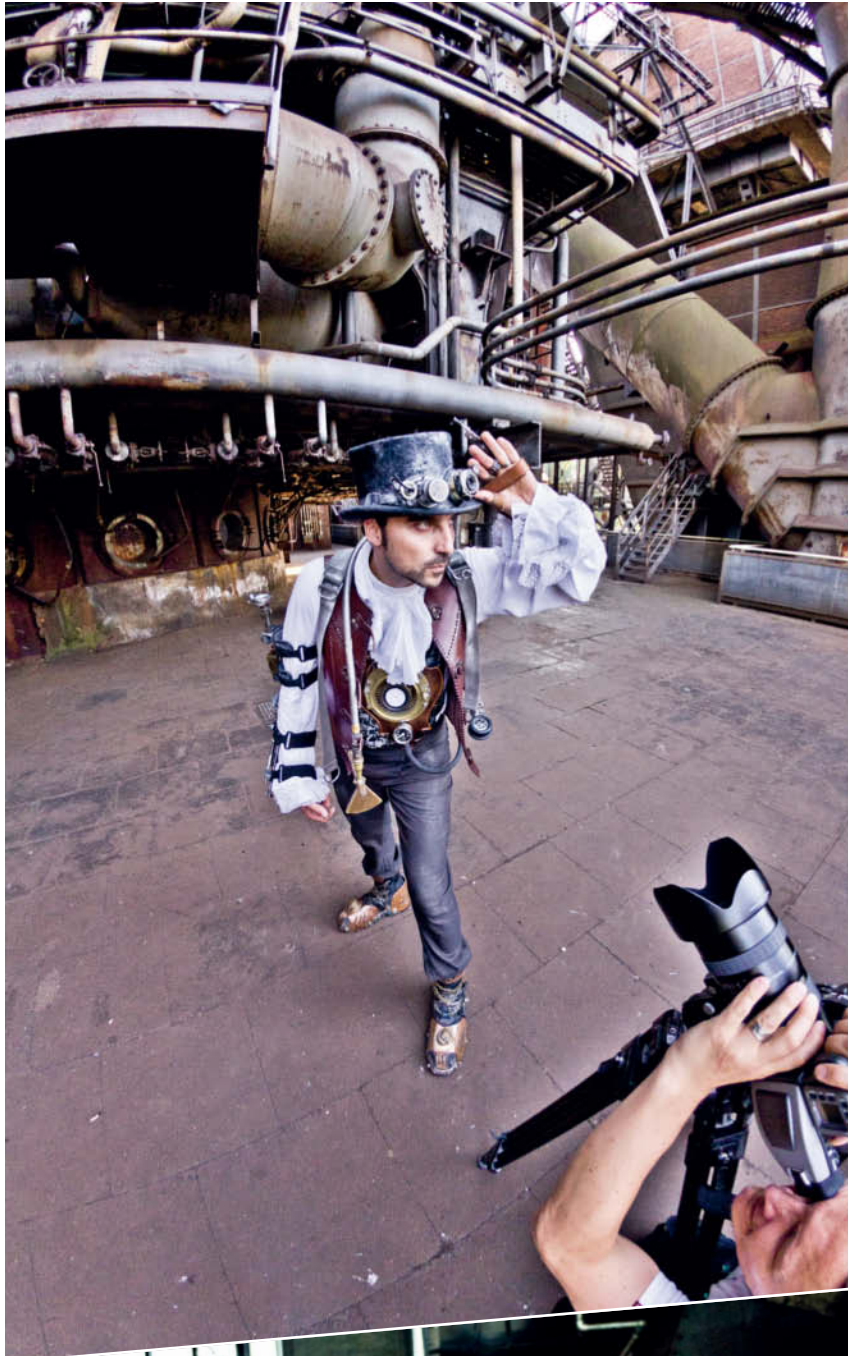


beloved Hasselblad and presided over the intricate post-processing of the images. He was ably assisted by co-photographer Stefan Arand, whose images also grace the pages of many previous editions of *c't Digital Photography*.

The Shoot

The eight-person team bowled up on location in the early morning with two vanloads of equipment, much of which was made up of the time travelers' mysterious gear. The magical surroundings, with their heavy equipment and huge dials, levers, valves and cog wheels definitely inspired our models. Initially quite cautious, they quickly got into the swing of things and ended up on an investigative quest that had them traipsing all over our enormous "stage" with the six-person crew carrying all the gear close behind. Countless views and poses were captured for posterity using only the ambient light and the light produced by the machines themselves, which was quite a challenge in some places. However, the long exposure times fitted well into the old-world atmosphere of the shoot, and the only lighting aids we used to brighten the odd shadow were reflectors made of cardboard, foil and Styrofoam.

Most of the photos you can see here were shot using a medium-format digital camera, resulting in a generally shallow depth of field that contributed to the nostalgic look of the finished images. The enormous range of detail and tonal values that this format produces gave us sufficient headroom for performing the complex post-processing that the project required.



Photographer Thomas Saur and model Christian Fischer in action



Alexander Schlesier was born in Plauen, Germany in 1977 and is a qualified advertising technician, designer and CAD illustrator. He has always enjoyed taking things apart to work out how they function, and has built many weird and wonderful machines over the years: "I was building oddball devices like these long before I had ever heard of steam punk."

He now works as a designer in the automobile industry and pursues various projects in his free time. He tells us, "The steam punk genre fascinates me, and the tinkering gives me the opportunity to experiment and live out my ideas of combining the old with the new. Life today is fuller than ever of rules and constraints and is increasingly heteronomous, giving us too little time to live out our fantasies. Steam punk is a kind of pressure valve for me and embodies a return to the materials and values of a bygone time. This approach provides a

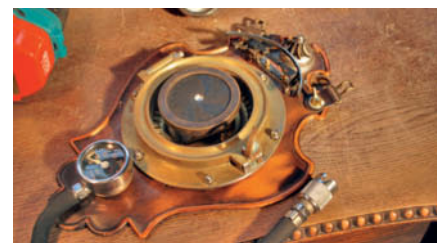
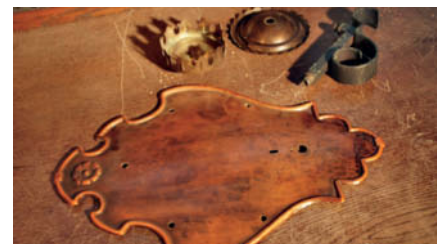
stark contrast to today's mass production, unbridled consumerism and the tendency to accept things as they are. I try to use old, authentic materials – such as brass, copper, leather and steel – as much as possible. I don't particularly want to be seen as an artist, and it is much more important to me to keep my creativity alive and to turn a few of my countless ideas into reality. The photo shoot was a lot of fun and a great experience – I can certainly imagine taking part in other projects like this should the opportunity arise."



Tales from the workshop

The Portable Time Machine

Alexander Schlesier explains: "The basic framework of the machine came from a 1970s wall lamp that I found in a scrap yard. I took it apart and bent the copper plate straight before sanding it down and ageing it artificially. I then bolted an old brass porthole from a flea market to the base plate and added a firefighter's pressure gauge and hose and parts of an old typewriter. The centerpiece of the device is a small, battery-operated plasma lamp that I fitted into the porthole and covered with an old optometrist's iris diaphragm."



Back to the Future

How we Created the Diary's Antique Look

Image quality

Early photographers used large-format plate cameras and uncoated lenses to produce photos on metal or glass sheets coated with light-sensitive chemicals. The technical limitations of the time often produced heavy vignetting and edge blur effects. To tone down the high quality of our source images to make them look authentic we used various soft focus effects to degrade the image edges and simulate the milky highlights often produced by old lenses. We also used a circular mask to simulate a classic vignetting effect.

Color shifts

We processed the colors in *Lightroom* and *Photoshop* to simulate the look of the pioneering days of color photography at the end of the 19th century. We wanted to produce heavy color shifts, the yellowing that characterizes old photos and the typical color casts that result from the varying stability of

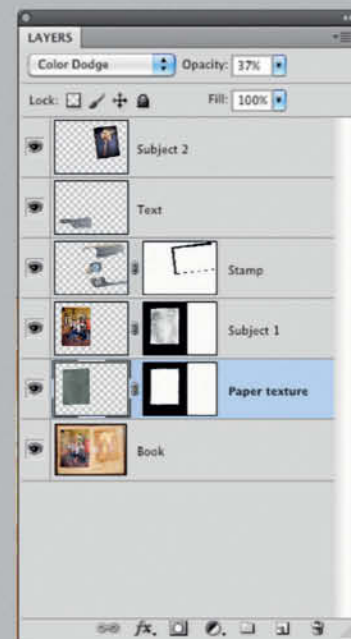
different colored dyes and pigments. In some places we simply got creative and used old, hand-colored Daguerrotypes as an inspiration.

The documentary look

We used scans and photos from old books and letters, as well as old cardboard picture frames and historical images to underscore the documentary feel of the diary, either superimposing them on our original photos or using them to create alpha masks.

Artificial ageing

Centuries of storage would have obviously left their traces on the diary. For an even more authentic look, we superimposed scratches, moisture streaks and evidence of mold or fungus on the images and added artificial folds, tears and paper textures. The result was a successful combination of our fictional images with real patina, producing a lifelike collage that we call *The Time Travelers' Diary*. (jr)

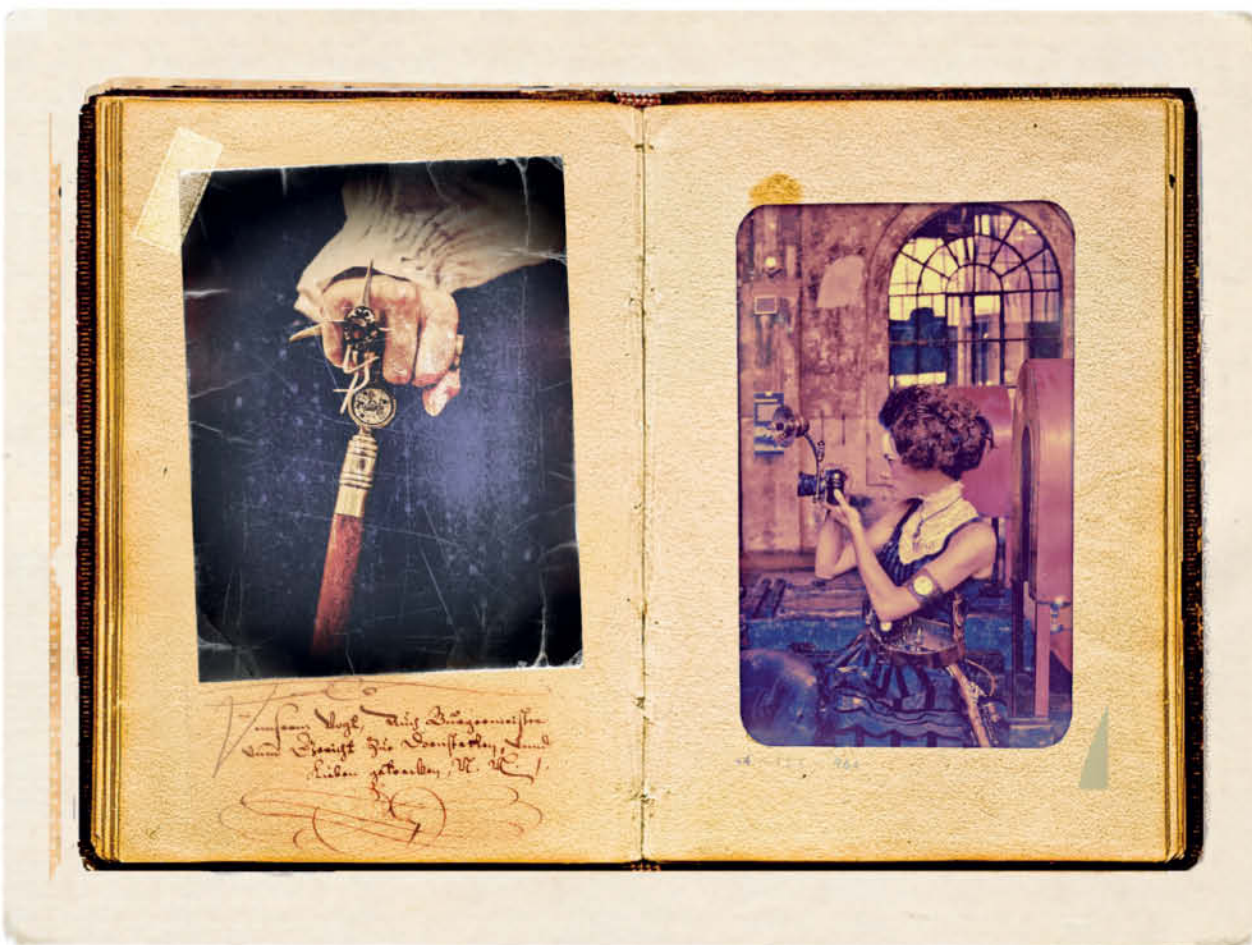


Layer techniques were used to produce complex collages of photos, paper texture and ageing artifacts



An old, worn book full of notes, drawings and apparently very old photographs is discovered. Tests show that the book had been lying there for more than 1,000 years. Thousand-year-old photos?





How can this
be? **The**
pho
tos

and hand-written
entries leave us no
alternative but to
conclude that the
book is a diary that
belonged to time
travelers.



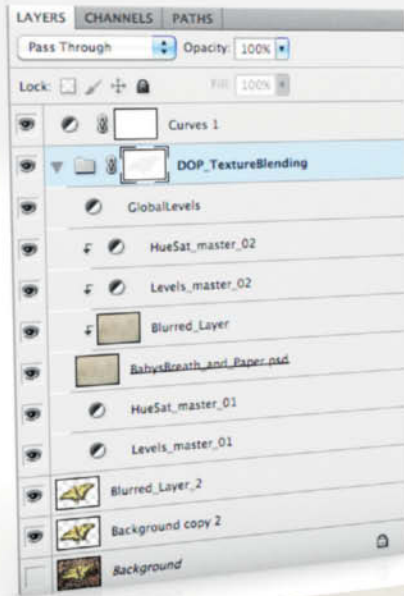


But why were they
traveling through time?
What were they
searching for - and
what happened to
them?

The Time Travelers' Diary started life as a photo shoot but, as we began to realize its potential, quickly mutated into a complex multimedia project. Our current plans include exhibitions, a book and a spin-off film. For more details visit

www.timetravelersdiary.com





Bettina Steinmueller, Uwe Steinmueller

Enhancing Your Photos

with Texture Blending

The idea of adding textures to paintings and photographs is as old as these art forms themselves. In a photographic context, the grain of black-and-white film was often considered to improve the artistic look of an image, although grain itself is largely a processing artifact. The same is true of oil paintings in which the paint and the canvas add their own texture. Digital photos, too, can benefit from added texture. This workshop demonstrates the diversity of texture blending techniques and gives you some ideas for applying the technique to your own photos. The results are images that often go well beyond simple photorealism.

What actually is Texture Blending? The idea is to combine main and texture content to create a new, enhanced image. Texture blending can result in subtle changes that are hardly perceptible to the viewer or major changes that give a photo a completely different look.

The result of blending a picture with one or more textures is often more than just the sum of the photos used. Texture blending is always a process of exploration. In one example, we use pebbles at the Pacific coast and a photo of pale grass that was shot on its own merit. Blending these images gives the resulting photo an entirely new look and feel (figure 1).

The Craft of Texture Blending

Analog photographers often create blended textures by making multiple exposures. This type of blending can be done by sandwiching multiple negatives or using in-camera blending techniques. Today, the digital blending process is easier to control using Photoshop, or any other image processing program that supports layers. The following sections assume that you already have a basic understanding of working with layers.

Step 1: Adding a Texture as a Layer

Add the texture image as a new layer on top of the main image. You can now apply various strategies. Either resize the texture layer to



Figure 1: Texture blending produces results that are more than just the sum of the content in the source images. This photo of pebbles at the Pacific coast has been given a completely different look by adding the texture of grass.

match the size of the original image (which is how we work most of the time) or, if the texture is larger than the original image, you can retain its size and simply place the section you plan to use on top of the main image. At this point only the texture layer is visible (figure 2). Simply lowering the opacity of this layer often produces interesting results, but Photoshop blending modes are a much more powerful tool.

Step 2: Blending Your Images

Blending is done mainly using Photoshop's blending modes (figure 3). We apply the blending mode in question to the top layer of our stack, whether this is a single layer or a merged combination of multiple lower layers. Depending on the blending mode you select, Photoshop calculates a new value for each pixel in the image according to the values present in the top and bottom layers.

