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The Complete **Photography** Manual

At its simplest level, taking a picture is done to record an event or capture a memory; taking a selfie, or a snap of loved ones on holiday, perhaps. This is how most of us have been introduced to photography. Our camera phones have become our first point of contact with the world of photography and, for many, it can lead on to more creative pastures with the purchase of a more advanced device such as a Compact System Camera or a DSLR. At this point, photography can seem quite daunting; especially for beginners. There appears to be a lot of technical knowledge that must be learnt, terms that need to be understood, even mathematics that have to be worked out. The more you uncover about it, the less you seem to know. Don't worry, photography is not nearly as complex and intimidating as you might think. Sure there are technical aspects, but with the help of this guide we hope to give you a solid grounding in all you need to know to use your camera with confidence and use it creatively.

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Colours of sunrise

Sunrise goes through some particular phases, each with its own quality of light. Pre-dawn is usually cooler in tone, with lower dynamic range and soft shadows but the clouds will normally start lighting up before the sun actually gets to the horizon. The minutes before sunrise are generally more orange/yellow in tone and shadows become more obvious. Then, once the sun is a couple of degrees above the horizon, you get long shadows that reveal detail in the landscape, crisp highlights and a marked increase in contrast.

Light up the horizon

Never discount an overcast sky as an opportunity to photograph a possible sunrise or sunset. Sometimes the clouds may start to break and reveal a glowing horizon, making a very dramatic image. These moments may be fleeting, but they can create gorgeous colours and contrast against the rest of the clouds in the sky.

Black and white

You might imagine that the starting point for any black and white photography would be to grab your camera, set its functions to black and white mode and start shooting. Be aware that many photographers always shoot everything in colour in order to maintain as much tonal variation in the Raw image as possible; it just gives you more data to play with when it comes to the conversion process.

PHOTOGRAPHY GEAR GUIDE

A quick guide to some cool gear, accessories, and gadgets

We can't speak for other photographers necessarily, but do you feel like you are always on the lookout for a new camera, lens, or device that can enhance your photography? Perhaps it's a new filter, backup camera, or a cool gadget that can make a part of your photography experience a little more creative, or just a little easier to achieve? Over these next few pages, we thought we would list off a few items that, in no particular order, we thought might be of interest. Some items may be brand new; some may have been around for a while but are still worth a look none the less. Some might even still be in a crowd funded development stage, or even just a silly toy that can offer a pleasing distraction. Whatever the case, whilst we believe the old adage that a new camera or gadget will not make you a better photographer, it may just offer you a new feature that you can use on your next shoot. You never know, a new gadget or lens type might yield a benefit that somehow lifts your work and creates a signature look that you can be identified by. When all is said and done though, we will forgive you if you just want a new bit of gear 'because you do'. ■

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> "You never know, a new gadget or lens type might yield a benefit that somehow lifts your work and creates a signature look that you can be identified by."

Canon EOS 80D

Affordable power in this great all-rounder

In today's fast-moving world of tech, a digital camera more than a couple of years old, is often discounted as being out of date and not worthy of people's time and hard-earned cash. There's no doubt that can be true in some instances, but in the case of the three year old canon 80D, we think not. The Canon 80D is a 24.2MP APS-C camera that replaced the much older 70D. Aimed squarely at enthusiast photographers, the 80D is simple enough for new users, but offers enough advanced features to grow with you as you become more experienced and creative. The 80D represents a very viable option for those new to photography altogether, or those looking to upgrade from an entry-level model whilst keeping an eye on their budget. Looking at canon's line-up, this model sits somewhere in the range between the 750D/760D and the 7D Mark II. **It is testament to the longevity of the 80D that it is still a sought after quality enthusiasts model.**

The beauty of a camera of this nature is that it is able to fulfil the needs of the enthusiast photographer, who may actually be harder to please than full-on professionals, since they need to be able to shoot a little bit of everything, in various conditions, with just the one camera. They also want access to many of the camera's top-level controls and features. Having said that, it's not without its problems. One of the key features we've come to expect in our digital devices of late is the ability to shoot 4K video. Unfortunately, the 80D only offers Full HD, but it can at least shoot at 50fps for x2 slow motion effects.

The 80D does boast improved dynamic range over its predecessor, but it cannot quite compete with the competition. That said, it still produces great quality, detailed images for an APS-C sensor, and with its new metering sensor, updated autofocus system, and well-design ergonomics, it remains a competitive choice for the budding enthusiast with a taste for photography and videography. ■

Specification at a glance

Sensor	APS-C
Resolution	24.2MP
Mount	Canon EF-S
Continuous shooting	7fps
Image processor	Digic 6
Video	Full HD 30p
Display	3.0 inch vari-angle 1,040,000 dots
ISO range	100-16,000
Max ISO	25,600
Viewfinder	Optical 100% coverage
AF points	45 cross-type
Memory	SD/SDHC/SDXC (UHS-1)
Weight	730g
Dimensions	139 x 105 x 79mm
Connectivity	Wi-Fi/NFC
Battery life	960 shots
Price	£879/$1199/€939

Canon Zoemini instant cameras

Fun, fast, on-the-go photography and printing

If you are a self-confessed selfie addict and love to share photos with your friends and loved ones, then you need something that is stylish, portable, and can give you instant results with the minimum of fuss. For every special moment that needs to be captured, you can have a camera and printer small enough to fit in your pocket and with such a compact system, it has never been easier to shoot and print on the go. Canon offers several options that range from 2-in-1 models with cameras and printers built in, to the option to use a portable printer that connects to your mobile devices for on-the-spot image capture and printing, just when you need it.

You might wonder how it is possible to build a printer into a compact camera and make it small enough to fit in the palm of your hand. It's all made possible by Canon's ZINK Zero Ink) photo paper. ZINK paper is infused with a layer of micro crystals that react when heat is applied by the device. If you've ever had a receipt printed in your local store, it's a colour version of that technology. Let's be honest, it isn't archival quality, but it is a great little toy for creating prints instantly.

There are several flavours of Zoemini devices that you can choose from, depending on your needs. The basic Zoemini is just a printer with a 10 sheet capacity that connects to your smart device via the Canon Mini Print app. Next up is the Zoemini C, which lets you both capture and print from the same device, incorporating a 5MP camera and 2x3" ZINK paper prints. If you need more resolution, you can opt for the Zoemini S with an 8MP camera and 314 x 600dpi prints. It's all you need for snaps on the go. ■

Specification at a glance

Zoemini S	
Camera resolution	8MP
ISO range	Auto ISO 100-1600
Print technology	ZINK
Print resolution	314 x 600 dpi
Colours	Matt Black, Pearl, White, Gold
Features	Selfie mirror and ringlight
Battery life	25 prints
Connectivity	Bluetooth
Weight	188g
Price	£149/$159/€169

Zoemini C	
Camera resolution	5MP
ISO range	Auto ISO 100-1600
Print technology	ZINK
Print resolution	314 x 500 dpi
Colours	Pink, Yellow, Green, and Blue
Features	Selfie mirror and ringlight
Battery life	25 prints
Connectivity	Bluetooth
Weight	170g
Price	£109/$99/€119

Zoemini	
Print technology	ZINK
Print resolution	314 x 400 dpi
Battery life	20 prints
Connectivity	Bluetooth
Weight	160g
Price	£80/$99/€111

Fujifilm XF10

A premium quality, pocket-sized compact camera

Today's smartphones are equipped with some pretty nifty camera technology and the shots you can take are amazing to say the least. If you really are looking to step up from selfies to more creative and higher quality images, then the Fujifilm XF10 may be just what you are looking for. The XF10 pulls off a neat trick by being able to appeal to a number of photographer types. It was designed partly as an upgrade path away from smartphones. It has a noticeable improvement in the quality of the images you get versus your smartphone and lets you get hands-on with some proper camera controls. The image quality it offers, thanks to a large APS-C sized sensor, is also suitable for enthusiast photographers who already own a DSLR, but are looking for a backup camera that is small enough, and light enough, to fit in a pocket and offers the same kind of creative control that they are used to having with their advanced compacts, mirrorless cameras, or DSLRs.

Before you go rushing off to the nearest Internet shopping site though, the XF does have some surprising and possible deal breaking features. The lens it has built-in is non-interchangeable and is a fixed focal length of 18.5mm. This is equivalent to 28mm in full-frame terms and that makes it a wide-angle lens. Sure, it has a nice bright f/2.8 max aperture, but that fixed wide angle does make it a fairly niche camera. It could be ideal for a bit of candid photography at parties and events, or for travel and street photography, but the moment you need a bit of 'reach' you'll be looking for your DSLR again. It doesn't have an optical viewfinder, relying on a fixed rear screen. There is no optical image stabilisation but thankfully, it does have some great high ISO performance and this coupled with the f/2.8 max aperture, means you should be catered for in low light situations.

There are those that might enjoy the fixed focal length as it encourages you to move about in order to frame images the way you might if you had a zoom lens, and just be more creative with your angles and composition. The impressive image quality is also worth noting since it does use a large APS-C sensor that you find in a lot of DSLRs and more advanced mirrorless systems. With 4K 15fps burst shooting modes, and 4K video capability, you have a little gem of a camera if you are not put off by its limitations. ■

Specification at a glance

Sensor	APS-C
Resolution	24.2MP
Continuous shooting	4K 15fps burst mode
Lens	18.5 (28mm equivalent)
Max aperture	f/2.8
Video	UHD
Display	3.0 inch touchscreen
ISO range	200-12,800
Max ISO	100-51,200
Digital zoom	1.8x
Memory	SD card
Weight	278g
Dimensions	76 x 43 x 73mm
Connectivity	Bluetooth 4.1
Price	£449/$449/€438

Olympus Tough TG-5

One of the best, rugged, and waterproof compacts you can get

We make no bones about it; DSLRs are the ideal option if you want the best optical quality in your lenses, and the best sensor technology in your camera body. There is a downside of course. The prices of new DSLRs are not exactly wallet-friendly and once you have invested in your amazing bit of kit, you are going to make sure no harm comes to it. That will put a limit on the kinds of shots you can capture. For those with a more adventurous streak, capturing action in precarious and more perilous locations, both above and below the water, will require a camera that is somewhat more rugged and suited for purpose. This is where a rugged action compact will stand you in good stead.

Enter the Olympus Tough TG-5. As the name no doubt suggests, it is designed to survive in situations where a typical DSLR would fear to tread. Short of being bombproof, the TG-5 is built to survive and keep shooting in some very arduous conditions. One look at the design of this camera shows its intent. It has a chunky build quality and claims to be crush-proof up to 100kg. It can be submerged to depths of up to 15m. If you want to go deeper still, then you can use the optional PT 058 waterproof case and dive to 45m while still having control over all the main camera functions. For those with butter fingers, it is also designed to be drop-proof from a height of 2.1m. For colder conditions, this camera is also very capable, being able to operate in conditions as low as -10°C.

There is not much doubt about its toughness then, but what about its image quality and video capture? The good news is that it uses the TruePic VIII image processor. This is the same processor you'll find in the flagship OM-D E-1 Mark2. Compact cameras are not usually renowned for ultra high image quality, but here, you will get class-leading quality, enhanced dynamic range and better, high ISO performance. Couple that with Raw file support, a four-mode variable macro system, and 4K video capture, and you have a super-rugged digital compact that can deliver images and video worthy of your next great adventure. ■

Specification at a glance

Sensor	1/2.3 inch
Resolution	12MP
Lens	25-100mm
Zoom	4x optical
Max aperture	f/2.0 - f/4.9
Continuous shooting	20fps
Image processor	TruePic VIII
Features	Waterproof, freeze proof, crush proof, shock proof
Video	4K at 30p
Slow motion	Full HD 120fps
Display	3.0 inch screen 460,000 dots
Price	£299/$449/€389

Crowd pleasers

Take a look at the best gadgets and new tech for photographers, videographers, and geeks of all types!

edelkrone FlexTILT Head 2 (£132/€149/$149)

FlexTILT Head 2 is a cool, pan and tilt solution that allows you to mount your camera and frame your shots easily and quickly. Free yourself from the restrictions of your tripod mount with a flexible system that has no buttons, locks or dials to master. The constant friction technology employed by this device allows instant height adjustment without having to resort to extending the legs of your tripod. It also allows forward and reverse movement, so you can extend the camera out beyond the tripod for unobstructed top-down shots. This device can rotate 360° for precise and smooth panning and as a bonus, should you need it, the FlexTILT Head 2 can also work as a camera stand on flat surfaces without the need for legs.

PetNow Wearable HD Dog Camera (Kickstarter)

Capture the world from your pet's point of view with the PetNow Wearable HD Dog Camera. If you've ever wondered how your dog spends their day while you're not around, now you can find out. Attached to an adjustable vest that comes in five different sizes, to suit all breeds, is a HD 1080p video camera with a 136° field of view that can stream video directly to your phone, so you can always see what your beloved pet is up to. The camera works in any lighting conditions and has an automatic night vision mode. It even has a 2-way on-board microphone so you can hear your dog and speak to it as well. With the addition of an SD card, you can store videos and photos up to 64Gb. Alternatively, you can remove it from the vest and set it up as a security monitor in your home.

Anamorphic iPhone Video Lens (£130/€145/$159)

Designed with professional mobile filmmaking in mind, the SANDMARC Anamorphic lens allows you to capture, on your iPhone, footage that is hard to distinguish from the kind you would see in the cinema. It can capture an ultra-wide field of view by squeezing the image. It is a method popular among moviemakers such as J J Abrams and Stephen Soderbergh. Crafted from best-in-class optics, the Anamorphic lens can take your iPhone based filmmaking to the next level. If it contains any bright point light sources, such as car headlights, streetlights, or any hard light during night shoots, it creates a dramatic lens flare similar to those seen in the movies. This multi-element and multi-coated lens simply clips over the top of your iPhone's built-in lens and since it only weighs 46g, it will not weigh your phone down or make it bulky and hard to handle.

Alter RFS - Rapid Filter System (Kickstarter)

Anyone who likes to shoot with some extreme screw-on filters, such as Infrared (IR) filters and 10-stop neutral density (ND) filters, will no doubt be aware of the annoying issues faced when trying to set up their compositions and getting the framing just right. By design, IR filters and 10-stop NDs are very, very dark. When you attach the filter, you can barely see anything when looking through the viewfinder, and this can be a pain since currently you have to remove the filter, set up the composition and then screw the filter back on. A company called Alter has been working on a crowdfunded project that uses a nifty screw-on hinged filter adapter that simply flips the attached filter out of the way when not required and then flips it back down when needed. Strong magnets hold the front ring in place while you work; a simple but brilliant idea.

Puluz Foldable LED Light Cube (£10/€13/$12)

Anyone who needs product photos on a regular basis, particularly if they are trying to sell items on certain popular auction sites, will benefit from being able to take good quality and well-lit photos of the items for sale. So, you want professional lighting but you don't have the space, or the money, for a professional lightbox setup. What do you do? Well, a company called Puluz may have the answer in the form of a small, lightweight, foldable studio tent. It measures 20cm x 20cm x 20cm and is equipped with two banks of LED lights, which can be plugged into a USB port to provide power and allow you to shoot with strong, continuous light that is flicker-free. It provides 6 coloured backdrops that can be placed inside the tent, which fastens together using Velcro material. Assembly takes less than a minute and then you are ready to shoot. There is even an aperture in the top of the tent to allow top down shooting of your products.

Woodsum Wooden Pinhole Camera (Kickstarter)

How about this for a uniquely retro approach to photography? It actually combines good, old, analogue, pinhole film photography and DIY, model making since it requires assembly before use. The camera uses 35mm roll film and is a lovely and memorable gift idea. The camera design uses premium wood components and is UV coated for a quality feel. They offer five different wood finishes including Maple, Walnut, and Pine. The assembly is quite straightforward thanks to easy-to-follow instructions. The camera is essentially a 3D puzzle with precut interlocking pieces that require no tools or glue. The camera is designed with a removable viewfinder and a mechanical shutter button to open the aperture and allow light to fall on the roll of film inside. For ease of use you can add a strap, since it provides mounting hooks either side, and you can use the mounting screw underneath to attach the camera to a tripod for more stable shooting. Simply insert your film, close the back panel, and use the winder on top to advance the film for the next shot.

Anker Bluetooth Selfie Stick (£17/€15/$14)

You love your smartphone right? You are a self-confessed selfie addict. Have you ever been a bit irritated that you can't extend your arm out any further, particularly if you're trying to get a group shot of you and your best friends? Then there is the question of activating the camera to take the shot. You can use a timer, and a lot of selfie sticks use a cable that connects to your device. Anker, a Chinese electronics brand well known for producing computer and mobile peripherals, has come up with a selfie stick that can hold a large number of different sized phones in its cradle, extend out to 29 inches and be used as a monopod. Best of all, it has Bluetooth connectivity. This means you can seamlessly pair it to your phone, or even a GoPro action camera, and control the taking of shots just when you want them. It has a 20 hour battery life, so plenty of time to get all those awesome selfies in the bag.

Bird Photo Booth 2.0 ($199 via www.birdphotobooth.com)

This is a great gadget that allows you to feed the birds in your garden and also photograph them with spooking them. The Bird Photo Booth 2.0 is a bird feeder, styled to look like a retro Rolleiflex twin reflex camera, with space inside it to place a small action camera that is perfectly positioned to view the action outside as birds land and peck seed from the feeder. You don't have to use the action camera, you can use your own iOS or Android smartphone, or GoPro if you have one, but the one provided by Bird Photo Booth is motion activated and optimised for the enclosure. The camera itself shoots 4K 30p video; it can also capture 16MP photos and can be controlled wirelessly from the comfort of your armchair. It has a very wide 170° field of view and can shoot bursts of photos in high-speed mode. It can also live stream the action for your very own wildlife show as the birds go about their business undisturbed. The enclosure itself is weather proof, so you can place it anywhere without fear of water ingress damaging your camera. This is a bird feeder like no other.

Pixapro CITI600

A mighty go anywhere battery powered flash

First things first. The CITI600 is something of a chameleon. The flash unit itself is a Godox AD600 and in the USA it is known by another name, the Flashpoint XPLOR 600. Once you have that straight in your mind, you can turn to the flash and its capabilities. This is a self-contained high powered flash unit. Units of this type are referred to as monoblocs. It even comes with a 10W modelling lamp to let you gauge where shadows will fall on your subject before you take the shot. Battery power is supplied by a hefty 8700mAh lithium power pack. This does make the unit fairly heavy overall but that's the price you pay for true portable power that can last you for a day's worth of shooting. With a guide number of 87m at ISO100, there is plenty of power for the most demanding lighting conditions. At close range, you can even use the flash to correctly light a deliberately unexposed scene. Fashion photographers use this technique of overpowering the sun for some memorable images.

Flash settings can be easily access and changed via the user-friendly LCD screen located on the side of the unit along with a number of control buttons and dials. At full power, the unit has a flash duration of 1/220s but if you drop it down, you can achieve action freezing flash durations of 1/10000. Used as an outdoor portable unit, the wireless capabilities mean you can work with it at distances of up to 100m with radio triggers and link multiple units together for more complex lighting scenarios.

There are two versions available. One is the TTL version compatible with Nikon and Canon cameras and there is also a full manual version where you are required to set the power yourself. This manual unit is cheaper and certainly an option if you are looking for this much power at a more wallet friendly price. ■

Specification at a glance

Guide number	87 at ISO 100
Max power	600Ws
Power range	1/1 - 1/256
Battery life	500 full power flashes
Recharge time	4 hours from empty
Recycle time	0.01 - 2.5 seconds
Flash duration	1/220s - 1/10000s
Sync mode	Up to 1/8000s
Wireless system	2.4GHz radio transceiver
Range	100m
Mount	Bowens S-mount
Metering	Supports full TTL
Size	220 x 245 x 125mm
Weight	2.7kg
Price	£599/$749/€590

Although the battery pack is something of a beast, it will keep you shooting for up to 500 photos.

Lowepro Pro Runner X450 II

Take it all with you with this pro backpack design

Over time, as your camera gear list grows, you might be faced with the possibility of how to transport your precious equipment. Eventually, you are going to be looking at getting a camera bag. For a typical day out where you might only need one camera body and a couple of lenses, you are well catered for if you want a simple and small backpack to keep your gear in. Once you step up to the next level and you need to transport more gear, then you need something that can accommodate your equipment in as versatile a manner as possible and still be portable enough to be useful.

With that in mind, here is another product with an incomprehensible model name. The Lowepro LP36876 Pro Runner RL X450 AW II (which we'll just call the Pro Runner II) is a camera bag with a difference. The Pro Runner II is made by Lowe who are one of the best know manufactures of camera bags and backpacks. It is a backpack that can convert to a roller case for those times, at an airport for instance, where you can pull it behind you like an normal piece of luggage. These days, there's every chance that you'll need not only your camera gear, flashes and accessories but your digital workflow equipment too. Luckily, the Pro Runner has been designed to accommodate not only two cameras, up to 7 lenses and a tripod but your laptop as well. This is like having a studio on two wheels that can fit into the luggage compartment of an airliner. ■

Specification at a glance

Material	680D nylon
Style	Backpack and roller case
Features	3D mesh padding
	Contoured shoulder straps
	Waist belt
	Weather cover
Internal size	31 x 16 x 43.3cm
External size	35 x 22.9 x 52.5cm
Weight	4.36kg
Fits	2 DSLRs (one with lens attached)
	5-6 lenses (one up to 300mm)
	15" laptop
	Smartphone
	Tripod
	Accessories
Price	£235/$299/€228

> "The Pro Runner has been designed to accommodate not only two cameras, up to 7 lenses and a tripod but your laptop as well."

Sony VCTR100 tripod

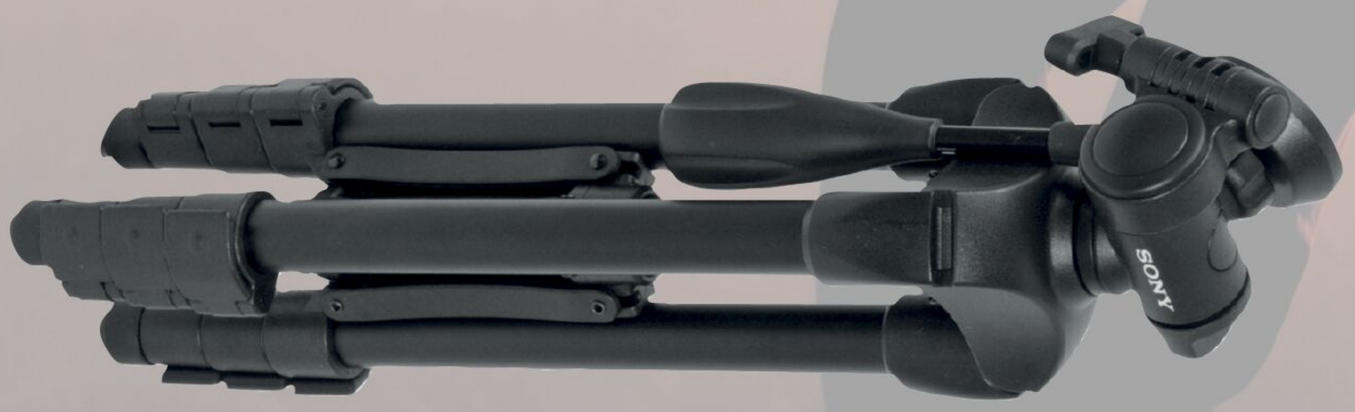
A lightweight tripod solution

We can never extol the virtues of tripods enough. After the purchase of a camera and lens, we would always recommend the purchase of a tripod. You never know when you might encounter that perfect low-light scene or challenging condition that merits the use of a tripod for steady, shake-free shots. Tripods, for the most part, come in two flavours depending on your particular requirements. Travel tripods are small and lightweight, sacrificing robustness and rigidity for maximum portability and a small compact size when folded away. Professional tripods are larger and heavier for maximum rigidity and robustness in all shooting conditions.

Some also offer a range of compatible tripod heads for different needs and can be reconfigured to allow the centre column to flip out over a 90° angle, to quickly shift your camera's perspective, to get into some more tricky shooting angles that more basic tripods don't allow. They are also designed to be able to support much larger cameras and lenses. The Sony VCTR100 falls under the lightweight travel tripod category. Its aluminium design allows it to be ultra portable and light enough to carry easily over distance. The 3-way pan and tilt head is designed to be easy and convenient for stable shooting with a centre brace for extra stability when using either camcorders or small cameras. The three-leg sections allow you to adjust the tripod up to a maximum extended height of 100cm. Whilst this is only just above waist high, it does mean it retracts to a very convenient 35cm for carrying or putting away in a backpack. As small, affordable tripods go, this is a good option for photographers on the move. ■

Specification at a glance

Colour	Black
Maximum Height (cm)	100
Maximum Load (grams)	1000
Minimum Height (cm)	35.5
Number of Leg Sections	3
Primary Material	Aluminium
Weight (g)	660
Price	£35/$40/€45



Gitzo GK1555T-82TQD Series 1

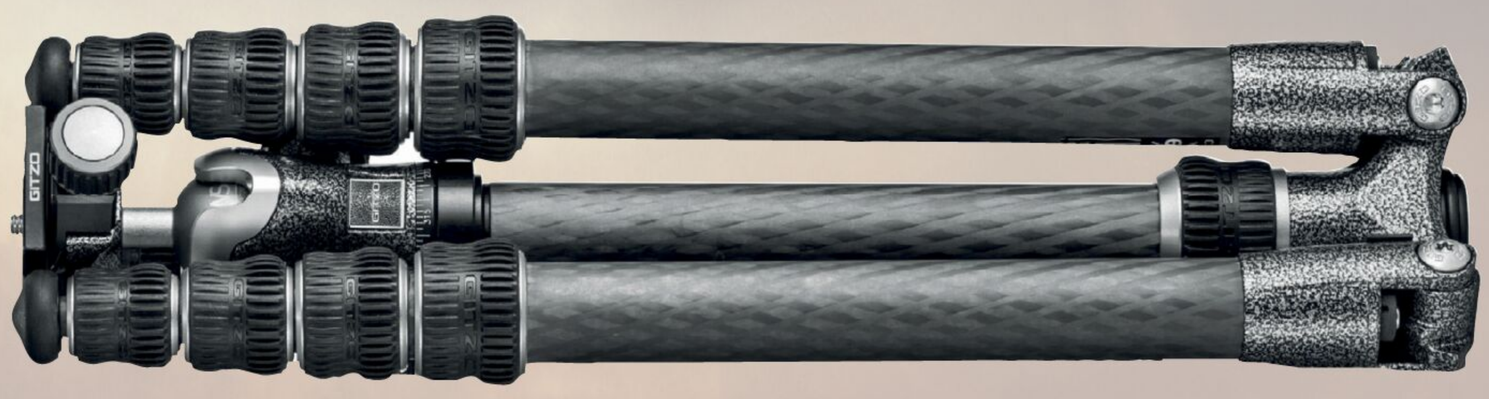
When you demand the best

After you've spent several minutes just pronouncing the Gitzo's model number, you can settle down and marvel at this flagship tripods specifications, and its price. This is not a tripod for the hobbyist photographer, unless you have a large disposable income that you would like disposed of very rapidly. At this price point, you are paying for a lot of engineering that makes the Gitzo one of the highest quality and stable tripods out there. Add to that the brand-name kudos and you have a Rolls Royce among tripods (at Rolls Royce prices of course).

At this price you would expect some great features. First the Gitzo weights just 1.4kg thanks to its carbon fibre construction. Fully extended, it reaches a height of 148.5cm and can support a maximum payload of 10kg, equivalent to a large DSLR with a big zoom lens attached. The ball head is engineered to be smooth and precise and thanks to the 180° folding mechanism that lets the legs fold back on themselves, it fits snugly between the legs making an easy to carry package for such a tall tripod. If you are looking for a taller tripod, then Gitzo does offer the GK2545T-82QD Series 2 that fully extends to 165.5cm and can support up to 12kg. ■

Specification at a glance

Leg sections	5
Max height	148.5cm/58.5"
Min height	35.5cm/14.0"
Weight	1.42kg/3.1lbs
Payload	10kg/22lbs
Price	£850/$1000/€980



The folding mechanism means the tripod can be folded down into an easy to manage configuration.

Memory cards

SanDisk Extreme Pro SDXC UHS-I

If you are a pro shooter or even just an enthusiast who is keen to maximise the speed of their image capture between camera and card, then you can't go wrong with a SanDisk memory card. They have become one of the leading brand names when it comes to digital storage. Their product is reliable and backed up with a lifetime limited warranty. Their Extreme Pro range of SD cards are also fast. When we say fast, it means that the card can can have data written to its solid state memory very quickly. Fast, in this case means at around 95MB per second. You might wonder why the speed is so important and what scenario you would find yourself shooting in to be worrying whether your card is fast enough. Well, for 95 per cent of the time, you probably wouldn't need to worry, unless you find yourself in a situation where **you're shooting bursts of images in Raw format, or shooting high resolution video. We can give you a simple example where the speed of the card hindered a shoot though.**

We were shooting a portrait using a technique known as the Brenizer method. This involves not only shooting the subject at close range with a 50mm lens or longer at its minimum aperture, but also capturing the entire scene around them by shooting something in the order of 30-60 overlapping frames that can be stitched together later to create a wide angle shot with an apparent depth of field matching an f/0.5 lens. It does require those 60 frames to be captured in rapid succession, to not only make sure light levels don't change but that your subject does not move too much in the period of time it takes to capture all those shots. We started the sequence and it became apparent very quickly that the card couldn't handle the data being fed to it from the camera's processor and it felt like an eternity waiting for the meagre few shots it could manage to be written to the card. It was an old SanDisk Ultra II card and it just wasn't able to handle the Raw file data coming from the Canon 5D Mark III. We swapped it out for a SanDisk Extreme 16GB card with a write speed of 60MB/s and the next attempt went much more smoothly with the card happily handling the flurry of shots.

The same can be said for sports shooters where they might be shooting a continuous burst of shots, tracking the action, hoping to pick out the one shot from the sequence that perfectly captures the moment. Use a slow card and you are going to struggle to write the data quickly enough and cause a data log jam that may lead to missed shots. At 95MB/s the SanDisk Extreme Pro is not the fastest card, there are cards that can handle write speeds up to 300MB/s, but it does represent great value for money. There are also a number a storage size options from 32GB up to 512GB, although be prepared to spend acres of cash if you go for the latter. A quick glance at the Internet and you may also see that there are many designations and ratings for memory cards that can be a bit confusing. To help out, here are some of the main ratings to look out for. ■

Class 10
This has a minimum sustained sequential write speed of least 10 MB/s.

Other Classes
There are also 2, 4 and 6 class ratings which indicate their minimum write speed in MB/s.

U1 rating
Recommended for 1080p video recording and has a minimum write speed of at least 10 MB/s.

U3 rating
If you are shooting 4K video, the faster U3 cards offer a minimum write speed of 30MB/s.

UHS-I
This stands for Ultra High Speed Phase-I. This is the first iteration of ultra high speed cards with a theoretical bus speed of 104MB/s.

UHS-II
The second iteration of the Ultra High Speed Phase for SD cards. This offers theoretical bus speeds up to 312MB/s

UHS-III
Released in 2017, the third iteration of the SD specification allows bus speeds up to 624MB/s and is perfect for huge amounts of data such as shooting 8K video.

Video speed
You may notice newer cards with V6, V10, V30, V60 and V90 ratings on them. This is a rating that guarantees minimum levels of of video capture performance.

Lee SW150 filter system

Now you can use filters on ultra wide lenses

Countless landscape photographers use filters to coax as much image detail and tonal range out of their shots as possible. The simple use of a graduated filter that darkens a bright sky but leaves the darker foreground unaltered is a popular example of a filter in use. That's fine for most lenses you can buy but there are issues if you want to shoot with a lens that has a shorter focal length than usual.

A good 16-35mm focal length zoom lens is perfect for most applications but if you want to use focal length lenses around the 14mm, 12mm and 11mm range, there are going to be some physical drawbacks to those lens designs. The problem is that ultra wide lenses may have a domed front element with a built in petal lens hood to which filters cannot be screwed. Another issue is that most are too large for standard filter system sizes. With that in mind, Lee have developed the SW150 system and lens adaptors for a range of ultra wide lenses that can hold filters in place without the fear of vignetting at the widest end of the zoom range.

You will need to purchase the SW150 system and also an adaptor that is design to fit over the lens you wish to use. Opposite is a list of ultra wide lens adaptors supported by the system.

Supported lenses

- Nikon AF-S Nikkor 14-24mm f/2.8G ED
- Nikon 14mm f2.8 D AF ED
- Nikon PC NIKKOR 19mm f/4E ED Tilt-Shift
- Canon EF 14mm f2.8 L II USM
- Canon EF 11-24mm f4L USM
- Olympus 7-14mm Pro f2.8
- Pentax FA 15-30mm f2.8 ED SDM WR
- Samyang 14mm f/2.8 ED AS IF UMC
- Sigma 12-24mm f4.5-5.6 DG HSM II
- Sigma 20mm f1.4 HSM Art
- Tamron 15-30mm f2.8 SP Di VC USD
- Tokina AT-X 16-28mm f/2.8 PRO FX

You simply attach the lugged adaptor ring to your lens and then attach the SW150 filter holder and light shield to it. Then you can use Lee filters as you would any standard filter system.

You can also purchase an SW150 screw-in lens adaptor that allows you to use the system with not only ultra wide lenses but also standard lenses, with filter thread sizes ranging from 72mm, 77mm, 82mm, 86mm, 95mm and 105mm. ■

The adaptor ring comes in various sizes to accommodate a series of ultra-wide lenses.

The SW150 system includes a light shield to protect against unwanted flare.

Exposure control

Long exposure photography has been immensely popular for many years. If you have never dabbled with long exposure techniques, particularly during the daytime, it's worth getting hold of some neutral density filters and exploring new areas of photography. 2 and 4 stop filters are the most popular, but there are also 10 stop filters you can use for very long exposures even on bright days.

Shallow depth of field portraits

Using a prime lens of around 50-85mm with a large maximum aperture of about f/1.8 allows you to create some quite intimate portraits of your friends and family. Rather than trying to keep everything in sharp focus, the large aperture of a good prime lens lets you create wafer thin areas of sharp focus that very quickly falls off into soft focus. In the case of a headshot, keeping the eyes in focus is a paramount concern. The ears and nose will go out of focus, keeping the eyes the main point of visual interest as seen in these two examples.