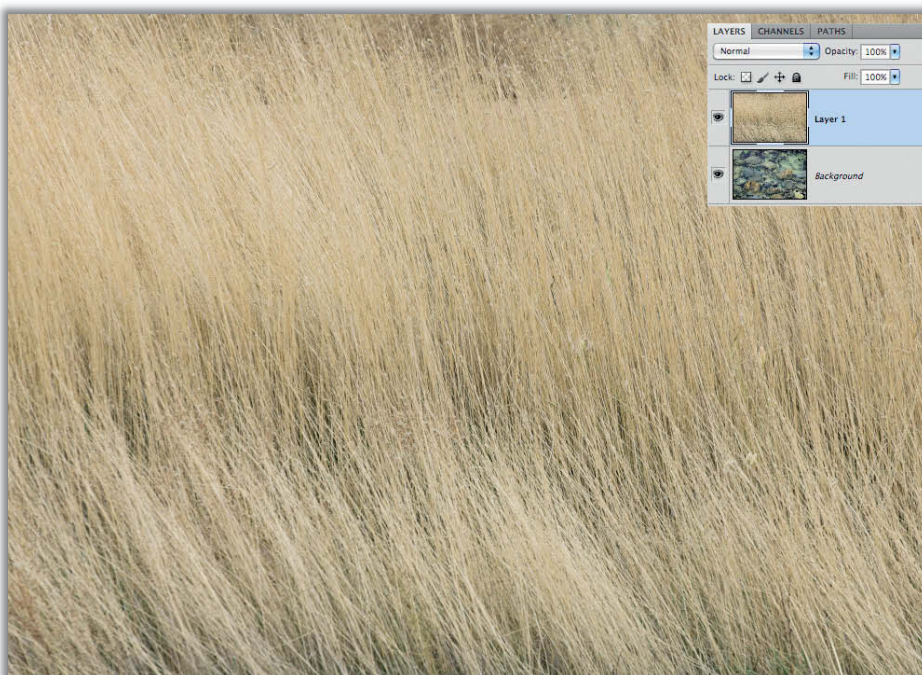


Figure 2: The texture image is placed on a new layer

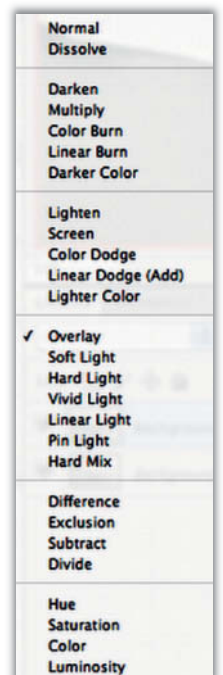


Figure 3: Photoshop offers a wide range of blending modes for you to experiment with

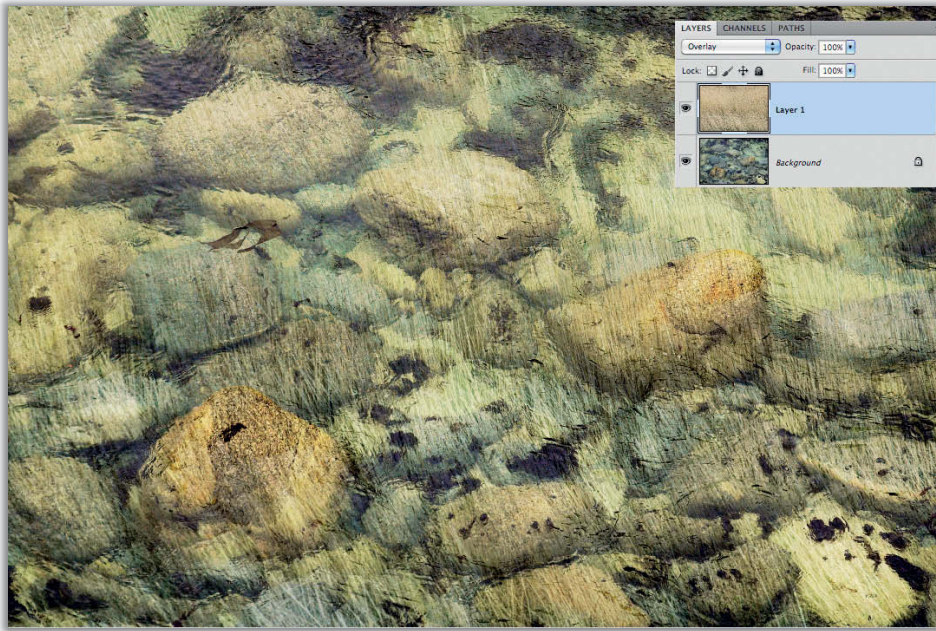
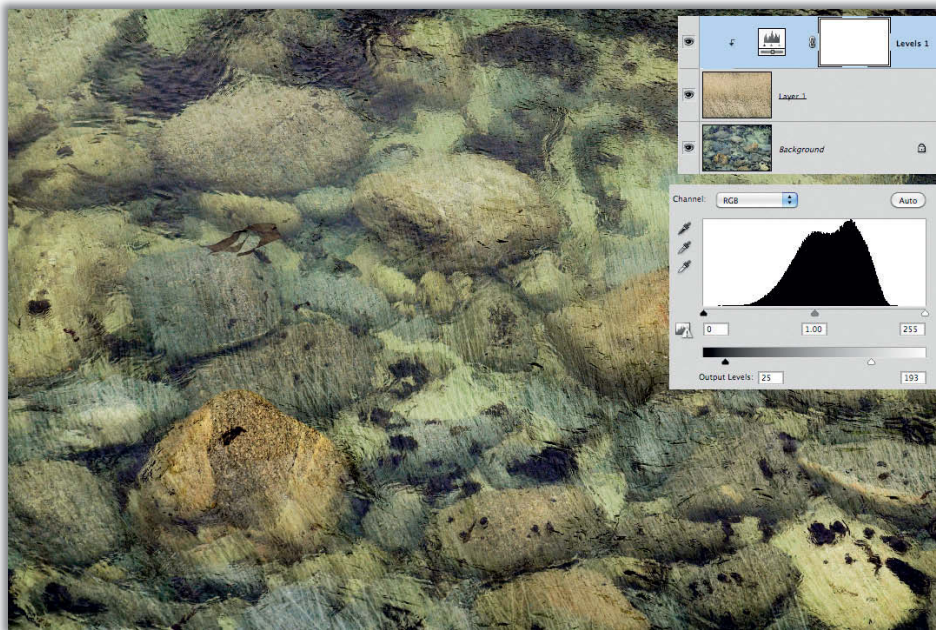


Figure 4a: Superimposing the texture on the main image is just the beginning. In the illustration below we have added a Levels adjustment layer as a clipping mask.



Normal is the default blending mode, and uses just the pixel values in the top layer.

Photoshop's blending modes are grouped in sections, but not all of them are suitable for creating texture blending effects:

- Normal/Dissolve: we don't often use Dissolve mode
- Modes that darken the image: Multiply is a good candidate in this section
- Modes that lighten the image: Screen can be used for some pastel effects
- Modes that darken and lighten the image: See our description of the Overlay section below for a basic understanding of these modes
- The modes included in the last two sections are not particularly useful for texture blending applications

Not all blending modes suit our purposes. We very often use Overlay mode, and we have also used Multiply quite a lot in the past. Soft Light and the other modes in the same section offer some interesting variations to experiment with.

What does Overlay blending do? All pixels within the texture that have tonal values below 128 darken the resulting image – the lower the value, the stronger the effect. All pixels with values above 128 have the opposite effect.

Step 3: Basic Blending Tuning

The upper image in figure 4 is by no means the final image. Once again, a simple tweak involves reducing the opacity of the texture layer. However, we use a slightly different technique. In this case, the highlights were a little too bright for our taste, so we added a Levels adjustment layer as a clipping mask.

A clipping mask layer only affects the next layer down. If we hide the texture layer the Levels layer would have no effect at all. The effect here is as if we were to apply Levels to the texture alone.

We use the Output Levels dialog to restrict the tonal range to between 25 (the darkest value) and 193 (the brightest value), thus reducing the black and white levels in our texture. Remember that we are currently altering an Overlay blend, not a complete image.

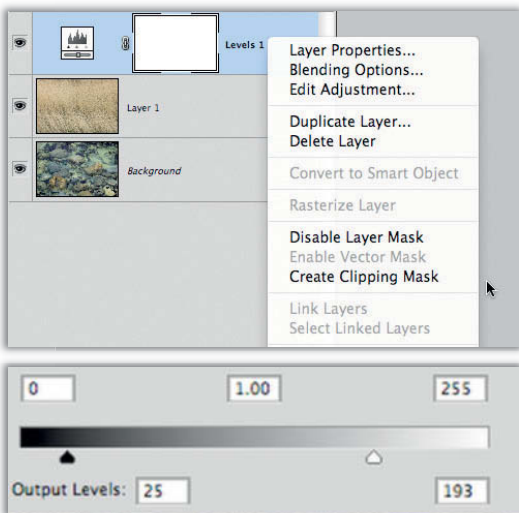


Figure 4b: Adjusting Output Levels in the clipping mask

Figure 5: To prevent the texture having an overbearing effect, an additional Hue/Saturation clipping mask can be used to reduce the intensity of the texture's own color

The texture not only changes the tonality and detail of the blended image but also blends in some of its own color. It is often prudent to allow less of this color (in our case, the faded yellow) to show in the result. To achieve this, we also added a Hue/Saturation clipping mask (figure 5).

Again, we use a clipping mask because we only want to target the texture and not the main image colors.

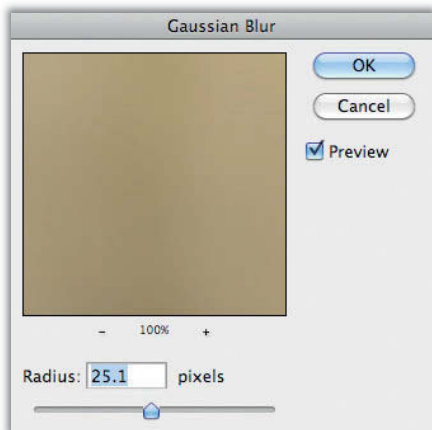
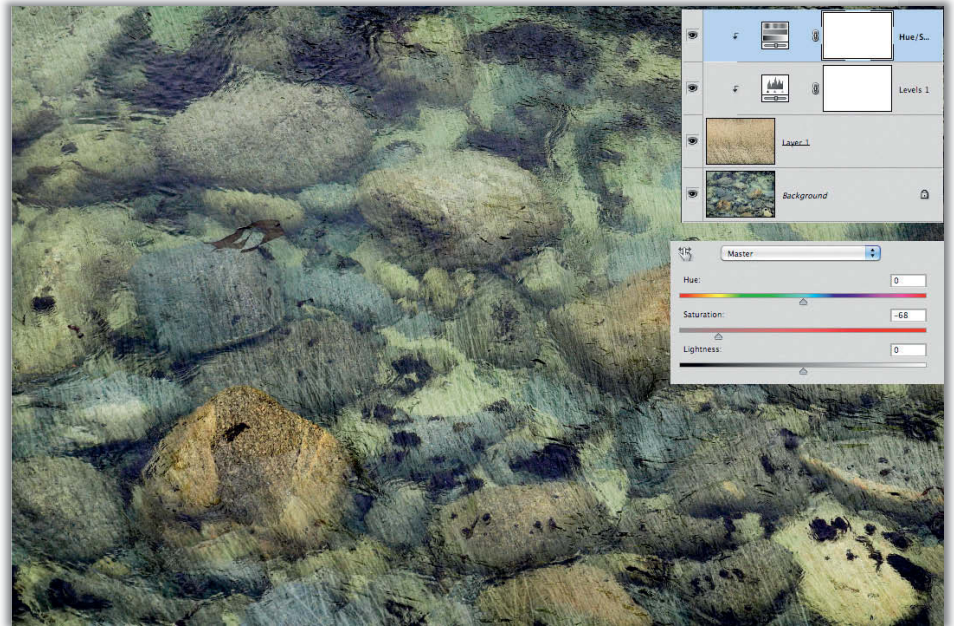


Figure 6: Using a blurred version of the texture layer gives the overall image a softer look. Here, we used a strong Gaussian Blur at 50% opacity.



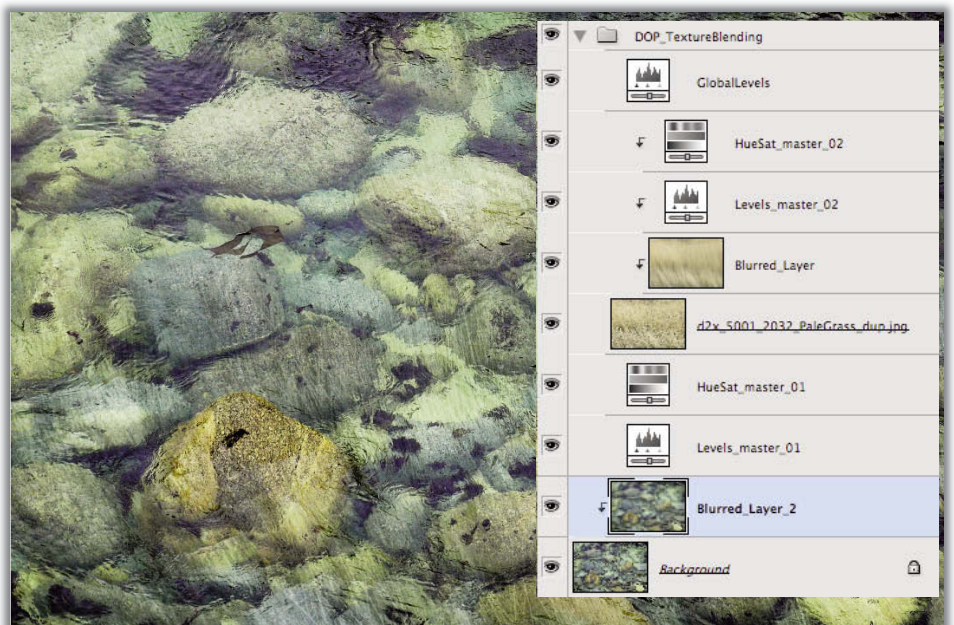
Figure 7: Here, you can see the effect of applying different opacity values to the blurred texture layer

This is where things start to get more complex. If we want to apply a blurred version of a texture to get a softer look, we create a blurred clipping mask copy of our texture layer (figure 6).

Here, we adjust the strength of the blur effect by adjusting the opacity of the blurred layer (figure 7).

These are the main elements and techniques we use for texture blending. Remember, texture blending is not a prescribed, mechanical process, and experimentation is the key to interesting results. We are always looking for ways to get unusual results. A great approach is to try out methods that your instincts tell you shouldn't really work.

Figure 8: The layer stack created by our DOPF017_TextureBlending script



The techniques we have described so far are just the basics, and the only real limit to what you can achieve are the limits of your imagination. We often blend more than one texture into an image using a custom script that we wrote (if you use our script you need to rename and collapse the upper layer group). Use masks to selectively blend or tune the results, and experiment with layer effects. These are just some of the techniques we use in the examples described below.

It is important to keep an eye out for new textures. We create and collect new textures all the time by photographing, collecting from the web (while respecting copyright, of course) and blending textures with other textures. Textures work best if they have high resolution, and we have found $3,000 \times 4,000$ pixels to be a good starting point for many of our projects, although there are situations in which low-resolution textures work just fine. See the link at the end of this article for an article we wrote about texture collecting and resources.

Advanced Texture Blending

The layer group we often use for blending is slightly more complex than the techniques described above. We create the group automatically using our own DOPF017_TextureBlending script. There is a free trial version of the script available for download that only works for resolutions of up to $2,000 \times 2,000$ pixels, while the full version costs US\$25.

Figure 8 shows the layer stack that the script creates with an additional blur layer added to the main image (created using our Texture Blending Tuning kit). There are also Levels and Hue/Saturation layers for adjusting the base image the same way as the texture image. Additionally, a global Levels layer allows us to fine tune the complete image. The entire setup is organized in a layer group that allows us to tune the overall blending effect and apply layer masks to the group to blend selectively. Our Texture Blending Tuning scripts also allow you to create texture blending templates that allow you to treat multiple images in a more consistent way (see also http://outbackphoto.com/CONTENT_2007_01/section_workflow_basics_2011/20110203_TextureBlendingTemplates/index.html). Our scripted layer group is a very practical way to approach texture blending, but all of the examples below can be reconstructed using standard image processing tools too.

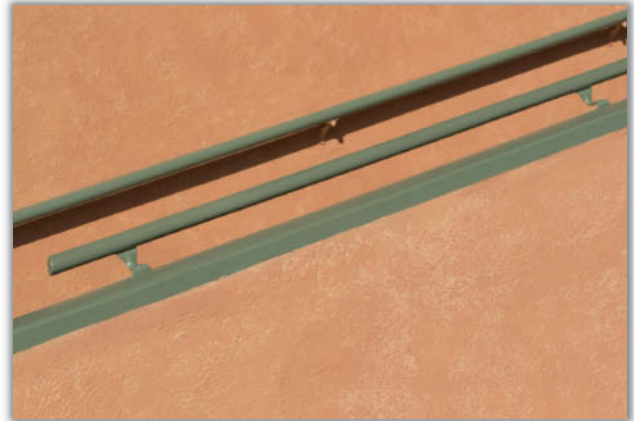
The Art Of Texture Blending

Some blended photos look like paintings. The important question here is whether this really is the look we are trying to achieve. The answer is "Probably not!", and we take a very different approach to that used by a painter creating a new picture. A painter starts with a blank canvas that already has a texture of its own, whereas we add textures later to increase the impact of "normal" photorealistic images.

Essentially, what we are doing is all about enhancing the overall mood of a photo, and we don't mind if a "painterly" feel sometimes results.