EXPLORE AND LEARN

The fundamental knowledge on which all good photography is based

Photographers come in various shapes, sizes, and skill levels. They range from professional photographers, who have studied at college and honed their technical skills over time, to accomplished photographers, who have just picked up a camera and learned their craft with a trial and error method. There are also enthusiasts who may have stepped up to a more advanced camera and are beginning to explore the new creative possibilities, and there are those who have been happy taking snaps on full automatic but now want to ramp it up and take control.

No matter what kind of skill level you are, the basics of photography are essential to all and they all need to have a firm grasp of the fundamentals before they can get their camera out of full automatic mode and truly start to explore the creative aspects of the medium. If you just want to brush up on your theory, understand a little more about how light works, or just improve your composition, this next section has what you need with some examples thrown in for good measure. ■

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The exposure triangle

The holy trinity for photographers

If you are keen to express your creativity and learn more about the nature of photography, then you will need to be daring and take your camera out of fully automatic mode and explore the skills required for shooting in manual mode. When you shoot fully manual, you have to be aware of the interplay between each of your camera's main settings of ISO, Aperture and Shutter Speed.

Connect them up

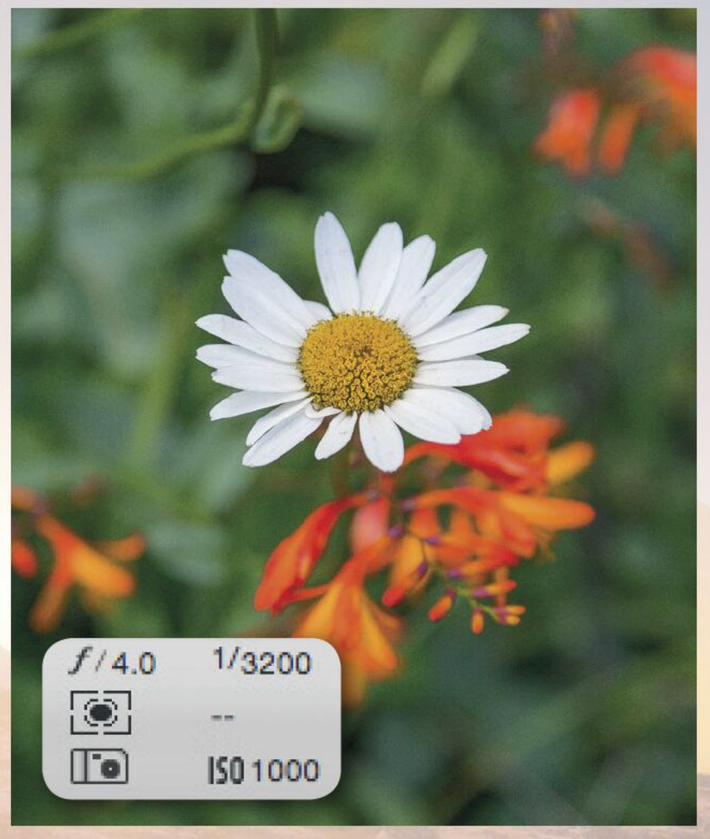
The exposure triangle is a popular visual method to connect the three main variables of aperture, shutter speed and ISO amplification that govern the final look of your image. Photography is a balancing act of these three elements when you capture an image. Once you have your camera ready and have a set of variables in place to give you a balanced shot, as soon as you adjust one of the three, at least one of the others has to be adjusted as well, in order to maintain the desired effect you are after in the shot. You are not only altering the exposure but also the quality and appearance of the image.

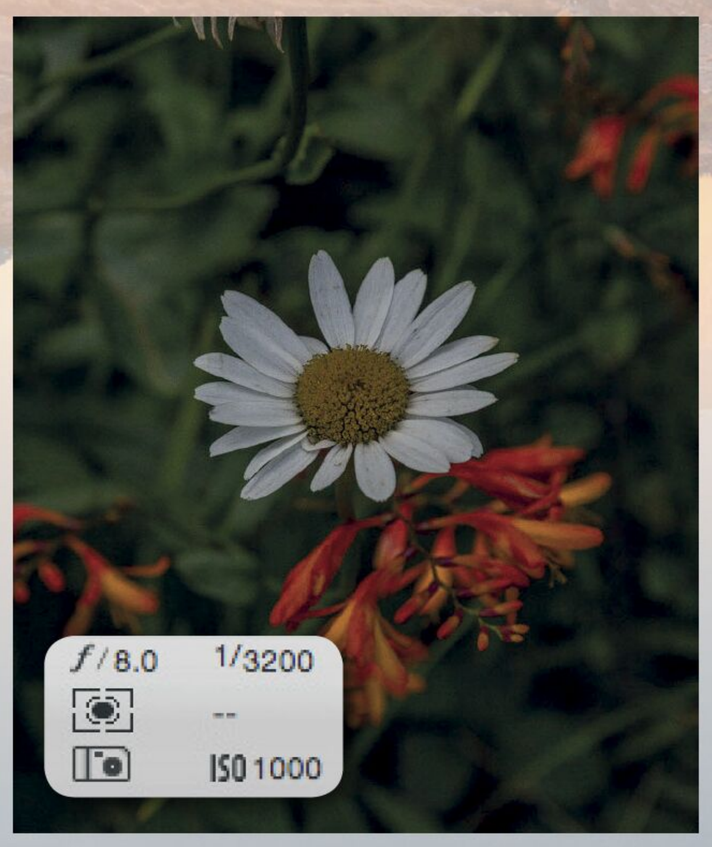
An example

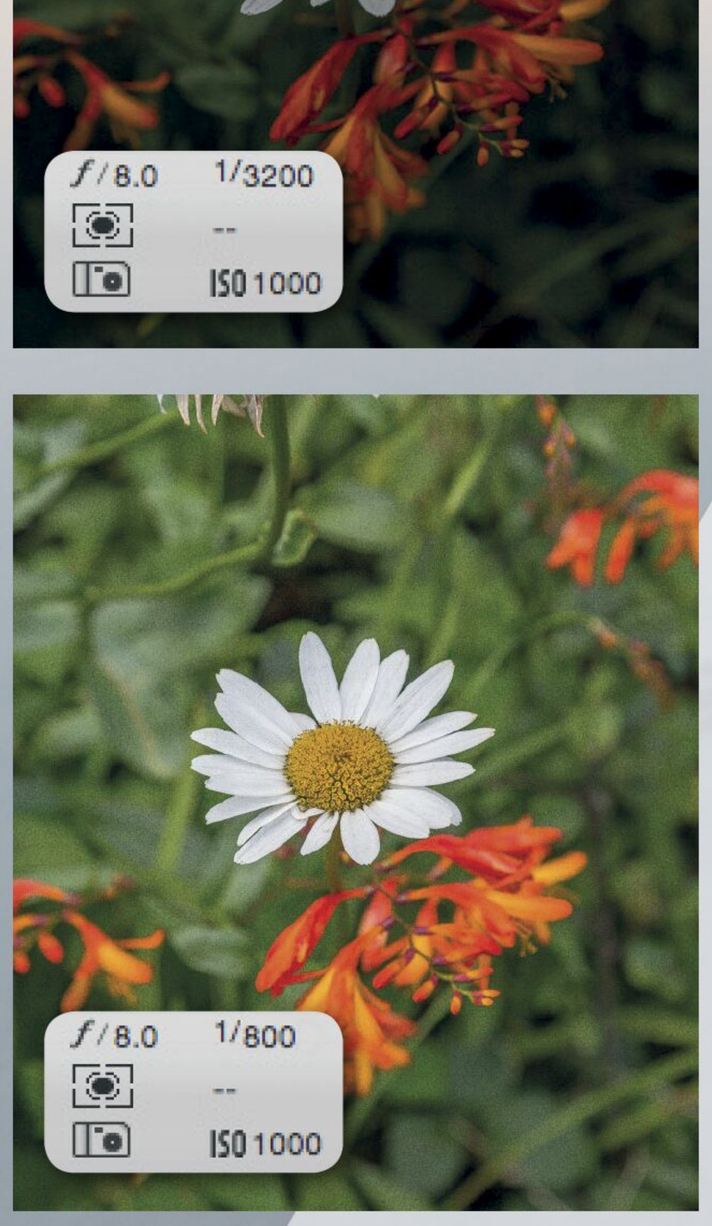
We'll try and sum it up in a theoretical example. If you are shooting a subject such as a flower in a shaded wood, with your camera in manual mode (this is important to keep in mind), you will need to balance your ISO, aperture and shutter speed to give you a well exposed image. The parameters you choose are down to your personal choice of course. In our theoretical example the settings were as follows: ISO 1000, aperture f/4 and shutter speed 1/3200 of a second (this was to keep the flower's motion frozen as it was a windy day), all well and good.

Making changes

If you decide however, that you need greater depth of field, you might change your camera's aperture to f/8, making the diameter of the aperture smaller, blocking more light but increasing depth of field. If you take the shot now, your image will have more depth of field but it will be very underexposed. What happened? Now that you are in manual mode, you have currently altered only one side of the exposure triangle. You would need to alter at least one of the other two in order to bring your image back to its proper exposure. You decide to keep the ISO at 1000, so the shutter speed will have to alter. If you increase the duration that the shutter is open, you can allow the camera to gather light for an extended period of time. In this case, because we changed from f/4 to f/8, which is 2-stops, we need to allow for 2-stops more light gathering from the shutter speed we use. 1/3200 of a second would need to become 1/800 of a second to allow for the 2-stop alteration you made to the aperture with the ISO remaining unchanged. A basic rule of thumb to keep in your mind is that a 1-stop alteration is equal to either a halving or doubling of a particular parameter. In this case the 2-stop alteration to our theoretical shutter duration means 1/3200 of a second slows to 1/1600 and then slows a second time to 1/800. ■







A word about ISO

Although ISO is included as part of the exposure triangle, it is worth noting that on digital cameras, higher ISO settings amplify the amount of light recorded in a scene depending on the ISO value you use. ISO is often referred to as the sensitivity of the sensor to light, but it is more accurate to understand that it is light/image amplification, rather than sensor sensitivity. Back in the days of film, if you used a film stock of ISO200 for example, you set your camera's ISO to match. From then on, only the other camera settings of shutter speed and aperture were used to get the correct exposure you wanted, as well as supplemental lighting if needed. The ISO value always had to remain at 200. These days, changing the ISO value only simulates different light sensitivities. ■

Shutter speed

We look at what shutter speed is and why it is one of the key ingredients in photography

The shutter of your camera is simply a mechanical barrier that prevents light from entering the camera until it is needed, controlling when and for how long light is allowed in to expose the sensor. The latest digital cameras have high-speed electro-mechanical shutters capable of timing exposures with an accuracy measured in fractions of a millisecond.

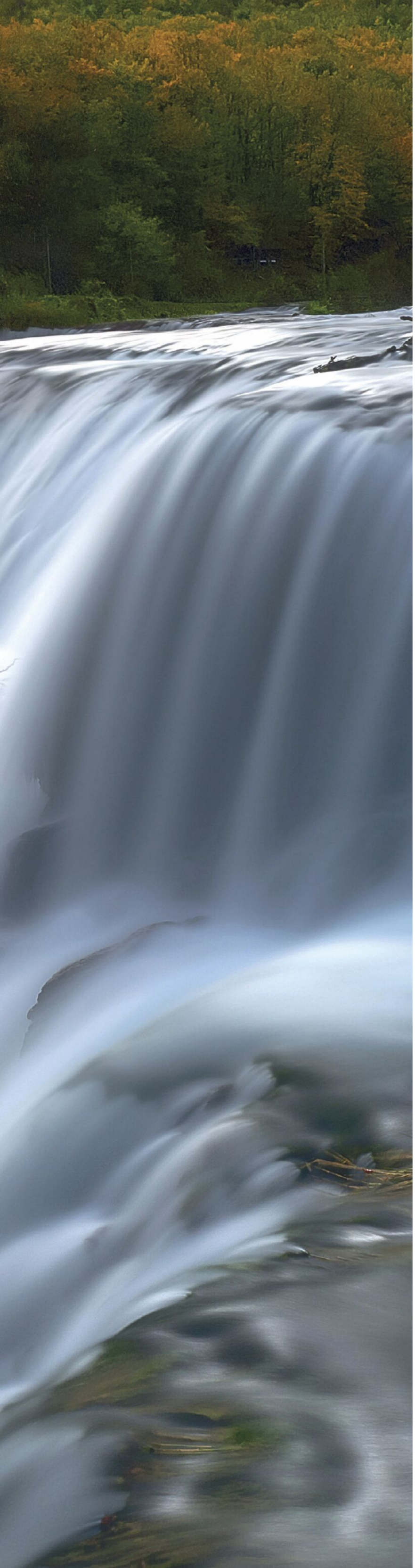
Along with the aperture setting and the ISO control, shutter speed is one of the three ways that photographic exposure is adjusted. When a picture is taken, the shutter is opened for a precisely measured amount of time allowing light to pass through. The duration of the exposure is set either automatically by the camera's light meter or manually by the photographer. The wider the range of available shutter speeds, the greater the creative versatility of the camera.

Modern digital SLR cameras have a very wide range of shutter speeds available, usually ranging from 30 seconds to as high as 1/8,000th of a second, and most also have a 'B' setting, in which the shutter stays open for as long as the shutter release is held down. The 'B' is from bulb. Very old cameras commonly used an air-bulb attachment as a remote shutter release.

Shutter speed can be manually adjusted in either full manual exposure mode or in shutter priority mode, the latter usually denoted by an 'S' or 'Tv' on the exposure mode dial. Shutter priority is a semi-automatic exposure mode in which the photographer sets the desired shutter speed, and the camera's exposure system adjusts the aperture accordingly to produce the correct exposure.

> "The wider the range of available shutter speeds, the greater the creative versatility of the camera."

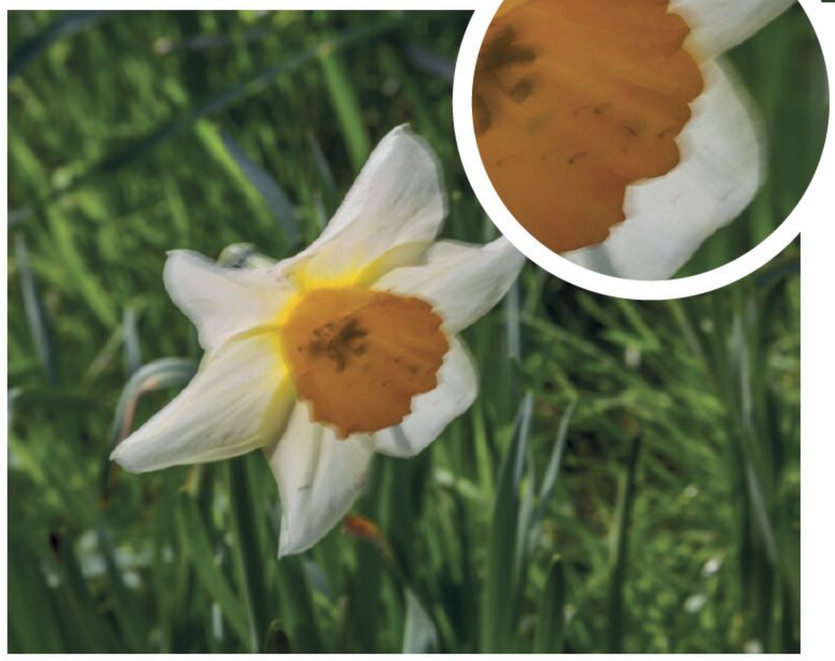
In automatic and program exposure modes the camera will set both the shutter speed and aperture automatically. Under normal daylight conditions, the shutter speed will usually be set to between 1/125th and 1/1000th of a second, since this is fast enough to freeze most movement and to reduce the effects of camera shake. However in low light conditions the camera may set a slower shutter speed, and with this comes an increased risk of movement blur caused by camera shake. Most cameras will display some sort of warning if this occurs. ■



AVOIDING CAMERA SHAKE

When shooting hand-held and wishing to avoid camera shake, as a rule of thumb you can safely use a shutter speed roughly equivalent to the reciprocal of the focal length you are using. For example if you're using a 100mm focal length then you can take a sharp hand-held shot at a shutter speed of 1/100th of a second or faster. If you're using a 35mm focal length then 1/35th of a second is safe, and so on.

Here's an example shot taken hand-held at a focal length of 100mm and a shutter speed of 1/100th of a second. As you can see it's sharp and shake free.



Here's the same hand-held shot but this time with a shutter speed of 1/10th of a second. At this speed and focal length it's much more difficult to hold the camera steady. As you can see, the result is quite blurred.

Many modern cameras include technology which can reduce the effects of camera shake at low shutter speeds. Many compact cameras use electronic processing to counteract movement, which does work but produces relatively poor image quality. Among digital SLR and CSC manufacturers there are two types of image stabilisation in common use. Nikon, Canon and Panasonic favour optical stabilisation, where elements within the camera lens are moved to counteract camera shake. Other brands including Pentax and Sony employ a system which moves the camera's sensor to achieve the same effect.

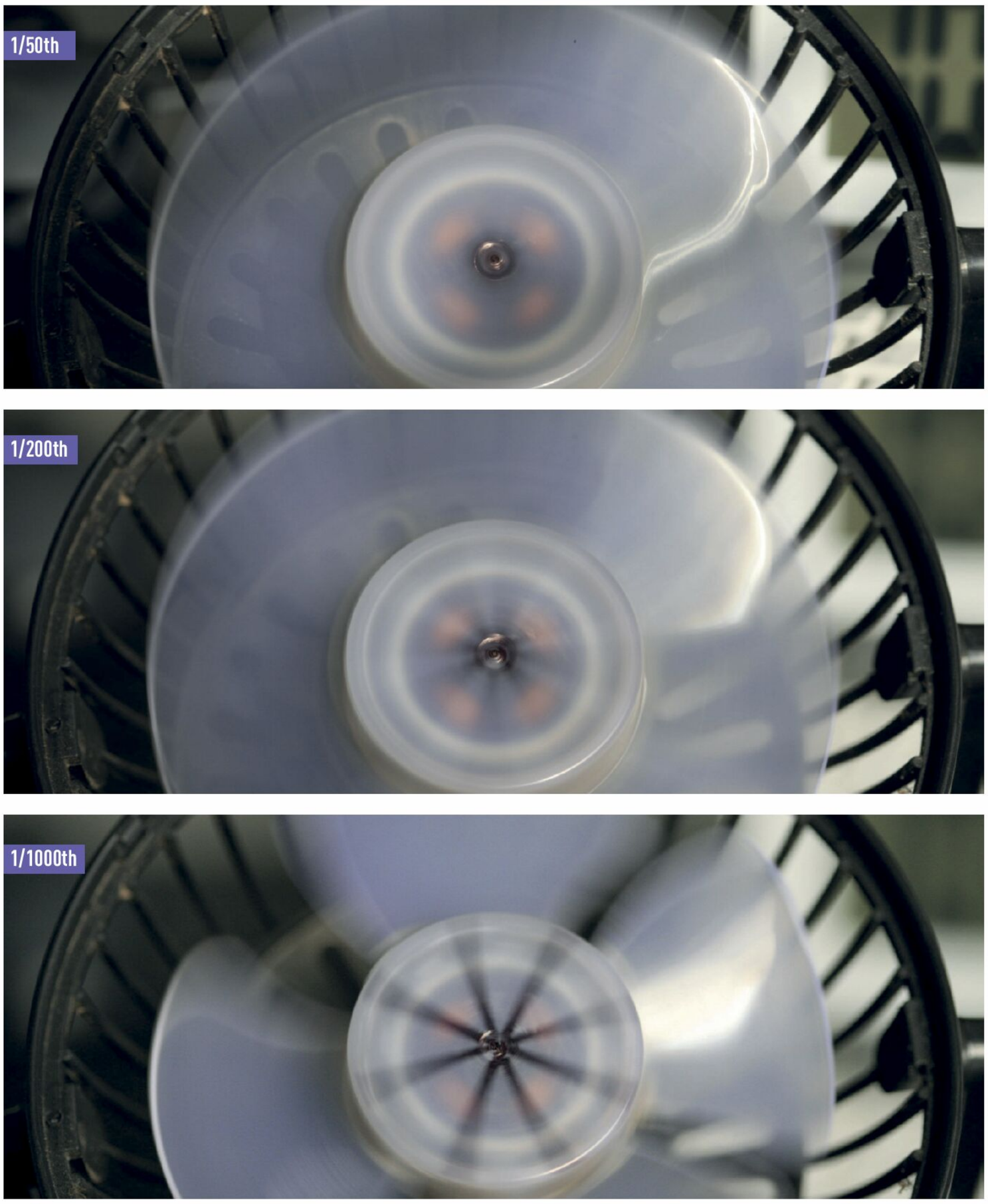
There is no clear advantage between moving-lens and moving-sensor systems. Modern image stabilisation systems of both types can provide around three or four stops of additional stability, however the sensor-shift method has an advantage for SLR users because the non-stabilised lenses are usually considerably lighter and are often also cheaper to buy, since the complex anti-shake system is built into the camera body. It also means that photographers using older predigital lenses can still have the advantage of image stabilisation.

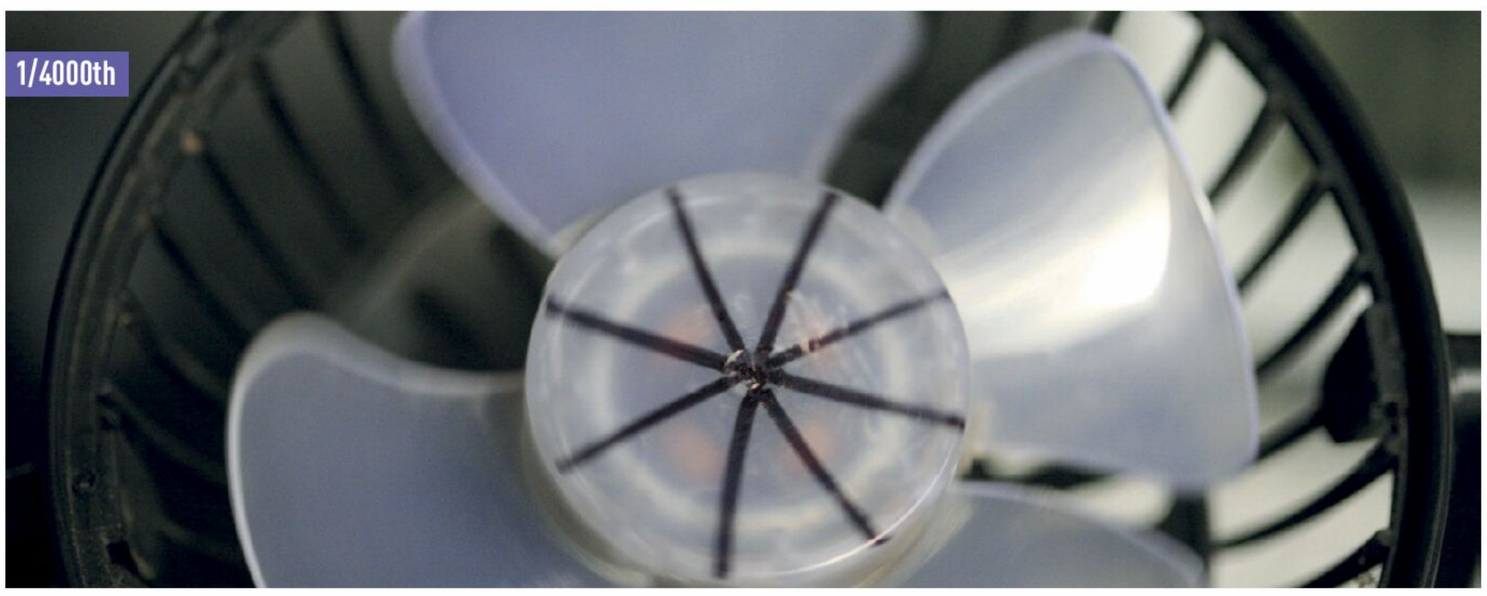
This example shot was taken with a focal length of 100mm at 1/10th of a second as before, but this time the image stabilisation (in this case a sensor-shift system) is switched on. It has detected the vibration and corrected it by moving the sensor to compensate, resulting in a much sharper shot.

MOTION BLUR

Any movement in the frame during the exposure will be captured in the picture, resulting in motion blur. Anti-shake systems can do nothing to correct this; the only solution is to use a shutter speed fast enough to effectively freeze the action and eliminate any sense of motion. With a fast enough shutter speed you can freeze even very fast-moving objects, as this next sequence of photos will show. They were taken at shutter speeds ranging from a fairly slow 1/50th of a second up to 1/4000th of a second.

As you can see, at 1/4000th of a second the blades of a desk fan can almost be frozen in place.

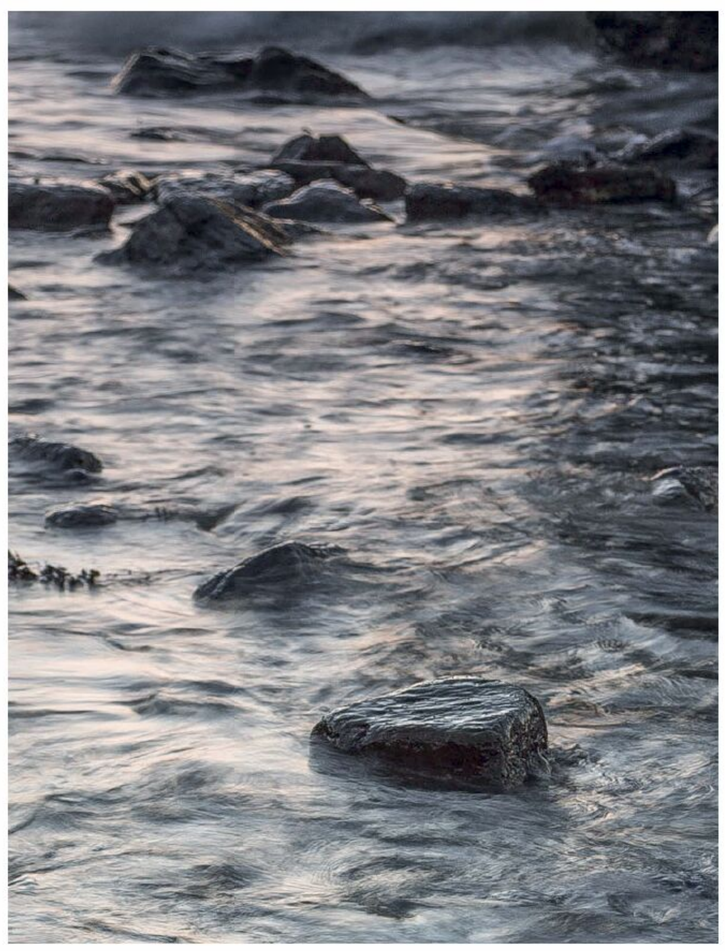




THE MISTY WATER EFFECT

One of the most effective uses of long shutter speed is photographing flowing water. It's a beautiful if slightly over-used effect, but it is very easy to achieve. Any moving body of water, flowing stream or waterfall will do, as long as it has moving and splashing water. This scene is a local beach in Torquay.

If you just point the camera and shoot on automatic, you'll end up with something like this (below). It looks nice enough, but it's a bit dull. This example was shot on at a shutter speed of 1/20th of a second and an aperture of f/4.



Fixing the camera on a tripod eliminates camera shake. You now need to get the slowest shutter speed you can. The image at the top of the page was taken from a similar position as the previous shot, but with an aperture of f/22 to get a shutter speed of 8 seconds.

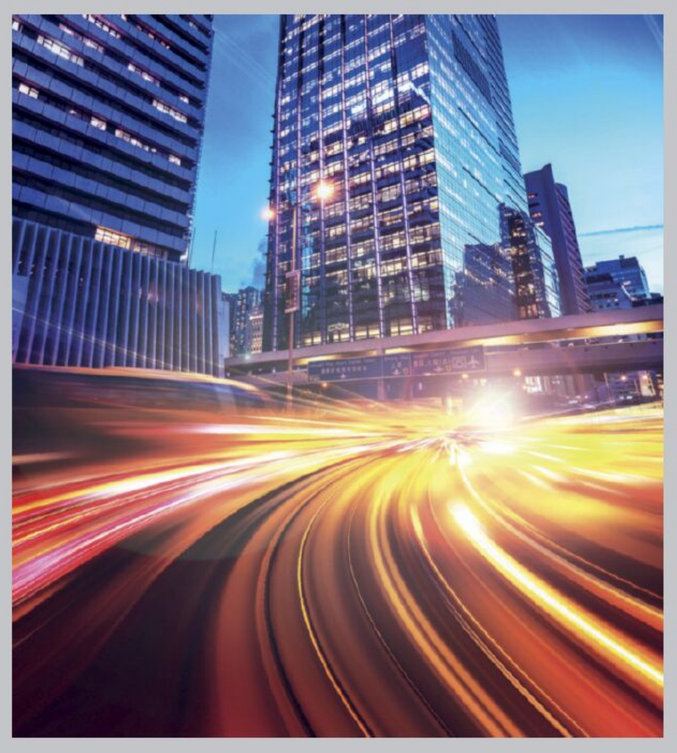
CAPTURING MOVEMENT

Freezing the action with a fast shutter speed produces a nice sharp image, but sometimes you might want to allow a controlled amount of movement blur to show that the subject was in motion. There are a number of ways to accomplish this.

In this first movement example, the camera was held motionless, with a shutter speed of 1/1000th of a second, while the car drove past in front of the lens. No camera movement ensures that the background is sharp and the fast shutter speed has frozen the movement. The result is sharp but looks slightly odd, as though the vehicle is now simply at a standstill.

In this additional example, this time with the camera mounted on a tripod, the settings were adjusted to allow a shutter speed of 1/30th of a second, and another vehicular subject is allowed to drive past. This time the background remains sharp, but the slower shutter speed has resulted in lots of movement blur, making the car appear to streak across the frame and remove any sharp detail.

In order to capture the feeling of movement (top image), the best technique is to use a slow shutter speed, but to pan the camera (move it side-to-side) to follow the moving subject as you press the shutter. It is a technique that requires practice, since you need to be able to keep the camera moving smoothly as the exposure is taken, and avoid up-and-down movement as you press the shutter. It may take several tries to get it right, but when it works the results are very effective, with the subject stationary against a movement-blurred background. This shot was taken hand-held at a shutter speed of 1/10th of a second. Some recent cameras have a setting on the image stabilisation system to correct vertical movement but not horizontal, which helps with this kind of shot.



CAR LIGHTS AT NIGHT

Another interesting effect achieved using long shutter speeds is streaking car lights at night. The camera was set up on a tripod, using manual focus and full manual exposure, with a cable shutter release. Starting with an aperture of about f/4, you will need to dial in your settings to get a balanced exposure. If your exposure duration is still too short, stop your aperture down to f/5.6 or smaller until you get a longer exposure duration that renders car lights as long streaks. Generally, a shutter speed of around 4 seconds is a good starting point.

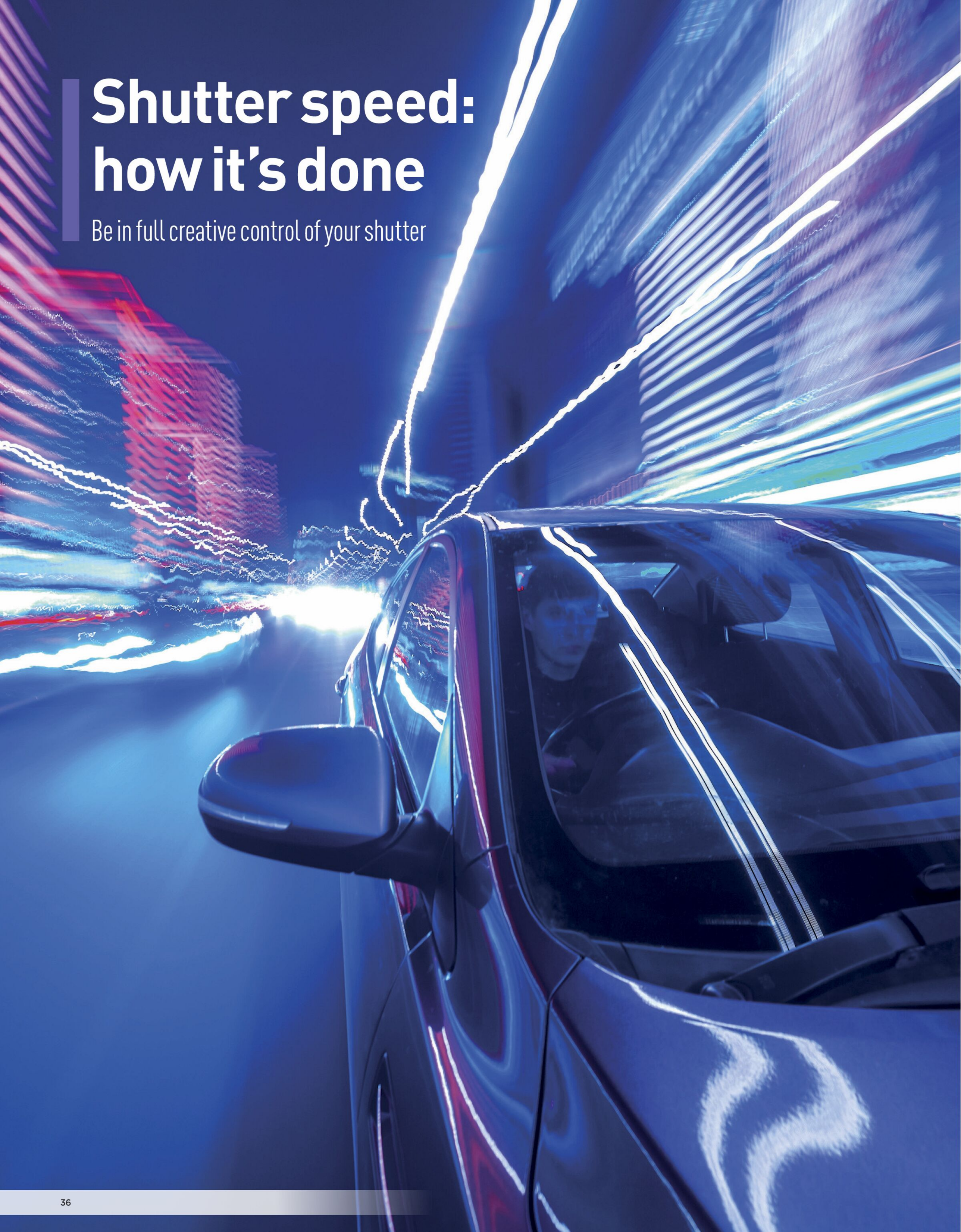
When shooting near heavy traffic at night it's obviously important to stay safe. Wear something bright and reflective, and don't get too close to the road. Also, never use a flash when taking photos of traffic. You could dazzle a driver and cause an accident.

FIREWORKS

One way to take good fireworks photos is to set your camera on a tripod some distance from the display, with the zoom set to a very wide-angle. Set a shutter speed of 2 seconds and as wide an aperture as you can manage. Getting the framing exactly right is simply a matter of luck, timing, and then cropping the photo later.

Shutter speed: how it's done

Be in full creative control of your shutter



Knowing when to use your camera's shutter speeds to their greatest creative effect is something that is easily learned but can often take time and practice to master. You have an immense range of shutter speeds to play with, from the fastest shutter speeds of 1/8000s down to durations measured in minutes or even hours. That is a lot to take in, but once you start exploring the effect of shutter speed on your images, you can start to exploit its great potential.

Camera shake notwithstanding, in scenes where there are no moving objects at all, the shutter speed is less important than in scenes where there is a lot of movement going on. You can choose to freeze movement from 1/250s upwards to combat camera shake and stop any slow moving objects in their tracks. However, there are times when slower shutter speeds can be used to great effect. In our examples, notice the difference between the two action shots. The first one was taken over approximately 3s from a moving car at night and the movement of the vehicle has turned the surrounding city lights into surreal neon trails. The other example image was taken at a motosport event and higher ISO values were used to make sure the shutter speeds were high enough to freeze the action in its tracks. ■

Using a very wide aperture and precise focusing, emphasis can be given to one subject to effectively isolate it from its surroundings.

Aperture and depth of field

With aperture you can control how much of your picture is in focus

WIDE APERTURE

NARROW APERTURE

Of the three main controls common to nearly all cameras, shutter speed, focus and aperture, it is aperture adjustment that is the least well understood. This is because it not only helps to control exposure, but also affects something called Depth of Field. Understanding the effects of aperture size is a vital skill for any keen photographer.

At least there's nothing mysterious about the name. The aperture is literally a hole through which light passes after it enters the lens. The diameter of this hole can be altered, allowing a greater or smaller amount of light to pass through on its way to the sensor. In the early days of photography, aperture was adjusted by slotting cards with different sized holes cut in them into the body of the camera behind the lens. These cards were known as 'stops', and this is still part of photographic terminology today. On modern cameras the aperture is controlled by an arrangement of curved shutters inside the body of the lens, which move to produce a continuously variable aperture, however the aperture settings are usually still referred to as 'F-stops'.

Aperture adjustment is used in combination with the shutter speed and ISO amplification to control photographic exposure. However it is also the primary means of controlling something called depth of field, a concept that may need a bit of explanation.

If you take a photo of a subject at a distance of about 3 metres with standard zoom lens, in good light with the focal length set to about 30mm, as

> "Understanding the effects of aperture size is a vital skill for any keen photographer."

long as the lens is focused correctly the subject should appear nice and sharp in the image. However you'll usually find that objects about 1.5m in front of the subject, and for about 4 or 5 metres behind the subject, also appear sharp. This distance, from the closest point of acceptable sharpness to the most distant, is known as the depth of field.

By altering the size of the aperture it is possible to control the extent of this depth of field, either reducing it so that only the main subject is in sharp focus, or expanding it so that an entire landscape can appear to be just as sharp.

If you have an older camera to hand, take a look at the lens. It will have a ring for controlling the aperture setting, labelled with numbers usually from about F2 to about F22. The focus control ring will have distances usually calibrated in feet and metres, and alongside it you'll usually find lines marked with the same numbers as the aperture ring, arranged in pairs either side of the focal distance mark with the larger numbers toward the outside. The purpose of this aperture scale is to help estimate the depth of field at a particular distance for any given aperture setting; with the focus set to a particular distance, anything between the two lines for the selected aperture setting should be acceptably sharp. Some older zoom lenses have a series of curved lines etched into the lens barrel for the same purpose. For some reason this scale is missing from most modern auto-focus, auto-aperture lenses, which is a shame because it makes the whole concept of depth of field much easier to understand. ■

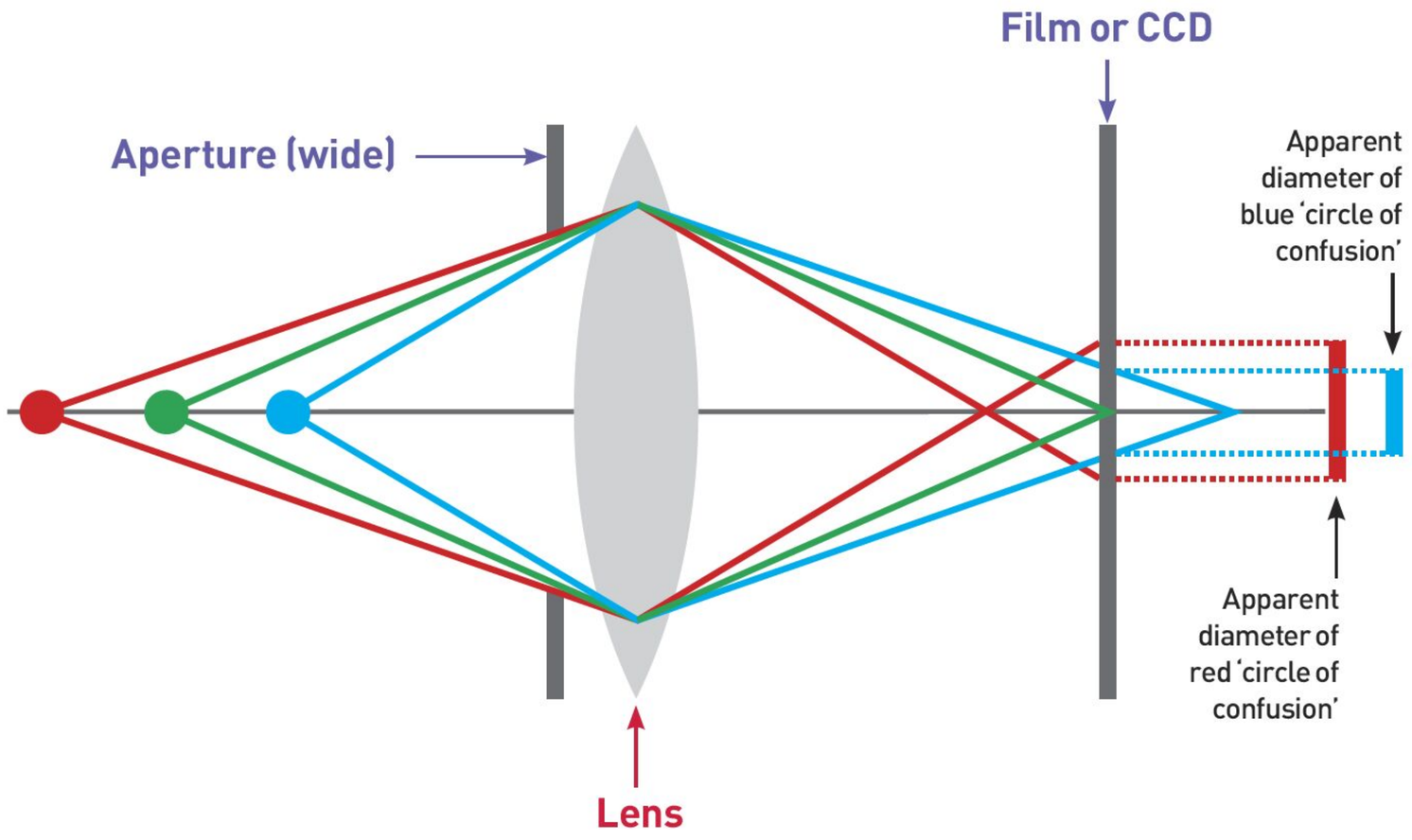
APERTURE RING

How aperture works

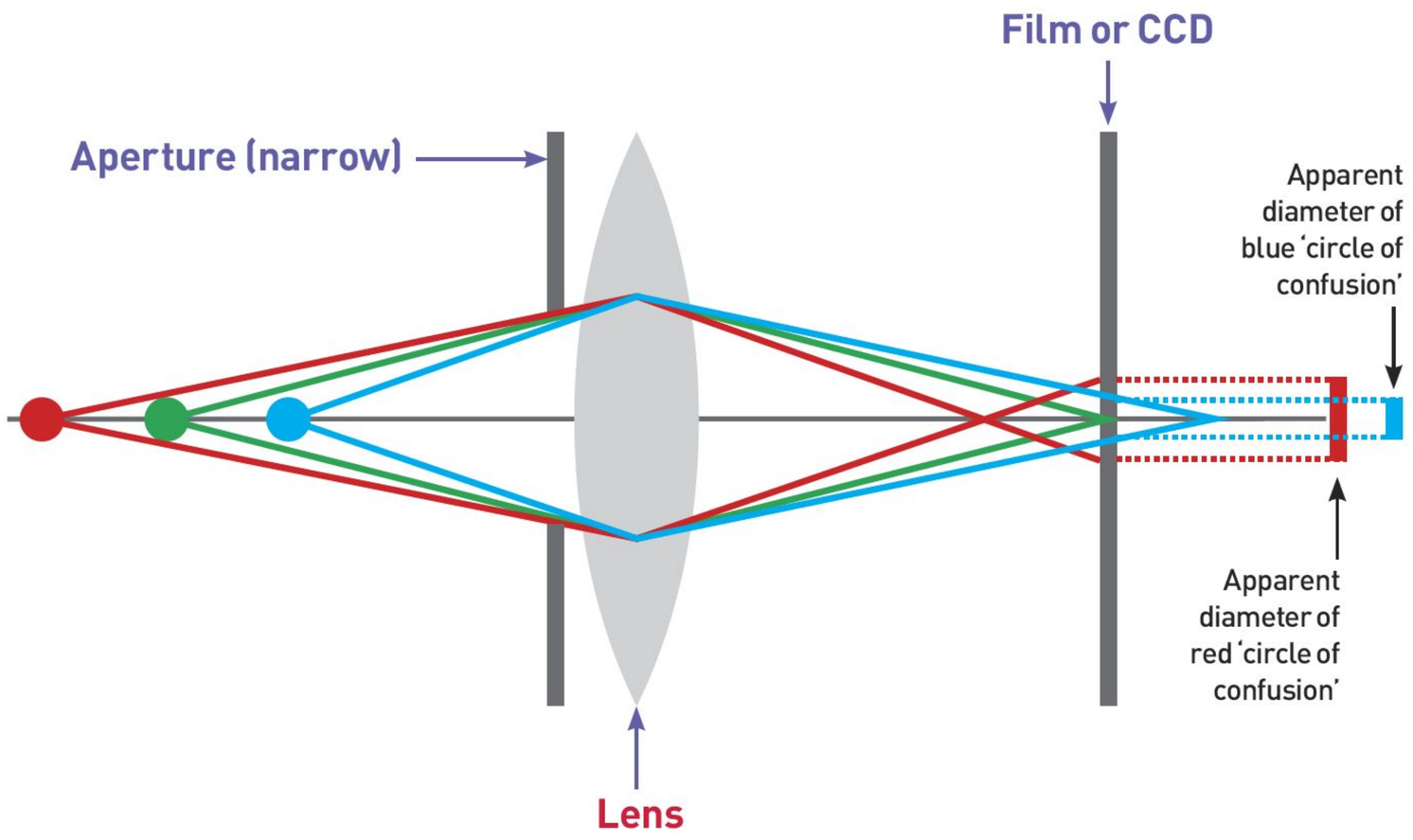
Explaining exactly why altering the size of the lens aperture alters the depth of field is a little complicated, but a few simple diagrams should help to shed some light on the matter. For a start, let's clear up some popular misconceptions about the difference between focus and sharpness.

This is a highly simplified diagram of the arrangement of lens, aperture and sensor inside a modern digital camera. In this first diagram, three subjects at different distances from the camera lens are represented by the red, green and blue dots. The lens is focused on the green spot, so light from it passes through the aperture and the lens and appears sharply focused on the sensor. Light from the red and blue spots also passes through the aperture and lens, but light from the red spot focuses a short distance in front of the charged coupled device (CCD), while light from the blue spot focuses a short distance behind it. The light from these other spots still hits the CCD, but due to light scattering it is unfocused and spread over a wide area.

What this means is that the red and blue spots will appear as large blurred spots on the final image, while the green spot will be sharp and in focus. The size of the blurred area of the red and blue spots is called the 'circle of confusion.'



The diagram below shows the same arrangement of camera and subjects, and the coloured spots are the same distance from the lens, but this time the aperture has been reduced to just a small hole. Again the lens is focused on the green spot, and the red and blue spots are out of focus. However the narrow aperture restricts the light scattering and the relative angles of the light paths, and as a result the 'circles of confusion' are much smaller. This makes the red and blue spots in the final image appear much sharper. They are still out of focus, but the effect is not so noticeable. To make circles of confusion as large as in the first image, the red and blue spots would have to be much further away from the green one.



FOCAL LENGTH AND DEPTH OF FIELD

The focal length of your lens, in other words how much you zoom in on your subject, also has a large effect on depth of field. Short focal lengths have much greater depth of field than longer focal lengths. This is one reason why, when taking a portrait shot, it's a good idea to step back a bit and zoom in rather than using a wide-angle lens up close.

In optics, particularly as it relates to film and photography, depth of field (DOF) is the distance between the nearest and farthest objects in a scene that appear acceptably sharp in an image. Although a lens can precisely focus at only one distance at a time, the decrease in sharpness is gradual on each side of the focused distance, so that within the DOF, the unsharpness is imperceptible under normal viewing conditions.

In some cases, it may be desirable to have the entire image sharp, and a large DOF is appropriate. In other cases, a small DOF may be more effective, emphasizing the subject whilst de-emphasising the foreground and background. In cinematography, a large DOF is often called deep focus, and a small DOF is often called shallow focus.

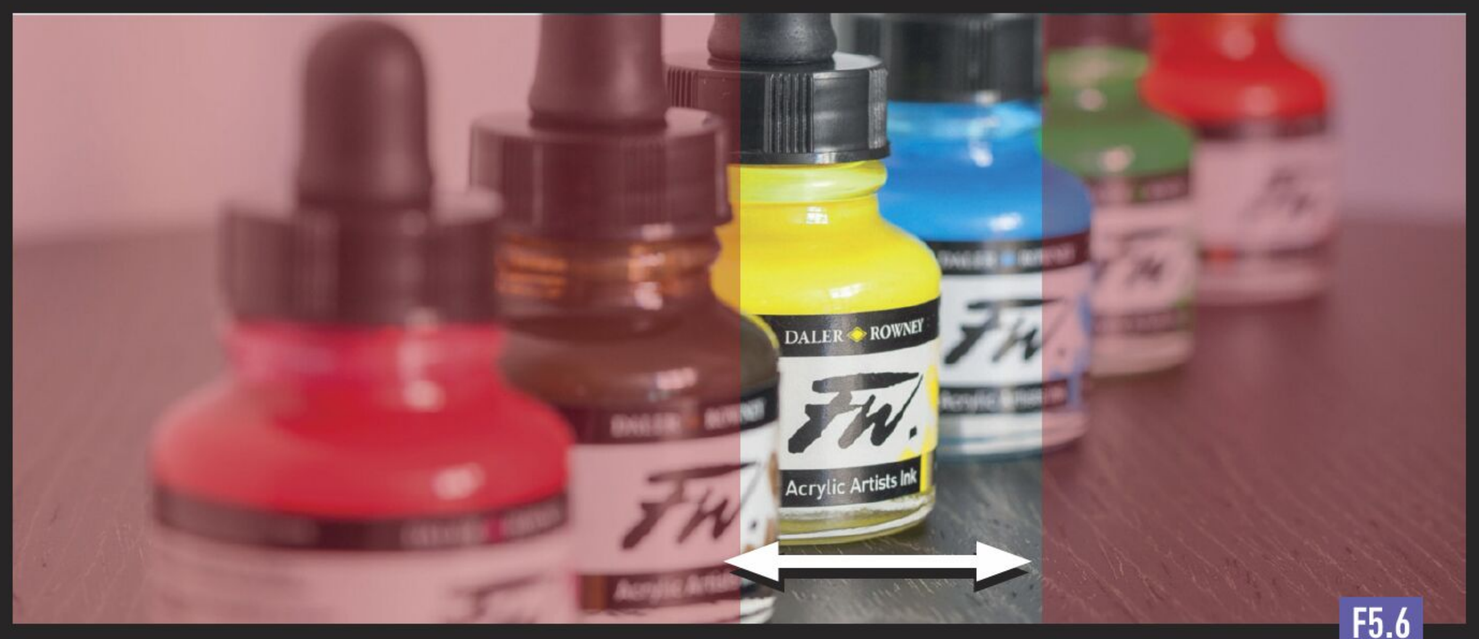
In the examples shown here, at f2.8, the yellow bottle of ink was the point of focus. It is the only object in sharpest focus and the brown and blue bottles either side are completely out of focus.

At f5.6 the area of acceptable focus has increased so that the brown and blue bottles are starting to come into focus.

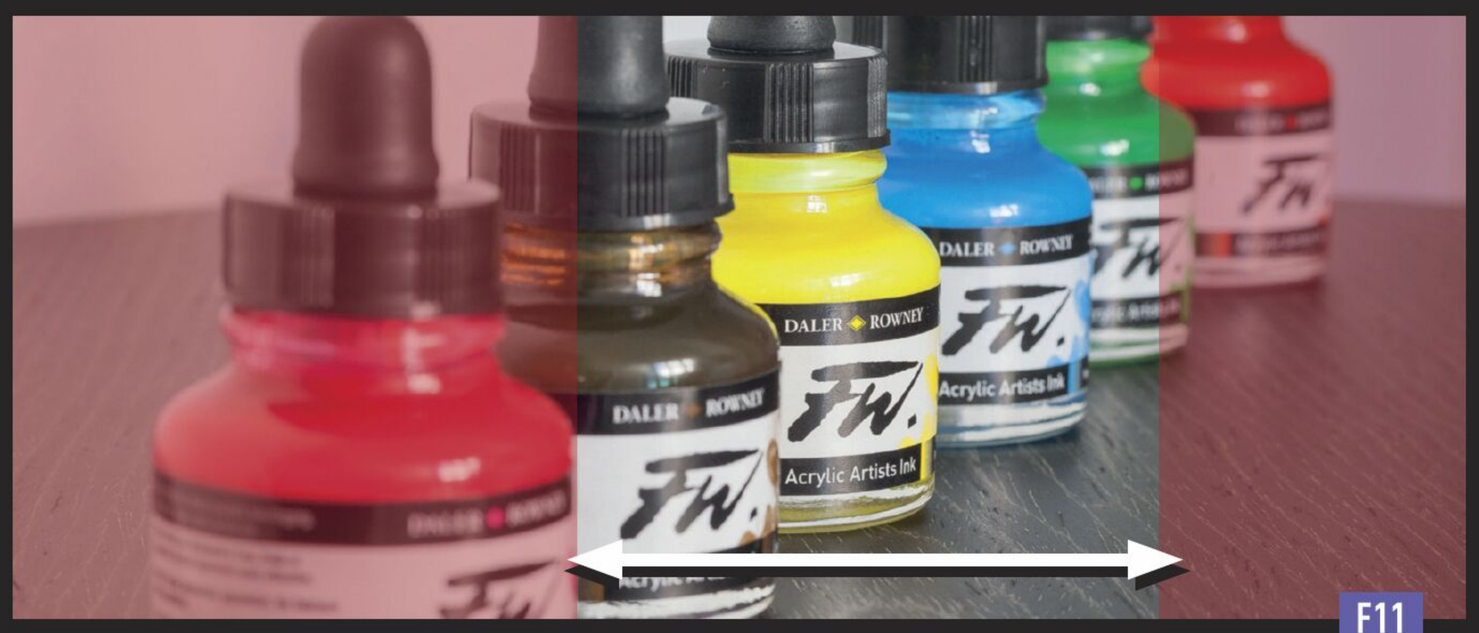
Shooting at f1 brings the brown and blue bottles into sharper focus and the green is less blurred than before.

Stopping the camera down to its narrowest aperture of f32 has all bottles looking reasonably sharp, apart from the red bottle at each end. If you were able to stop this lens down even more, all the bottles would eventually be in focus.

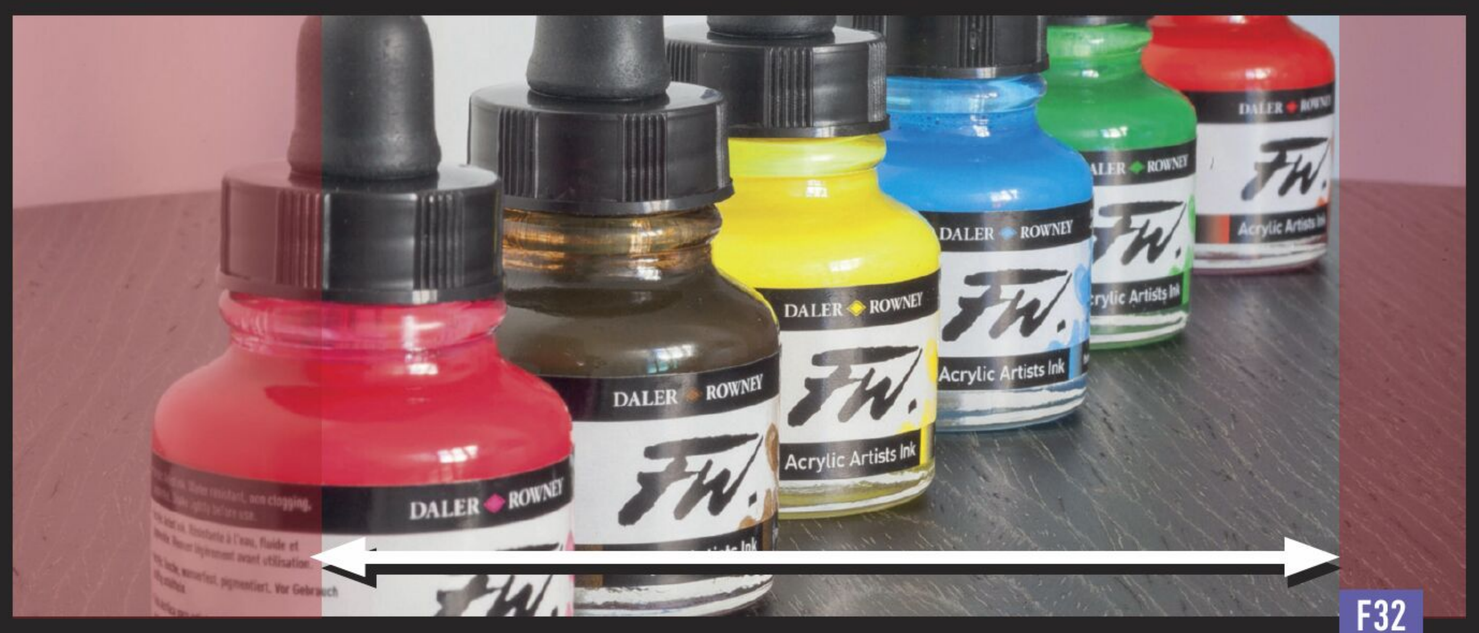
F2.8



F5.6



F11

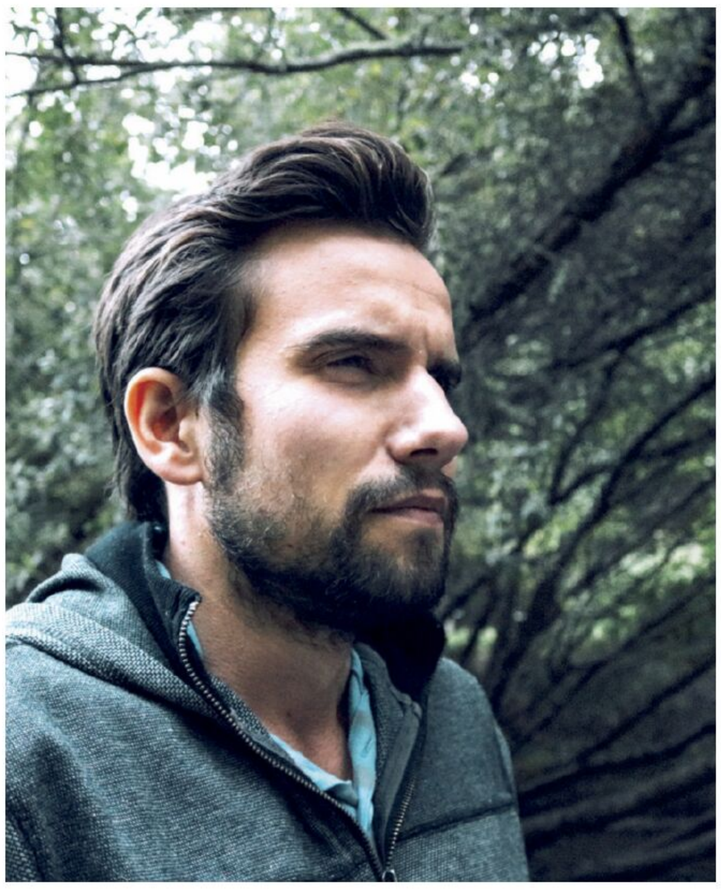


F32

> "In optics, particularly as it relates to film and photography, depth of field (DOF) is the distance between the nearest and farthest objects in a scene that appear acceptably sharp in an image."

Practical uses for depth of field

There are several situations where controlling depth of field is important. The most common is portrait photography. Subjects shot on an automatic camera using a medium aperture usually have a lot of sharp foreground and background detail, which can distract attention away from the main subject.



As you can see in this example, which has a larger depth of field, the subject is in focus and the background is visible, which draws the viewer's attention away from the subject.

By using a wider aperture, and moving the subject further from the background, only the subject is now in sharp focus. A blurred background is much less distracting, and concentrates your attention on the subject, making the subject really stand out from the background.

LANDSCAPE PHOTOGRAPHY

Another situation in which depth of field is an important issue is landscape photography. Here it is often important to maximise depth of field, so it is usual to use the smallest possible aperture. Shots like this, taken using an aperture of f/16, ensure that both the foreground and distant background are in focus. It also uses something called Hyperfocal Distance, which involves a bit of maths to calculate.

Aperture and depth of field: how it's done

Sharp or beautifully blurred, you decide

Much like learning when to use fast shutter speeds or slow ones, how you use aperture to control depth of field in your shots is just as important a creative choice as any in photography. Whilst it does come down to personal preference, there are a couple of golden rules we've mentioned that are worth bearing in mind. A good portrait photo with a cluttered background for instance, is not going to work if the background is in sharp focus along with your subject. The shot will be confusing and that background will just be an eyesore. That's when setting your lens to its maximum aperture to create shallow depth of field will help massively. A good prime lens around the 50-135mm focal length range with a wide aperture of f/2.8 or even f/1.4 will blur your background beautifully whilst drawing the eye to your subject.

Alternatively, if you are shooting a landscape and you want as much of the scene in focus as possible, then a wider angle lens, typically something in the range of 14-24mm, is your go to guy for that situation. Correctly focusing the right distance into the scene and stopping down your lens to about f/16 will ensure as much front to back sharpness as possible. Whilst these are guidelines rather than hard and fast rules, they are a great place to start as you develop your skills as a photographer. Practice, and the willingness to try different things, will result in better photos and you'll have fun along the way. ■

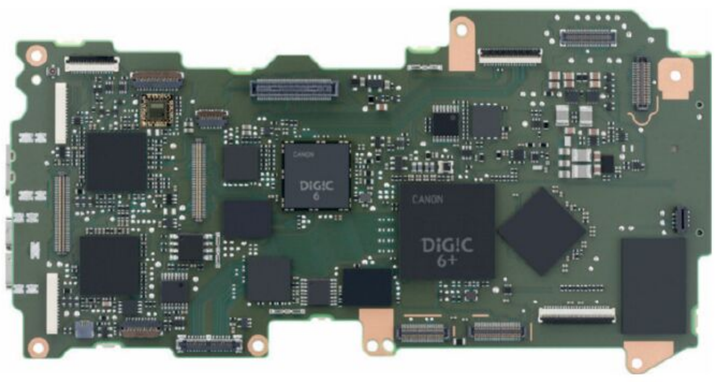
ISO and image noise

High ISO gives you faster shutter speeds in low light, but there's a price to pay

Anyone who has owned a digital camera for a while will be familiar with the concept of image noise. It's that grainy distortion that spoils pictures shot in low light conditions with high ISO settings. What is image noise, where does it come from and what can be done to prevent it?

All electronic devices generate noise. The background hiss of a radio, the sound of an over-amplified electric guitar, or the interference on a badly tuned television, all of these things are electronic noise, and so is the noise seen in a digital photograph.

This noise comes from a variety of sources. Some of it is generated by imperfections in the electronic components, or as a by-product of their normal operation. For instance, capacitors generate a small amount of noise as they charge and discharge. Electronic components can also be affected by environmental noise, such as the electrical fields that constantly surround us.



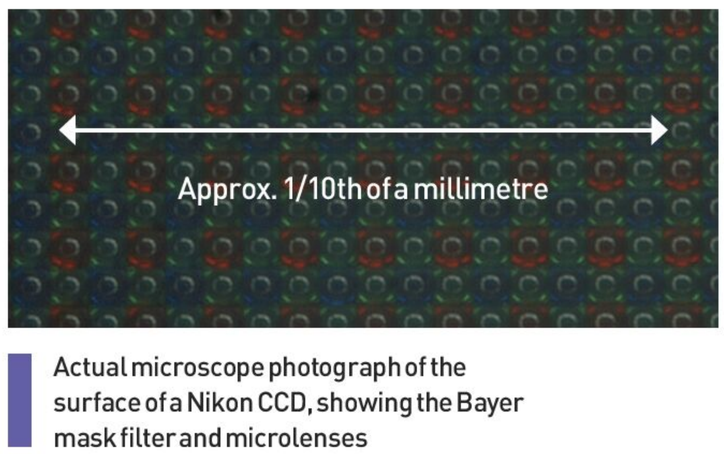
This is the main circuit board from a Canon EOS 5D MkIV digital SLR, showing the powerful DIGIC6 and DIGIC 6+ image processing chips.

Circuit noise can be minimised by superior manufacturing and rigorous quality control. Unfortunately some cheaper camera brands, or even budget models from better-known brands, may use components of lower quality, which is why these types of camera generally produce noisier images than the more expensive models.

Sensor noise

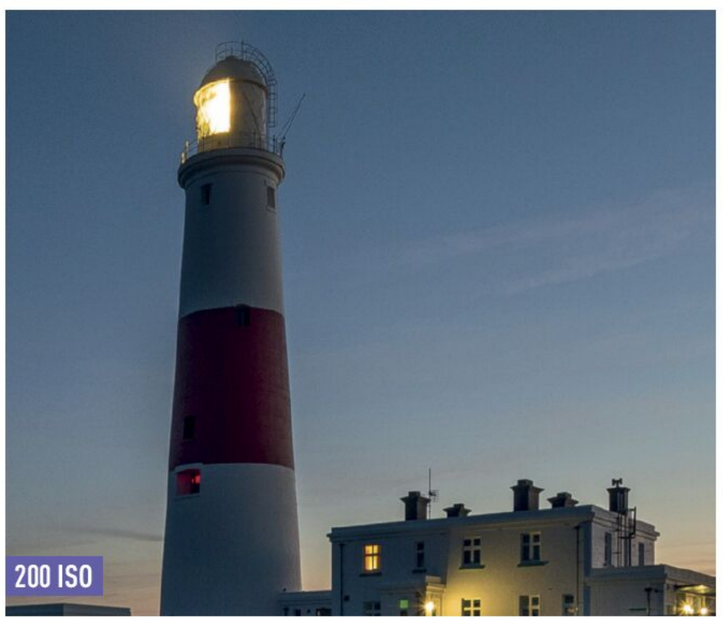
The other main source of image noise is the sensor itself, and in most cases this is unavoidable. The individual photocells on a digital camera sensor are incredibly small, especially with high-resolution compact camera sensors.

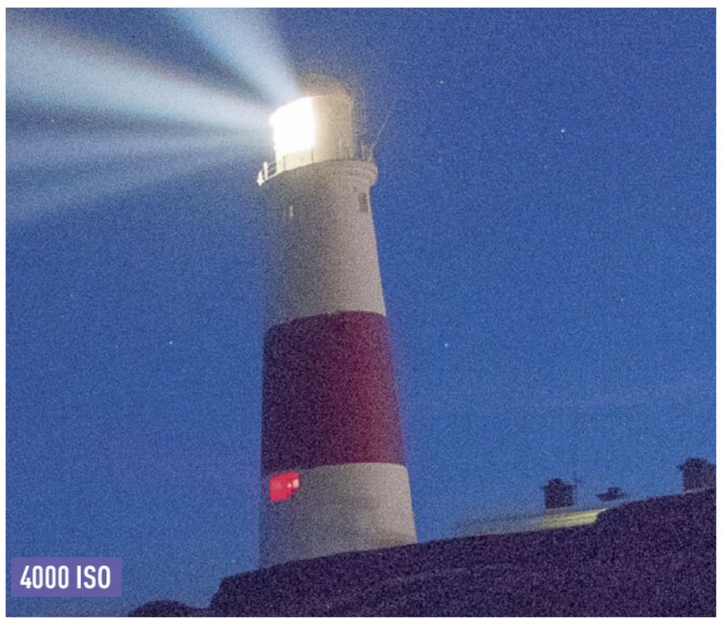
Most compact camera sensors have over 10 million individual photocells crammed into an area of less than 30 square millimetres. These photocells are so small that in low light conditions they may only be collecting a few thousand photons (individual light 'particles') during an exposure, so the level of the electrical signal produced by the cell can be affected by random statistical fluctuations in photon density. This is the main reason that physically larger sensors are much better than smaller ones. The individual photocells are larger and collect proportionately more light during the exposure producing an inherently higher signal to noise ratio.