The following examples use original images, textures and blended results to give you some tips and ideas about how to adjust and enhance your own images using blending techniques. These examples were all created using our DOPF017_TextureBlending script but can just as well be recreated using standard Photoshop tools or any other image processing program that has layer support.

Too Clean



This image shows handrails that we photographed in Monterey. The photo has a simple, pleasing composition, but nevertheless looks a little too "clean".



The blended version of the photo has a more interesting mood to it, although the effect an image has is always a matter of the viewer's personal taste. We certainly like the blended image more than the original! The apparent shadows in the new version were created using this texture:



Textures can make interesting images in their own right, although this photo of a dirty wall (shot expressly for use as a texture) is not particularly interesting on its own. In this case, the main photo and the accompanying texture were photographed on the same walk through Monterey.



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Abstraction



This time, we want to show you the final result first. We particularly like the abstract nature of this image.



The original image is of compacted cardboard at a recycling yard. We used the texture shown below to blend and then convert the original image to black-and-white.



The main photo and the texture were both taken with an iPhone. The texture photo was modified using the Hipstamatic iPhone app.

Skies can be so Humdrum



It is difficult to take interesting photos of these beautiful oak trees near our home because the sky framing them often looks quite boring. The solution is, of course, texture blending.



The trees suddenly appear special in the blended version of the image.



Here, the texture itself is the result of blending one of our own creations with a publicly available texture. We don't even know any more how many individual textures were involved, but we can remember using paper, pebbles and an abstract texture we found on the Internet.

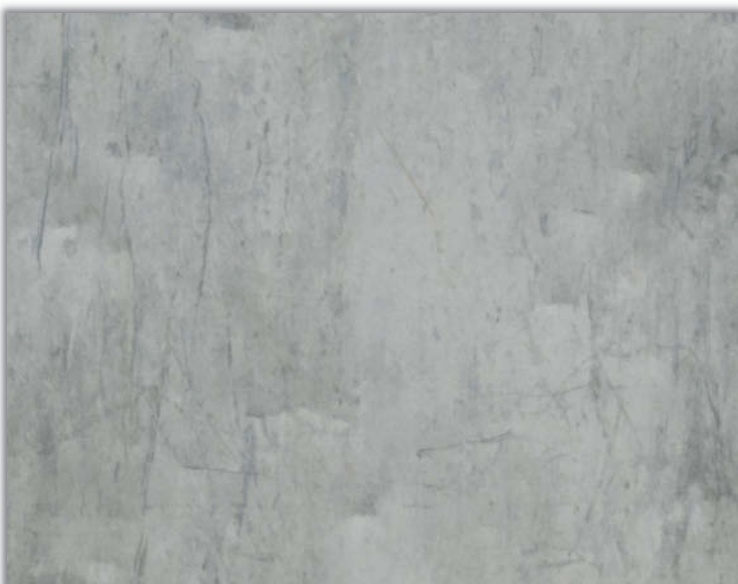
An Etched Look



The look of this photo is a lot like that of an etching, although this was not necessarily our intention when we started work. The look was purely the result of our experimentation during the blending process. The original photo is a digital infrared photo taken using a modified camera.



The nature of the texture we used may come as a surprise, as is often the case in a texture blending context.



It is, in fact, the surface of a metal fish container photographed at the commercial pier in Monterey.

The Tale of a Swallowtail



This Swallowtail butterfly has been captured in good detail, but the background detail is distracting. In this case, we decided against blending a texture with the original background and instead decided to isolate the subject first.



We blended the butterfly selection with one of our favorite textures to produce the following result.



Our selection is not perfect but, as you will see, it is certainly good enough for blending.



We also used the mask we generated during the selection process to reduce the degree of blending for the butterfly itself. Masking is a technique that can often be used to enhance blending work.

Conclusions

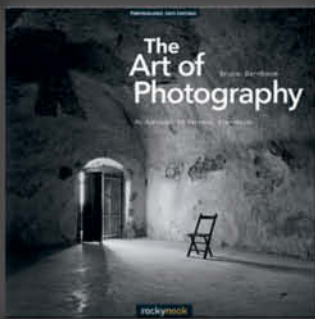
We recently selected our top 10 images from 2010. To our surprise, it turned out that all of them were texture blended to some degree. Texture blending can be used to refine your work or to create entirely new images. It is interesting to note that some painters like to create a photorealistic look in their work, we photographers are now taking steps to make our images look more painterly. In the end,

many photographers want to go beyond a pure photorealistic copy of their subject and, although this type of image abstraction and enhancement doesn't work with all types of photographs (in a journalistic context, for example), in many cases texture blending can add a unique mood to your photographs. We think that texture blending is a technique that is well worth exploring.

References

Further reading on Texture Blending
outbackphoto.com/tiny/TB1.html
outbackphoto.com/tiny/TB2.html
outbackphoto.com/tiny/TB3.html

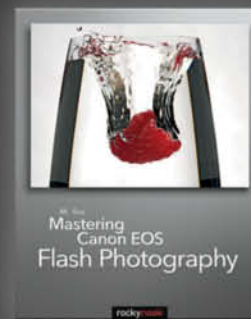
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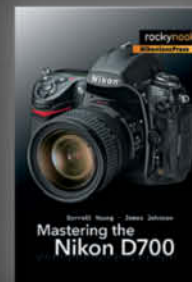
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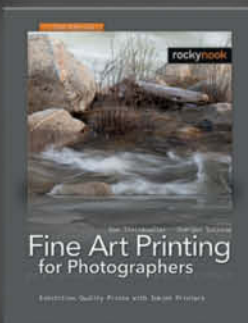
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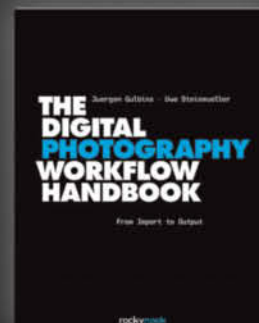
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Alexander Altmann

Fantastic Photos with Unusual Lenses

Most lenses are designed for ease of use and to provide high-quality images in everyday use. Alongside these "normal" lenses, there is a wide range of unconventional and fun lenses available for exploring offbeat photographic concepts. This article delves into the wonderful world of shift lenses, Lensbabys and fisheyes, and takes an excursion into the outer reaches of pinhole and plastic lens photography.





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Photographers have very different demands when it comes to accessory lenses. Beyond the standard kit zoom or normal lens delivered with the camera, experience and personal taste mean that the next lens you buy can be anything from a super-telephoto to an ultra-wide-angle. Many photographers choose macro lenses as their second fiddles, as these also make very effective portrait lenses.

Further down the line, most photographers start to play around with unusual compositions and there are enormous numbers of unconventional lenses out there that are perfect for taking off into the realms of experimental photography. Extreme wide-angle views, selective focus and a nostalgic look are just some of the possibilities. If you feel

inspired to follow the pinhole photography path of the earliest photo pioneers, there are accessories available for you, too. Or maybe you feel like tilting the plane of focus to attract your viewer's attention to a particular detail? All this and more is possible in the digital age, and the use of unusual lenses is experiencing a serious renaissance.

A quick look at what's on offer from lens and accessory manufacturers reveals a broad selection of more or less exotic lenses, ranging from tilt/shift and fisheye to variable-bokeh portrait lenses. Our search also led us to unorthodox creations such as the Lensbaby, the Diana+ and the Toy Lens, as well as a whole range of simple screw-on lenses and pinholes. This article shows just what you can do with some of these oddball optics.



Tilt/Shift Lenses

Since the days when photographers had to deal with heavy view cameras with huge sheet film negatives, bellows focus and a cloth for shading the focusing screen, technological advances have made photography a lot easier. But some old-school photographic skills, such as adjusting the plane of focus, have been lost along the way. It is possible to move the plane of focus back and forth using

a wide aperture setting and a camera with a full-frame or APS-C image sensor, but it still remains parallel to the sensor plane. All the objects that are located on the current plane of focus are reproduced in focus whether you want them to be or not. This behavior is self-evident in the light of our habits and expectations, but is neither essential nor necessarily beneficial.

The plane of focus can tilted and/or rotated at will using a view camera. This is achieved by using the bellows to tilt the lens plane in relation to the film plane. Macro bellows (for example, from Novoflex) are the only accessory available for conventional cameras that have built-in bellows. All other types of lens are firmly attached to the camera body, which makes them cheaper to produce



The Canon TS-E 45mm f/2.8 can be rotated on its mount, but cannot be tilted and shifted in opposite directions

Tilt and Shift

Shifting involves moving the optical axis of the lens perpendicular to the sensor plane. Architectural photographers often use this functionality to prevent the occurrence of converging lines in their images. If you tilt your camera upward while photographing the front of a building, you will be able to capture the entire façade in one shot, but the vertical lines contained in it will converge. If, however, you align the sensor plane of your camera parallel to the building's front, you will no longer capture converging lines, but you will also no longer be able to capture the full vertical extent of the building. Shifting the lens vertically upward includes more of the upper parts of the building in the shot but,

because the sensor remains parallel to the building, there will not be any converging lines in the resulting image.

If you photograph a row of houses from diagonally in front using a wide aperture, only a small portion of the façade will remain in focus. To ensure that the entire row remains sharp you will either have to stop the aperture right down or tilt the lens until the plane of focus is parallel to the fronts of the houses. Shift functionality can nowadays be simulated digitally, but requires the use of a short focal length lens and plenty of extra space around the subject to allow for subsequent distortion and cropping.



A Nikon 24mm f/2.8 AI lens mounted on a Sony NEX-5 using a Tilt Transformer. The crop factor of the APS-C sensors gives the lens an equivalent focal length of about 35 mm.



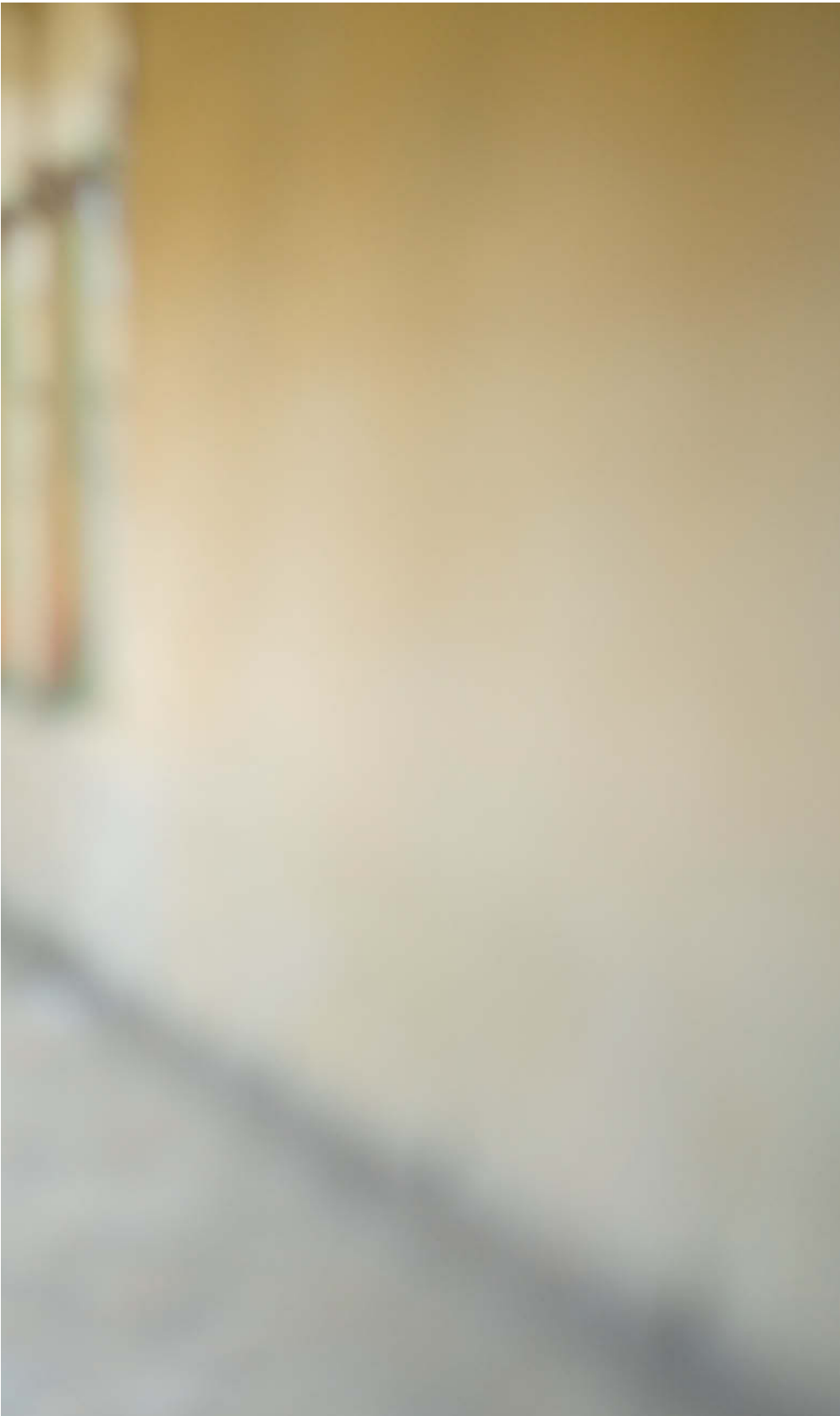
and more stable, and is also conditional on the mechanical limitations of a 35mm camera body with its shallow flange focal depth (i.e., the distance between the lens throat and the sensor plane).

High-end lens manufacturers still sell special-purpose tilt/shift lenses for use in architectural and other specialized situations. They are complex, expensive and fairly tricky

These three images were all shot at a constant aperture but using different tilt settings. In the uppermost (non-tilted) image, the plane of focus is aligned with the advancing pawn. We tilted the lens toward the chessboard in the center image, which positions the plane of focus parallel to the board at the level of the heads of all the pawns. In this case, the board itself is out of focus. The lower image shows the effect of tilting the lens upward – the plane of focus is now almost vertical.

Canon EOS 5D Mark II,
TS-E 45mm lens at f2.8





to operate, which is why their effects are seldom seen in everyday photos. This is a shame because the effect is not only impressive, but can also be used to draw the viewer's attention to specific image details.

Canon and Nikon manufacture tilt/shift lenses with various focal lengths ranging from 17 to 90 mm (see the table on page 126). The least expensive Canon tilt/shift model is the TS-E 45mm f/2.8 for about US\$1,300. The best value offering from Nikon is the PC-E 85mm f/2.8D Micro Nikkor at about US\$1,700. If you want to experiment with longer focal lengths, you will have to use a medium-format shift adapter, as described below.

Medium-format Shift Adapters

In order to prevent vignetting when they are shifted or tilted, tilt/shift lenses project a much larger image circle than conventional lenses. A good value alternative to purchasing a specialized lens is to use a third-party tilt adapter. The only prerequisite is that your lens was manufactured for use with a camera with a larger sensor format than the one you want to adapt it for – i.e., the diameter of its image circle is greater than the width of the image sensor. This means that we can adapt 35mm or full-frame lenses for use with APS-C cameras.

The Ukrainian company Arax Foto (araxfoto.com) manufactures a tilt adapter for mounting lenses with Pentacon Six, Practisix and Kiev 60/88 mounts on most DSLRs. The adapter has a maximum of eight degrees of tilt and costs US\$125 plus US\$27 for delivery. Arax Foto also sells suitable medium-format lenses, and there are many bargains to be had on the second-hand market if you shop around. Usable 80mm (medium-format standard) lenses can be found for US\$100 or less.

Tilt lenses allow you to position the plane of focus exactly where you want. In this photo, it runs from the left-hand foreground to the door in the background, and is almost vertical.

Sony NEX-5, Lensbaby Tilt Transformer with a 35mm f/2 Nikkor set to f2.8



A tilt lens can be used to focus exclusively on a person's eyes while leaving all the other details in a portrait out of focus.

In this example, the upper image was shot without tilt, while the lower one was shot using tilt to shift the plane of focus so that it was positioned on a plane that joins the two figures. This makes it obvious that they are looking at each other.

Canon EOS 5D Mark II, Carl Zeiss Jena Biometar 80mm f/2.8 and an Arax adapter, 1/2 second at f2.8



rotated, the Tilt Transformer moves the lever, although there is no precision involved, so the results are non-reproducible. Older lenses with built-in aperture rings are the better alternative if you have access to them.

We can thoroughly recommend the Tilt Transformer for creative photographers who owns Nikon lenses and are considering buying (or already own) a mirrorless, interchangeable lens camera. The Sony NEX-3 currently costs about US\$350 and the Olympus PEN-EPL1 about US\$400 (both prices for the body only). If you already own a DSLR, an Arax adapter with a used medium-format lens is probably a less expensive way to go.

Tiltable Lenses for Mirrorless Cameras

The Lensbaby Tilt Transformer, which is available bundled with the Lensbaby Composer for US\$350, is designed for mounting and tilting Nikon lenses on Micro Four Thirds or Sony NEX cameras. The mechanics of the unit are based on the fact that the flange focal depth of these cameras is significantly shallower than that of most DSLRs. Nikon lenses used with the Tilt Transformer also allow the use of semi-automatic aperture control. Even though the newer G-series lenses don't actually have an aperture ring, the aperture is set the same way as it was 50 years ago using a small lever in the bayonet mount. When



A Canon EOS 550D/Rebel T2i fitted with an Arax adapter and an 80mm medium-format lens. The lens can be tilted by up to eight degrees and rotated in any direction.