Actual microscope photograph of the surface of a Nikon CCD, showing the Bayer mask filter and microlenses

The level of noise produced by the sensor and other components in the camera is usually constant and at a fairly low level. When taking photographs in good light the level of the signal vastly outweighs the level of noise; in other words the signal to noise ratio is very high, and consequently noise isn't a problem.



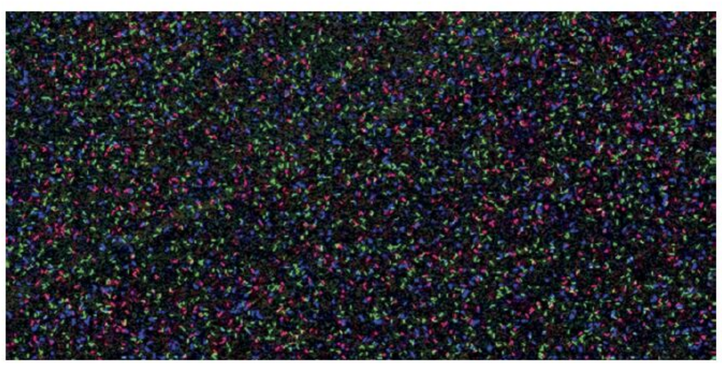


> "When we set a higher ISO we are increasing the amount by which the signals from the sensor are amplified and unfortunately the noise gets amplified as well."

The problems start when shooting in low light, as the level of the signal drops nearer to the constant noise level, producing a lower signal to noise ratio. At extremely low light levels the signal may be entirely drowned out by the noise.

This problem is made worse when shooting at higher ISO settings. When we set a higher ISO we are increasing the amount by which the signals from the sensor are amplified, and unfortunately the noise gets amplified as well. If the signal to noise ratio was already very low then this just produces more noise without improving the image. This is why high ISO images are always more noisy than ones taken at lower settings.

Another type of sensor noise can also be a problem when using exposures longer than a couple of seconds. Sometimes the photocells that make up the sensor may not all respond to light to an equal degree, causing single pixels to appear very bright or very dark. The charge build-up over a longer exposure makes this problem more noticeable. Since the pattern of these "dead" or "hot" pixels is usually consistent from one frame to the next this type of noise is remedied by applying a filter during image processing. Most modern cameras do this automatically but it can be a problem on older models. Images taken on older cameras can show a lot of "hot" pixels, especially during long exposure photographs with no long exposure noise reduction. Below is an example of how bad it can get.

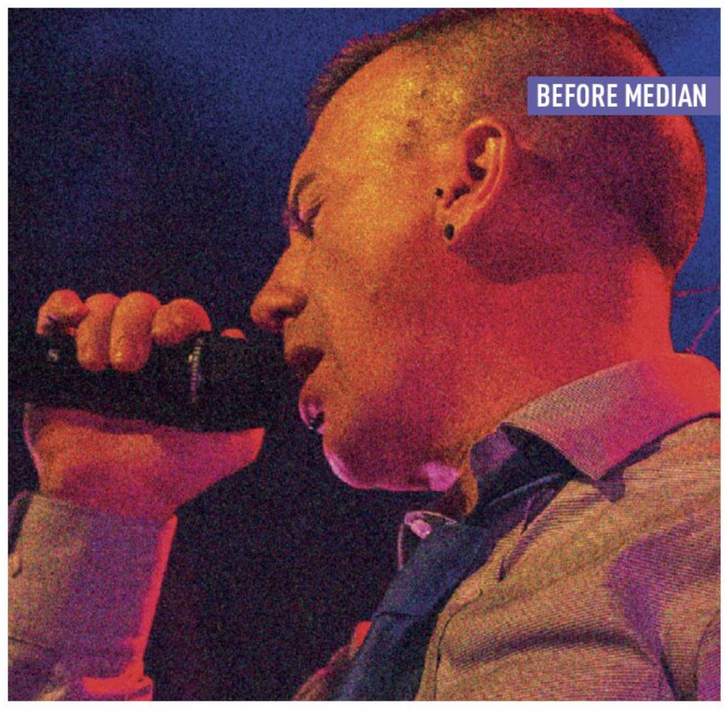


Noise reduction

Cameras reduce image noise by using smoothing filters during image processing. The most commonly used is called a Median filter. This works by comparing each pixel to the ones surrounding it, and if it has a brightness that is different from its neighbours then it is replaced by a new pixel with the average value of the nearby pixels. This eliminates noise effects, but also reduces detail and contrast. Compare these next two images. The first is unfiltered, the second has had a median filter applied. The second image is "cleaner", but as you can see the level of detail has been greatly reduced.

Another type of noise reduction is called "pixel binning", although this is less widely used in recent digital cameras. In this process, the signals from groups of four, nine or even 16 adjacent photocells are grouped together into a "super pixel". This has the effect of increasing the signal to noise ratio, but of course it also reduces the effective resolution of the image. It increases the signal to noise ratio, but it also reduces the quality of the image.

The only effective remedy to image noise is to use larger, more sensitive photocells. Digital SLRs have a major advantage in this area, since they have physically larger sensors. Compact camera sensor technology continues to improve, both in image processing and sensor design. We will undoubtedly see further advances in the future, but for now image noise is something we just have to accept. ■



> "Autofocus technology has improved immensely, and these days even the most basic modern AF systems are generally fast, accurate and reliable."

Focusing

Getting the best out of your autofocus system

With only one or two exceptions, all current digital cameras have automatic focusing. The first autofocus systems were developed by Leica in the 1970s. The first autofocus compact camera, the Konica C35 AF, was introduced in 1977, and the first autofocus 35mm SLR, the Pentax ME-F, was launched in 1981. Since that time autofocus technology has improved immensely, and these days even the most basic modern AF systems are generally fast, accurate and reliable.

Although we now rely on autofocus for the vast majority of photographs, anyone who has tried taking a photo in low light, with fast-moving subjects or using very long telephoto lenses will have noticed that sometimes even the best AF system can run into problems. We've all stood there with the lens whirring in and out of focus, trying to get a lock on our subject, and eventually missed the shot. It's very frustrating when this happens, but with a few simple tips you can help your camera to focus quickly and accurately even in difficult situations.

There are two main types of autofocus system in common use today. All compact cameras and most CSCs use something called contrast-detection AF, which samples the image from the main picture taking sensor and detects sharp high contrast edges in the details of the scene. Meanwhile all digital SLRs and Sony's new SLT cameras use something called phase-detection AF, which uses an array of separate dedicated sensors usually mounted below and in front of the

main imaging sensor. Phase detection is a more complex system, but it is usually much faster, more accurate and works better in low light. However both systems require some detail in the scene to 'lock on' to. Try it for yourself: point your camera at a plain wall or a sheet of white paper and see if it will focus on it. Even if you own a top-of-the-range DSLR it won't be able to focus on a featureless surface.

There are a couple of ways to help your camera to focus quickly on a scene. Most digital cameras have the option to select either single or continuous autofocus. Your camera will normally start to focus on the scene as soon as you half-press the shutter button. In continuous focus mode it will continue to update the focus if you then move the camera, but in single AF mode it will hold the same focus setting as long as you hold down the button, until you actually take the shot. You can use this to focus the camera on low detail targets by finding an object in the scene that's the same distance away as your chosen subject, focusing on that, and then holding the focus and reframing the shot. Similarly you can use it in reverse to focus on objects that aren't in the centre of the frame.

Different lenses have different minimum focusing distances, but many modern zoom telephoto lenses also have macro-focusing capabilities for close-ups.

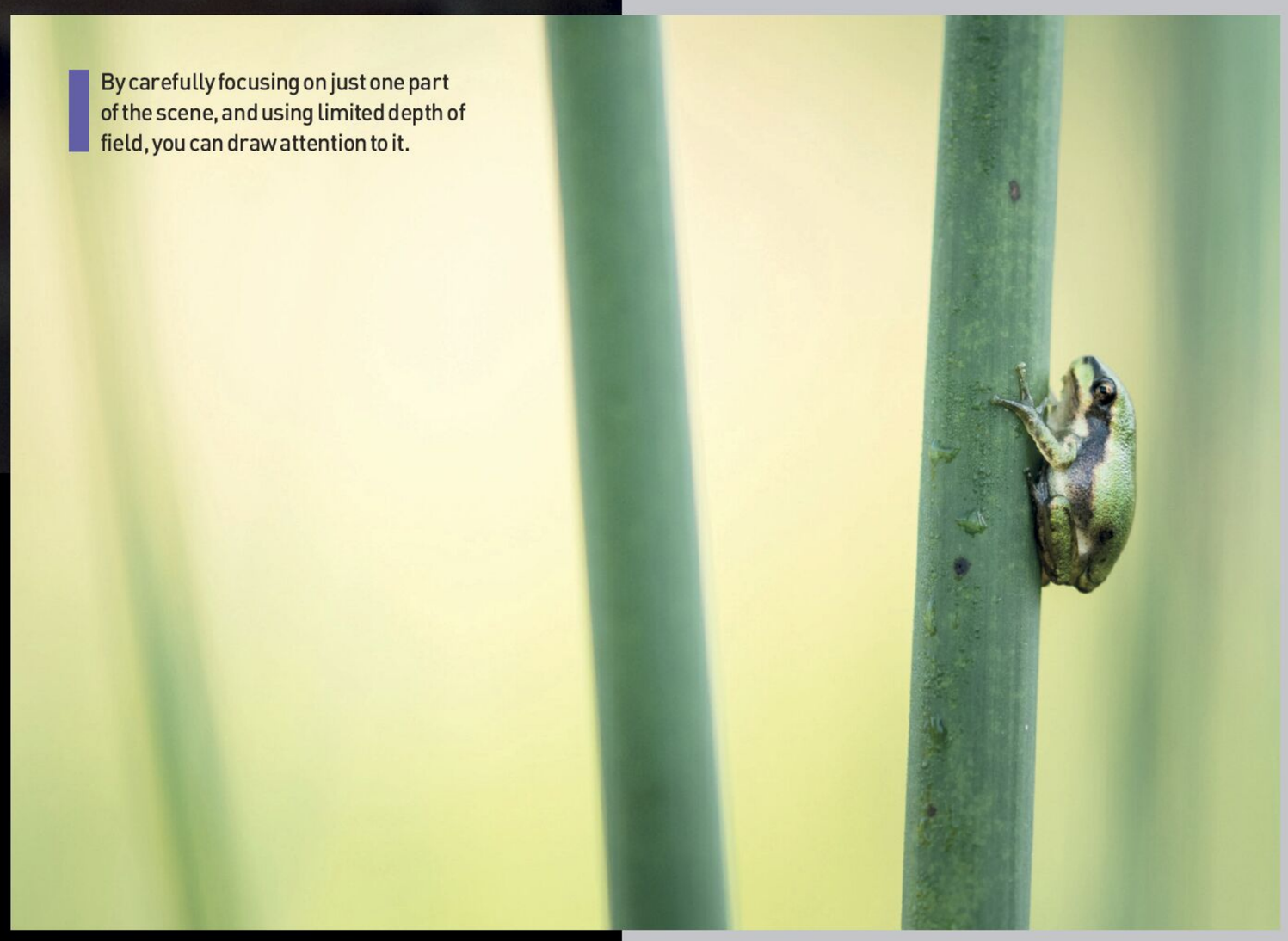
Moving targets

Compact camera AF systems are usually somewhat slower than those in DSLRs, which means they can have a real problem focusing on moving subjects. The way around this is either to use continuous AF or, if your camera has this option, to use manual focus. If you can tell where your subject is going to be, such as a car going round a tight corner on a race track or a child on a swing, you can pre-focus the camera on this point and wait to take the picture at the right moment. This method takes some practice and good reflexes, but it can produce excellent results.

Close-ups

All cameras and lenses have a minimum focusing distance, a closest point beyond which they cannot focus. For many compact cameras this distance can be very small, in some cases as little as 2cm (1in), but for standard DSLR lenses the distances tend to be longer. Most compact cameras have a 'macro' setting, usually denoted by the symbol of a flower. To get closer focusing with a DSLR or CSC, special close-focus macro lenses have to be used.

Depth of field is greatly reduced at very close focusing distances, and you may find that your AF system doesn't focus on the right part of the subject, for example if you are trying to photograph the centre of a flower, but the AF focuses on the petals, because they're closer. The best option is to use a tripod, and manually set the focus to the closest distance. Move the tripod until the front of the subject comes into focus, then carefully manually adjust the focus point to get the right part of the flower to look sharp. ■



By carefully focusing on just one part of the scene, and using limited depth of field, you can draw attention to it.

Focusing: how it's done

Choose your focusing method for the job in hand

Along with unwanted camera shake, one easy way to ruin a shot is to incorrectly focus on your subject. This can be down to the camera's autofocus system being confused by other obscuring objects in the scene and attempting to lock on to that instead of your subject; or just good old human error in the way you might have set up your autofocus options. We can speak from embarrassing experience where a number of portrait shots at an event were taken when the lens' autofocus button was knocked onto manual and we didn't pay enough attention to the fact that the focus confirmation light wasn't coming on. Luckily we noticed during a quick review of the shots taken, and could remedy the problem, but could you imaging getting home only to find all the shots being out of focus? That's a bit of a nightmare. Of course, the nature of your subject and their movement is key to deciding your choice of focusing technique.

A studio-based still life shot, for example, is fine with focus set to manual as you can determine your point of focus and leave it here without fear of anything moving and the focus shifting. Portrait shots with the camera in portrait orientation mean you can use a one-shot autofocus mode. You can lock focus by pressing the shutter button halfway, recompose the shot to how you want it and take the shot by fully depressing the shutter button.

For unpredictable moving targets like pets, you need to use a continuous-autofocus mode. You select an AF point and with the shutter pressed halfway, keep the AF point over the subject you want the camera to attempt to keep focus lock on as it moves. Tracking moving subjects can be quite tricky but as always, with practice it is a great technique to have at your disposal. ■

Focal length and zoom

Understanding how focal length works in composing shots

Nearly all modern compact cameras have zoom lenses, and most users of digital SLRs or CSCs will also have at least a couple of zooms in their kit. Focal length is one of your primary tools for adjusting composition. Selecting the right focal length for the scene allows the photographer to control perspective, angle of view and magnification, and can radically alter the mood and style of the photo. Some focal lengths are more suited to particular types of photo, and the properties of wide-angle and telephoto lenses can be used to produce particular effects. Understanding how focal length works and how it affects your photos is a vital photographic skill.

LENSES AND FOCAL LENGTH

> "Selecting the right focal length for the scene allows the photographer to control perspective, angle of view and magnification."

There are basically two types of lens: those with fixed focal lengths, also known as prime lenses; and those with variable focal length, or zoom lenses. They both have their own advantages and disadvantages. Prime lenses are usually smaller and lighter than zooms, and also generally have much faster maximum apertures than a zoom lens at equivalent focal length. The optical quality of prime lenses is also usually a little higher than the equivalent zoom lens. Zoom lenses however are much more convenient, allowing the photographer to cover a wide range of focal lengths with just one or two lenses, rather than carrying around a bulky collection of prime lenses. There are some fast zoom lenses, but they tend to be extremely expensive.

The focal length of a lens is an expression of its magnifying power, and is usually stated in millimetres. If you look on the front of your camera, usually inscribed around the front of the lens you'll find the focal length, or a range of values for zoom lenses. For a typical DSLR kit lens this will usually be around 18-55mm.

For digital cameras it is fairly usual to see two figures quoted, both the actual focal length and the 'equivalent' length. The reason for quoting both is simply that most people are more familiar with the sizes of 35mm lenses, so they know that 28mm is wide-angle and suitable for panoramic shots, or that 200mm is a telephoto lens, suitable for long-range subjects.

Real and equivalent focal lengths are different because most digital camera sensors are a lot smaller than a frame of 35mm film, and are fitted much closer to the lens than the film would be. Most consumer DSLRs use the APS-C sensor format. Exact sizes vary from one manufacturer to the next, but are typically around 22.5 x 15 mm. A frame of 35mm film measures 36 x 24mm, which means that the edges are 1.6x longer, so the focal length of the lens would need to be 1.6x greater to produce the same image size and magnification. This is usually referred to as the 'conversion factor' or 'crop factor'. It means that a typical 18-55mm DSLR zoom lens is roughly equivalent to the popular 28-80mm zoom lens often used on 35mm systems.

Compact camera sensors are even smaller still. Because there are several different sizes of sensor in common use it is more usual for compact camera zoom lenses to be rated in terms of their magnification power, such as 3x, 4x, 10x etc. This relates to the difference between the minimum and maximum focal lengths. A lens with a range of focal length from 5.8mm to 17.4mm is called a 3x zoom, because 17.4 = 3 x 5.8.

While in older prime lenses a 200mm lens would literally be 20cm long, modern optical systems use multiple lens elements working in combination, which means that the light path can be shortened while still maintaining the same effective magnification. As a result quite powerful telephoto and zoom lenses can be relatively compact.

Wide-angle and telephoto are relative terms. On a 35mm film SLR a 50mm lens produces approximately the same perspective and magnification as the human eye, and has traditionally been the standard lens for this type of camera.

Anything longer than 50mm is considered a telephoto, while anything shorter is considered wide-angle. Digital SLRs tend to follow this rule too, although considering the crop factor the mid-point is approximately 35mm. ■

300MM TELEPHOTO

50-200MM ZOOM

18-55MM KIT LENS

14MM WIDE-ANGLE

MAGNIFICATION

The most obvious effect of altering focal length is the change in magnification. Anyone who has ever used a zoom lens will be familiar with this effect. If you want to take a photo of something a long way away, you zoom in and the subject appears closer.

This series of photos shows the effect of a wide-angle zoom equivalent to 25mm, medium zoom of 100mm and a telephoto of 400mm, all taken from the same position.

What is happening here is not the subject being brought closer, but the angle of view being reduced so that a smaller proportion of the scene fills the frame of the sensor. If we look at a cropped-down section of the centre of the wide-angle 25mm view we can see that it looks very similar to the 400mm view, although rather less sharp, because this cropped-down section of the frame obviously has far fewer pixels than the full-frame zoomed-in image. This is the way that digital zoom works on a compact camera, and is why digital zoom should never be used as a substitute for optical zoom.

> "A cropped-down section of the frame has far fewer pixels than the full-frame zoomed-in image."

As you can see, cropping the wide-angle image produces the same effect as zooming in, but greatly reduces quality.

ANGLE OF VIEW

Changing the angle of view can be used to produce some interesting effects. If we move closer to the subject while shortening the focal length we can see that although the subject fills roughly the same area of the final image, in a wide-angle shot a lot more of the background is included.

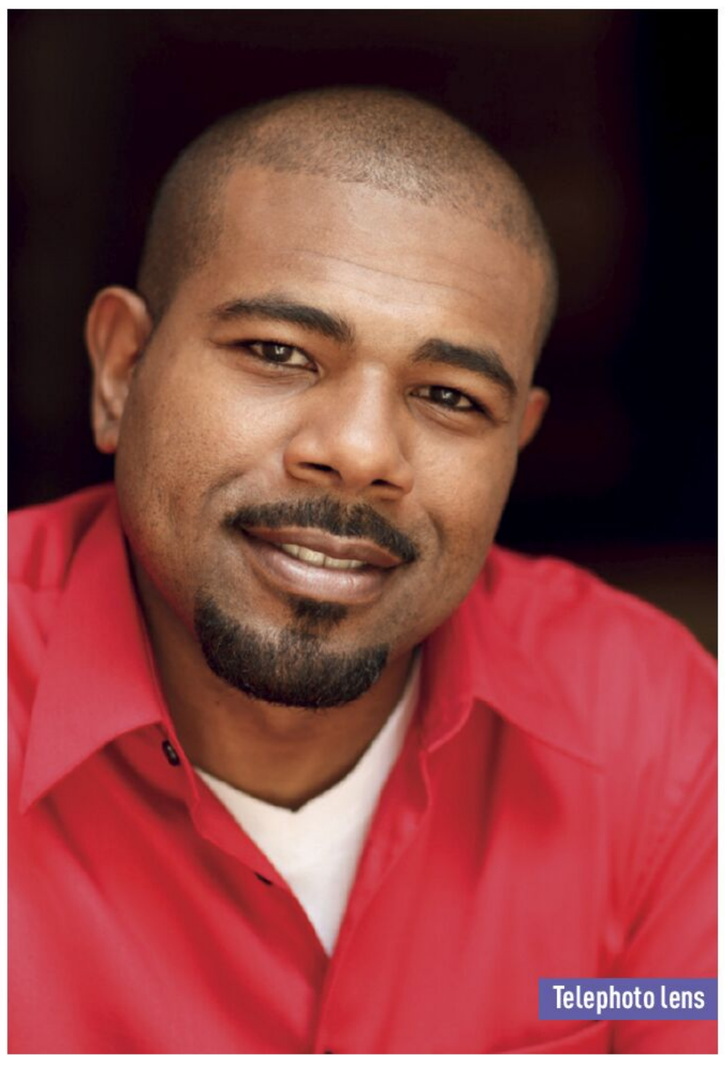
Take a look at this series of five pictures, each one taken at approximately half the focal length of the previous one. As the focal length is reduced more of the background comes into view behind the subject, while objects in the foreground appear much closer to the camera, increasing the appearance of extreme perspective. Watch out for unflattering distortion on human subjects as you get closer to them and shorten the focal length.

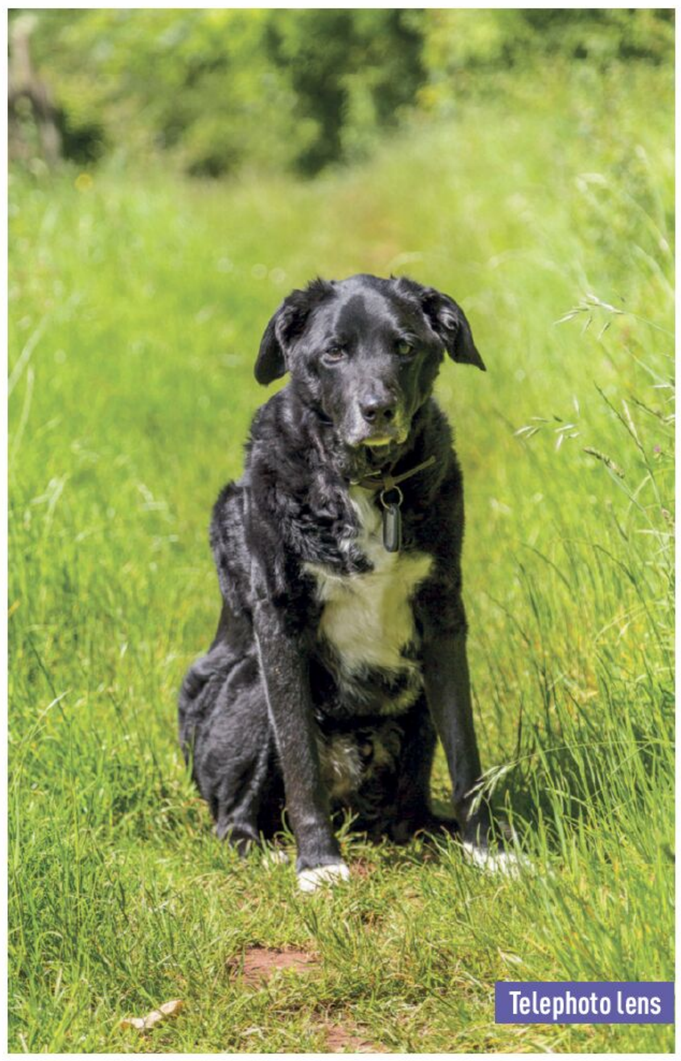
DISTORTION

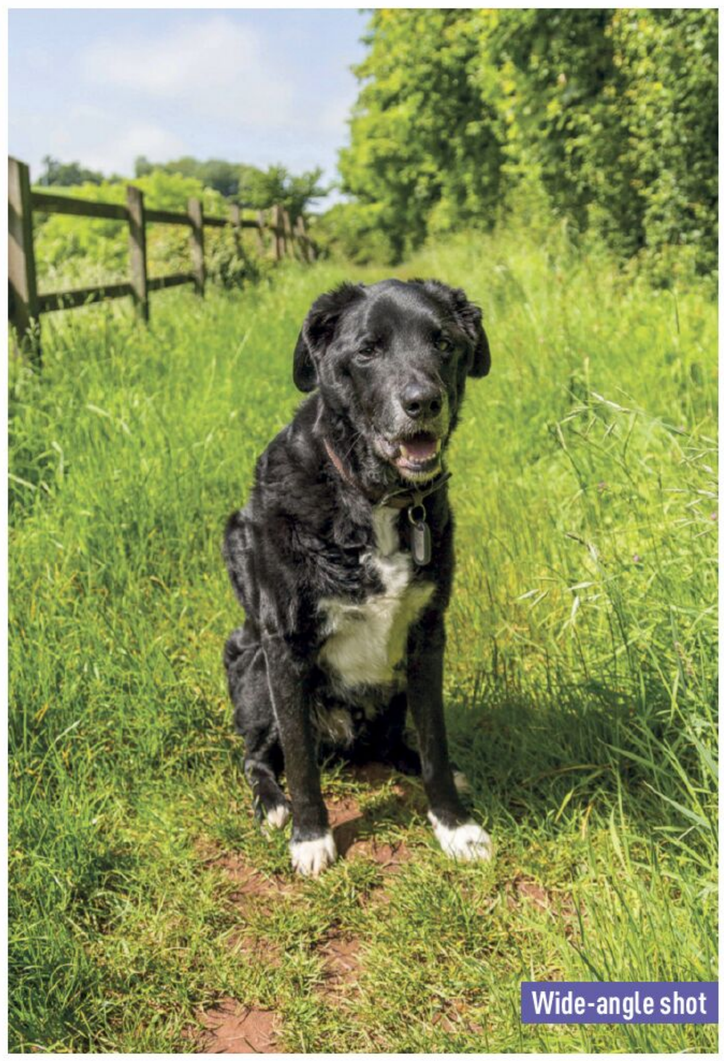
Wide-angle shot

Changing the angle of view is important to remember when shooting portraits. If you use a short focal length to take a facial portrait at close range the parts that are closest to the camera will appear disproportionately larger, distorting the facial features. The result is a 'ballooning' of the face as it appears to bulge outwards, like a reflection in the back of a spoon: not such a flattering look, as illustrated above.

Most portrait photographers prefer to step back a little and zoom in. The most popular choice is a focal length of about 80-100mm, since this gives a flattering, natural-looking perspective.


Telephoto lens

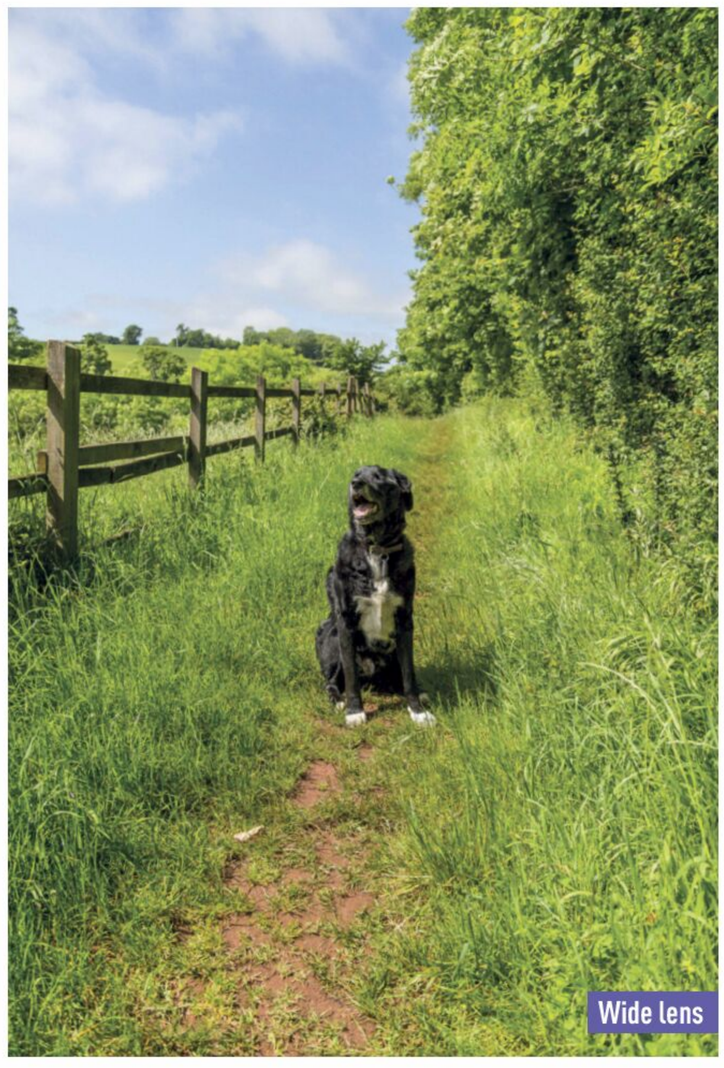

Telephoto lens


Wide-angle shot

DEPTH OF FIELD

The perspective-flattening of long lenses can also be used in other circumstances, such as drastically reducing depth of field. You can use this to isolate a subject by blurring out the background, as in the shot above on the left.
Compare this with the same shot on the right, but taken with a wide-angle lens from a much closer range. The relative size of the subject is the same in both shots, but due to the increased depth of field in the wide-angle shot, the background, although apparently more distant, looks sharper.

Telephoto lens


Wide lens

TELEPHOTO LENS

Careful focusing with a long telephoto lens can pick out individual subjects despite busy surroundings, such as focusing on a student at a school music festival. A similar scene shot using a wide-angle lens presents a very different image. The examples we've used here are extremes intended to emphasise the effects we're demonstrating, but in fact a lot of people only ever use their zoom lenses at either maximum or minimum settings. Don't do this out of habit; instead use the full range of the lens to explore all the different possibilities it offers. Focal length is one of your primary creative tools, so make good use of it.

Focal length and zoom: how it's done

Use of focal length is a key tool to shot composition

When buying new lenses, it is important to know what different ones are used for and which are right for you. The focal length of a lens is actually measured from the point of converging inside the lens to the sensor, not from the front of the lens.

Ultra wide-angle

Usually in the 14-24mm range, these lenses are considered specialty devices and do command some very high prices. Ultra wide lenses are often used in landscape, architectural and event photography to get the maximum amount of scene into a single photo, or when space is restricted.

Wide-angle

With focal lengths starting at 24-35mm, these lenses are widely included as kit lenses starting at 24mm with a zoom range up to about 105mm. They are often used by photojournalists or people who want a good 'walkabout' lens.

We have two examples taken at opposite ends of the zoom range. One was shot with a 15mm fisheye lens, covering a 180° field of view and the other was shot with a 400mm telephoto lens on a crop sensor body to create an effective focal length of 640mm.

Standard

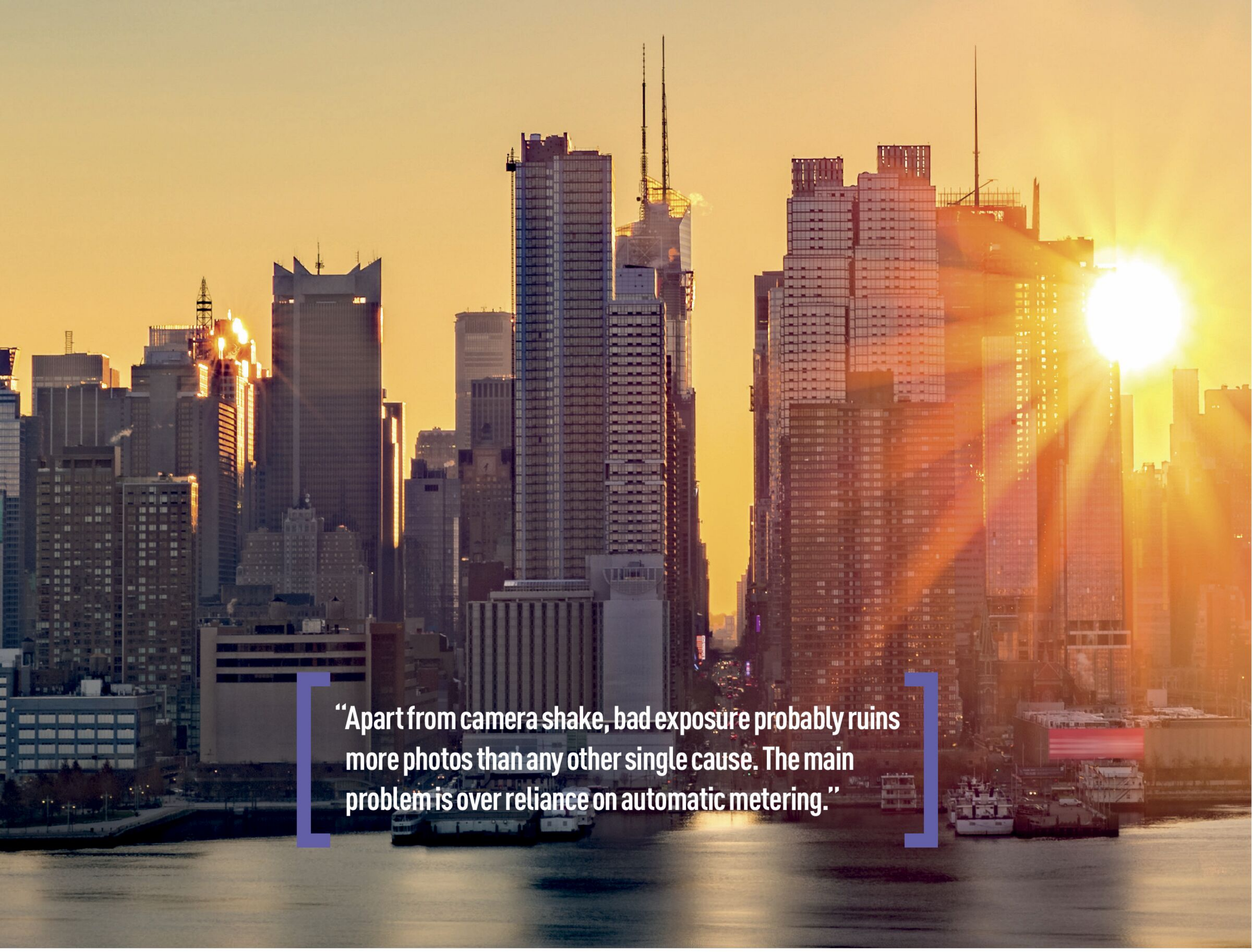
Within the range of 35-70mm, a lens will reproduce the world roughly as our own eyes see it. A 50mm lens is considered one of the best focal lengths at which to shoot portraits because they look more natural with less distortion than a wide-angle lens.

Medium telephoto

Between 70-105mm is the top of the zoom range for kit lenses. This range is also equally good for shooting portraits.

Telephoto

105-400mm covers the range of telephoto lenses. Used for bringing distant objects closer and flattening perspective. Above this range you are into super telephoto lenses used by sports and wildlife photographers reaching focal lengths of up to 800mm. ■



> "Apart from camera shake, bad exposure probably ruins more photos than any other single cause. The main problem is over reliance on automatic metering."

Exposure and metering

Accurate exposure is the key to good photography

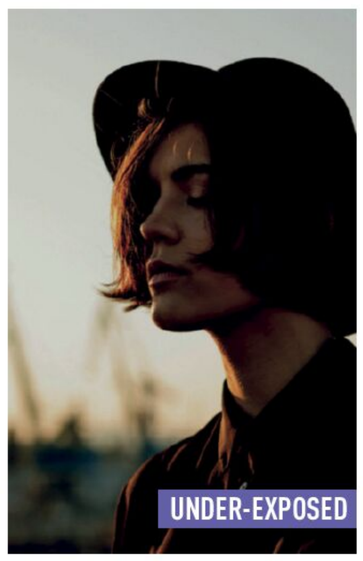
Understanding exposure and how it affects your photographs is probably the single most important technical skill you can learn in photography. It's certainly the one that most people get wrong, and apart from camera shake, bad exposure probably ruins more photos than any other single cause. The main problem is over reliance on automatic metering.

Most modern cameras, even relatively cheap compacts, have sophisticated built-in TTL multi-zone evaluative exposure meters that measure light levels at dozens, in some cases hundreds, of points within the frame, instantly comparing the results with a built-in library of exposure situations and automatically adjusting the shutter speed and aperture to deal with problems such as back-lighting, close-ups or moving subjects.

In most cases these automatic exposure systems are very good, and can reliably cope with most common circumstances. However even the best automatic meter can be fooled, resulting in poorly exposed photos. By overriding the camera's automatic settings and adjusting exposure manually we can avoid these problems and take much better photos.

Let's take a look at a couple of examples. In this first scene we have a portrait of a brightly lit fair skinned model shot against a dark background. This was taken using a typical DSLR camera set on automatic exposure. As you can see the camera has badly over-exposed our model's face, losing details in the highlight areas.

In this second example the same camera has been used to photograph the model, but this time standing in front of a brightly lit background. In this case the camera's automatic exposure system has seriously under-exposed the shot, leaving the model's face in deep shadow with little detail visible.



The same usually reliable exposure meter took both of these shots, so what went wrong? In order to understand what happened and accurately correct it, it is necessary to know how light meters operate, and the rules by which exposure is calculated.

FIG 1. ORIGINAL SCENE

FIG 2. THE LIGHT METER WILL AVERAGE THE SCENE

FIG 3. THE AVERAGE RESULT WILL BE MID-TONE GREY

Fade to grey

Take a look at the main picture above. What you see there is a photograph of the New York skyline in early sunrise conditions, with a good tonal range, plenty of colour, and some nice crisp light. What your camera's light meter sees is very different as our example above shows. Try it out for yourself. Find any nice, average snapshot scene, properly lit and with good contrast like our example **FIG 1**. Start up your image editing software and open your picture. Light meters only see in black and white, so reduce the saturation of the shot to zero. Your light meter doesn't see detail, so set your Gaussian blur filter **FIG 2** to maximum diameter and apply it a couple of times. Use the eyedropper tool to measure the RGB colour value of the resulting tone. You should find that it averages out to a mid-tone grey **FIG 3** with an RGB value of around 127,127,127.

It's an interesting and curious fact that any average scene reflects 18% of the light falling on it. Look out of your window, and unless you live in Antarctica the scene you see is reflecting exactly the same amount of light as the scene out of my window. That 18% reflection is exactly the same as a mid-tone grey, midway between black and white.

Light meters are calibrated with this fact in mind. When your camera takes a light reading, the meter averages the scene and adjusts the exposure to produce that mid-tone grey (or 12% luminance, but that's another discussion altogether). If you point the camera at a black stage curtain, it will try to make the black into a mid-tone grey, so it will over-expose. If you point it at snow it will try to make the white into grey, so it will under-expose.

Adjusting exposure

Let's take a moment to explain how exposure is controlled, and what is meant by some of the terminology. If you already know the basics, feel free to skip to the next page.

On all cameras, exposure is adjusted by altering two settings; aperture and shutter speed. Between them they control the amount of light that hits the sensor when the shot is taken.

Shutter speed is self-explanatory, it is simply the amount of time that the sensor is exposed to light. This is usually controlled by an electrically operated mechanical shutter in front of the sensor that opens and closes very quickly for a precisely measured period of time, usually in the order of a few hundredths of a second. Obviously a shutter speed twice as long lets in twice as much light, one half as long lets in half as much.

The aperture is literally just a hole through which light passes on its way to the sensor. The diameter of that hole can be adjusted to precisely calibrated sizes. A smaller hole lets in less light, and a larger hole lets in more.

These calibrated aperture sizes, for largely historical reasons, are called stops, or f-stops. An aperture setting one stop larger lets in twice as much light. For reasons that are both historical and mathematical, the standard full-stop aperture settings that you are most likely to encounter go f/1, f/1.4, f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16 and f/22. The smaller numbers refer to larger apertures, and the larger numbers to smaller ones. Many cameras can set apertures in increments of 1/3rd of a stop, but the whole-stop numbers are the ones to remember.

Let's consider an example. With your camera set to automatic exposure point it at a scene and take a light reading. For the sake of argument, say the light meter sets an aperture of f/8 and 1/200th of a second. You can produce the same exposure by increasing the aperture by one stop to f/5.6 and halving the shutter speed to 1/400th of a second, because this lets the same amount of light through to the sensor. Similarly, reducing the aperture to f/11 and setting the shutter speed to 1/100th of a second will also produce the same exposure.

However by altering one setting without altering the other you will change the exposure. In our example, changing the aperture to f/5.6 but leaving the shutter speed at 1/200th of a second will increase the exposure by one stop, or one exposure value (EV), making the picture brighter. Decreasing the aperture to f/11 will reduce the exposure by one EV, making the picture darker.

Similarly, changing the shutter speed whilst leaving the aperture alone will also change the exposure. Double the shutter speed to 1/400th at f/8 and you reduce the exposure by one stop, halve the speed to 1/100th and you increase the exposure by one stop.

The Zone System

In 1939-40 the pioneering photographers Ansel Adams and Fred Archer developed an exposure system based on this fact, a system that is still used today. It is called the Zone System, and is quite possibly the most useful piece of photographic knowledge you'll ever learn. There are several variations on the original system, but I'll go with the one that is easiest to understand.

Starting with 18% grey as the mid-point, the system divides all the tones between black and white into 11 zones, numbered 0-10. Zone 0 is featureless black with no details visible, which in your image editor would have an RGB value of 0,0,0. Zone 10 is pure white with no details visible, and an RGB value of 255,255,255. The mid-tone 18% grey is zone 5, and should have an RGB value of about 127,127,127.

The zones represent exposure values, or EV. The difference between one zone and the next is equivalent to the difference between one exposure setting and another one exactly one stop higher or lower.

> **"The difference between one zone and the next is equivalent to the difference between one exposure setting and another one exactly one stop higher or lower."**

PUTTING IT ALL TOGETHER

If we relate the tone scale of the Zone System scale to real world objects we can use it to help produce accurately exposed photos. The zones are roughly equivalent to the following scene elements (adapted from Adams' descriptions).

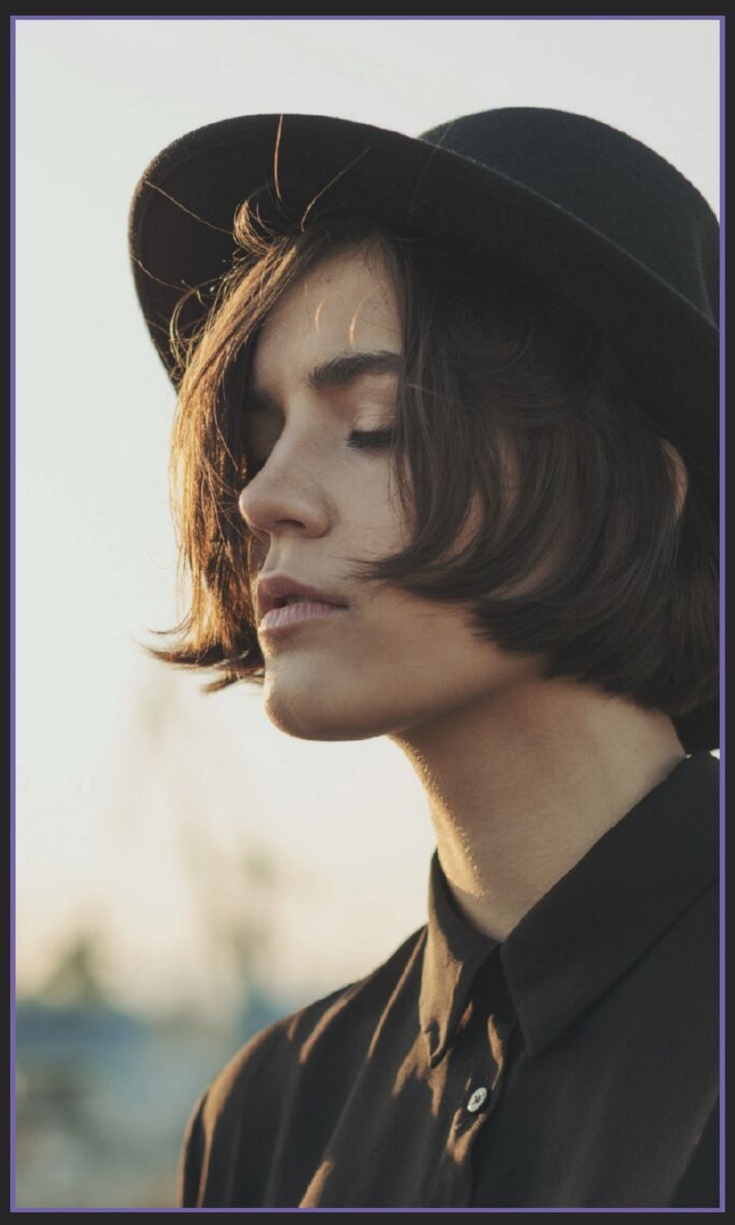
Zone 0	Pure black, no details or texture visible.
Zone 1	Black tone but no texture. This is normally as black as you want to get in a picture.
Zone 2	First hint of texture and detail, very deep shadow.
Zone 3	Dark materials, details visible.
Zone 4	Dark foliage. Dark stone. Landscape shadow. Shadow on portraits in sunlight.
Zone 5	Clear north sky. Dark skin. Grey stone. Weathered wood. 18% mid grey.
Zone 6	Average Caucasian skin value. Light stone. Shadows in sunlit snow.
Zone 7	Very light skin. Light grey objects. Snow with side lighting.
Zone 8	White with texture. Snow in shade. Highlights on Caucasian skin.
Zone 9	Glaring white surfaces. Snow in flat sunlight. White without texture.
Zone 10	Light sources, reflections of sunlight on metal. Pure white.

Let's go back to the two troublesome portraits from the first page. If we use the spot meter to take a reading from the subject's face, we know that the light meter will give a reading that would make the face mid-tone grey, which is zone 5. However from the zone chart we know that average Caucasian skin should be zone 6, so we need to increase the spot metered exposure by one stop, in this case from 1/640th at f/5.6 to 1/640th at f/2.8. In the resulting shot the background details are all burned out, but the subject is correctly exposed.

For the over-exposed portrait against the dark background, we can use a similar approach. Spot metering the background gives an exposure setting of 1/3rd sec at f/5.6 to render it as zone 5 mid-grey. By reducing that exposure by four stops to 1/3rd at f/8 we can make the background come out as what it should be, zone 2 deep shadow, leaving the model's face also correctly exposed.

The zone exposure system can help with difficult exposures, but it is helpful in another way. Learning to think of images in terms of tone and dynamic range will encourage you to approach these concepts in a creative way, and to use them to produce better pictures. Controlling exposure is the primary creative tool of the photographer, and learning how to use it will make the difference between what are mere snapshots and professional artistic photographs.

This system has been used by professional photographers for over 70 years. Used properly, it can help to improve your photography immensely, probably more than any other single technique. ■



"The zone system can help with difficult exposures. Learning to think of images in terms of tone and dynamic range will encourage you to approach these concepts creatively."

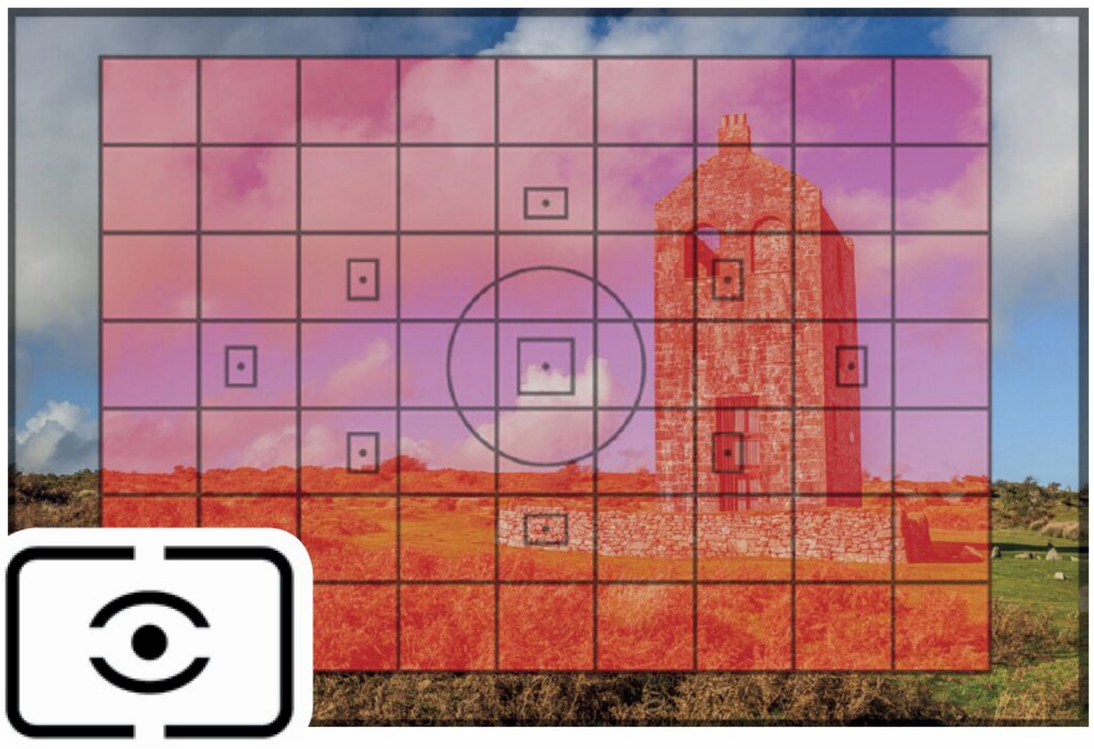
Metering modes

Methods you can use to measure light in a scene

Nearly all digital cameras, from top-of-the-range DSLRs to the humblest budget point-and-shoot compacts, have multiple light metering options. Knowing how and when to use these different metering modes can make a dramatic difference to the quality of your photography; unfortunately most people don't understand what the different modes are for, how they work or how to use them.

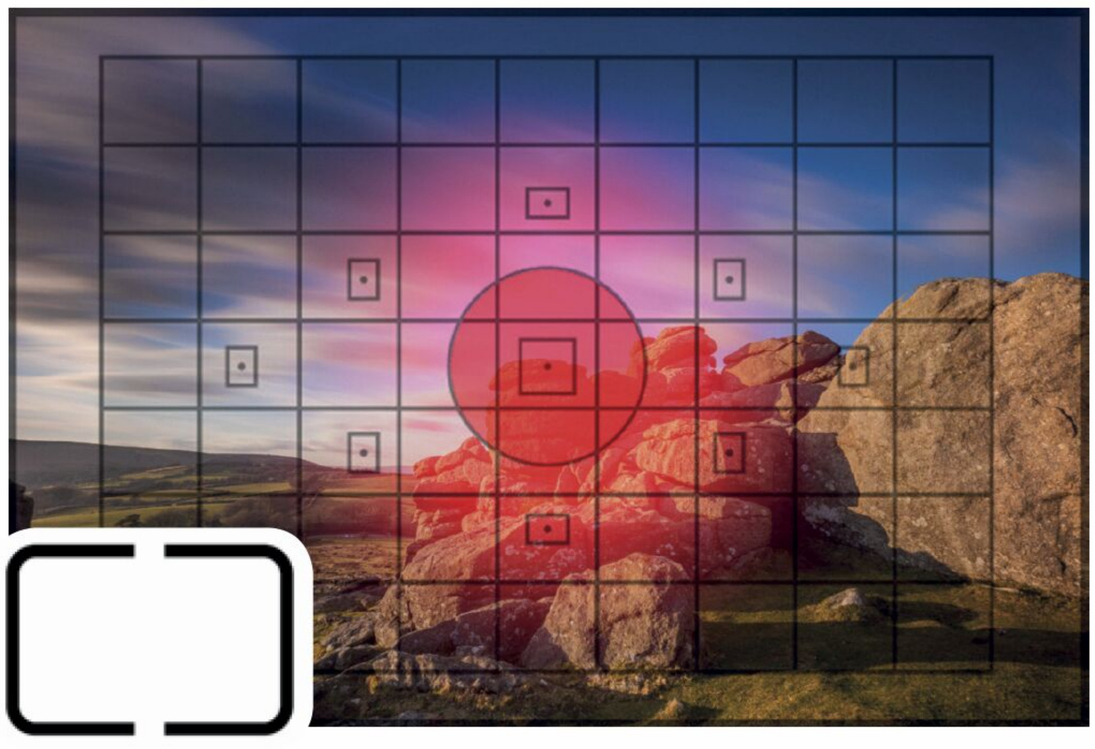
Depending on your camera you'll find metering options either in the menu or with their own separate control. In cameras with a fully-automatic setting, this will usually disable the metering options, automatically selecting multi-zone metering as the best option for day-to-day scenes and snapshots.

The most common light metering modes are found on nearly all digital cameras. They are spot metering, centre-weighted metering and multi-zone metering. The symbols used for these modes are just about universal. Multi-zone metering is shown by a rectangle filled with a centre spot surrounded by a pattern of shapes; centre-weighted metering is usually shown as a centre spot with shapes above and below it; whilst spot metering is usually a rectangle with just a centre spot.



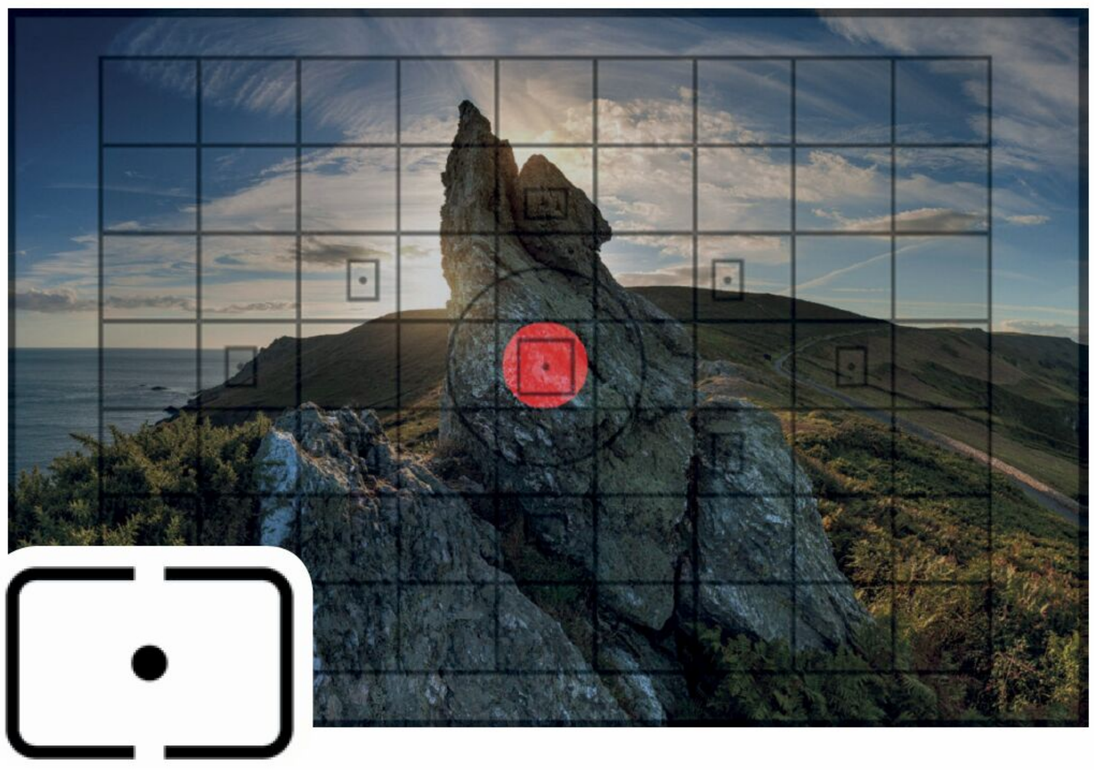
Evaluative metering

Sometimes know by proprietary names such as ‘matrix’, ‘multi-segment’ or ‘esp’ metering, this is the most commonly used metering mode and is usually the default mode in fully-automatic operation. In this mode the camera takes multiple light readings from many different parts of the scene, and compares the results with a range of pre-programmed patterns in order to set the exposure, to give the best results. The actual number of segments varies widely, with simple systems measuring just a handful of segments, whilst more sophisticated systems may take thousands of measurements. In most common lighting situations this mode can be relied upon to produce averagely good exposures; more advanced systems can also cope with unusual lighting, such as strong back-lighting or very high contrast scenes.



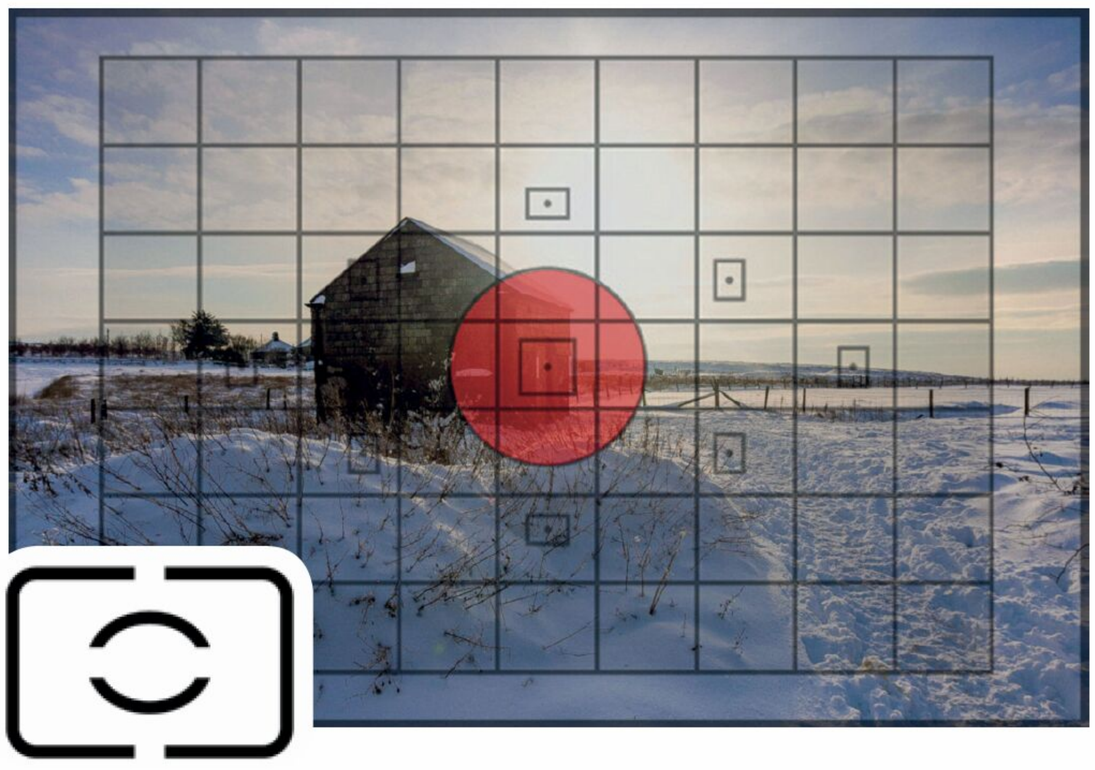
Centre-weighted

Until the invention of multi-zone metering in the 1980s centre-weighted metering was the standard option on most cameras. In this mode the camera measures light from across the scene but the metering it provides works on the assumption that the most important part of the scene is in the centre of the frame. The readings towards the centre of the frame are given emphasis, so bright light sources at the edges of the frame will have less effect on the exposure reading. It is a useful mode for shooting in the early morning or late evening when the sun is likely to be in the frame; it’s also good for conventional portraits since it will meter for the subject’s face whilst ignoring background details. Centre-weighted averaging is regarded as a bit of a throwback compared to newer metering modes.



Spot metering

Spot metering is the most accurate mode, and is the best option for complicated or unusual lighting situations but also the hardest to use, requiring some skill and knowledge before it can be used effectively. In spot metering mode the camera only takes a light reading from the centre of the frame in an area comprising about 3 per cent of the entire frame. Spot metering is usually used in conjunction with another little-used camera function, auto exposure lock (usually abbreviated AEL), and also with exposure compensation. The way to use this combination of features is to select the area of your picture from which you wish to take your light meter reading, centre this area in the viewfinder and either press your AEL button to lock the exposure or hold the shutter button while reframing the shot, then press the shutter release button fully to take your picture.



Partial metering

This mode is most effective when your background in the scene is much brighter than your actual subject. This is referred to as backlighting. Partial metering, like Spot metering, covers a small area in the centre of the frame. In this case it is about 10 per cent of the entire frame. This area is metered to obtain a standard exposure.

Some cameras have two extra spot metering options, highlight and shadow metering. In these modes, the meter is calibrated for zones eight and two on the zone system chart. In highlight metering mode, taking a spot meter reading from the most brightly lit parts of a scene will result in a correct exposure, so that highlights are bright but with detail visible. Likewise using the shadow metering on the darker areas of the scene will produce dark shadows but with visible detail.

Metering modes: how it's done

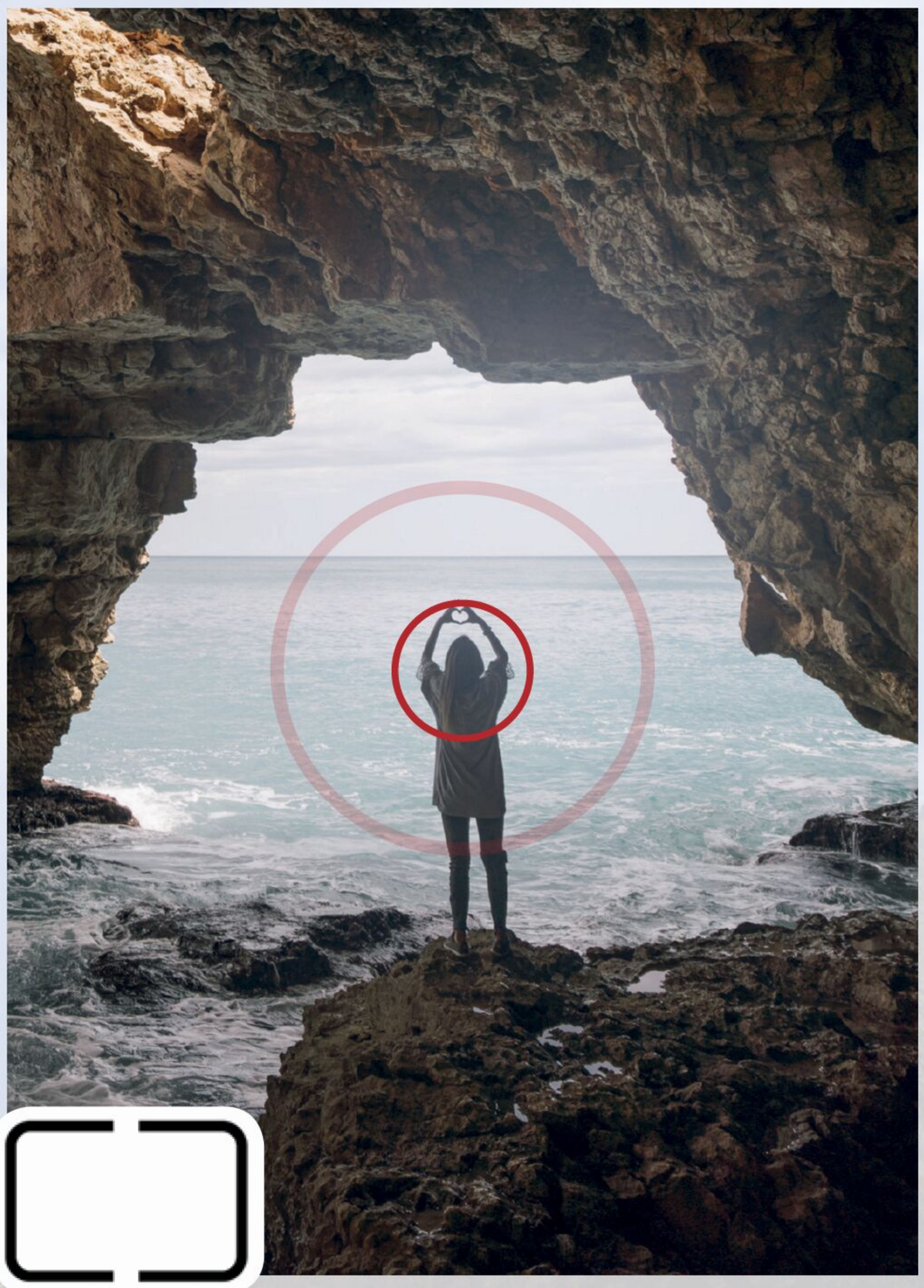
Modern cameras give you choice when it comes to metering your scene

Having talked about metering and the various options available, we thought it would be wise to show them in action with a simple practical demonstration. In most cases, you could happily leave your camera in evaluative mode, where it measures the entire scene to work out an average for it but it's good to know that you have the other metering alternatives. They say: it's good to have them and not need them rather than need them and not have them. We have as a theoretical example, a particularly tricky backlit scene, which is the usual bane of digital cameras, with a lot of contrast between the brightest and darkest parts of the shot. Hopefully we can demonstrate the different ways your camera can approach how it measures the light in the scene you're about to shoot and what kind of results you can expect.

Imagine that you've got your own example scene and have the camera set to all its defaults. Set your camera to Aperture Priority and compose the scene so the subject is in the centre of the frame with the strong backlight around them. The centre AF point falls directly on our subject. There is no exposure compensation being used, you are going with whatever the camera decides, based on its metering mode. ■

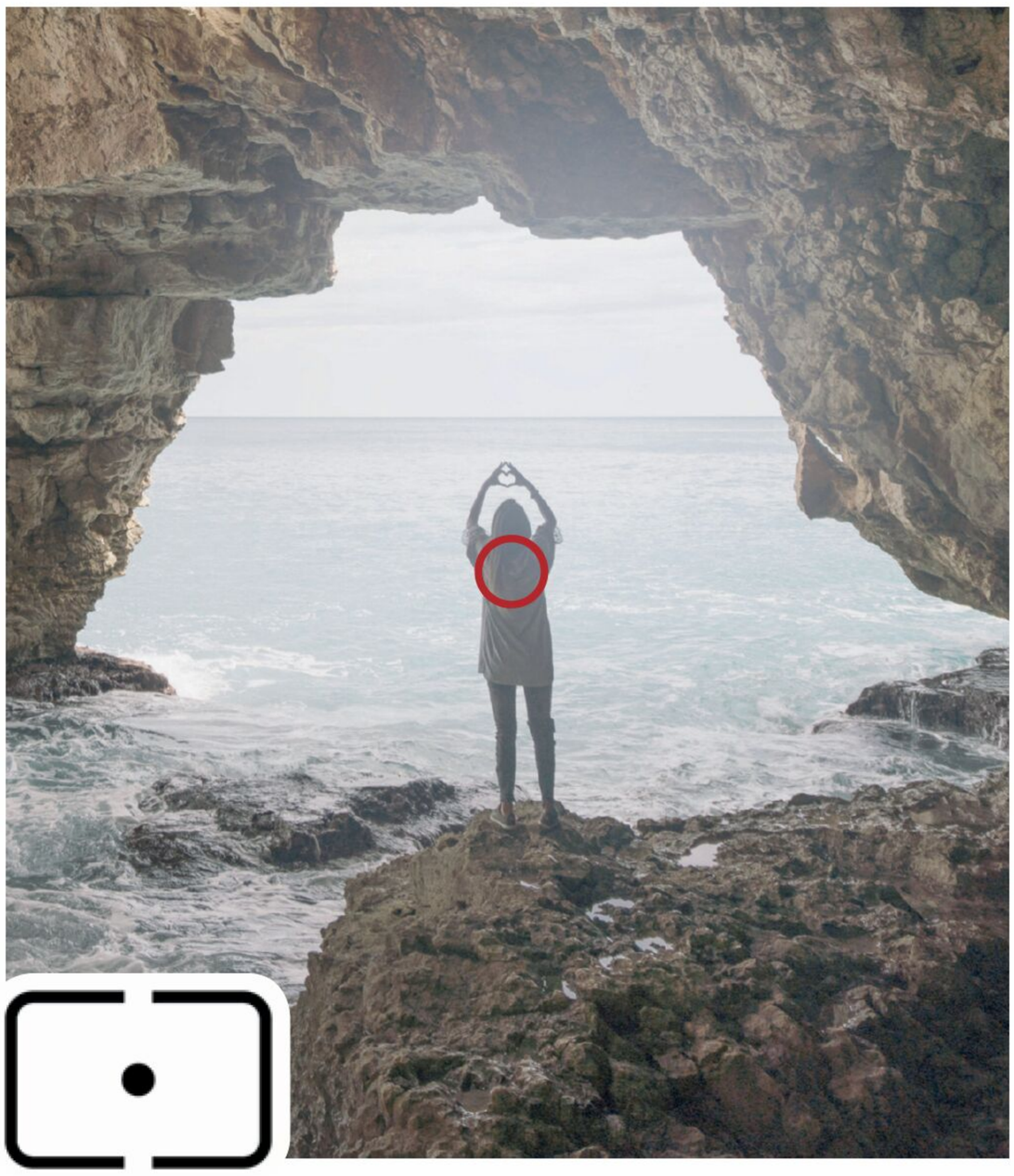
Evaluative Metering

Here, the camera has assessed all the lighting information in the scene and has made its best guess at an average exposure.