Lensbabys

A few years ago, US photographer Craig Strong felt that his lenses were stifling his creativity, so he built his own and called it the Lensbaby. The first ever Lensbaby was a simple glass lens attached to a flexible bellows that could be bent, stretched and compressed in any direction. The movements of the bellows determined the plane of focus and the “sweet spot” at which focus was (fairly) sharp. “Fairly” because the non-coated glass lens that Strong used not only produced the now well-known Lensbaby asymmetry and image curvature, but also prismatic color shifts and a significant degree of blur. Long exposures weren’t possible with the first Lensbaby because it sprung back to its original position the moment you let go of it.

Lensbabys rapidly gained popularity and there are now four basic models to choose from called Muse, Composer, Control Freak

and Scout. They cost US\$150-400 and the basic difference between them is the way in which focus is set and fixed. The Muse is freely movable, while the Control Freak has three threaded adjustment screws and a locking mechanism for making precise settings. The Composer’s entire lens assembly is mounted on a ball and socket mount that makes it quick and easy to perform smooth selective focusing, and a locking ring allows you to hold the position you have found during long exposures, or while you shoot a sequence of identically composed shots. The scout model cannot be tilted, and is configured as a fisheye in its base version.

All Lensbabys have swappable front elements and the company’s own Optic Swap system offers a range of alternative optics including plastic and (coated or non-coated) glass lenses, as well as pinhole/zone plate, fisheye and soft focus models.

There is also a range of Lensbaby accessories, including +4 and +10-diopter macro lenses, a 1.6x telephoto attachment, and 0.6x and 0.42x wide and ultra-wide-angle attachments that transform a standard lens into a 30mm or 21mm (equivalent) lens. Remember to allow for the crop factor if you use Lensbabys with an APS-C or Four Thirds camera. All Lensbabys are available with Canon, Nikon, Pentax, Sony and Four Thirds mounts.

A typical Lensbaby image.

The sweet spot is located on the tram and the other details are blurred. Images like this are strongly reminiscent of macro photos of miniature models.

[Canon EOS 550D/Rebel T2i, Lensbaby Composer, 1/60s at f2.0](#)



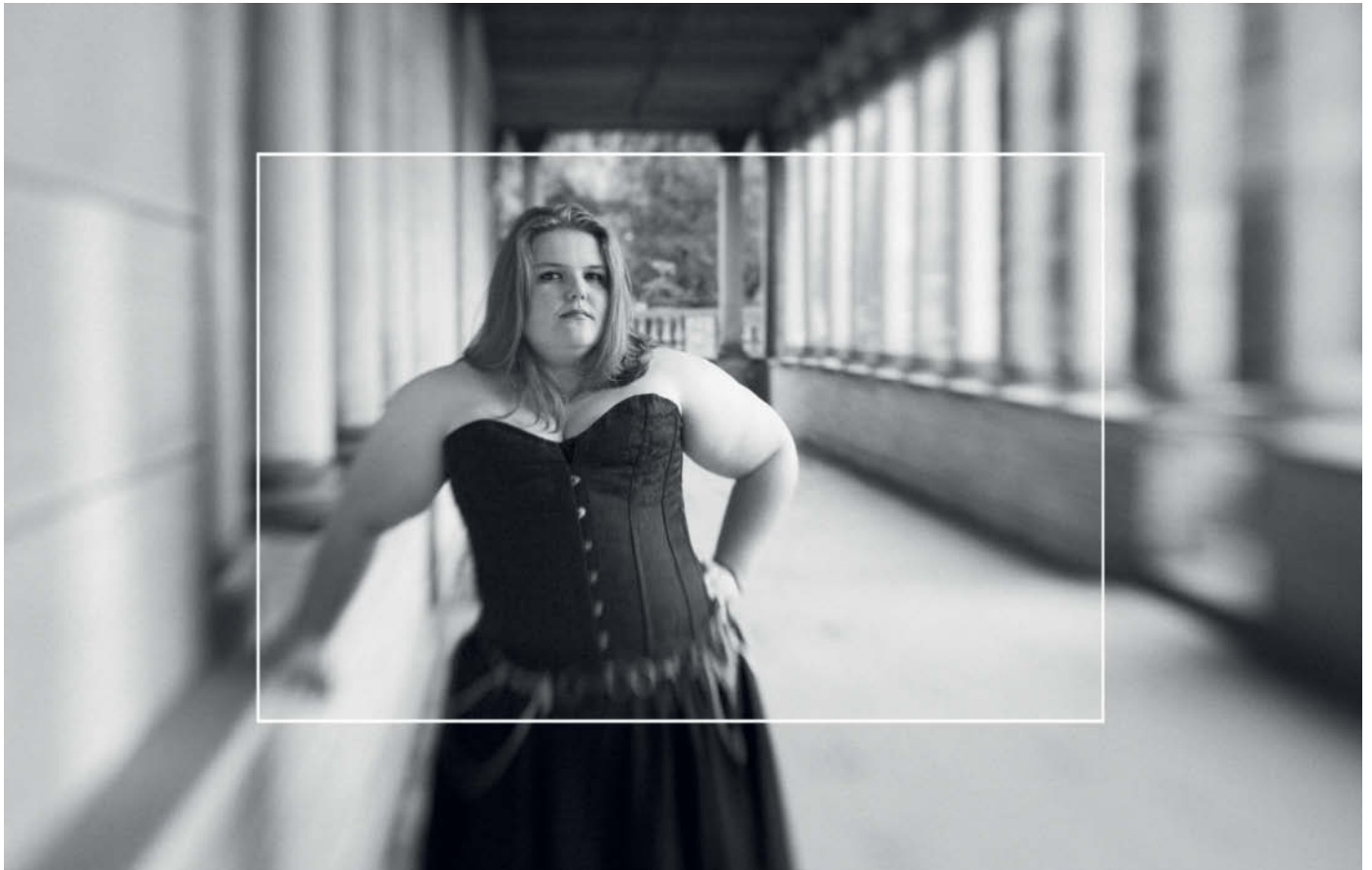


Typical Lensbaby blur creates a feeling of movement, which we combined with some real motion blur on the part of our "ghost"

Canon EOS 5D Mark II, Lensbaby Composer, 1/80s at f2.0



The Lensbaby Composer kit includes aperture disks ranging from f/2.8 to f/22 and a magnetic storage box that doubles as an inserter/remover tool. The default maximum aperture (without a disk) is f/2.0.



It makes a difference whether you use a Lensbaby on a full-frame or a small-sensor camera. Much of the characteristic edge blur lies outside the crop camera's image frame.

Canon EOS 5D Mark II, Lensbaby Composer, 1/60s at f4.0

Lensbaby How-to

Although Lensbabys are tiltable they are not "true" tilt lenses. The simple optical construction makes it impossible to keep the entire field of view in focus. The lenses do not have a plane of focus, but instead a single point called the "sweet spot" at which the subject is in focus. The size of the sweet spot is determined by the size of the aperture, which is in turn adjusted using replaceable metal disks with holes of different sizes cut in the center. The aperture disk is held in place magnetically and is easy to swap using the special tool included with the kit. The system is slightly complicated but has the advantage that the circles of confusion produced by the lens are always perfectly circular (or oval), not pentagonal, hexagonal or septagonal like the ones produced by most SLR lenses.

In order to portray an object in sharp focus, you not only have to make the right distance setting, but also adjust the sweet spot to coincide with the subject. This makes focusing something of a challenge: we recommend

that you align the sweet spot first, before you focus using the manual focusing ring. It is sometimes necessary to realign the sweet spot once you have set focus, especially if you are using a wide aperture. Getting it right requires a tripod and some patience. If your camera has live view, using it magnified makes life a lot easier. With some practice and a relatively flexible definition of "sharp", you will soon be able to get great results, even shooting handheld.

Alongside exposure and framing, the Lensbaby sweet spot provides an additional compositional element to play with. It takes some practice to get used to using it but, once you have mastered its idiosyncrasies, you will find that the effect can enhance many types of image, including portraits.

Lensbabys are perfect for focusing the viewer's attention on a particular detail

Canon EOS 5D Mark II, Lensbaby Composer, 1/30s at f2.0

Lensbaby also sells the multi-function Lensbaby Composer with Tilt Transformer kit for Micro Four Thirds and Sony NEX cameras. This version is fully compatible with the optic Swap system and has a slightly brighter maximum aperture of f1.6. The lens costs US\$350.



Plastic Lenses



Diana+ 55mm, 38mm and 20mm fisheye lenses fitted with Canon adapters

Effective images have a tangible effect on the viewer, whether they remind us of the past, draw our attention to a new aspect of the present, or present familiar objects in an unusual way. The scratches on those old photos of Dad looking young or Mom playing with the kids on the beach are what makes them authentic, and the yellowed look of old color snaps makes it obvious that the scenes they portray took place a long time ago. The feel of the paper, the often odd-looking colors, the grain, the vignettes and even the blur all contribute to the mood of a vintage image.

Nowadays, even though all of these effects can be reproduced using the “retro” buttons in an image processing program or functions built into a camera’s firmware, many photographers still prefer to take the supposedly more authentic route of using special lenses, filters and other accessories to produce unusual or old-school visual effects. If it’s a slightly blurred, low-contrast look you’re after with a few color fringes thrown in for good measure, then look no further than the next plastic lens. These are usually made completely of plastic, from the bayonet to the optical elements, and are available as part of a disposable camera, built into the legendary Lomo or as interchangeable lenses for plastic medium-format cameras.

This section reviews three plastic lenses built for use with the Diana+, a cheap medium-format analog film camera made of

plastic. Complete Diana+ cameras are available for as little as US\$50 from www.lomography.com. Diana cameras have just two shutter settings, called Normal (N), which is equivalent to about 1/60s, and Bulb (B), which keeps the shutter open for as long as the shutter button is pressed. However, used with an appropriate adapter, Diana+ lenses can be mounted on modern DSLR cameras and can thus take advantage of all the flexible exposure options these offer.

If you use Diana+ lenses with a crop-sensor or full-frame camera, then only the center of the image circle will be recorded, automatically doing away with the vignetting and edge blur that characterize Diana images. When used with the medium-format Diana+ camera, the 38mm Diana lens has an ultra-wide angle of view, while the 20mm lens produces circular fisheye effects. Used with a full-frame DSLR, the 38mm produces medium-wide-angle effects, while the 20mm lens produces images with straight lines that

are distorted but otherwise pretty unspectacular. We found that the effects produced by the 20mm lens and a crop-sensor camera were simply dull.

Diana+ lenses cost US\$40-50 plus US\$15 for a Nikon or Canon adapter. The price is acceptable as long as you don’t equate value with optical quality! We recommend that you glue the adapter to the lens, otherwise the loose fit can cause it to simply fall off while you are focusing.

These lenses have no aperture setting of their own (aperture settings are made in the camera body), and have an equivalent aperture of about f9.5 when used with a DSLR, making them unsuitable for low-light use or if you want to use aperture settings to affect the depth of field in your images. The light meters in some low and mid-range Nikon DSLRs don’t work with manual lenses, so if this is the case, you will have to follow the classic “Lomographic” principle of “guess the exposure and shoot”.

The accessory specialist enjoyyourcamera.com sells 26mm f/1.4 and 35mm f/1.7 plastic lenses for Micro Four Thirds cameras under the SLR Magic Toy Lens brand. These both have steplessly adjustable apertures and focus and, once we had played around with the settings for a while, produced results similar to those we achieved with the Lomo lenses. The typical optical characteristics of these lenses are a sharp central area with shallow depth of field at full aperture (similar to the Lensbaby sweet spot) and interesting bokeh and vignetting effects at the edges of the frame.

The Monochrom Subjektiv is named after the opposite of “Objektiv”, which is also the German for “lens”. The Subjektiv consists of a set a set of five lens inserts (glass, acrylic, Fresnel zone plate, pinhole and variable aperture), providing you with a wide range of experimental configurations and settings. This lens costs about US\$280, is available with various mounts and is extremely well made (www.monochrom.com).

Other plastic lenses:

The lens on the left is the Monochrom Subjektiv. The other two are Micro Four Thirds models from SLR Magic.





The upper image was shot using a 38mm Diana+ lens and shows significant blur and inauthentic colors – in this case, the vignettes were added later.

The lower photo was shot using a Canon EF 24-105mm f/4 lens. Here, we adjusted the colors digitally to make them more like the ones produced by the Diana+ lens.

Photos: Ralph Graef, www.graef-fotografie.de

Photos: Ralph Graef, www.graef-fotografie.de

Top: Shot using a 38mm Diana+ lens mounted on a Canon EOS 5D Mark II. The focus and highlight effects were all produced by the lens and were not otherwise processed or altered.
Bottom: The same scene photographed using a "proper" lens.

Nikon Portrait Lenses

A portrait lens must have an appropriate focal length and a decent maximum aperture, but most importantly it must be capable of reproducing differentiated skin tones. Overall image definition shouldn't be too sharp and bokeh should be as smooth and unobtrusive as possible. Normally, lens designers have to choose between emphasizing the quality of background or foreground bokeh and, once the decision has been made, the results are permanently built into the lens. This is, however, not the case for Nikon's 105mm and 135mm AF DC Nikkor lenses. Introduced in the early 1990s, these are still the only models

available that allow the photographer to directly influence the characteristics of the bokeh they produce.

It is generally accepted that highlights that become darker toward their edges produce more pleasing bokeh effects. The opposite effect is grating and can spoil a photo completely. Lens designers control bokeh effects by adjusting the corrections made for spherical aberration in the lens elements. In principle, spherical aberrations are sharpness errors, and they cause a lack of microcontrast and consequent softness in the resulting images. Spherical aberrations are usually

corrected as much as possible in quality lenses which are designed to produce maximum sharpness. Deliberate "under-correction" is often used to reduce absolute sharpness and produce pleasant background bokeh.

Nikon engineer Kouichi Ohshita explained that the DC (Defocusing Control) mechanism only became possible once rear-focusing (RF) technology had been perfected. The front group of elements in the 105mm lens remains completely stationary during focusing, while slight movements of one of the elements in this group cause changes in spherical aberration without producing additional chromatic aberrations or other significant lens errors. With the DC ring at its zero setting, spherical aberration within the lens is almost completely corrected and the results are extremely sharp. Rotating the DC ring in the "R" (Rear) direction causes under-correction of spherical aberration and produces better background bokeh. Shifting the ring in the opposite "F" (Front) direction produces over-corrected spherical aberration and better foreground bokeh. The DC ring has markings up to 5.6 in both directions, but can be rotated beyond these. If the DC setting is larger than the current aperture, the lens produces an overall soft focus effect.



Well-defined but not overbearing sharpness combined with a soft transition to the blur of the background – the effects produced by the AF DC Nikkor 105mm f/2.0D are specially tailored to the demands of high-end portrait photography.



Two Nikon portrait legends:
On the left is the 1971 AI-S Nikkor 105mm f/2.5, with its 5 elements in 4 groups design.
On the right is the 1993 AF DC Nikkor 105mm f/2.0D – bigger, heavier, brighter and even better than its predecessor.

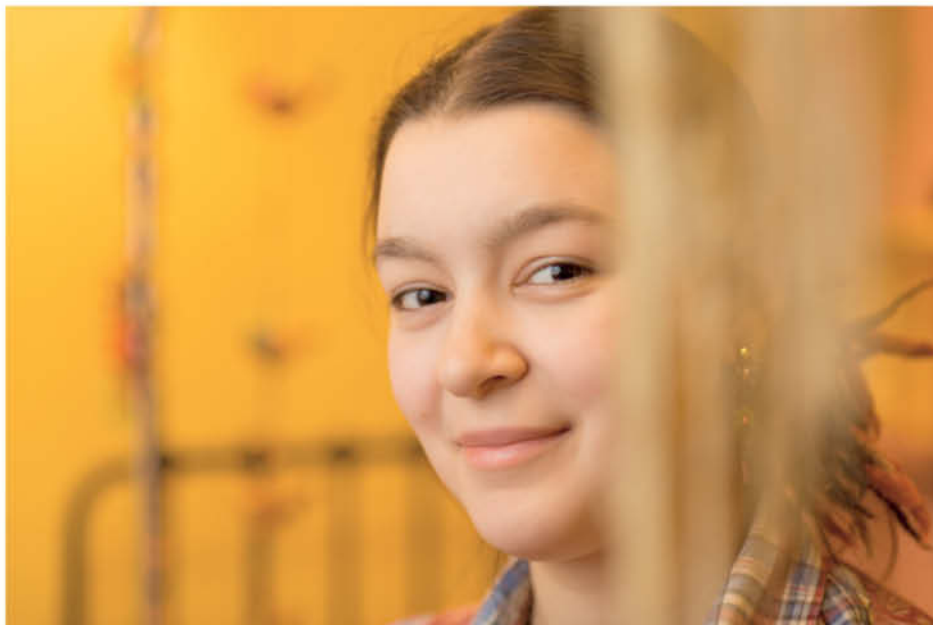
Handling

The defocusing effect is controlled by selecting an F or R setting that is the same as the currently selected aperture setting. You can only focus after making the DC setting, as this also affects focus, making the numbers on the focus scale slightly inaccurate. This is why it is possible to focus this lens “beyond infinity”.