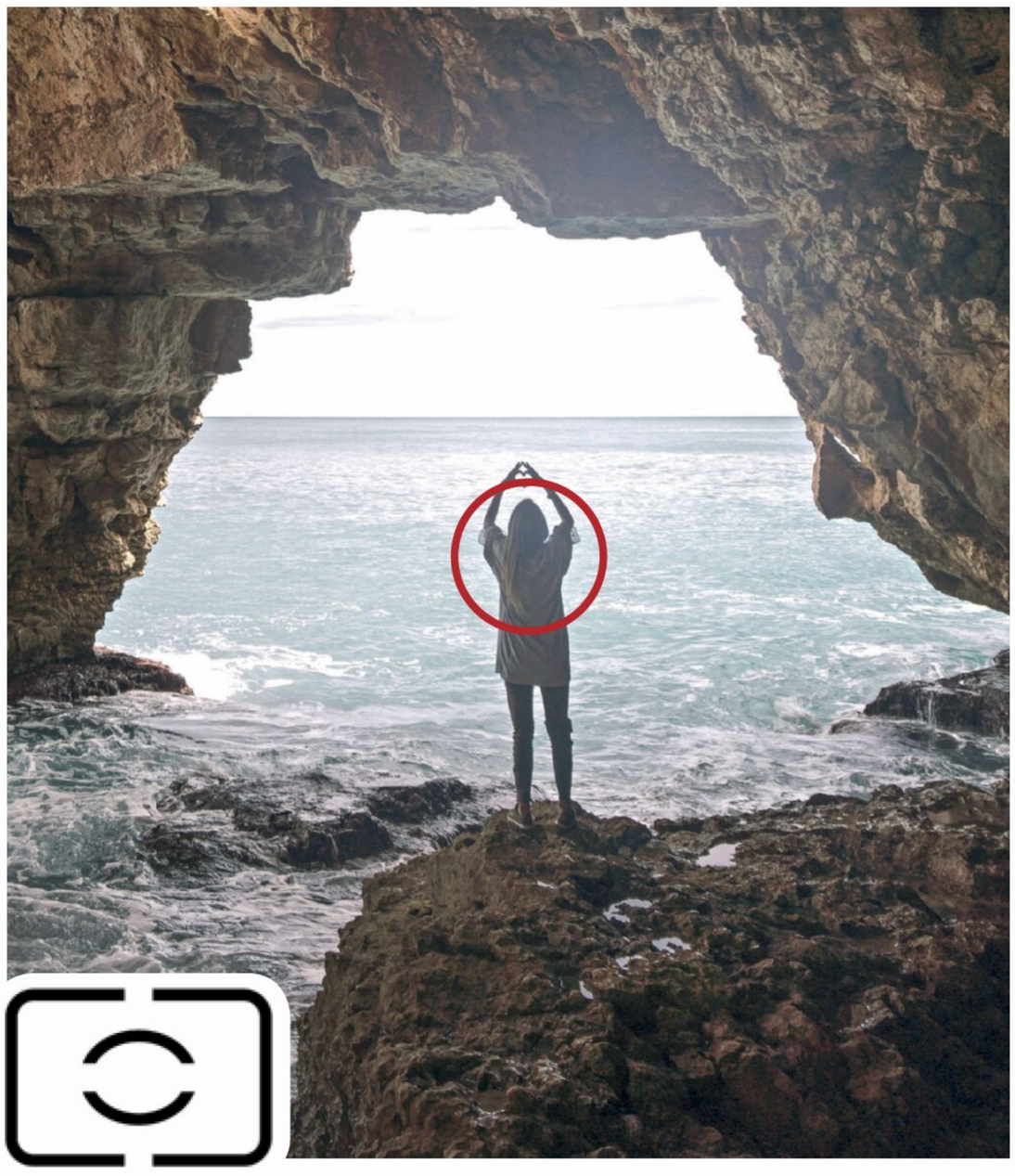
Centre Weighted

The camera is taking another average of the scene but its main metering decisions are focused on the centre of the image.



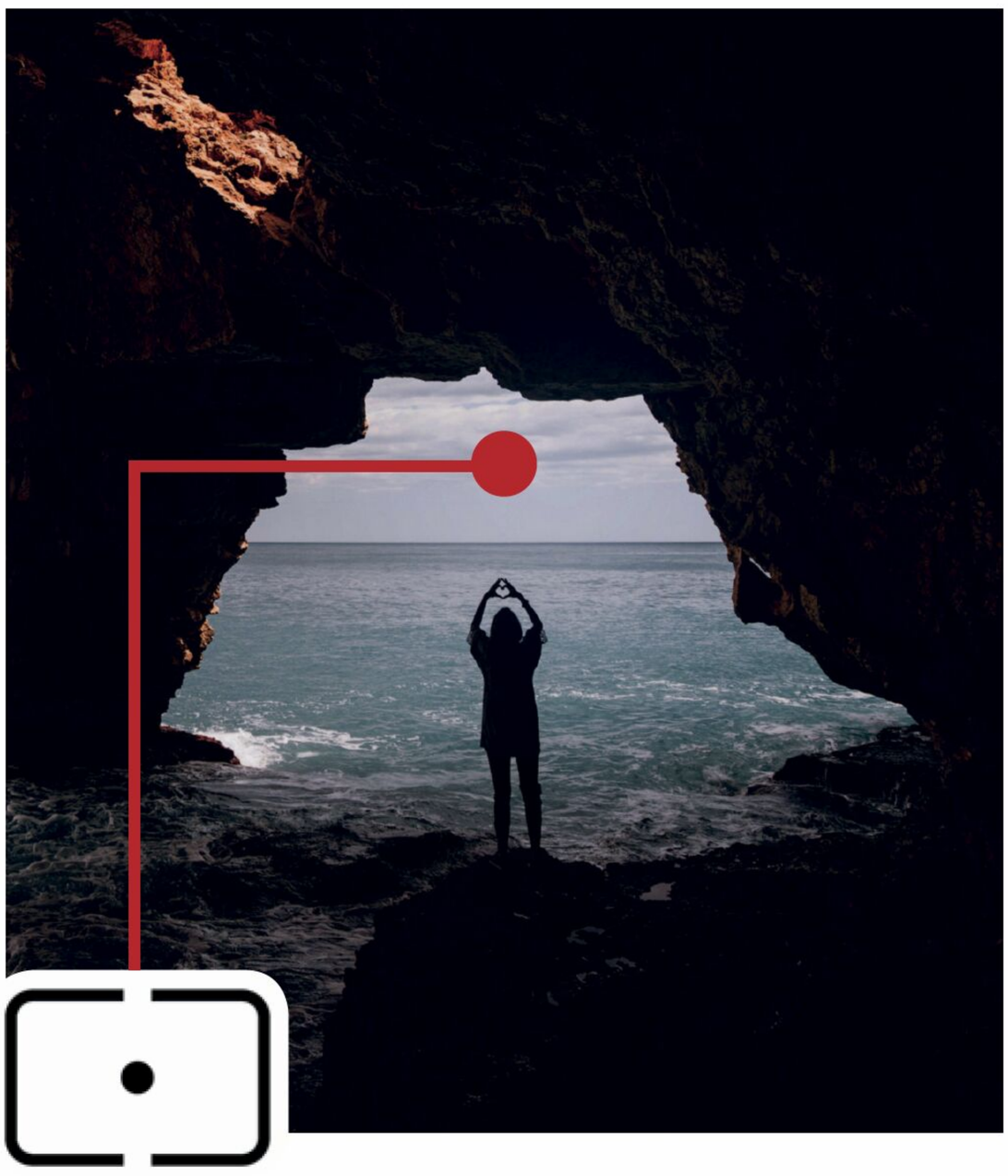
Spot Metering

This time, the camera is not averaging the entire scene but taking its information from the small spot in the centre of the frame.



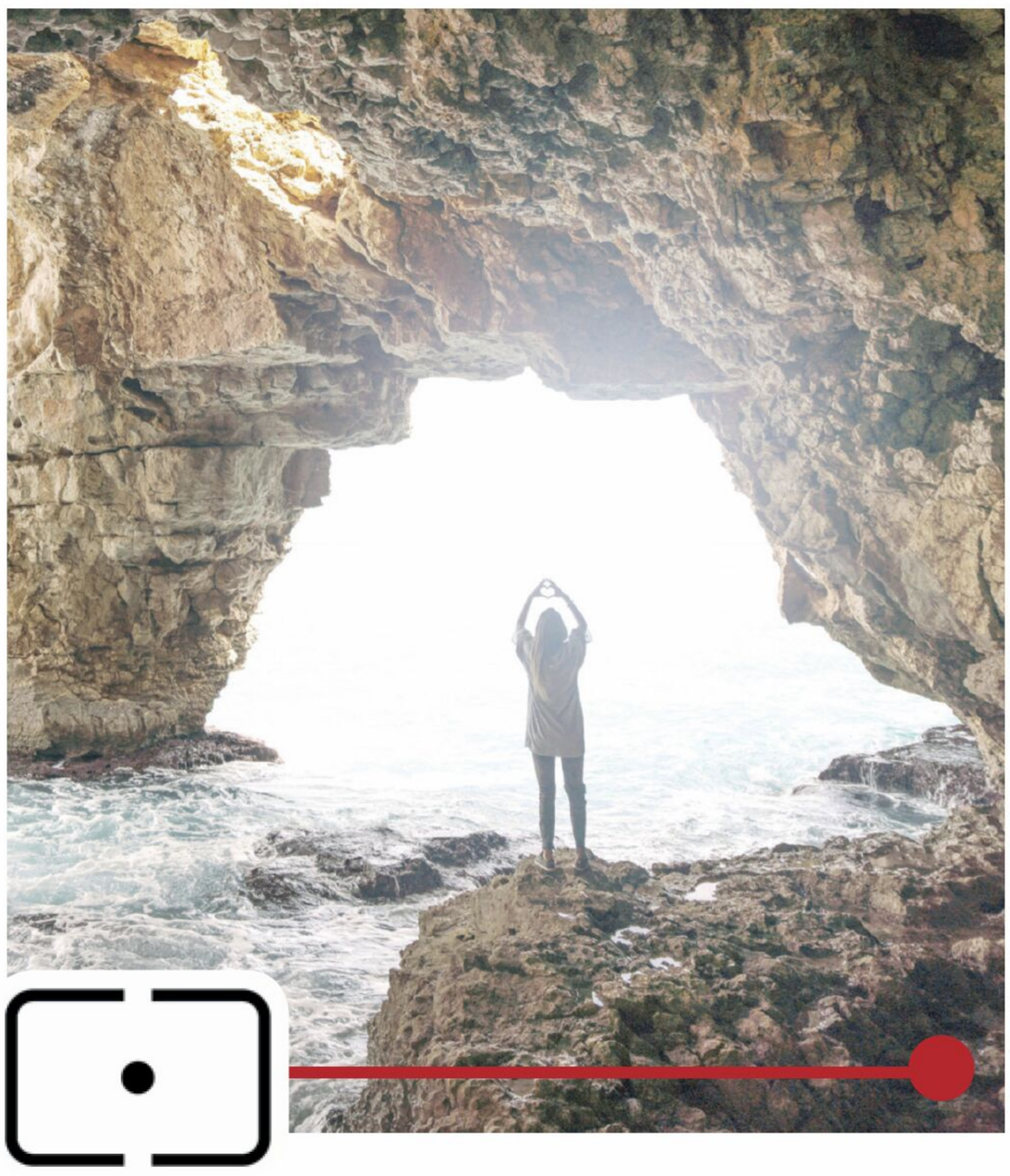
Partial Metering

Partial metering, as we've already mentioned, uses a larger centre spot from which it takes information about the scene.



Spot Meter Highlights

This time we've deliberately spot metered the brightest part of the scene and then recomposed the shot to match the others.



Spot Meter Shadows

For comparison, the darkest areas were also spot metered and the shot was taken once it had been recomposed like the highlights version.

Flash techniques

A guide to some common uses of flash

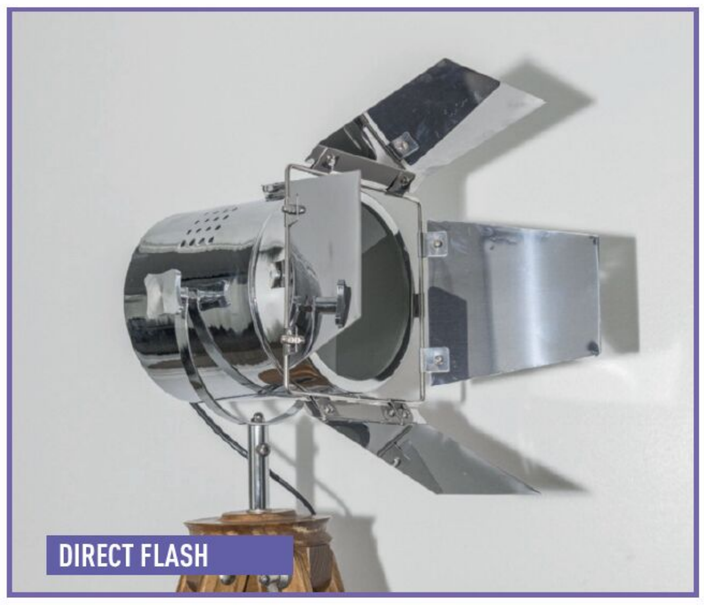
Flash is used mainly for taking photos in low light conditions but few people know how to use it properly. However there are some simple techniques that are possible, even with budget-priced equipment, that can seriously improve your photography; or if you don't use it correctly, can actually ruin a shot.

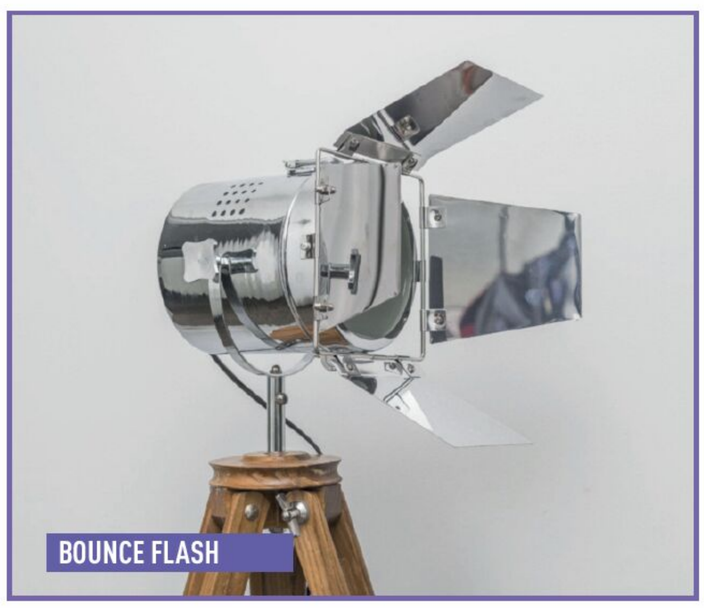
Direct Flash

Of all the flash techniques around, this is not really a technique at all, this is the way in which most flash photographs are taken. The flash, either built-in or mounted on the camera, is pointed directly at the subject when the photo is taken. Although the subject is brightly lit, the photograph is very harsh with glaring reflections and hard-edged shadows. It is very unflattering and gives your subjects the startled rabbit in the headlights look, or something akin to a police mugshot.

Bounce Flash

If you have a decent camera-mounted flashgun for your DSLR or high-end compact, it probably


DIRECT FLASH


BOUNCE FLASH

BROLLY FLASH

FILL FLASH BEFORE

FILL FLASH AFTER

has what is called a 'bounce and tilt' head. This means that the top part of the flashgun, containing the flash tube, can be tilted upward. If you're thinking of buying a flashgun it's best to get one that has this feature, because it produces much better results than direct flash when shooting indoors.

By tilting the flash head upwards the light is reflected off the ceiling, which is often white or at least lightly coloured in most buildings. The flash sensor, usually mounted on the non-tilting part of the gun, is still pointing at the subject and can adjust the flash output accordingly. Reflecting the light diffuses it, removing glare and softening the shadows. Since the illumination is from above the results look much more natural. Some flashguns have heads that can swivel sideways as well, for use in portrait format or to bounce the flash off walls.

Light Modifiers

Another good way to take flattering flash photos, that can also be used outdoors or where bounce flash isn't possible, is to take the flash off the camera altogether and mount it on a separate stand with a diffuser of some type, usually a brolly. These are quite cheap and come in a variety of sizes. A 90-100cm type is ideal for use with a normal flashgun. The brolly itself is just that, an umbrella coated with a reflective finish. Usually the cover can be removed and reversed. One side will usually be white or silver, while the other side is gold coloured, because this gives a much warmer and more flattering light for portraits. The brolly and flashgun can be attached to a normal tripod using a simple adapter available from most camera shops. The flashgun is positioned pointing away from the subject so it fires into the brolly, and the diffused reflected light bounces back to illuminate your subject. By positioning the brolly off to one side and slightly above the height of the subject's head, you can cover a large area and use it for group shots. For tighter portraits, the alternative to bouncing light off a brolly is to use a shoot through brolly which uses a white semi-transparent material to diffuse the light from the flash.

Fill Flash

Fill flash is a simple but highly effective technique for coping with backlighting, where you are photographing your subject against the light of the sun or a brightly lit background. A carefully measured level of flash is used to balance the ambient lighting and fill in the shadows. Back in the good old days of manual-only cameras and fixed-output flashguns it took multiple light readings and careful calculations to get the right exposure to balance the flash light to the ambient light; these days tough, modern TTL exposure systems and dedicated flashes can produce perfect fill-in flash automatically in an instant. If you flash has enough power, you can also underexpose your sunny background by several stops whilst still being able to correctly light your subject. This is a technique used by fashion and wedding photographers and gives a very dramatic result. ■

Sometimes, a flash does not have to be quite so intrusive. This example uses a flash and a large softbox to create a fill light that keeps the subject's face from falling into shadow due to the bright backlighting.

Flash photography: how it's done

Light up your shots and get creative with your photography

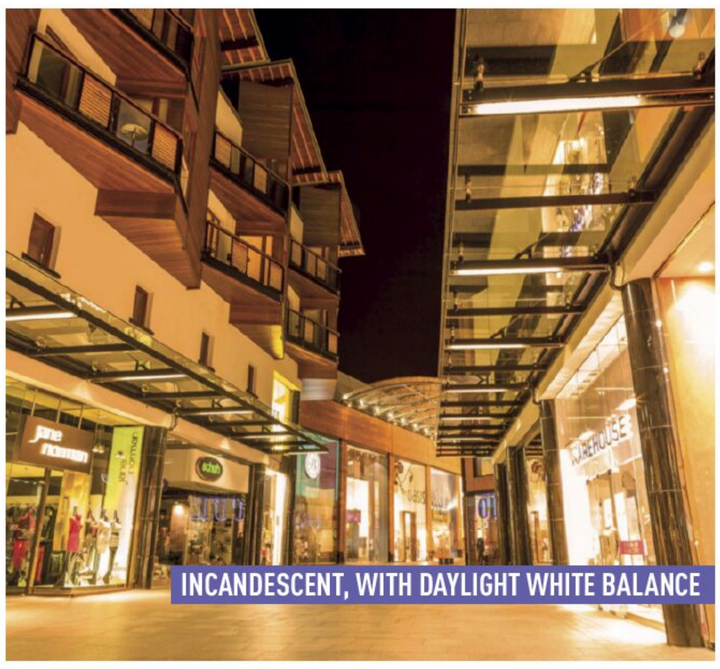
We've always maintained that at a certain level, most people who like to take photos can shoot images similar to the pros if they were in the same situation with similar gear. An often quoted example is that of the wedding photographer who turns up and is shooting the bride and groom in natural light with a particular brand of camera and lens. Uncle Phil, a guest from the bride's side of the family, has the same gear and is standing next to the photographer and snapping away too. The likelihood is strong that they are going to capture similar photos. One of the best ways that any photographer can create images that set them apart from the Uncle Phil's of this world is by using light in ways he can't.

This is where the flash comes in and not just a flash mounted on top of the camera. We're talking about off-camera flash. This is the key to great lighting in your shots. A camera mounted flash is possibly one of the most unflattering lighting solutions you can use but as soon as you get the flash off camera with a wireless trigger and receiver system, you are looking at much more potential. Couple a softbox or brolly to diffuse your light and you can really take some next level shots and add amazing lighting creativity to a shot that might have otherwise been an Uncle Phil shot. ■

Being able to use additional lighting in your shots, rather than just relying on ambient light, is a truly creative way to raise your game when it comes to photography. Modern flash equipment is easy to use and gives impressive results. This example uses a powerful flash and softbox arrangement to correctly light the subject even though the camera settings have been used to dramatically underexpose the available ambient daylight.

White balance

White may not be as white as you think


INCANDESCENT, WITH DAYLIGHT WHITE BALANCE

INCANDESCENT LIGHT, INCANDESCENT WHITE BALANCE

When you look at, for example, a sheet of white paper, your brain adjusts what you see so that it matches what you are expecting to see. However your digital camera doesn't have any expectations, and the colour that it "sees" is the actual colour present in the scene.

'White' light visible to humans can actually vary in colour from reddish orange to greenish-blue. This variation is usually described as a temperature range, with warm being the red end and cold at the blue end, and is usually measured in degrees Kelvin using a colour meter. Confusingly, the higher the colour temperature, the cooler the tone and vice versa.

We perceive various shades of white light illuminating a scene as neutral, a clever trick performed by our brains to maintain a sense of normality. Digital cameras can perform the same trick using a feature called automatic white balance. The camera evaluates the scene through the lens, analysing areas it guesses should be white (highlights) and black (shadows). More expensive cameras have a more reliable ambient white balance sensor that measures the temperature of general, focused light. However these automatic systems can be fooled, so most cameras give you the option of setting the white balance manually, either from pre-sets that cover most normal lighting conditions or by making an accurate measurement of the prevailing lighting conditions.

In the example pictures on this page you'll see an image with ordinary incandescent light bulbs, also called tungsten lighting. As you can see, when the camera is set to the warm artificial light white balance setting that suits this lighting, the light areas of the scene are neutral. The same scene looks very different when the camera's white balance is set to normal daylight colour temperature. Now there is a distinct reddish-orange cast. Light bulbs can shine with various colour temperatures. Cheap traditional, low wattage light bulbs tend to be the warmest in colour, while low voltage halogen bulbs are cooler in tone.

Another example is a typical noon day outdoor scene where the ambient white light temperature is cool. When the camera's white balance setting matches the cool tone of the brightness of the sun, everything looks quite normal. On the other hand, if the camera has been set for tungsten artificial light, the scene appears to have a very

DAYLIGHT, WITH DAYLIGHT WHITE BALANCE

DAYLIGHT, INCANDESCENT WHITE BALANCE

blue cast. Sunlight, like artificial light, can vary quite considerably in colour temperature. Early morning and late afternoon daylight is warmer as cooler components of the light are filtered out because it has to shine through more atmosphere and its pollutants as the sun is nearer the horizon. Meanwhile, cloudy and overcast conditions deliver a cooler light because warmer components are filtered out by the cloud.

Our third example is lit with fluorescent lighting, and presents an even harder challenge for your digital camera. The visible spectrum of fluorescent light is not a nice smooth line, it's full of peaks and troughs. Some fluorescent lights have a green cast and others a pink cast. These differences are visibly evident where strip lights of different tone have been fitted side by side. So-called daylight tone fluorescent lights are not equivalent to real daylight. Better digital cameras will have a number of presets for fluorescent light to help you match the white balance in these conditions more accurately. In our example here, the fluorescent light is a greenish yellow in tone.

Know your camera

Nearly all digital cameras offer white balance adjustments accessible either from a settings menu or, typically on higher spec cameras, via an external button in conjunction with an LCD display.

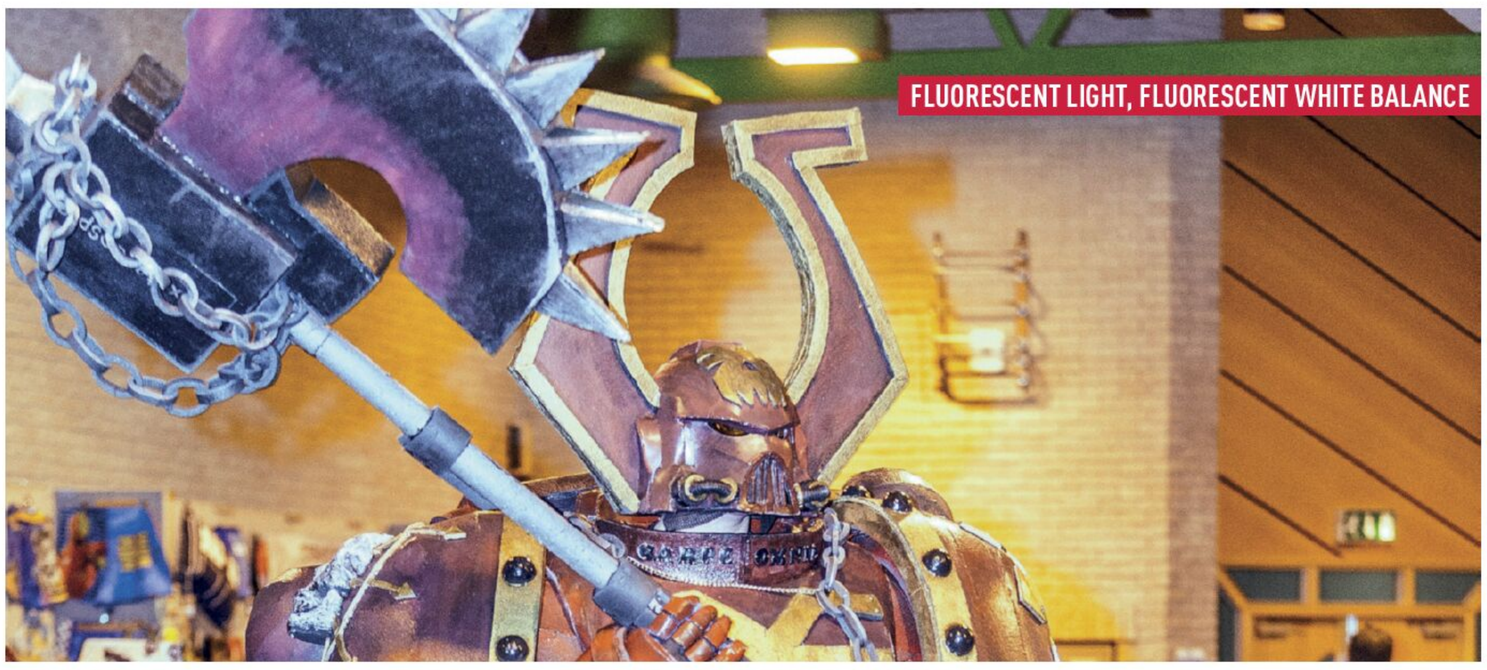
Manual white balance

Some cameras can let you calibrate the white balance setting manually. You simply hold a white card in front of the camera lens and press a white balance calibration button. The camera adjusts its white balance setting until the card is reproduced neutrally. Beware of this setting remaining on as when you return to normal shooting conditions it may spoil your pictures!

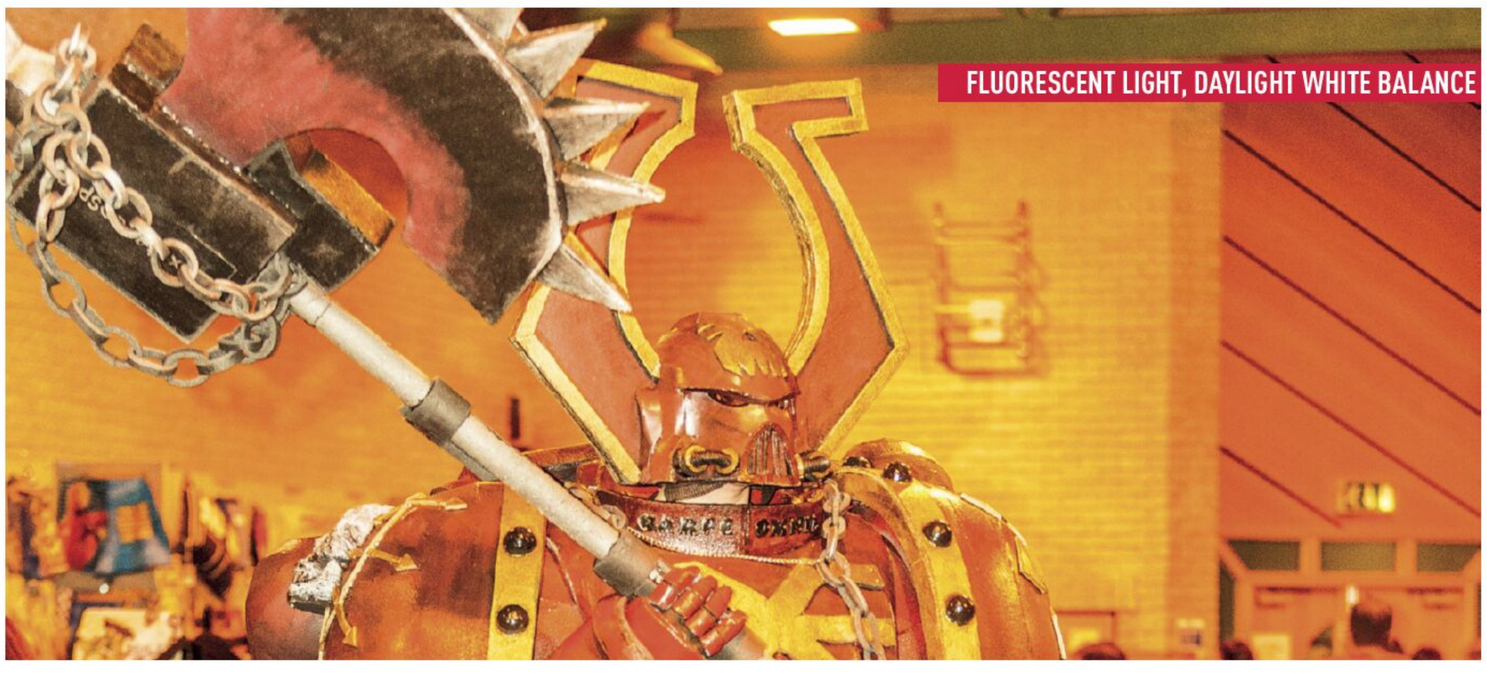
Preset white balance

All digital cameras offer a choice of white balance presets, and some cameras let you choose the setting via colour temperature values. Some really advanced cameras let you bracket white balance settings, or take a series of shots with settings above and below your standard setting. ■

> "We perceive various shades of white light illuminating a scene as neutral, a trick performed by our brains to maintain a sense of normality."



FLUORESCENT LIGHT, FLUORESCENT WHITE BALANCE



FLUORESCENT LIGHT, DAYLIGHT WHITE BALANCE

TYPICAL WHITE BALANCE VALUES

TUNGSTEN/ARTIFICIAL

2500-3000K

Indoor lighting using traditional non-fluorescent light bulbs.

FLUORESCENT

3500-5500K

Include strip lighting and modern compact fluorescent lamps

NORMAL DAYLIGHT

5500-6000K

Typical mid-morning to mid-afternoon conditions at sea level.

CLOUDY/OVERCAST

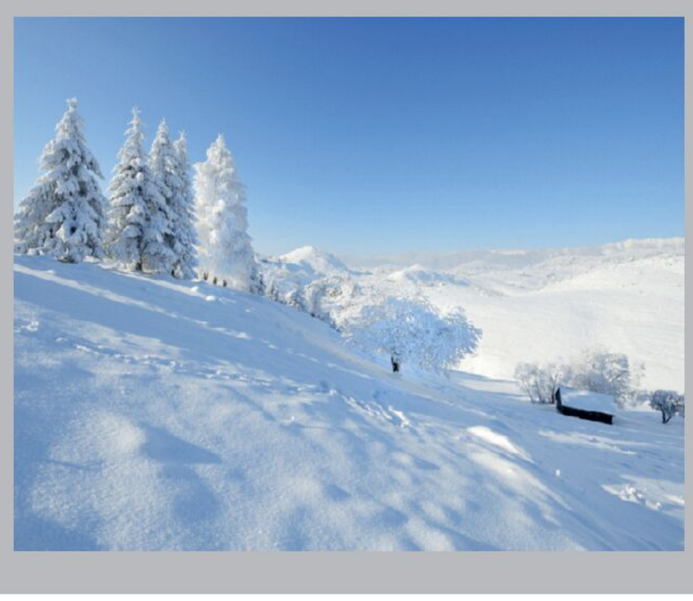
6000-8000K

Hazy or overcast conditions.

CLEAR BLUE SKY

10,000-15,000K

Exceptionally clear mid-summer or high altitude conditions, especially snow scenes.