Both lenses also produce excellent results without use of the DC functionality. Both have relatively simple designs (6 elements in 6 groups for the 105 mm, compared with 7/6 in the 135mm) and are therefore not prone to significant diffraction effects. Additionally, the front element in the 105mm version is quite deeply recessed, making it possible to shoot almost directly into the light without producing too many unwanted reflections. The rear focus system makes for fast autofocusing, but only with Nikon cameras that have an AF motor built into the camera body. The minimum focus distance for the 105mm model is 90 cm, which doesn't equate to true macro scale but does allow you to shoot portraits from very close up.

The AF-S VR Micro-Nikkor 105mm f/2.8G ED-IF can focus at closer distances and is known for its sharp, high-contrast reproduction characteristics, but doesn't reproduce skin tones as well. One comment that we found on the Web expressed the opinion that the Micro-Nikkor was designed by a scientist, whereas the DC-Nikkor was obviously designed by an artist.

Three portraits shot using the AF DC Nikkor 105mm f/2.0D mounted on a Canon EOS 5D Mark II. The two upper images were shot at f2.8 with defocusing settings of R2.8 and F2.8 respectively. The uppermost image displays the best bokeh (see the red hanging ornament on the far left). The lower image was shot at f2 with the DC ring set to beyond R5.6. The result is a nice overall soft focus effect that is more subtle at less extreme settings.



Fisheye Lenses

Fisheyes certainly belong “unusual lenses” category. The ultra-wide angle of view and the extreme barrel distortion they produce make photos shot using fisheyes immediately identifiable. As with other unusual lenses, the effect can quickly become tiresome if it is used too often or in inappropriate situations. However, if used carefully, fisheye effects can help to create fascinating images. Using a fisheye is the only way to capture a 180-degree field of view in a single photo.

In fact, fisheye lenses are constructed much like the human eye, and it is only thanks to the excellent “real-time distortion correction” performed by our brains that we don’t see the world with a fisheye perspective.

A fisheye lens projects an image with accurate proportions but distorts all the angles and straight lines that don’t pass through the horizontal center of the frame. The further straight lines are located from the center of the frame, the more distorted they appear in the final image. In principle, fisheye lenses are simply uncorrected lenses with large angles of view. In contrast, ultra-wide-angle lenses are heavily corrected in order to render straight lines and angles accurately and in a natural-looking way. Lens corrections of this type falsify the proportions within the image, and the further an object is located from the center of the frame, the larger and more distorted it will appear.

Thanks to their simple construction, fisheye lenses are less prone to diffraction and reflection effects than ultra-wide-angles, and they do not suffer from unwanted vignetting, making them eminently suitable for astronomical, meteorological and town planning applications.

Fisheye lenses have a larger angle of view than equivalent ultra-wide-angle lenses of the same focal length. The shortest focal length full-frame ultra-wide-angle lens that we know of is the Nikkor 13mm f/5.6 AI-S, constructed with 16 elements in 12 groups and an angle of view of “only” 118 degrees compared to the 180 degrees covered by the current 16mm f/2.8 Nikkor fisheye. The fisheye has 8 elements in 5 groups and is four times as bright as its 13mm cousin.

Types of Fisheye Lens

There are two basic types of fisheye lens that differ in the type of projection they produce. Early, 8mm circular fisheye lenses don’t illuminate the entire rectangular film frame, but instead produce a circular image with a diameter that is equal to the 24mm height of the frame (a 7.5mm fisheye produces an image circle that is only 23mm in diameter). They have vertical and horizontal angles of view of 180 degrees so, if you lie on the

ground on your back and shoot upward, you will produce a semi-spherical panorama that includes the sky and the entire surroundings from just above the ground and upward.

Nikon was by far the most adventurous manufacturer of fisheye lenses in the period from the 1960s to the 1980s. Their most famous creation was the 6mm f/2.8 Fisheye Nikkor with a retrofocus design that obviated the need to lock up the mirror to mount the lens on a camera. This monster weighs 10½ pounds and has a front element with a diameter of 22 cm and its own built-in tripod mount. The extraordinary angle of view of 220 degrees means that this lens can actually “see behind itself”.

The effect of circular fisheyes quickly became passé and the images they produce are difficult to display effectively alongside “normal” images, so the next logical step was the development of full frame fisheyes. These lenses project an image circle that is 43 mm in diameter and have a diagonal angle of view of 180 degrees. This design results in 15 or 16mm focal lengths and produces images that completely fill a 35mm frame without vignetting effects at the corners.

Lens manufacturers have now begun to produce full-frame fisheye lenses that fit cameras with smaller image sensors. The sensor “crop factor” of 1.5 or 1.6x results in lenses with 10 mm focal lengths.

The Sigma 10mm f/2.8 EX DC HSM is a full-frame fisheye lens with a 180-degree angle of view designed for use with crop-sensor cameras. On the left, you can see the slip-on front element protector with its removable lens cap.



Uses for Fisheye Lenses

Thanks to their large angles of view, fisheye lenses are ideal for capturing maximum detail in cramped spaces. The typical fisheye barrel distortion is less obvious if you position your camera parallel to the floor and aim it at a detail that is located midway between the floor and the ceiling. When using this type of lens, even the smallest changes in camera position have a marked effect on the look of the resulting image.

If you use a fisheye to shoot a landscape, make sure that the horizon runs precisely through the vertical center of the frame and that there are no objects that contain straight lines located toward the edges. If you adhere to these guidelines, you can capture sweeping landscapes that do not include any obvious fisheye effect. However, if you deliberately position the horizon slightly above the center of the frame, you can produce an effect that visualizes the curvature of the Earth. This particular effect is most convincing if you shoot from a slightly raised viewpoint and keep the angle of tilt of your camera subtle.

Fisheyes also make great “special effects” lenses. Their typical distortion, extreme depth of field and stretched perspective effects are perfect for accentuating the effects of spatial depth or narrowness. It takes some practice to find subjects that work well with fisheye effects, but half the fun is experimenting and finding out just how strange and wonderful things can look if photographed this way.

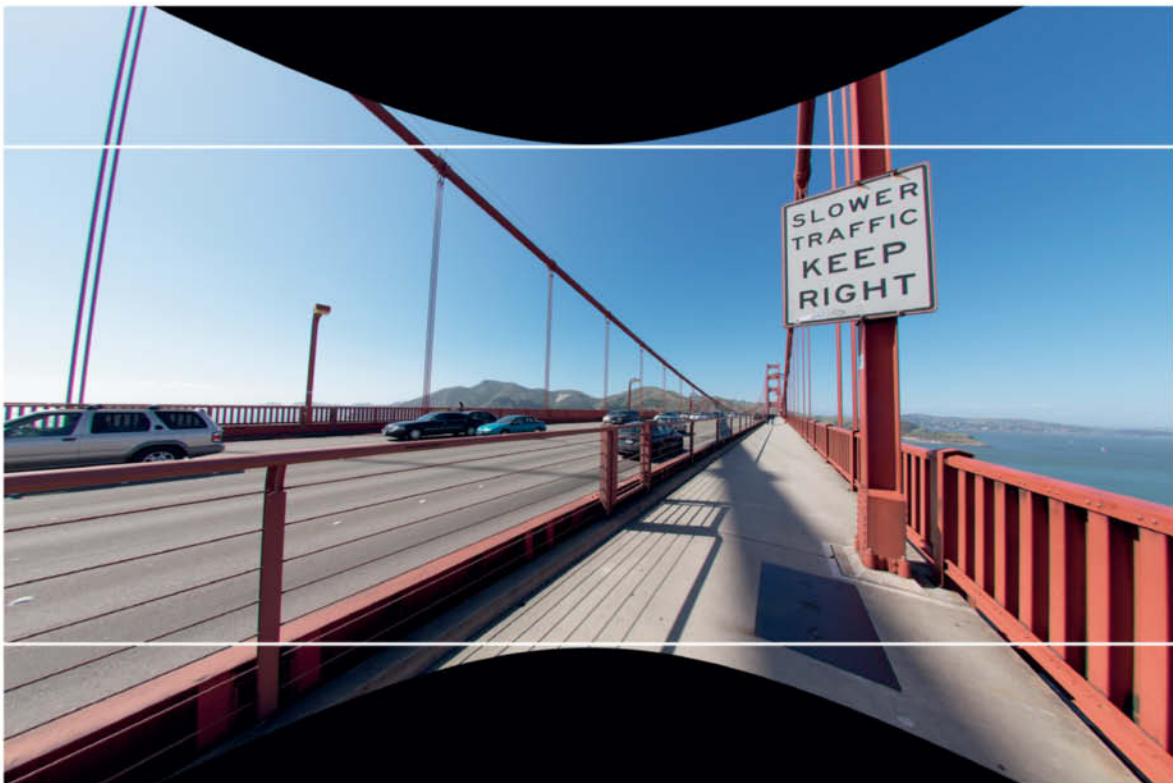
Software-based Distortion Correction

The *PanoTools* software suite – developed by Helmut Dersch, a professor of mathematics and physics – forms the basis of a number of cheap and free software packages and plug-ins that are designed for correcting the barrel distortion in fisheye photos and converting them to pseudo-ultra-wide-angle views. *PTLens* (www.epaperpress.com/ptlens), for example, is available for Mac and Windows as a standalone program or as a *Photoshop* plug-in. The trial version of the software allows you to process 10 images and the full version costs US\$25. The program is capable of correcting pincushion and barrel distortion, vignetting, chromatic aberration and perspective for a wide range of lenses. The *Hugin* package, a free alternative program with similar functionality, is also available for Linux and FreeBSD.



Fisheye lenses are great for shooting in restricted spaces

Canon EOS 550D/Rebel T2i, Sigma 10mm f/2.8 fisheye, 1/40s at f5.6



The original image is shown at the top, and the "corrected" version (made using PTLens), with its ultra-wide-angle look is shown beneath. The "stretched" car on the far left shows how dramatic the effects of lens correction can be. Correcting fisheye photos this way results in the loss of the parts of the image that lie above or below the white horizontal lines.

Canon EOS 550D/Rebel T2i, Sigma 10mm f/2.8 fisheye, 1/320s at f8.0

Pinhole Attachments

Any investigation into the roots of photography sooner or later leads to the pinhole camera – the simplest of all optical systems. A pinhole camera consists of a lightproof box with a tiny hole in its front and a light-sensitive plate or film inside the back. Any DSLR or EVIL camera can be used as a pinhole camera by attaching a suitable “tiny hole” in front of the sensor. Many people use a lens cap with a hole drilled in the middle as a makeshift pinhole attachment, although drilling the hole correctly isn’t quite as easy as it might sound.

In order to produce a halfway decent image with an acceptable degree of focus, the pinhole has to be extremely small, precisely circular and cleanly drilled without rough edges. It is easier to drill such a hole in metal than in plastic, so the simplest solution is to insert a drilled metal disk into a lens cap. The models available at www.ramaidea.it are a good example of this approach (for details, see the table at the end of this article).

The size of the hole depends on the distance between the hole itself and the sensor, and ranges between 0.1 and 0.3 millimeters for most DSLRs. Larger holes reduce the exposure time but create blur that can make the subject almost unrecognizable. Theoretically, smaller holes create sharper images but, in practice, increase the incidence of refraction, which then negates any potential increases in sharpness. If you know the diameter of your pinhole and the distance to the sensor (i.e., the flange focal distance), you can calculate the effective aperture of your pinhole as follows:

Aperture = Sensor Distance/Pinhole Diameter.

For Canon EOS cameras with their 44mm flange focal distance, a 0.25mm pinhole equates to an effective aperture of f176. This is about six f-stops darker than the normal minimum SLR aperture of f22, and thus

The uppermost image was taken using a standard lens. In the center pinhole photo, the details disappear into a soft blur, making the image even more “flowery”. The lower image shows just how prone to backlight artifacts a pinhole can be – shot without shading the lens, the photo displays severe color smears that cover the entire image area.



Fun Lens Overview					
Manufacturer, URL	Available Through	Product	Type	System ¹	Street Price (US\$)
Tilt/Shift					
Canon, www.canon.com	Retail channels	TS-E 17mm f/4	Tilt/shift lens	C-EF	2,350
Canon, www.canon.com	Retail channels	TS-E 24mm f/3.5	Tilt/shift lens	C-EF	2,100
Canon, www.canon.com	Retail channels	TS-E 45mm f/2.8	Tilt/shift lens	C-EF	1,300
Canon, www.canon.com	Retail channels	TS-E 90mm f/2.8	Tilt/shift lens	C-EF	1,300
Nikon, www.nikon.com	Retail channels	PC-E 24mm f/3.5	Tilt/shift lens	Ni	1,979
Nikon, www.nikon.com	Retail channels	PC-E 45mm f/2.8	Tilt/shift lens	Ni	1,899
Nikon, www.nikon.com	Retail channels	PC-E 85mm f/2.8	Tilt/shift lens	Ni	1,829
Tilt					
Lensbaby, www.lensbaby.com	store.lensbaby.com	Lensbaby Muse (50mm f/2)	Tilt lens with "sweet spot"	C-EF, Ni, OI-E, Pe-K, S-AF	150
Lensbaby, www.lensbaby.com	store.lensbaby.com	Lensbaby Composer (50mm f/2)	Tilt lens with "sweet spot"	C-EF, Ni, OI-E, Pe-K, S-AF	250
Lensbaby, www.lensbaby.com	store.lensbaby.com	Lensbaby Control Freak (50mm f/2)	Tilt lens with "sweet spot"	C-EF, Ni, OI-E, Pe-K, S-AF	350
Tilt Adapters					
Arax Foto	www.araxfoto.com	Tilt adapter	Tilt adapter for medium-format lenses	All 35mm/full-frame systems	125
Lensbaby, www.lensbaby.com	store.lensbaby.com	Tilt Transformer	Tilt adapter for Nikon lenses	MFT, Sony NEX	230
Lensbaby, www.lensbaby.com	store.lensbaby.com	Composer with Tilt Transformer	Tilt lens with "sweet spot" for Micro Four Thirds and built-in Nikon lens adapter	MFT, Sony NEX	350
Lomo					
Lomography, www.lomography.com	http://shop.lomography.com	Diana+ 20mm Fisheye	Medium-format plastic lens (Pentacon Six bayonet)	C-EF, Ni (with Adapter)	49 (plus 17 for an adapter)
Lomography, www.lomography.com	http://shop.lomography.com	Diana+ 38mm	Medium-format plastic lens (Pentacon Six bayonet)	C-EF, Ni (with Adapter)	42 (plus 17 for an adapter)
Lomography, www.lomography.com	http://shop.lomography.com	Diana+ 55mm with macro attachment	Medium-format plastic lens (Pentacon Six bayonet)	C-EF, Ni (with Adapter)	55 (plus 17 for an adapter)
Portrait Lenses					
Nikon, www.nikon.com	Retail channels	AF DC Nikkor 105mm f/2.0D	Portrait lens with defocusing and bokeh control	Ni	1069
Nikon, www.nikon.com	Retail channels	AF DC Nikkor 135mm f/2.0D	Portrait lens with defocusing and bokeh control	Ni	1390
Fisheye Lenses					
Canon, www.canon.com	Retail channels	EF 8-15mm f/4L Fisheye	Circular/diagonal full-frame fisheye zoom	C-EF	1499
Nikon, www.nikon.com	Retail channels	AF DX Fisheye Nikkor 10.5mm f/2.8G ED	Diagonal fisheye for DX format cameras	Ni	775
Nikon, www.nikon.com	Retail channels	Fisheye AF Nikkor 16mm f/2.8D	Diagonal fisheye for FX (full-frame) cameras	Ni	900
Sigma, www.sigmaphoto.com	Retail channels	10mm f/2.8 EX DC HSM Fisheye	Diagonal fisheye with ultrasonic AF	C-EF, Ni, Pe-K, Sigma AF, S-AF	649
Tokina, www.tokinalens.com	Retail channels	AT-X 10-17mm f/3.5-4.5 AF DX Fisheye Zoom	Diagonal/full-frame fisheye zoom (180/170-100 degree angle of view)	C-EF, Ni, Pe-K, Sigma AF, S-AF	599
Lensbaby, www.lensbaby.com	store.lensbaby.com	Lensbaby Fisheye Optic 12mm	Fisheye for the Lensbaby Optic Swap system, 160-degree angle of view	Lensbaby Composer & Scout, others with adapter	150
Pinholes					
Ra.Ma.	www.ramaidea.it	Rising Pinhole Lens	0.22 mm pinhole diameter, approx. aperture f/216	C-EF, Ni, S-AF, OI-E, Samsung NX	40
Others					
SLR Magic	enjoyyourcamera.com	Toy Lens 26mm f/1.4	Multicoated glass lens with sharp center area	MFT	99
SLR Magic	enjoyyourcamera.com	35 mm f/1.7	Multicoated glass lens with sharp center area	MFT, S-Nex	140
Monochrom	www.monochrom.com	Subjektiv	High-end kit with five optical inserts	C-EF, Ni, OI-E, S-AF	280

¹ C-EF = Canon EF, MFT = Micro Four Thirds, Ni = Nikon, OI-E = Olympus E, Pe-K = Pentax K, S-AF = Minolta/Sony AF, S-Nex = Sony NEX

requires you to use an exposure time that is 2⁶ = 64 times as long as you require at f22.

If you want to take pinhole photos in low light or using lower ISO values, you will definitely need to use a tripod to keep the camera still during the resulting exposures,

which can be as much as several minutes long. The viewfinder image is extremely dark at an effective aperture of f176, so the best way to adjust your framing is to take a test shot and zero in on the optimum settings from there.

Pinholes do not produce fringing or distortion effects, but don't allow you to alter the depth of field in your image by changing

the aperture. They are equally sharp (or, more accurately, unsharp) from the close foreground right up to infinity, so it is a good idea to choose a photogenic background to experiment against.



The illustration on the left shows a home-made pinhole attachment, while the one on the right shows the thin metal pinhole insert of one that was professionally drilled. This approach makes it possible to produce smaller, more precisely dimensioned pinholes.



The effective focal length of a pinhole attachment is equal to the flange focal distance of your camera plus the thickness of the lens cap or attachment you are using, which usually equates to about 50mm. This means that you can use extension rings to increase the focal length. The same pinhole attachment has an effective focal length of between 75 and 100mm when used with small-sensor cameras with a crop factor of between 1.5 and 2.

Pinhole photography fans have their own global festival (www.pinholeday.org), which they celebrate every year on the last Sunday in April. Anyone who is interested is invited to make pinhole photos on the day in question and upload the results to the festival site. (pen)



Evenly distributed blur that stretches from the foreground to the background is typical of a pinhole photo **ct**

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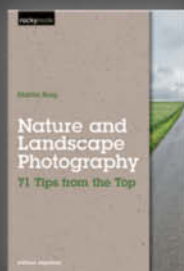
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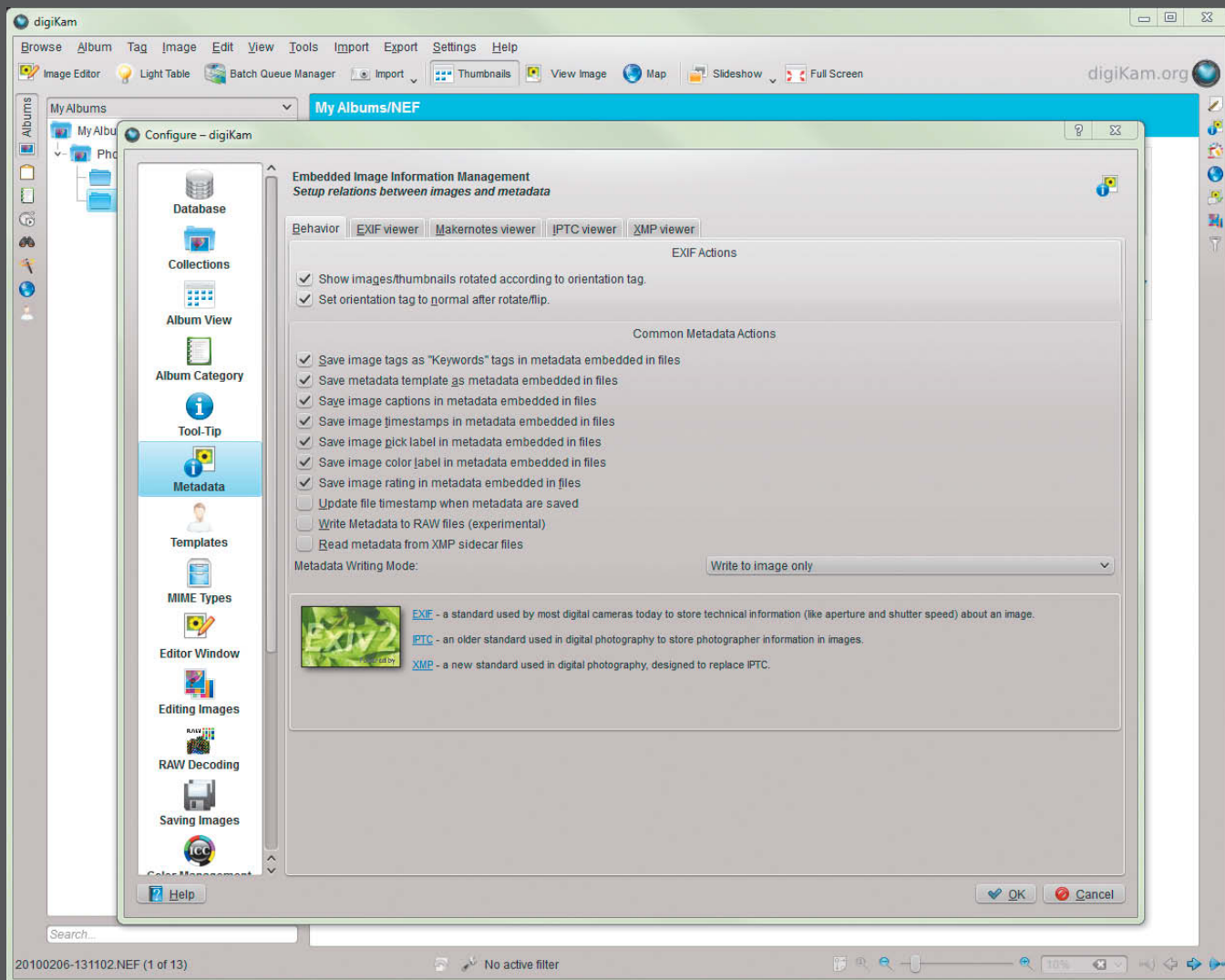
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Dmitri Popov

The digiKam All-in-one Open Source **Photo Workflow Tool**

Similar to GIMP, digiKam is a free open source package but, while GIMP is a pure image editing application, digiKam excels at managing and processing photos too. In fact, the two applications complement each other, so you can use digiKam to keep tabs on your photo collection and do some basic photo tweaking and leave the job of advanced photo retouching to GIMP. Now that we've sorted that out, let's whet your appetite with a closer look at some of digiKam's key features.

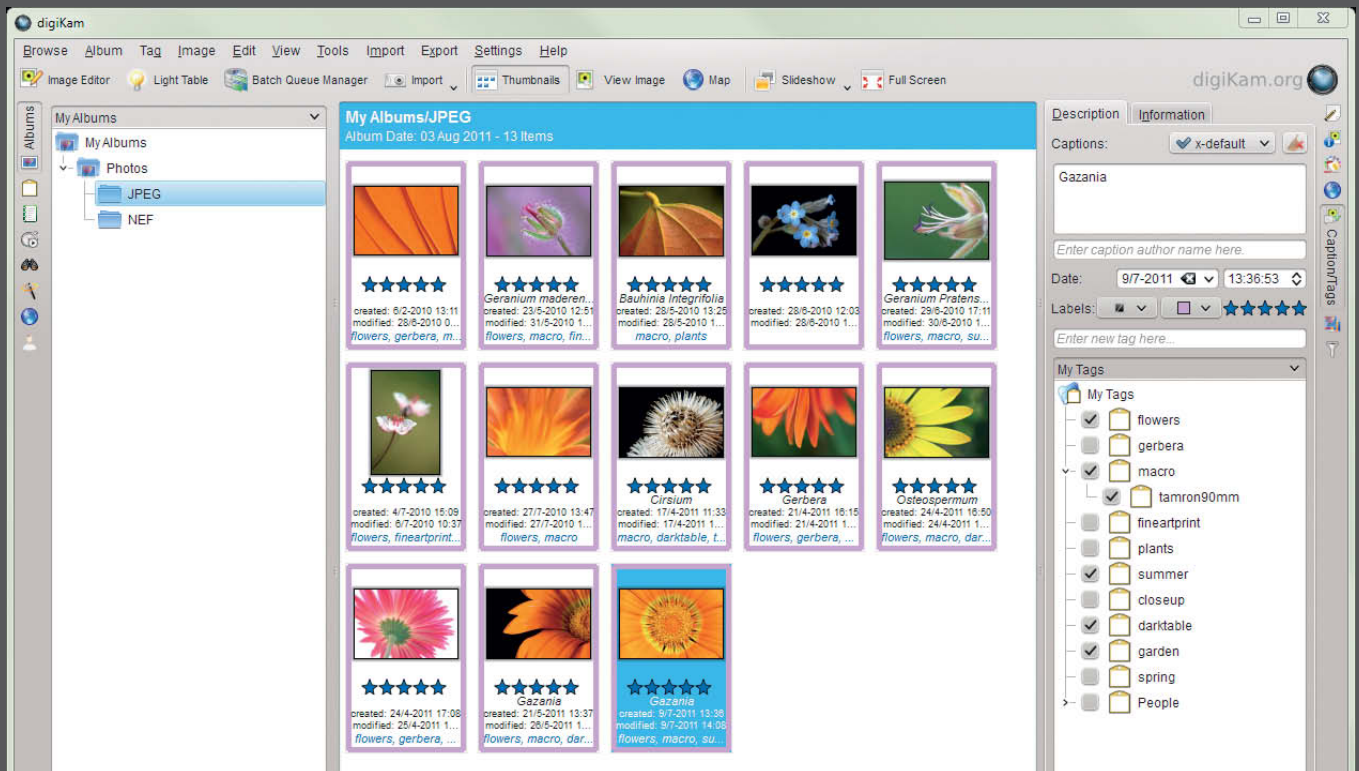


The Configure interface lets you tweak a wide range of settings. You can configure the way digiKam handles RAW files and metadata, enable and disable Kipi plugins, switch between different database back ends and much more besides.

While commercial tools like Adobe Lightroom and Nikon Capture NX2 are popular choices among serious amateurs and professional photographers alike, they are not the only fish in the sea. And before you splash out serious money on high-end software, you might want to consider lesser known yet powerful alternatives like digiKam. While this open source application reigns supreme on the Linux platform, it still remains relatively unknown among Windows and Mac OS X users – primarily because there was, until recently, no easy way to install and run digiKam on these platforms. However, the digiKam developers made the latest beta version of digiKam available as a Windows installer, which makes it significantly easier to give digiKam a try.

Feature Highlights

- Thanks to the LibRaw RAW decoding and processing library (www.libraw.org), digiKam can handle a wide range of RAW formats, including the usual suspects like NEF, CRW, CR2, RAF and DNG. digiKam currently supports 427 cameras that shoot in RAW, and new models are added almost as soon as they hit the market. Quick tip: You can view a list of all supported cameras by choosing the Help > Supported RAW Cameras menu item.
- digiKam offers several ways to view your photos. You can use a conventional album view, browse photos by tags or by date, or display your photos as a timeline. You can also view your photos on a map, provided they have been properly geotagged.
- The application sports a separate interface for working with geodata, which you can use it not only to geotag photos, but also to geocorrelate them. digiKam offers another useful feature called Reverse Geocoding, which allows you to retrieve human-readable data such as city, street and country names based on a photo's geographical coordinates. This data can then be stored in the form of new tags, so you can easily search for photos taken in a specific country, city or street.
- The photo management interface provides a wide array of tools to help you to keep tabs on your photos. As with any photo management program that is worth its salt, digiKam offers tagging and rating features, as well as Color labels and Picks tools. The former lets you apply color codes to photos,



digiKam is capable of assigning multiple tags and sub-tags to photos, and even supports custom keyboard shortcuts for frequently used tags

- while the latter can come in handy for rating and prioritizing your photos.
- ❑ digiKam includes powerful filtering and search capabilities. The dedicated Filters sidebar in digiKam's main interface offers a simple yet flexible way to filter photos using nested, user-defined criteria. For example, you can set up a filter that displays photos that contain specific tags and color labels, and that have a rating of three or more stars.
- ❑ The application supports non-destructive editing and versioning. This allows you to tweak photos to your heart's content without affecting the original image data. In addition, you can save multiple modified versions of a single original and use digiKam to organize them as well as keep track of changes made to each version.
- ❑ When it comes to editing, digiKam offers a smorgasbord of useful tools. As well as the standard Curve and Level adjustment tools, the package boasts exposure blending, lens correction, perspective adjustment, black-and-white conversion and many other nifty features. Better yet, the application sports powerful batch processing capabilities that allow you to apply multiple editing and conversion operations to sets of photos.
- ❑ Thanks to a comprehensive collection of bundled plug-ins, you can publish your

photos using many popular photo sharing services without leaving the photo management interface. Flickr, Picasa, Facebook and SmugMug are just a few of the supported services.

Weaknesses

It's not all good news, though, and digiKam does have several weak spots. Let's start by taking a look at the limitations of digiKam for Windows.

When you plug a camera into a Linux machine, you can access it directly and pull photos from it from within digiKam. This feature doesn't yet work on Windows, so you have to use the Windows import tool to move photos from the camera to your computer and then add them to the digiKam library.

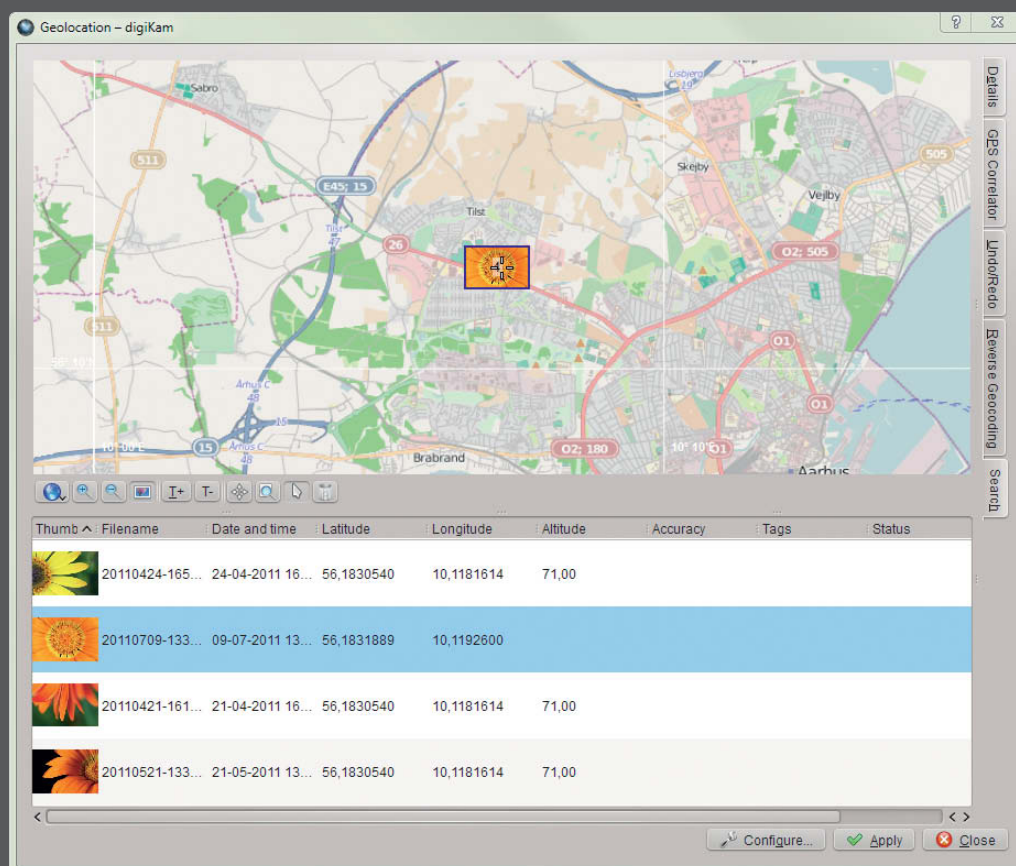
The Trash feature doesn't work either, but you can work around this issue by deleting photos instead of sending them to the trash. To be fair, these issues are not caused by digiKam itself, but are due to bugs in the underlying KDE libraries that the application relies on. The digiKam interface is also an acquired taste. It lacks the polish of commercial applications, and the sheer amount of available features and tools can be overwhelming. To make matters worse, there is no proper documentation, and while it is

not particularly difficult to figure out how to use the application's basic features, getting to grips with some of the advanced functions requires a fair amount of effort.

Installation

Running the installer tool guides you through the installation process, but before you can fire up the program, there are a few additional things that you need to do first. Although the version of the installer used for this article adds entries to the Start menu, they all point to the wrong locations. To fix this issue, you need to point each item to the correct executable file. For example, to fix the digiKam entry, right-click on it in the Start menu, choose Properties, and replace the existing C:\Program Files\digiKam\kde4\bin\digikam.exe path with C:\Program Files\digiKam\KDE4-MSVC\bin\digikam.exe. Repeat this step for other digiKam-related entries in the Start menu.

The program includes the nifty Exposure Blend feature that allows you to merge several photos with different exposures into a single image with improved dynamic range. To make this feature work in digiKam, you need to install two additional packages. First, download and install the Hugin application (<http://hugin.sourceforge.net/download/>),



The Geolocation interface makes geotagging your photos simple. The Search sidebar can be used to quickly find the desired location on the map, while the GPS Correlator section lets you geotag photos using a GPX file. Additionally, the Reverse Geocoding sidebar provides tools for transforming geodata into human-readable location data.

then copy the `align_image_stack.exe` executable from `C:\Program Files\Hugin\bin\` to `C:\Program Files\digiKam\KDE4-MSVC\bin\`. Grab the latest version of the Enblend package, extract the `enfuse.exe` executable from the downloaded zip archive and move it to `C:\Program Files\digiKam\KDE4-MSVC\bin\`. Once you've done all the preparatory work, launch digiKam and follow the instructions in the setup wizard to configure the basic settings.