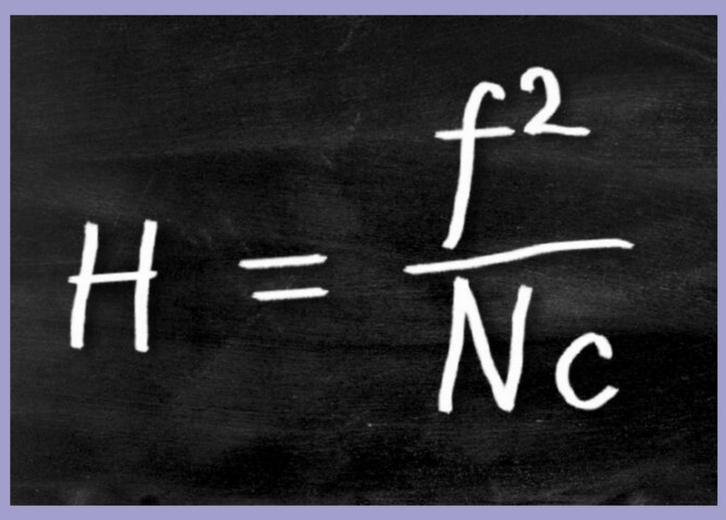
Understanding hyperfocal distance

How to calculate the best depth of field

A very important part of photography in general and landscape photography in particular is to ensure that your prime point of interest, your main elements are in sharp focus. Nothing ruins a shot more than the image being fuzzy and blurry when you need it to be tack sharp. The problem however, is that in many cases in landscape photography you have a foreground element as well as a distant object that you want to be in as sharp focus as possible at the same time. Shooting with a wide-angle lens and setting a very narrow aperture of f/22 or even f/32 will yield greater depth of field but you will also run into the optical phenomenon known as diffraction, which is a softening of the image due to the bending of light rays as is passes through the narrow aperture of your lens. This means you will normally be operating around the f8 - f/16 mark when setting aperture. You may find that the depth of field provided at these apertures is not enough to render everything you need in sharp focus.

This is where the hyperfocal distance comes into play. When you focus on an object, technically speaking, only that point of focus is sharp. Beyond that focus point, extending both in front of and behind, is a plane of focus running parallel to the camera sensor. This area is known as the depth of field and it is this region that is deemed to contain an area of acceptable sharpness. The key to hyperfocal distance is knowing the closest distance at which a lens can be focused while keeping objects at infinity as acceptably sharp as possible. Everything from half the hyperfocal distance out to infinity will be in focus.

A very basic rule of thumb is to compose your scene and then focus roughly one third of the distance into the scene. This can be quick and reasonably helpful, particularly where your scene has excluded the horizon or near foreground, but rarely is it optimal to get the best out of the depth of field. You could use your camera's live view function to visually set focus on the most distant object in your scene and then slowly adjust the focus closer whilst keeping an acceptably sharp background. Finally of course, there is the mathematical way to calculate the exact point. There is a bit of assumed knowledge when using the mathematical formula. You will need to provide the focal length of the lens you are using, the Circle of Confusion value for a given sensor size, which is the largest blurred spot that the human eye can detect (usually a value of around 0.03 - 0.02) and the f-stop you are using. If you have a calculator you can do the following:



H = Hyperfocal distance
f^2 = focal length x focal length
N = Aperture number (f-stop)
c = Circle of confusion

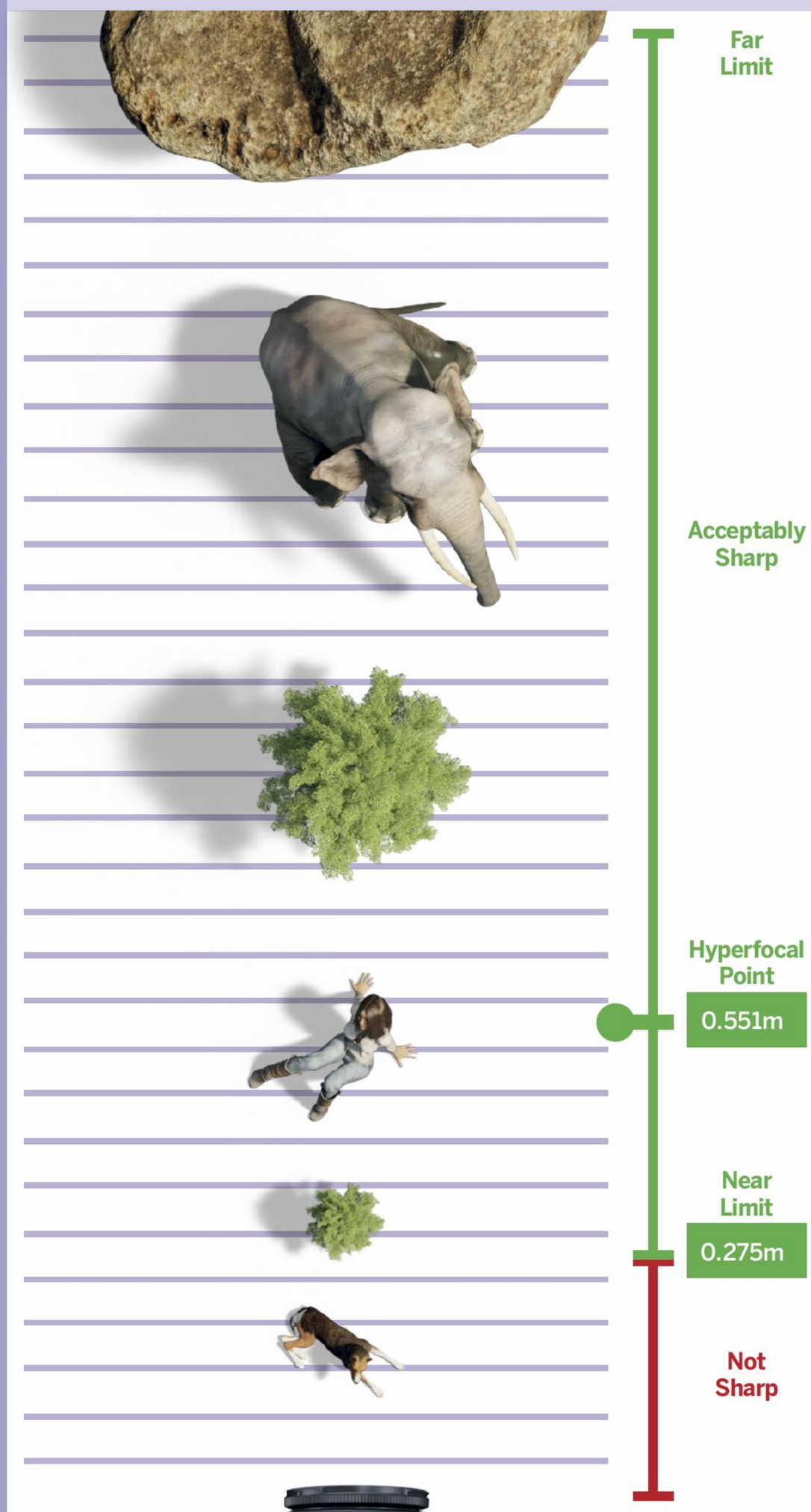
The result, in millimetres, will be the distance at which you need to focus to attain greatest depth of field. Thankfully there are plenty of on-line calculators and apps for your phone that can do all the heavy lifting for you. Just so we can say we understand the theory, let's try out a couple of examples as shown here. We're using a full frame camera with a Circle of Confusion value of .029 as an average on a 16mm lens and a 50mm lens. Both are set at an aperture of f/16. ■

This landscape image taken on Dartmoor was shot on a wide-angle lens at f16. Using the hyperfocal calculations shown, the point of focus was only 0.5m away from the camera's position, but resulted in a very sharp image.

Example 1: 16mm lens at f/16

$$H = \frac{16mm \times 16mm}{f/16 \times 0.029}$$

$$= 551mm\ (0.551m)$$

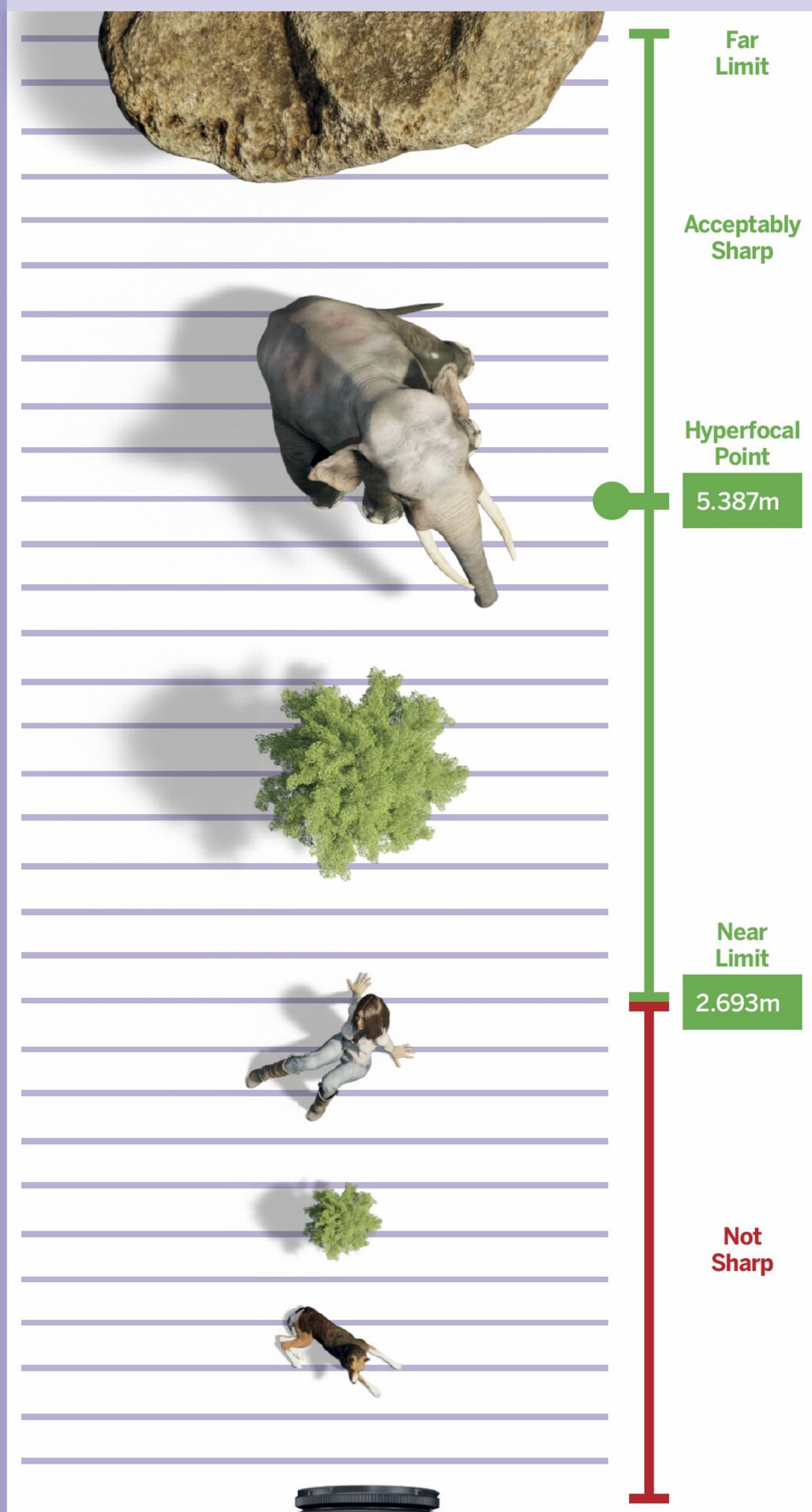


Full frame 16mm lens at an aperture of f/16

Example 2: 50mm lens at f/16

$$H = \frac{50mm \times 50mm}{f/16 \times 0.029}$$

$$= 5387mm\ (5.387m)$$



Full frame 50mm lens at an aperture of f/16

The near limit of acceptable sharpness is half of the hyperfocal value, stretching out to infinity.

Please note: these images are not to scale and are for illustrative purposes only.

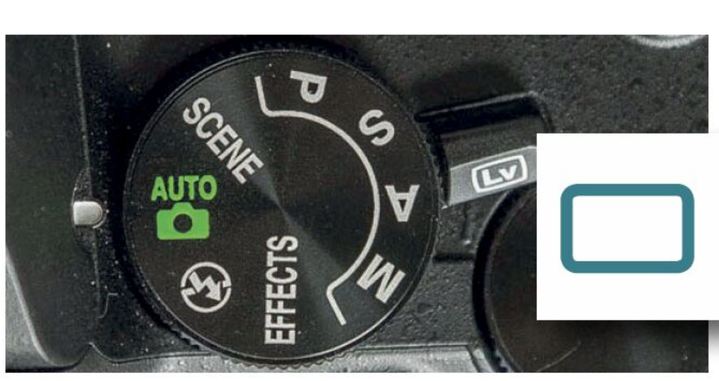
Shooting modes

Choosing the best setting for the correct shooting conditions

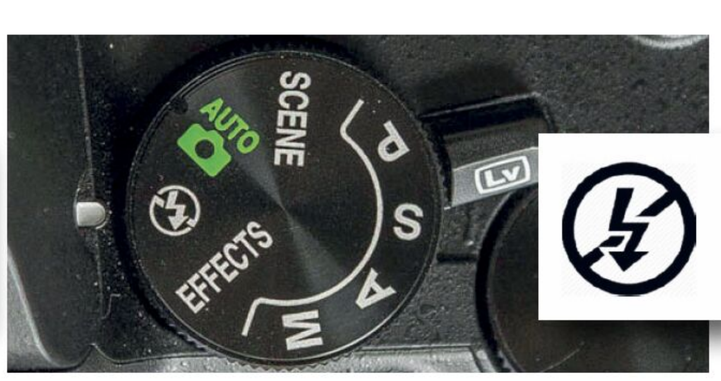
All but the most basic budget compact cameras have a selection of shooting modes, usually chosen by a dial on the top or back of the camera. Easy-to-use, mainly automatic cameras in the range will only have a few shooting modes, while the more sophisticated cameras such as the DSLR may have as many as a dozen, including manual exposure options and user-programmable special settings.

As newer models appear in the range or older models are updated, the shooting modes available will be revised and possibly expanded. Shown on this spread are some of the most often used modes selected from the mode dial on the top of the camera and in some cases, from the menu screen on the back of the camera. ■

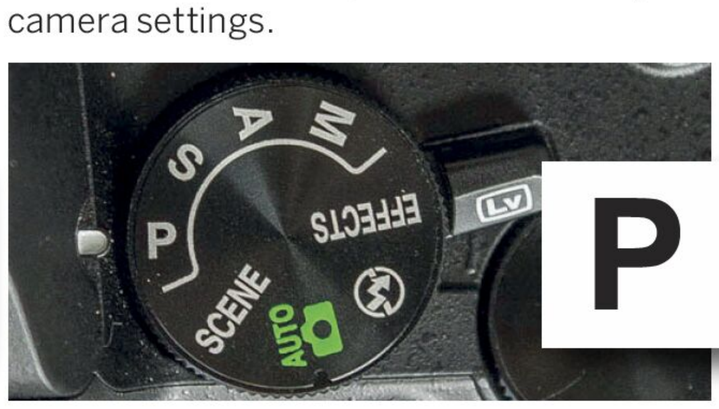
Auto
The camera will analyse the scene and choose all the best settings.



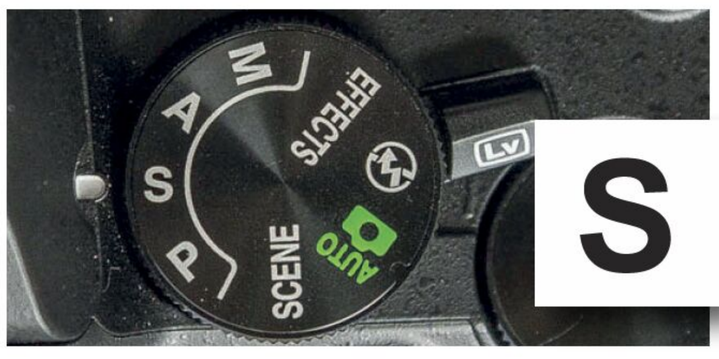
Auto (flash off)
As in full auto mode but the flash will not be activated when shooting.



Programmed AE
Programmed auto is recommended for shots where there may not be time to adjust camera settings.

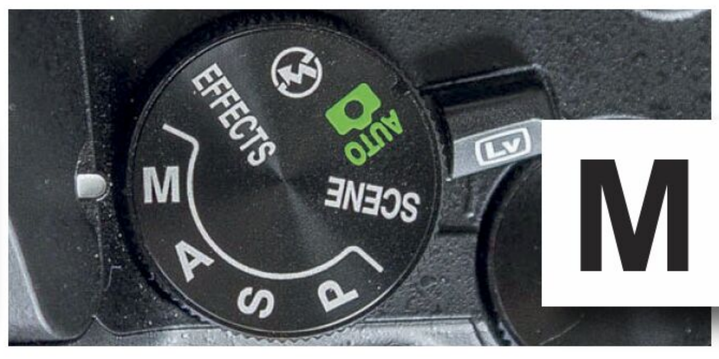


Shutter Priority
Shutter speed is manually selected to blur or freeze motion. Aperture is set by camera.



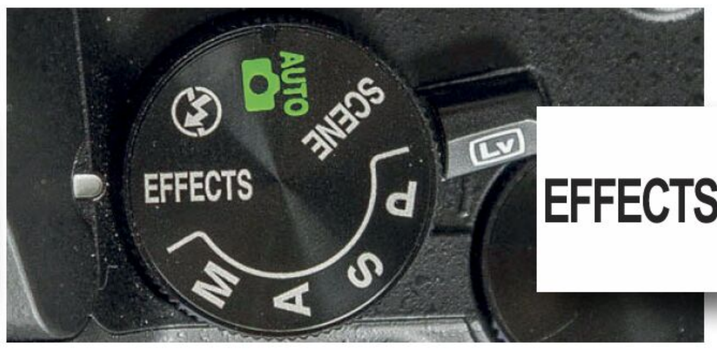
Aperture Priority
Aperture is manually selected to blur or bring background into focus. Camera chooses shutter speed.

Manual Exposure
The user can manually choose shutter speed and aperture.



Bulb Mode
Allows you to take photos for as long as the shutter button is held down for exposures longer than 30 seconds.

Effects
Can be used to add filter effects to your images when they have been shot.



Scene - Portrait
Background details will be blurred to add a sense of depth to the composition.

Scene - Landscape
Landscapes taken during the day will have front to back sharpness. Colours will be made more vivid.

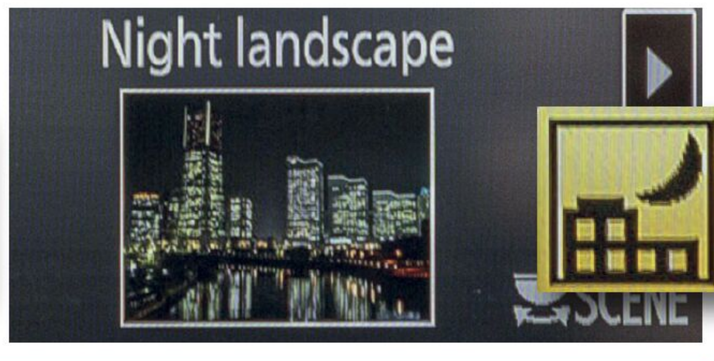
Scene - Child
Skin kept soft and natural whilst clothes and backgrounds are more saturated. Shutter speeds will be faster to capture movement.

Scene - Sports
For dynamic sports. Shutter speeds will be high enough to freeze the action.

Scene - Close Up
For close up and macro shots of insects, flowers and other small objects. Backgrounds will be out of focus.

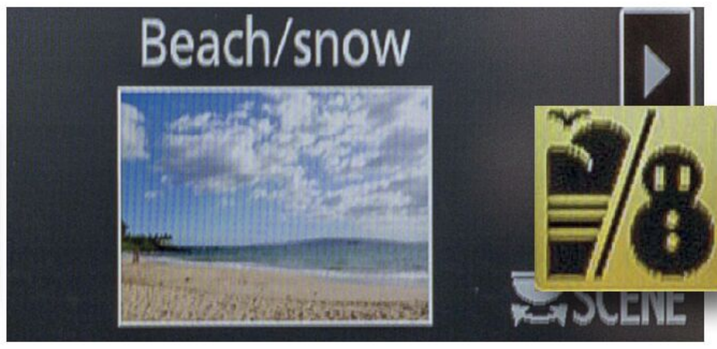
Scene - Night Portrait
Creates a natural balance between your foreground subject and low light backgrounds.

Scene - Night Landscape
Will reduce noise and strong colours such as street lights and neon.



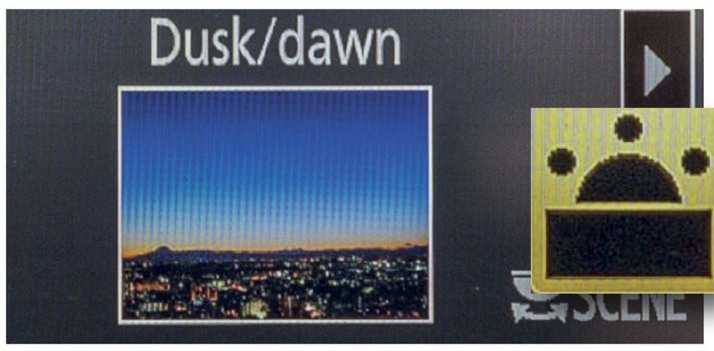
Scene - Party/Indoor
For indoor scenes and other social gatherings. Captures indoor background lighting.

Scene - Beach/Snow
More accurately capture the brightness of areas like snow or sand in daylight.

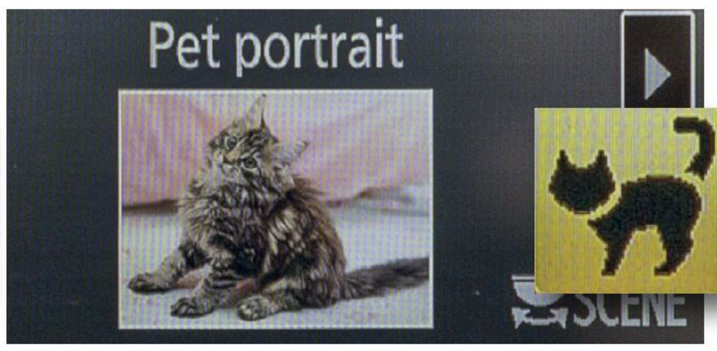


Scene - Sunset
Maintains the rich colours and hues of the sunrise or sunset.

Scene - Dusk/Dawn
The cooler tones of dusk and dawn are maintained. No flash is used.



Scene - Pet Portrait
Faster shutter speed is employed. No AF assist light is used so as not to scare the animal.



Scene - Candlelight
The deep orange and red tones of scenes lit by candlelight are enhanced. No flash is used.

File types and image compression

How is it possible to store so many images on such a tiny memory card?

If you've had a computer or a digital camera for more than a couple of days, you'll have come across JPEG images, usually denoted by the file extension '.jpg', and you may be wondering exactly what it means. The letters themselves stand for the Joint Photographic Expert Group, a body of scientists, programmers and engineers from the imaging industry who got together several years ago to come up with a new standard for file storage that would allow images from different computer programs to be interchangeable, so that a picture from one computer could be viewed on another without having to use file conversion programs.

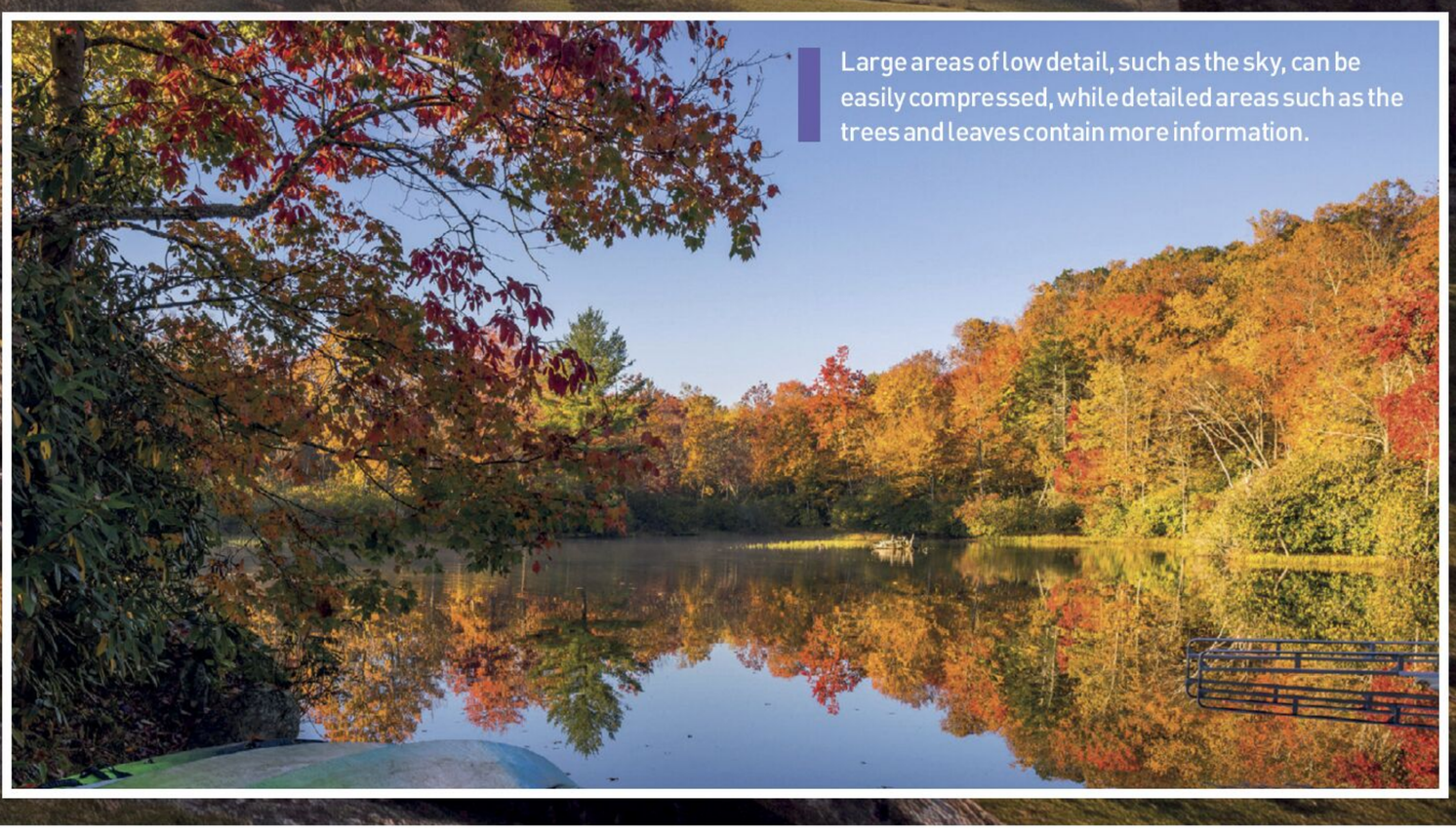
File compression uses complex mathematical algorithms to squeeze big image files into small spaces, but quality can suffer.

The JPEG standard also happens to be an ideal format for storing pictures on a digital camera, because it uses something called file compression. This is a technique that allows a large number of images to be stored in a relatively small amount of memory by squashing the files so they take up less room. For this reason JPEG has become the standard image file format for all digital cameras.

A full technical explanation of file compression would fill a decent-sized textbook. It uses complex mathematical techniques that you simply don't need to know unless you're a software engineer working on a new digital camera. As consumers, all we need to know is that it reduces the size of the picture file by reducing the amount of information stored in it. JPEG compression reduces file size by reducing picture quality, and for this reason it is called 'lossy' storage. For most purposes this quality reduction is imperceptible and fine for day-to-day use, but for maximum image quality there are other types of image file which are uncompressed and lose no quality, the most common one being TIFF, which stands for 'Tagged Image File Format'.

Basically, the way JPEG compression works is like this. An average digital photograph contains varying levels of detail. For example,

> "For maximum image quality there are other types of image file which are uncompressed and lose no quality, the most common being TIFF."



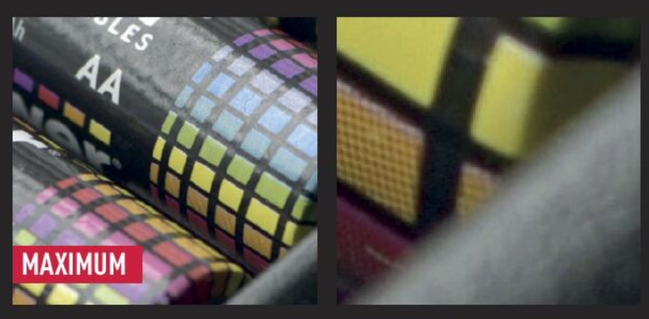
Large areas of low detail, such as the sky, can be easily compressed, while detailed areas such as the trees and leaves contain more information.

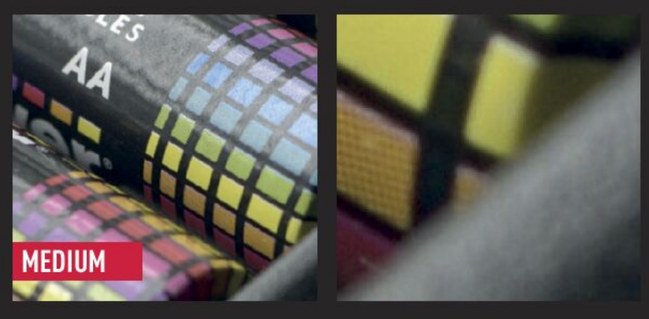
take an average holiday snap of a family on a beach. While the main subject, the people in the foreground, contains a lot of detail, there will also be large areas such as the sky, the sand and the sea, which contain relatively little detail. In order to reduce the size of the file, some data from the lower detail areas can safely be lost without affecting the quality of the picture too much. The way this is done is usually by reducing the number of tonal variations between areas of similar colour, so you may notice artefacts that look like squares or stripes in highly compressed images.

Whatever make or model of digital camera you have, it will almost certainly have an option in the menu that allows you to select image quality. What this option is doing is setting the level of file compression. If you select the lowest quality, you will probably find that you can fit about four times as many images onto your memory card as you can at the highest setting, because the higher JPEG compression setting makes the files one quarter as big, but reduces the quality of the picture to compensate. Most people will use the highest setting most of the time, but unless you intend to print all your pictures at the largest size possible, you really can get away with using a lower quality setting and still have pictures to be proud of, plus you'll be able to take twice as many. ■

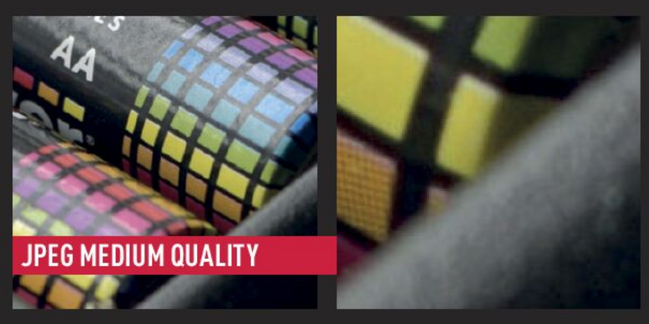
COMPRESSION SETTINGS

Even shooting at your camera's lowest quality setting will still produce acceptable results under most circumstances. These three photos were taken using a DSLR using the Maximum, Medium and Minimum quality settings. As you can see the differences are very hard to spot.

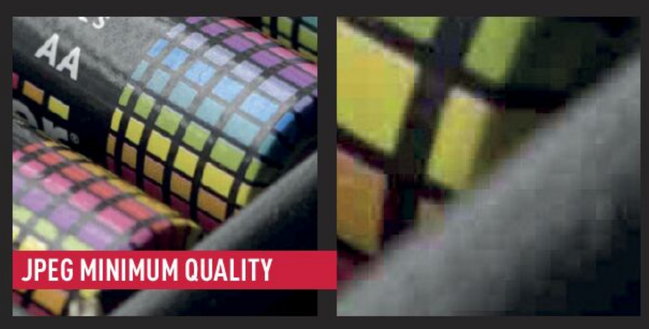




The next picture is the same Minimum quality shot as above, but resaved as a JPEG using Adobe Photoshop using the Medium compression setting. While the quality is a little lower, the image is far from useless.



For comparison, this next image takes the Minimum quality original and is then resaved in Photoshop using the Minimum quality compression settings. Now more compression artefacts are visible in the image.



Composing your photos

Simple guides to making a good picture great

The main difference between a well taken snapshot and a truly artistic photograph is simply a matter of composition. By changing the focal length, the angle and the position of the camera, the photographer can change the relative positions and sizes of objects in the frame to produce a more visually pleasing effect. Learning to do this is mostly a matter of practice and experimentation, but there are a number of simple tips and rules-of-thumb that can help you to take better pictures.

The first and most important thing to remember is to take your time. Look at the scene in the viewfinder or on your monitor and try to see it not as simply a view but instead to imagine it as a finished print. Ask yourself if there's any way that it can be improved by maybe zooming in a little, or by moving the camera. A tripod is a very useful tool for this, since it lets you view a completely static image without the need to hold the camera steady.

The Rule of Thirds

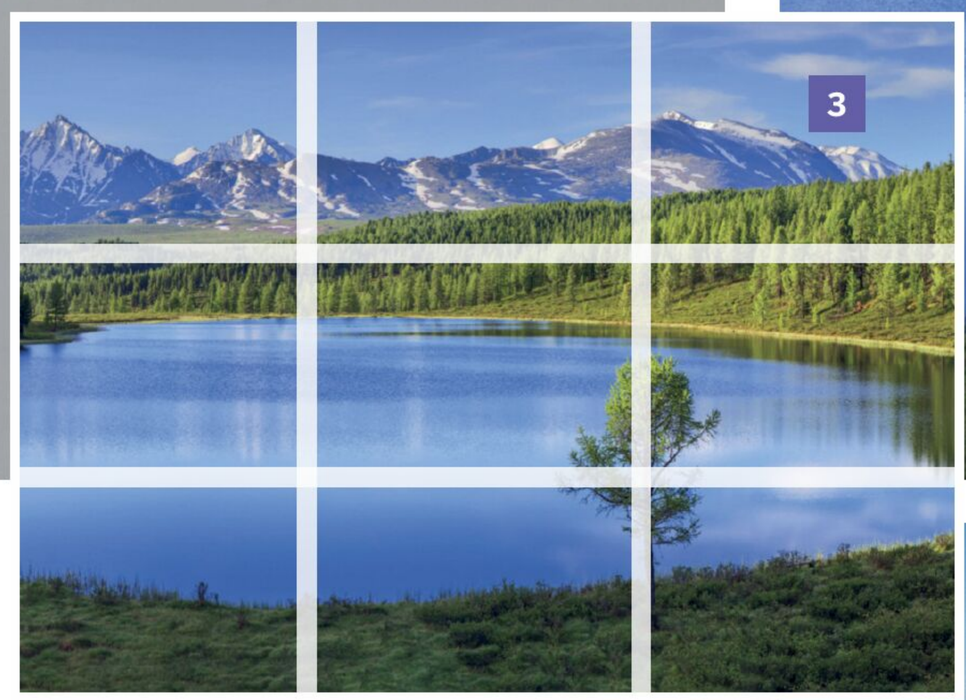
The most commonly used compositional technique is called the Rule of Thirds, and it's really very simple. Let's take a look at an example landscape picture [1]. It's a nice enough shot, correctly exposed, in focus and nicely lit, but now look at the next example [2]. Doesn't that feel better? It's obviously the same scene, and taken from roughly the same position, but this composition is much more appealing. The reason it works is because the tree is now positioned off-centre in the frame, in fact it is one third of the distance from the right to the left. This type of composition is known as the Rule of Thirds.