Configuration

Although you can start using digiKam right away, it's worth spending a few minutes tweaking the default settings located under `Settings > Configure digiKam`. By default, digiKam uses the SQLite database to store all key information and metadata, although it does support a remote MySQL database too. Using MySQL as digiKam's back-end allows you to access your photo collections from multiple digiKam installations – for example, on your notebook and desktop machines. Of course, this approach requires a MySQL server, and you need to set up two dedicated databases for your metadata and your thumbnails. Hooking the program up to the MySQL back-end is easy: in the Configure

window, switch to the Database section, select MySQL from the Type drop-down list and specify the required connection information.

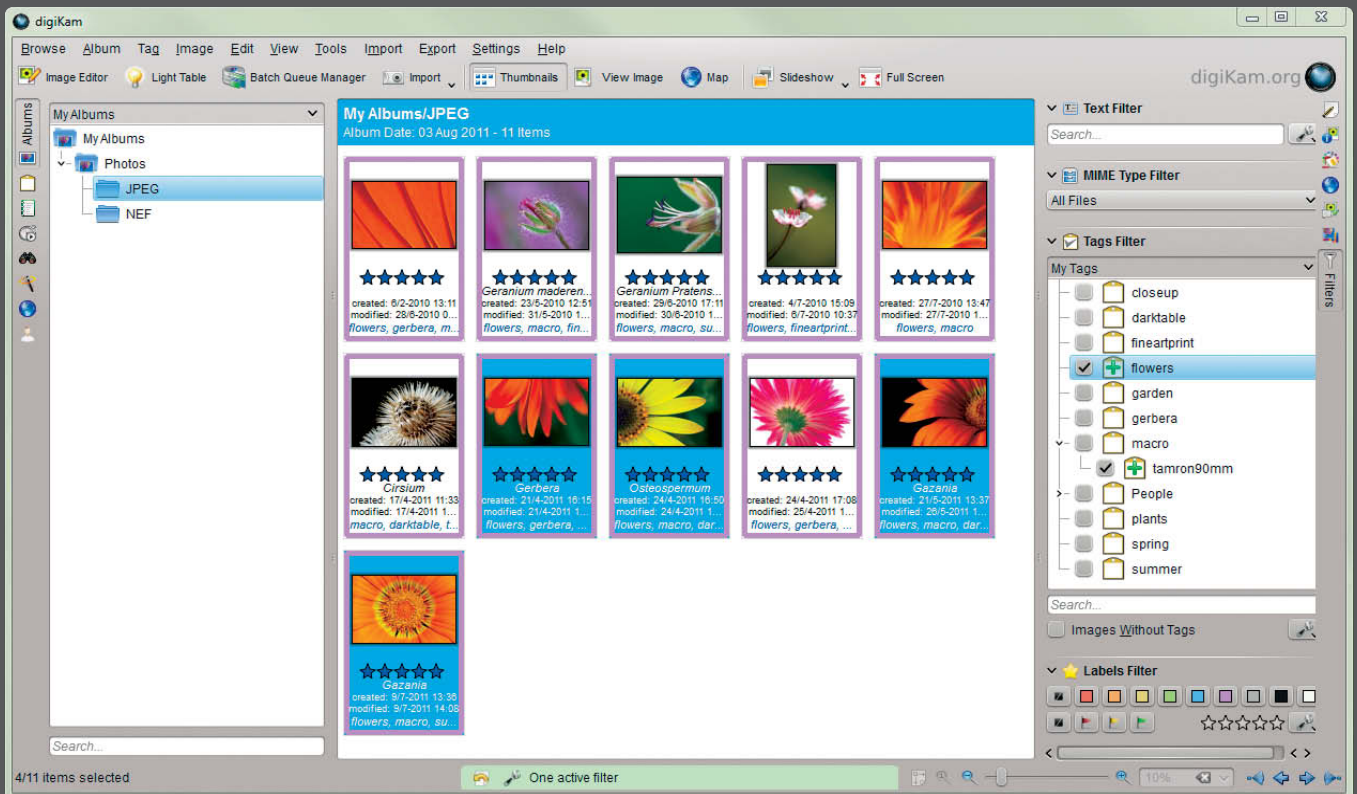
Next, you should add so-called collections (i.e., folders) where you store (or plan to store) your photos. digiKam supports collections stored on local drives, removable media or a network share. To add collections, switch to the Collections section, press the Add Collection button next to the appropriate collection type, and select the desired folder.

digiKam can write metadata directly to photos, or you can configure it to save each photo's metadata in a separate XMP sidecar. Storing metadata this way has several advantages. It is significantly faster than saving metadata to image files and also allows you to store metadata for RAW files without writing it directly to RAW, which can be problematic. To enable the XMP sidecar functionality, choose `Settings > Configure digiKam`, switch to the Metadata section and select the desired option from the Metadata Writing Mode drop-down list. You can choose between *Write the XMP sidecar only* and *Write to image and XMP sidecar* options. Enable the *Read Metadata from XMP sidecar files* option and press OK to save your settings.

digiKam sports two separate interfaces for organizing and processing photos. The main interface is designed for asset management

and provides access to the organizing, viewing and search tools. To put all the features at your fingertips, the main interface has two sidebars and a main working area, where currently selected images or albums are displayed. The left-hand sidebar is used to switch between different view modes, such as Albums, Tags, Timeline, Map Searches, etc. The album view is the default, and displays a hierarchical tree of existing albums. Selecting an album displays its contents in the main window. The right-hand panel can be used to view and edit a photo's histogram and access previous image versions. The Filters sidebar lets you specify filters for displaying photos that match specific criteria.

Populating collections with photos is a pretty straightforward procedure. In the Albums view, select the collection you want and choose `Import > Add Images` to import individual photos or `Import > Add Folder` to import a complete folder. Once you've imported photos, you can tag them to simplify image management. digiKam lets you create and assign an unlimited number of tags and sub-tags to create a highly granular view. For example, you can create a "macro" tag and then add "tamron90mm" and "nikon105mm" sub-tags for shots taken using specific lenses. You can also assign keyboard shortcuts to speed up the tagging process – simply right-



digiKam's filtering capabilities help you to quickly find and view images that match specified criteria. The Filters sidebar has options for filtering photos by type, tags, color labels and ratings. You can set up advanced filters by combining multiple criteria.

click a tag in the Captions/Tags sidebar (on the right) and choose Properties. Press the Shortcut button and hit the key combination of your choice to register the shortcut and click OK to save it. You can now apply the shortcut directly to selected images using your chosen keystroke.

Color labels is another feature that can come in handy for keeping track of your photos. As the name suggests, it allows you to color code photos using one of nine color labels. Each color label has a keyboard shortcut assigned to it, which speeds up the process of applying them. How you use this feature depends on the way you structure your workflow – for example, you can apply one color label to photos you share on the web and a different one to photos you plan to use in your portfolio.

The Image > Geolocation command opens the program's dedicated geodata interface, which offers several ways to obtain the geographical coordinates of the place where a photo was taken. You can use the mouse to locate the desired spot on a map or, if you know the full or partial address of the location, you can use the built-in search feature to find it

automatically. Click on the Search tab, enter the address in the search field, hit the Search button and you should see a list of matching results with corresponding pins on the map. The easiest way to add geographical coordinates to photos is to drag them from the list to the desired spot on the map. Alternatively, you can assign the geographical coordinates of a specific search result by making a selection from the image list, right-clicking the desired search result and picking the Move Selected Images to this Position item from the context menu. Once you have assigned the geographical coordinates, press the Apply button to write geotags to the selected image (s).

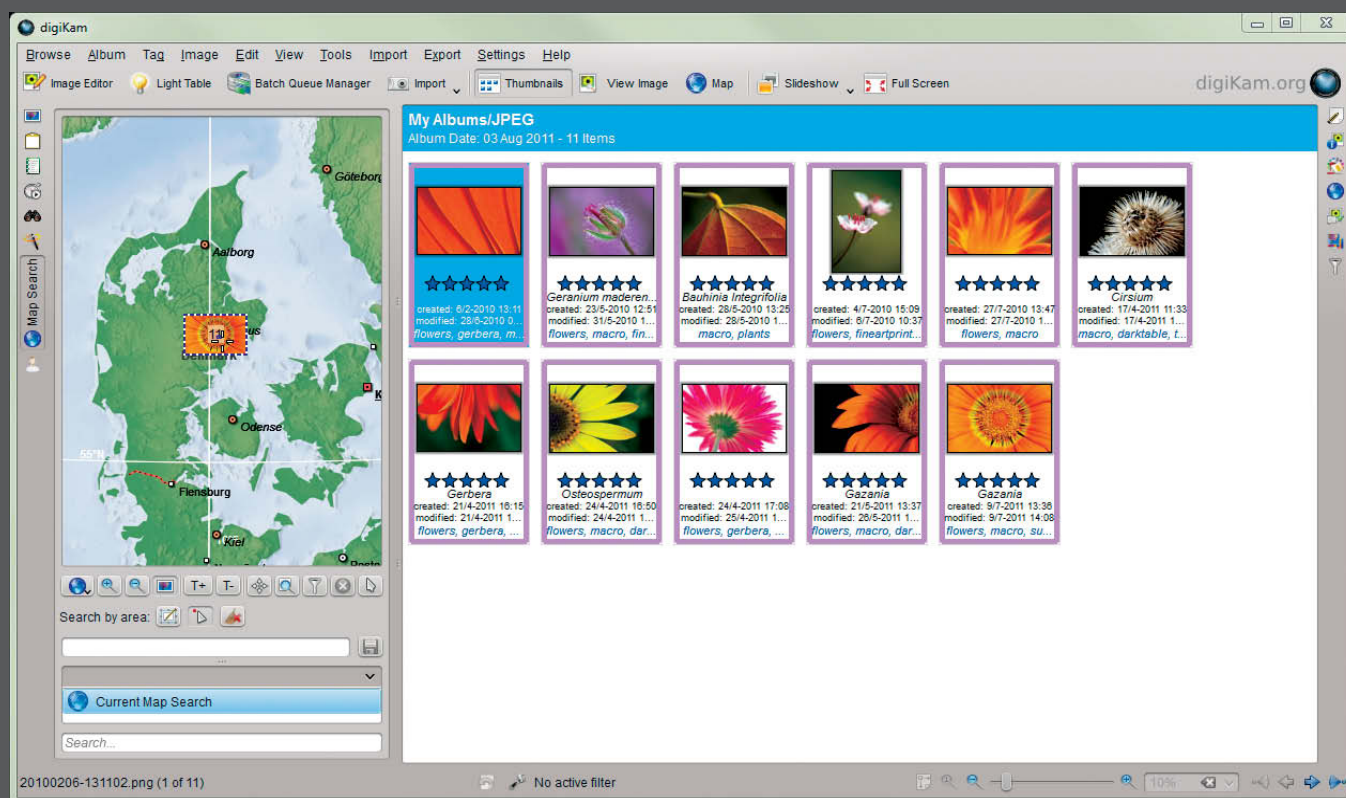
Searching and Filtering

digiKam is designed to manage hundreds or even thousands of photos, and includes powerful search and filter capabilities. Simply enter a search term in the search field of the Text Filter section and digiKam automatically finds photos with filenames, comments or tags that match your specified criteria. The list of available tags in the Tag Filter section can be

used to locate photos containing specific tags – simply select one or more tags to display all matching photos in the current album. The Labels Filter section lets you filter photos according to their color labels, picks and ratings. Click on a particular label or status, and you should see all matching photos. To use the rating filter, select the desired number of stars with the mouse. The software then narrows the view to include only matching photos.

In addition to the search and filtering tools in the Filters sidebar, digiKam offers advanced search features, including the Calendar, Timeline, Search, and Map Search options. These are accessible via the left-hand sidebar.

The Calendar section lets you quickly find photos for a specific year, month and date. Use the folder tree in the sidebar pane to locate the year and month you are looking for. If you want to view photos taken on a specific date, use the calendar at the bottom of the pane. Dates containing photos are marked in bold type. The Timeline section offers a different way to locate and view photos covering a specific period of time. Here, your photos are presented as a bar chart, and you



The Map Searches sidebar uses a map to find and display photos taken at a specific location. The current search can be saved for later use.

can view photos for a specific period by clicking on the appropriate bar.

The Search section is designed for performing searches in a more traditional way. Type a search term in the Search field and digiKam automatically displays matching photos in the main pane. To make your search more precise, press the Advanced Search button. This opens the Advanced Search dialog window, where you can specify additional search options.

As you might have guessed, the Map Searches section lets you locate photos taken at a specific location. The map itself displays thumbnails representing groups of geotagged photos. Each thumbnail contains a counter indicating the number of photos found in the specific area. To view these, press the Region Selection button (the middle button in the Search by area section) to create a region selection from a thumbnail. Using the Area Selection button in the Search by area section, you can view all photos in a manually selected area on the map. To do this, press the button, click anywhere on the map and drag a rectangle around the desired area.

Working with RAW Files

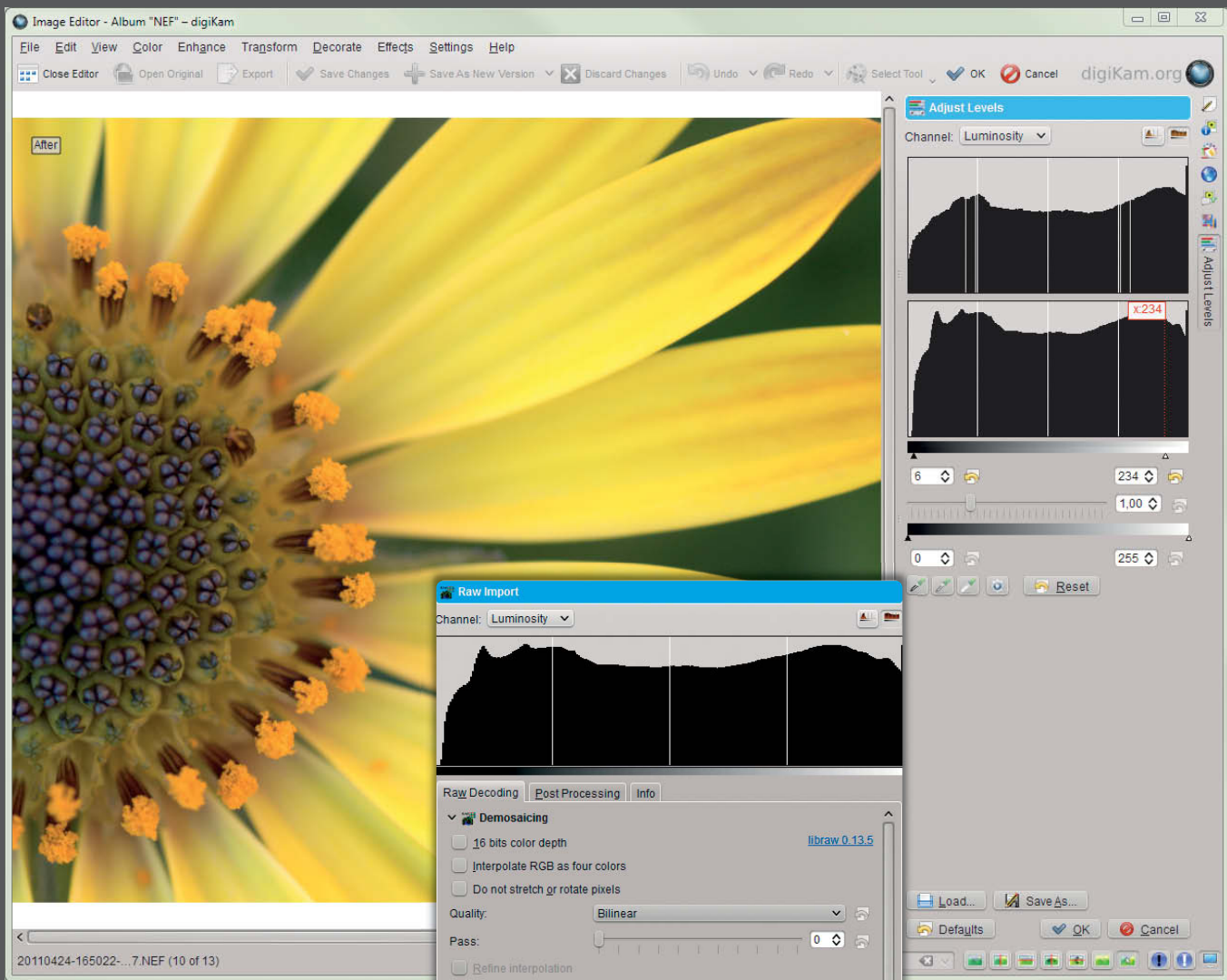
The ability to process RAW files makes digiKam a viable alternative to existing photo management applications for hobby and advanced photographers. By default, digiKam automatically processes RAW files when you open them for editing. If you prefer to tweak your RAW files manually, you can enable the RAW Import Tool. To do this navigate to the Image Editor section in the Configure dialog and enable the *Use RAW Import Tool to handle RAW images* option. The next time you open a RAW file for editing, digiKam will automatically open the RAW Import interface where you can adjust your RAW import and post-processing settings.

The RAW Import sidebar is split into RAW Decoding, Post Processing and Info tabs. In the RAW Decoding section, you can adjust demosaicing, white balance, noise reduction, chromatic aberration correction and color management settings.

digiKam supports several demosaicing algorithms (Bilinear, VNG, AHD, LMMSE and others), and the Shift+F1 keyboard shortcut

shows a brief description of each algorithm. Since the RAW Import interface allows you to preview tweaked images before you commit your adjustments, you can try different algorithms to see which one works best for the current file. Select the algorithm you want, and press the Update button to preview the result.

The RAW Decoding section lets you tweak other settings, too. Here, you can choose the 16-bit color depth option, which provides better tonal range than the (faster) default 8-bit mode. If you choose to work in 16-bit mode, enable and configure the Color Management options to prevent your images from being rendered too darkly by the image editor. You can adjust white balance settings and specify how the system should handle highlight clipping (i.e., overexposed image areas) in the White Balance section (again, the Shift+F1 keyboard shortcut displays descriptions of the supported methods). In addition, you can also enable and adjust the Exposure Correction option and manually tweak exposure compensation settings. The Corrections section includes a selection of



The Adjust Levels tool can be used to adjust brightness and contrast manually using its built-in sliders or automatically using the Auto Adjust button located to the left of the Reset button

The tools provided in the RAW Import interface can be used to make manual adjustments to RAW files. You can choose between different demosaicing algorithms, adjust white balance, enable noise reduction and much more besides.

noise reduction algorithms and a chromatic aberration correction option.

Finally, the Post Processing section includes settings for adjusting brightness, contrast, gamma, exposure and the luminosity curve. Although you can make these types of changes later when editing the converted image, you can also set the program to streamline the editing process by performing them automatically during RAW import.

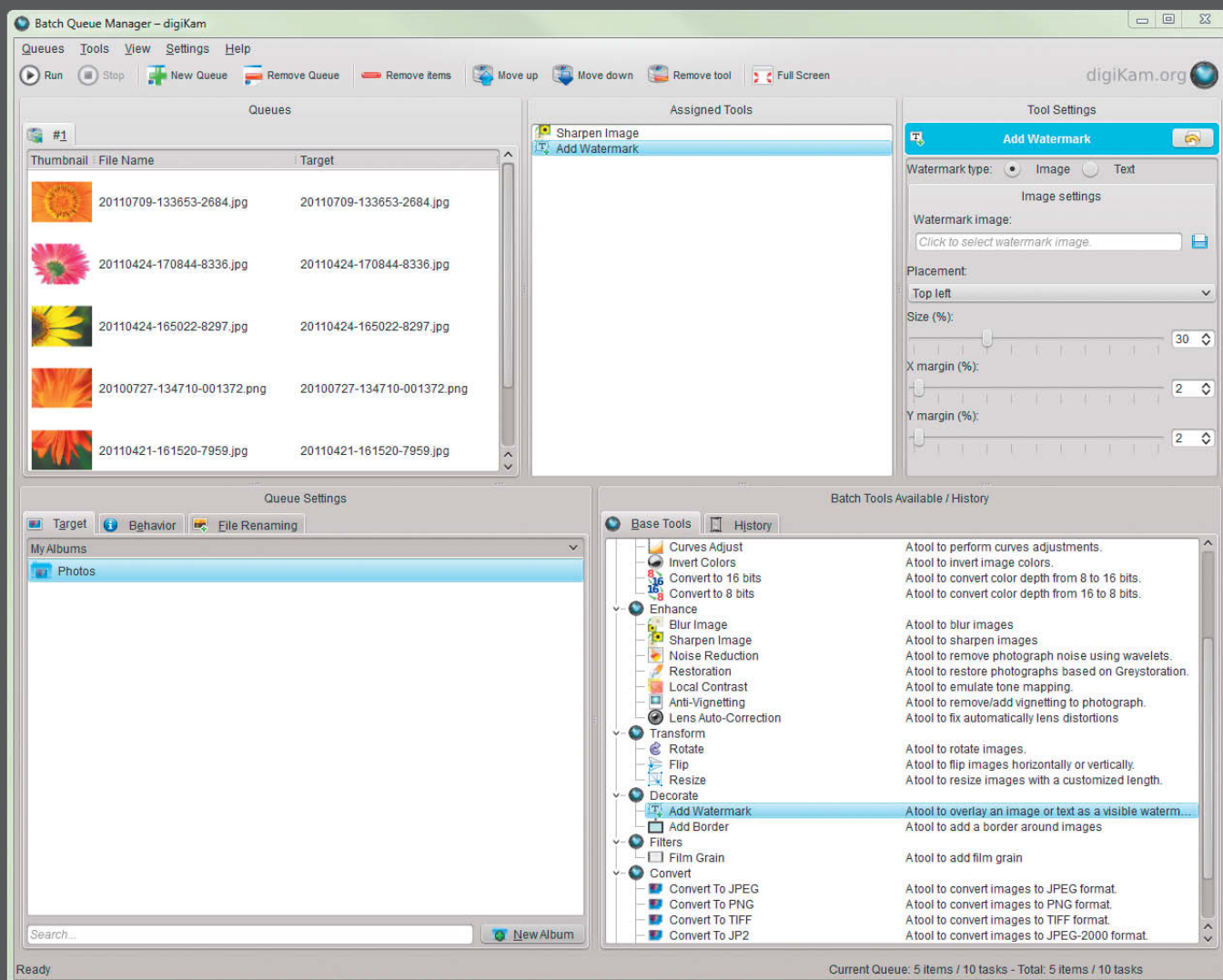
You can use the RAW Import Tool to process individual RAW files, but what if you

need to simultaneously convert multiple files? This is where the Batch RAW Converter comes into play. As the name suggests, the tool allows you to process several RAW files at once. Simply select the RAW files you want to process and choose Tools > Batch RAW Converter, configure the available options to your liking and press the Convert button.

Editing Images

digiKam includes a wide range of editing tools. Obviously, it would be impossible to

cover them all in one article, so let's take a look at a couple of the most interesting ones. Like any quality photo editing application, digiKam features curve and level adjustment tools. The latter can be used to adjust brightness and contrast by specifying the location of pure black, pure white and midtones in the image histogram. This makes it a handy tool for tweaking under- and overexposed image areas, as well as improving overall tonal range. The Color > Levels Adjust command in the Edit interface opens the Adjust Levels tool. Select



The Batch Queue Manager helps you to simultaneously apply several actions to multiple photos. Among many other features, the tool can be used to watermark entire batches of photos with a minimum of fuss.

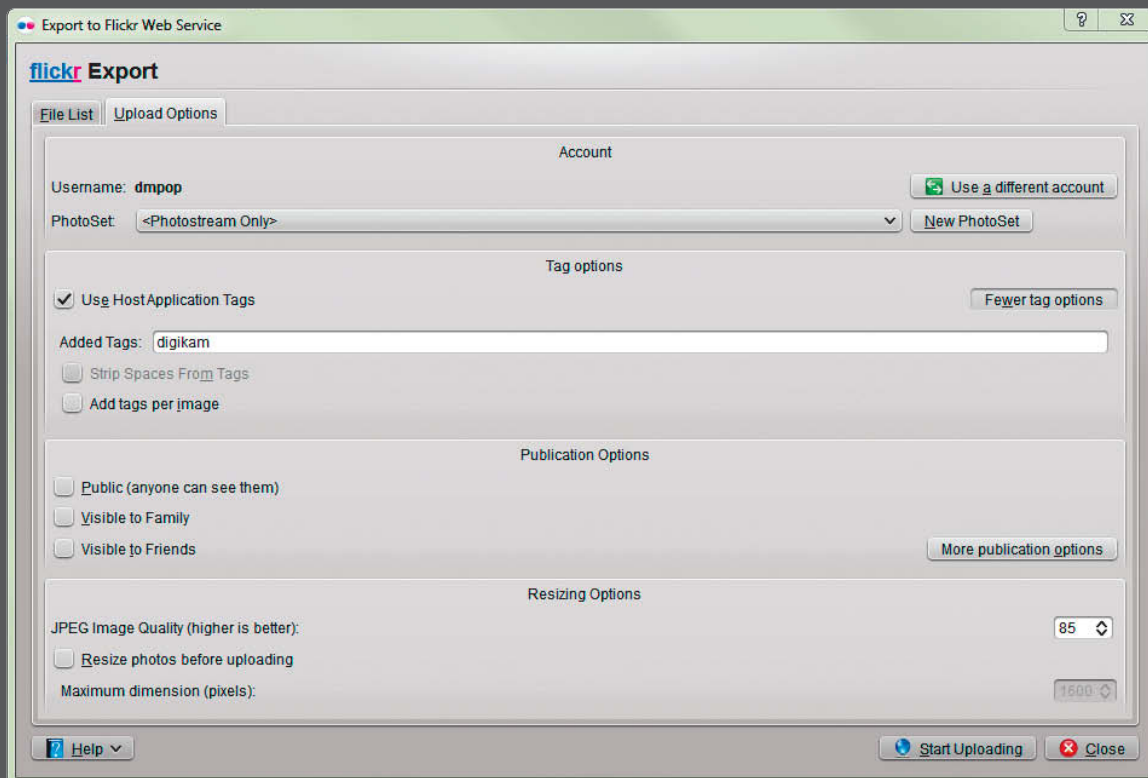
Luminosity from the Channel drop-down list, and press the Linear button. The histogram in the tool's sidebar contains two sliders for adjusting shadows and highlights. For example, if you want to darken shadow areas in a photo, move the black point slider to the right. Conversely, moving the white point slider to the left boosts the highlights. Another way to tweak levels is to use the three color pickers next to the Automatic level adjustment button. To fix shadows, press the shadow tone color picker button and click on an area in the image that

represents black. You can then adjust midtones and highlights in a similar manner using the appropriate color pickers. Adjusting levels in the Red, Green, and Blue channels help to boost colors and fix color casts.

Instead of using the Levels tool, you can also use the Enhance > Local Contrast feature to improve the dynamic range of an image by reducing global and increasing local contrast. You can apply up to four tone mapping operations (called "Stages") and you can adjust the Power and Blur parameters for

each. Power controls the desaturation level, while Blur enables you to directly adjust affected image areas.

The Tools > Blend bracketed images tool merges multiple shots with different exposures into a single well-exposed image. The feature is fairly basic, but is straightforward to use and produces impressive results. The Exposure Blending Import wizard will guide you through the entire process, which consists of adding source images, aligning them and then blending them into one. The alignment feature is really useful if you shot your source



Thanks to the Kipi plugins, you can upload photos directly to many popular photo sharing services directly from within the application

images handheld. Once digiKam has finished the blending process, you can tweak the results manually using the Exposure Blending editor.

You can either use the editing tools to tweak individual images or the Batch Queue Manager tool for simultaneously editing multiple images. The tool enables you to set up advanced processing profiles and manage multiple queues. To add photos to the Batch Queue Manager, select them in the main program window and choose Image > Add to Current Queue. To specify the actions you want to perform on your queued images, select the desired tools from the Base Tools section and specify the settings for each in the Tool Settings pane. The File Renaming section in the Queue Settings pane lets you specify renaming rules to prevent batch jobs from overwriting your original files.

digiKam supports non-destructive editing and versioning, which is useful not only for modifying photos without affecting your original image data, but also for saving multiple versions of a photo and keeping track of the changes you make. To enable this feature switch to the Image Editor section in the Configure dialog, tick the Enable Non-destructive editing and versioning check box,

and configure the settings as you wish. Using the versioning feature is simple – all you have to do is press the Save As New Version button in the editor. To view all versions of a specific photo, select the original in its album and expand the Versioning sidebar on the right. You should then see all versions of the selected photo with a complete list of the editing actions you applied to them.

Sharing Photos

digiKam is designed not only for organizing and editing photos, but also for sharing and publishing. The application supports a wide range of sharing options, from creating static HTML photo galleries and generating KML files for viewing your photos with Google Earth, to uploading photos to popular photo sharing services such as Flickr, Picasaweb, SmugMug and many others. In addition to photo sharing web services, digiKam supports popular self-hosted photo sharing applications such as Gallery and Piwigo.

The program's sharing capabilities are simple to use. For example, if you want to upload selected photos to your Flickr account, choose Export > Export to Flickr. Authenticate your account when prompted by the website

(which will identify the dialog as FlickrUploadr) and enable the Flickr export feature. In the Flickr Export window, select the photos you want to upload and specify the desired visibility settings (i.e., Public, Family or Friends). The Upload Options tab includes settings such as the target photoset, custom tags, and image resizing and quality options. Once you're done, hit the Start Uploading button and wait while digiKam takes care of everything else. The other sharing options are just as simple to use, making it easy to share your photos without the digiKam interface.

Conclusions

digiKam offers all the tools you need to set up a complete digital photo workflow, from importing and organizing to editing and sharing. Even if you have already built a workflow using a commercial application like Adobe Lightroom, there are still situations in which digiKam can be a useful addition to your toolset. For example, if you install it on your notebook to enable you to quickly organize and process photos that you have taken while you are out and about. However you decide to use it, digiKam is free, so there is no harm in giving it a try. (jr)



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Coming up in Issue 7 ...

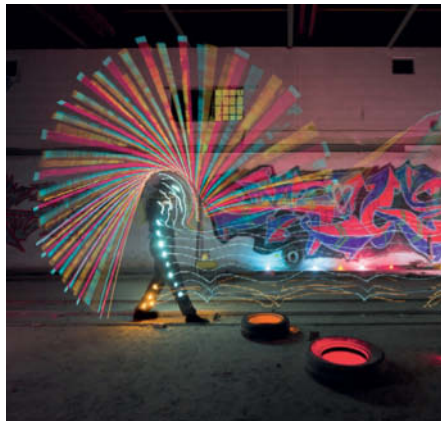


Extreme Detail with Gigapixel Images

An entry-level DSLR is perfectly sufficient for shooting the countless source images that make up gigantic "gigapixel" images with virtually unlimited resolution. Viewers can zoom right into every detail of an online gigapixel image and even the smallest sections can be printed clearly and sharply. This comprehensive article shows you how to produce gigapixel images using conventional photo gear and specialized software, and tests the limits of human and machine in the process. The rewards for all this effort are spectacular images that provide a unique view of the world.

Dances with Light

Painting with LEDs using custom light suits during extremely long exposures has turned into an art form of its own. Light Art Performance Photography (or LAPP for short) is rapidly gaining a worldwide following. JanLeonardo Woellert is one of the genre's originators and one of its most prolific and prominent practitioners. This article provides a look behind the scenes of this mysterious and fascinating world and includes sample images by the master as well as tips and tricks for creating your own LAPP images.



Lightroom Workflow Secrets

Photoshop Lightroom is the perfect digital photo workflow tool. Its five basic modules, from Library through Develop to Print and Web output, make it simple to control the overall image creation process. In addition to the basic workflow, *Lightroom* also offers a wide range of specialized tools and functions for simplifying and enhancing the cataloging and image development processes. In this article, *Lightroom* expert Maïke Jarsetz uses a travelog to take us through the entire workflow, using practical, real-world examples to demonstrate many of the software's standard and less well-known features.

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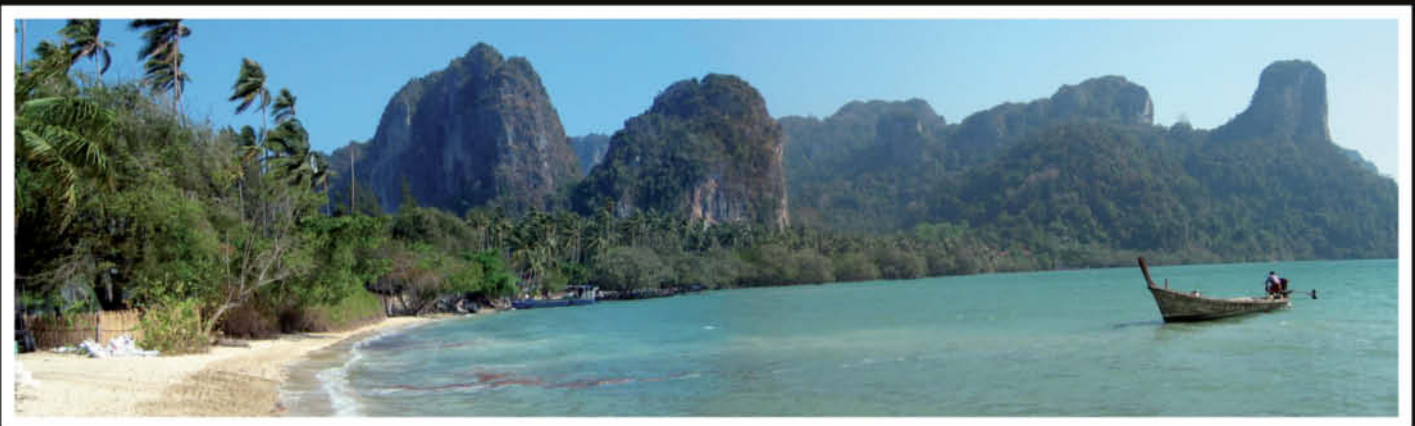
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