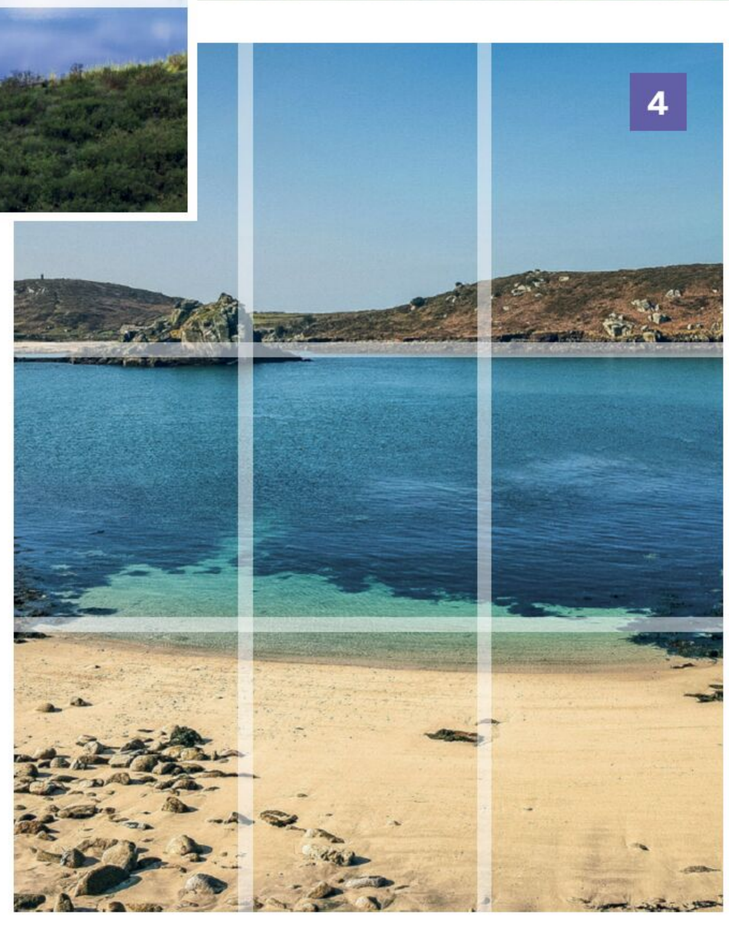
The best way to apply the Rule of Thirds is to imagine the frame divided up into thirds both vertically and horizontally, rather like a Noughts and Crosses (Tic Tac Toe for those in the USA) grid [3]. If you position the main elements of the image on these imaginary lines, or better yet on the intersections where the lines meet, you'll find that your image will look a lot more pleasing to the eye.

The Rule of Thirds works just as well in vertical-format shots, and is useful in landscape photography, since features on the horizon makes a natural dividing line [4].

Portraits can also benefit from Rule of Thirds composition. By positioning a subject's eye at a point where the imaginary lines intersect [5], will give your portrait balance and really help to draw the viewer's attention into the picture.

Most digital cameras feature an option to superimpose the Rule of Thirds grid on the monitor screen to make this type of composition easier. Now you know why it is there. ■





"Look at the scene in the viewfinder or on your monitor and try to see it not as simply a view but instead to imagine it as a finished print."

ZOOM

You can use your camera's zoom lens to improve composition. Below (left) is a photograph of a striking evening scene, taken with a 16mm wide-angle lens.

Whilst it does capture a striking skyline with interesting visual content, there's too much going on in the picture. The jetty in the foreground, the buildings both sides of the river and the bridge are confusing, so it becomes unclear what the subject of the shot is.

By moving a short distance and zooming in to exclude the surrounding scenery, we can get a much tighter composition (below right). Now there's no question about the subject of the photograph. The shape of the building where it intersects the sky and the river now conforms to the rule of thirds.

> **"By moving a short distance and zooming in, we can get a much tighter composition."**

FRAMING

A less popular technique, but one which can produce good results under the right circumstances, is framing. This is where you use objects in the foreground to frame and thus emphasise the main subject of the picture. It is difficult to do well, because there is the risk that the foreground objects will distract the viewer from the main subject. However if the framing objects are sufficiently nondescript and contrast from an eye-catching main subject then this compositional technique can work very well.

In the picture on the left the framing doesn't work because too much of the foreground is visible and in sharp focus; it distracts from the subject of the picture. However, framing an image by zooming in so that only a few leaves are visible and out of focus, the effect in the right image is a lot more successful.

Thanks to the conventions reinforced by decades of Hollywood films, framed shots where most of the framing object is on the lower edge of the frame tend to look sinister, like you were stalking the subject, while a frame of overhanging foliage tends to be associated with romance, and is often used by wedding photographers.

Angle

By far the most common compositional mistake is to take a photo from the wrong angle. If you see something that you think might make a good photo, don't just point the camera and snap away. Pause for a moment and think about what you actually want to see in the picture, and what would be the best way to capture it. Take this shot for example:

This display of fruit and veg outside a greengrocers has some good elements. The light is great, it has plenty of colour, and some interesting

shapes and textures. However shot from this angle it is completely uninteresting, just a random snapshot. However if we get down lower and in closer, we find this view:

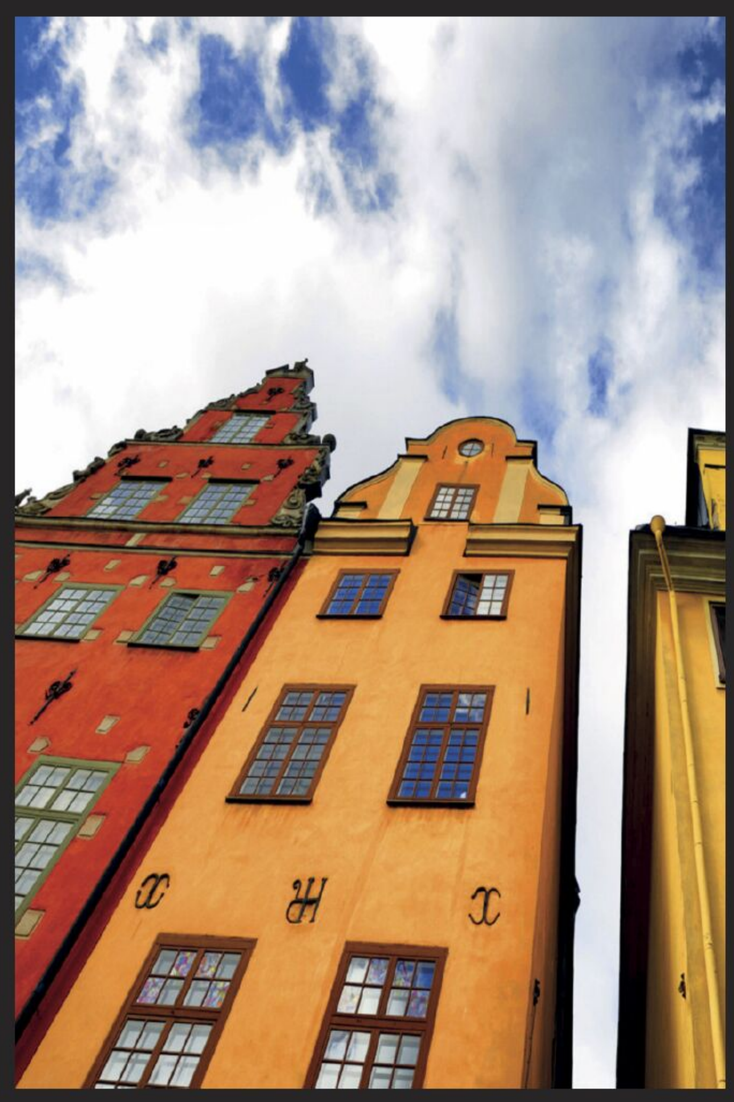
It would have been better still to have the strawberries in the shot as well, but here the contrast in shape and colour between the melons and the pineapple stalks makes for a much more striking image, and the slightly blurred price tag in the background adds a nice finishing touch.

One of the best uses for this tip is when taking photos of children or animals. If you kneel down and shoot from their height you'll get much better results than if you stand up and just snap away, because all you get then is photos of the tops of their heads. The best wildlife photographers know that to get a good picture of an animal you have to share its environment, so make a bit of an effort and try to get down closer to you subject's head height. You may risk getting your clothes dirty, but you'll get a much better shot.

When shooting children or animals, capture the world from their perspective by crouching down so that the camera is level with their head height.

Perspective

Perspective is what gives us our perception of three dimensions, and we can use this to achieve a number of different effects. Most types of perspective shots are achieved using wide-angle lenses, since the exaggerated angle of view emphasises the effect. The most common type of perspective effect is "one-point perspective". By using a wide-angle lens, groups of lines converging on a vanishing point within the boundaries of the frame can add energy



to an otherwise fairly dull scene, giving a sense of movement and drama. This effect works best for photographs taken when within or surrounded by buildings, but it can also work on roads, railway lines, even rivers and beaches.

Photographs of buildings can be enlivened by using "two point perspective", photographing the building from a low angle pointing upward so that the parallel sides converge both upward and to the side, creating two vanishing points which are usually outside of the frame of the picture. This is also achieved by using a wide-angle lens to emphasise the effect, however the main danger is that many wide-angle lenses, especially the zoom lenses on compact cameras, produce what is known as barrel distortion, where parallel lines appear to curve. Better quality lenses minimise this distortion. ■

"The best wildlife photographers know that to get a good picture of an animal you have to share its environment."

FOREGROUND, SUBJECT AND BACKGROUND

Squinting at your subject through the viewfinder of your camera, it's all too easy to overlook what else is in the frame. You're concentrating so hard on getting your subject not to blink when the flash goes off that you completely miss that tree in the background that looks like it's growing out of her head, or the discarded crisp packet lying distractingly in the corner of the frame.

Along with your main subject, a photograph will usually have both a background and a foreground, and these are just as much a part of the image. The trick is to compose the photograph in such a way that you strike a balance between these different elements. When done properly this adds life and interest to the picture, as well as making it seem more natural.

Take this photo of a famous and much-photographed Dartmoor landmark, the ancient clapper bridge at Postbridge in Devon. It's very easy to simply take a snapshot of the bridge, but that simply looks the same as the photographs that hundreds of visitors take of it every year. It's very pretty, but it's also a little dull. By including some foreground detail, and positioning the camera to capture the background of the moorland and forest, the bridge is now one element of a much more balanced shot, and one which shows the bridge in its surroundings.

Similarly this photo of a familiar London landmark is flat and boring, and doesn't really show the building in the context of the city around it.

By choosing a completely different location we can add foreground detail the shot, and instantly it becomes more balanced and dynamic. Of course the improved weather helps too, but that's another thing to which you should pay attention when you are setting up and composing a photograph.

Balance

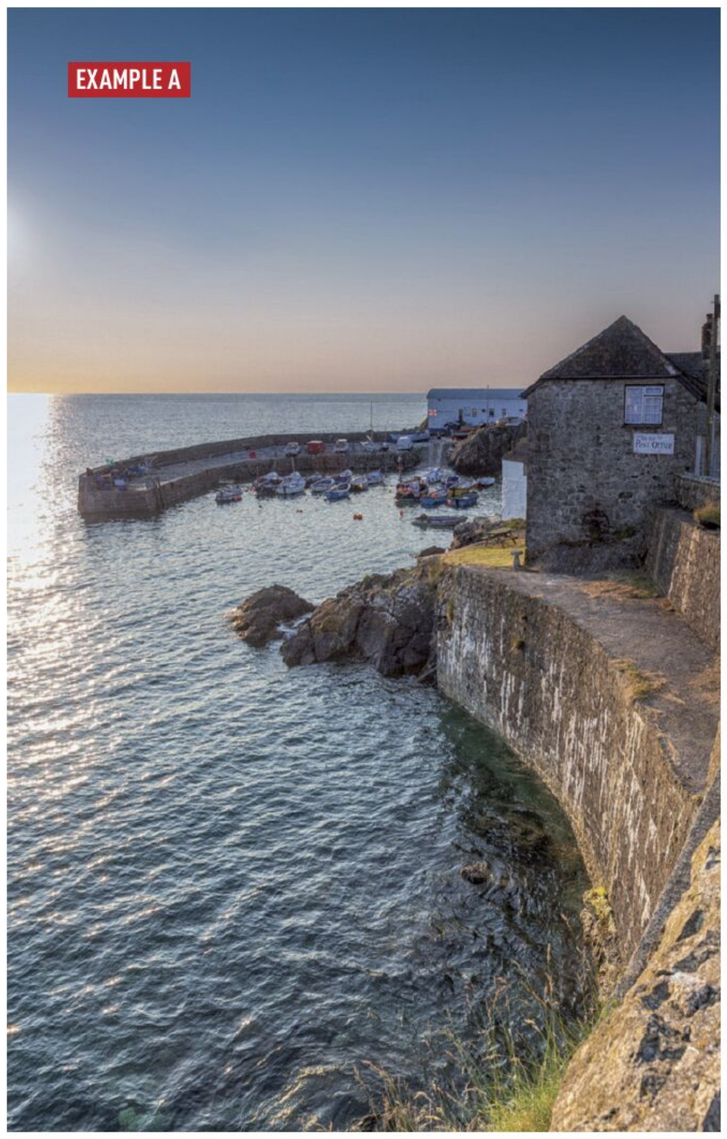
When your photograph has more than one subject you can achieve a better composition if you give each subject equal weight in the composition, so that the subjects form a harmonious balance within the frame. As with many artistic techniques it's largely a matter of practice, experience and individual taste.

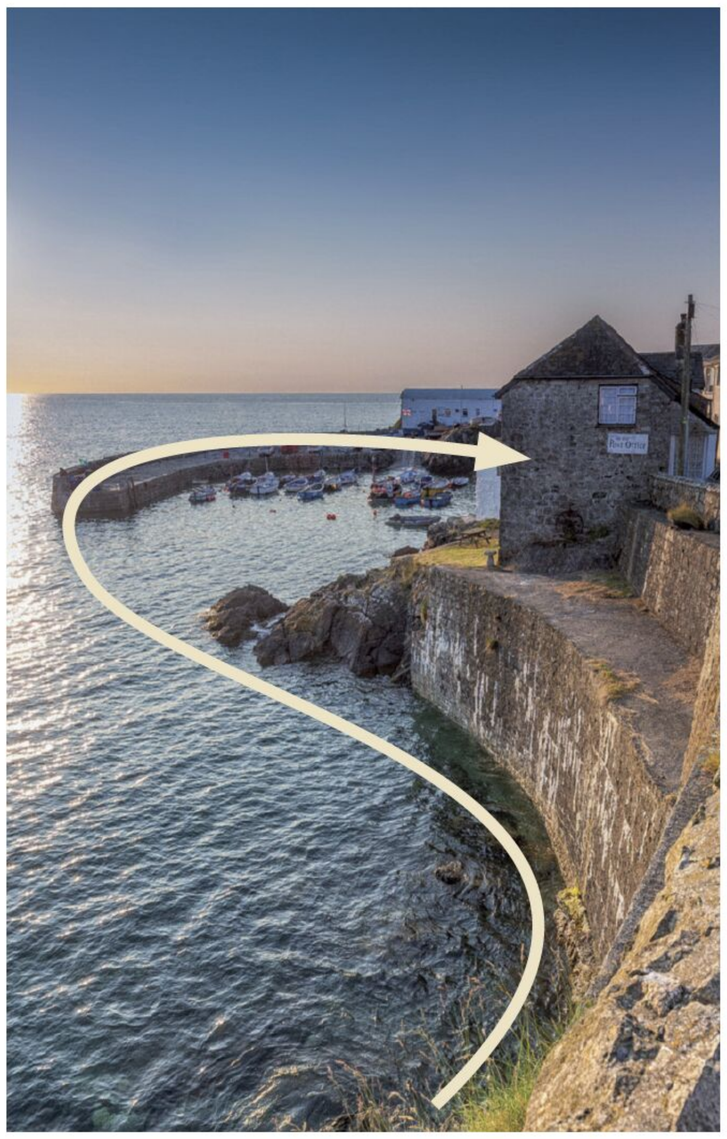
Try to position your subjects so that they are the same distance from the edges of the frame, and also more-or-less symmetrically balanced around either the centre of the frame or some visible dividing line. A diagonal composition works in most cases, especially with portraits of couples. Perfectly symmetrical arrangements where the subjects are the same height within the frame tend to look forced and unnatural.

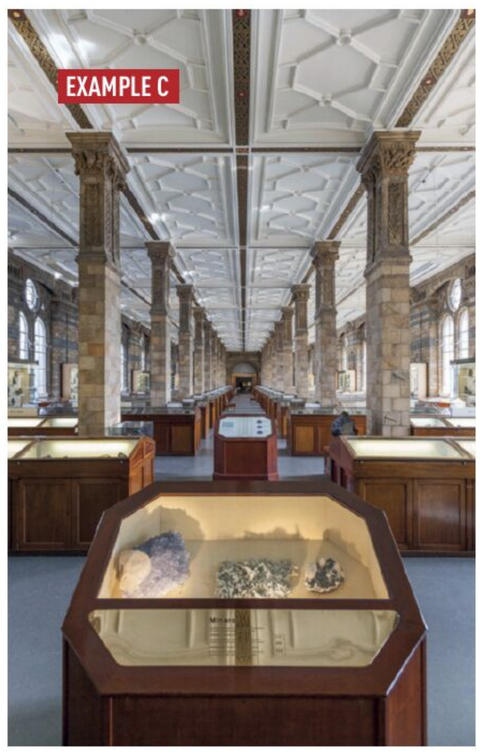
In this first example, the two fish are balanced by the stone jar in a diagonal arrangement that makes for a pleasing and harmonious composition. If you can't see it, try covering up the jar with your hand and see how dull the fish look on their own.

In this second example, the photo was cropped to balance the composition between the two guys talking in the background and the horse in the foreground. In this case the horse is closer to the edge of the frame, but then it is much bigger and closer to the camera, so it looks more natural that way.

LEADING LINES







Closely related to perspective is the concept of leading lines. When you look at a photograph for the first time, your eye will naturally be drawn to certain areas. It is possible to subtly lead the viewer's eye around the image to areas of interest using the visual cues of line and perspective.

For some reason best known to anthropologists our eyes find broad "S" shapes very appealing, so any feature in a photograph that resembles this shape will naturally tend to attract the viewer's attention. The eye naturally tends to follow the S-shape into the picture, usually starting at the closest and/or lowest point and moving upward. Many features can be used to create leading lines, but favourites include rivers, streams, footpaths, roads, hedgerows, or the line of surf on a beach. In figure or portrait photography, the line of the limbs, hands, hair or items of clothing can also be used to create leading lines that draw the eye into the photo.

In example A, the elevated angle allows the long curving line of a harbour wall to form a leading line drawing the viewer into the picture. Leading lines are most often used in landscape photography, because so many natural features make those appealing S-shapes. In example B the line of the path leads the eye up past the hikers to the mountains beyond.

Leading lines don't have to be S-shaped curves, straight lines can work as well. In example C, the perspective of the walls, the ceiling decorations and pillars draw you from the front of the shot down the corridor to the exit. Use leading lines to emphasise a particular point in a photograph, or to highlight a particular subject in a busy environment.

In this studio portrait shot (example D), the position of the model's hand and the line of her hair combine in a leading line directing the viewer's attention to her eyes.

Implied movement

A photograph freezes a moment in time, which is great if your subject is a stationary object or person, but what if your subject is moving? How can you capture movement in a still image?

There is a technique involving a slow shutter speed and panning the camera to follow the movement, but it's difficult to master and only works about one time in ten anyway. Far easier is freezing the action with a nice fast shutter speed, and using a subtle compositional trick to simulate movement.

The trick is very simple. Just position the moving subject within the frame so that it appears that it is moving into the middle of the picture. For example, if you are photographing a boat moving from the left to the right, position it on the left of the frame so that it is moving inward towards the centre, leaving room in the frame into which the boat could move. The best way to illustrate this effect is with a couple of examples. Take a look at this shot:

Here the boat is positioned incorrectly, and

appears to be about to exit out of the picture. There is a lot of empty space on the left of the picture, and it looks awkward and unbalanced.

In this shot, the boat is moving into the

picture, giving it better balance and a dynamic feeling of speed and movement. If you look at pictures by professional sports photographers, you'll see this technique applied to everything from sailing boats to football players. ■

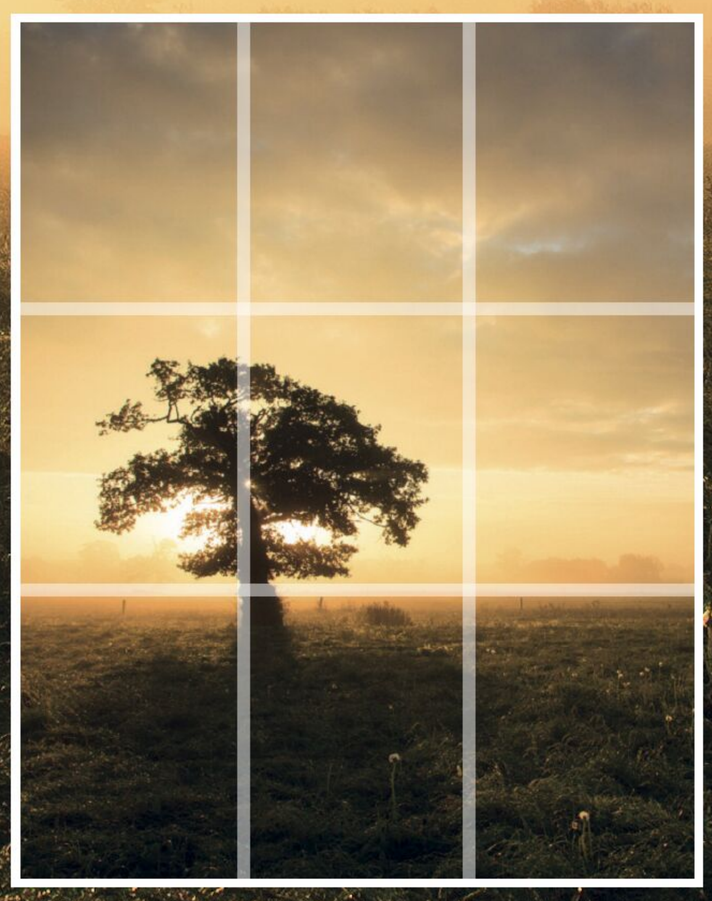
Composing your photos: how it's done

You know the rules, now you can use them or bend them

Having read the theory of how to compose your shots, it's time to get out there and start shooting with a fresh eye for composition. As we've said regarding most rules and techniques, they are for guidance and are a good place to start but can be open to interpretation based on your creative preferences. Sometimes you can bend the rules, push the limits of composition and place the subject of your shots far off the intersecting lines of the imaginary rule of thirds grid. This can create a certain visual tension that actually works in your favour.

Rather than composing a portrait image using the rule of thirds guide, you can push them far over to one side, even cropping part of their face so only a portion of it remains. If a person is photographed moving in a scene, you normally leave space in the shot for them to 'move into'. However, for shots taken of a runner, for example, why not place them so they are about to exit the frame, rather than have space for them to run into. A landscape takes on a different feel if the horizon is pinned very near to the bottom of the frame but the main subject still falls on one of the vertical grid lines, allowing the sky to dominate the shot. Landscape shots that have a strong horizon line and a perfect reflection in a body of water are often placed dead centre vertically to make the most of that mirror image in the water. Don't forget to use foreground objects to create leading lines that guide the viewer's eye into the shot and also bear in mind that the actual rule of thirds grid is not limited to being perfectly square in your shot, you can actually imagine the grid at an angle so the lines run diagonally through your composition giving you some more creative options for subject placement. This is the thing with rules, they show you how to make photos better, but a little experimentation now and again can make them special. ■

This image uses classic rule of thirds framing to balance the shot. The tree is placed on the left vertical and the horizon is placed on the lower horizontal. The photographer used this alignment to give more emphasis to the sky, rather than the ground.



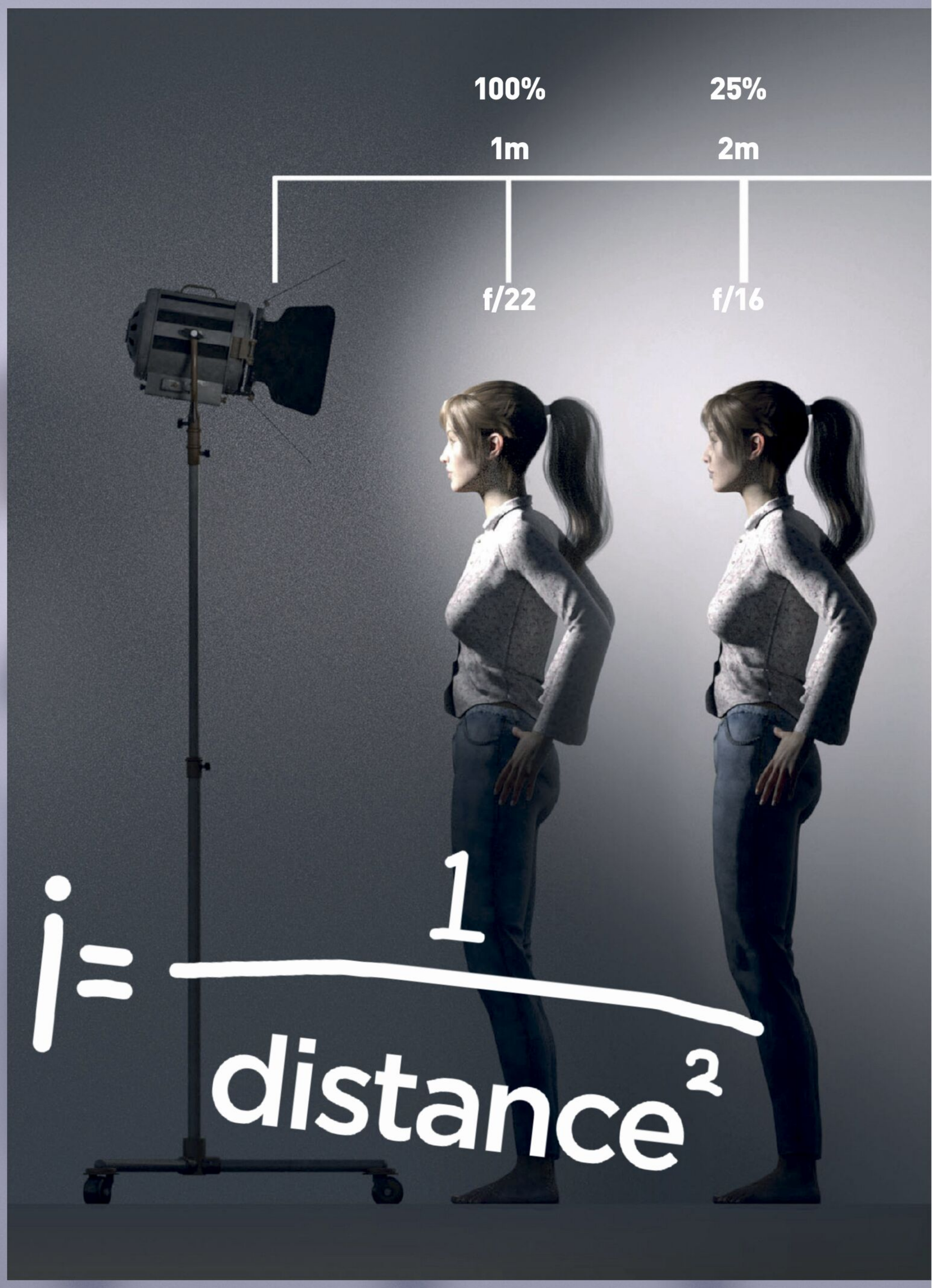
This shot of a bare tree on a crisp, cold, morning works due to the sun casting a strong and powerful shadow directly toward the viewer. It creates a strong visual cue that acts as a leading line that draws you up through the composition.

The inverse-square law

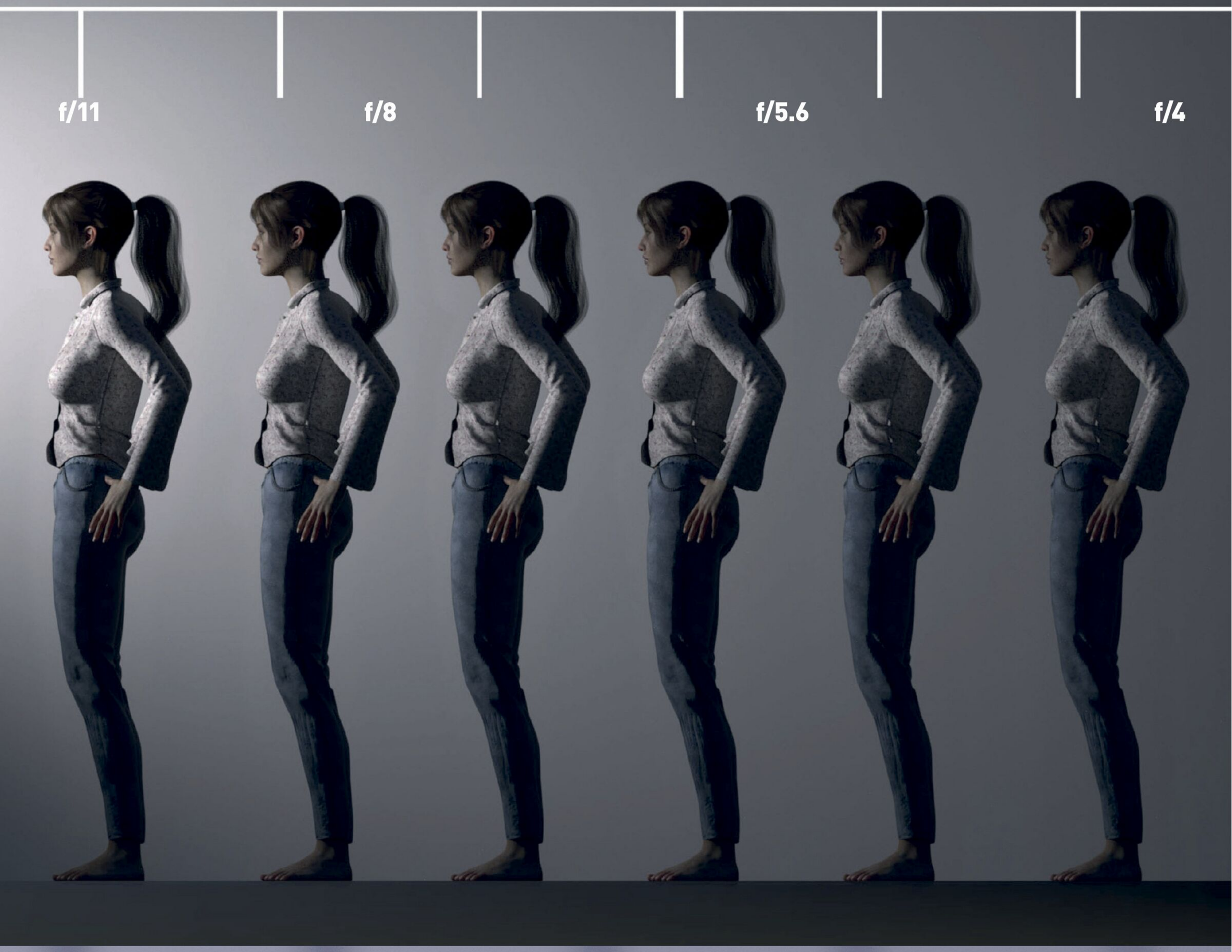
Understand how light and distance work

Don't worry, this isn't going to turn into a maths class, or a lecture on physics. It's an old adage that photographers work with light and understanding a little about how light affects your scene is a useful thing to know. In reality, you don't have to be able to carry a headful of fractions and do mental arithmetic, just know that light has some interesting properties as it travels from its source, to your subject. This brings us to the inverse-square law. This law applies not only to light but any physical quantity, but for our purposes it states that the intensity of a light source is inversely proportional to the square of the distance from that light source. **Reading that you may be tempted to flip over to the next page, but bear with us.**

The actual formula reads: intensity of light = 1/ distance2. So why is that worth worrying about? Those who are new to using light sources such as flashes and studio lights are likely to imagine that if you place a subject next to a light source and take a photo, then move the light twice the distance from the subject and take another shot, the light will be half as powerful. This is not the case because of the way light falls off using the inverse square law. To sum it up we have a diagram that lays out the values and intensities you will encounter as you move your subject away from a light source. We have a theoretical light source set at full power and a subject who starts at 1m away from the light. If you use the formula and take the distance of 1 and square it you get 1 (1 x 1 = 1 so 1/1 intensity). Move your subject to 2m and rather than the intensity being half power the formula tells us otherwise (2 x 2 = 4 so 1/4 intensity). At double the distance from the light source, the intensity is actually 1/4 the brightness or 25 per cent. At 3m (3 x 3 = 9 so 1/9 intensity) it is now 1/9 or 11 per cent (we've rounded up the numbers) and so on. Whilst this is all well and good, how does it help us in the real world? If you look at the percentages, from 1m to 2m, there is a 75 per cent drop in intensity. From 3m to 6m there is only an 8 per cent drop in intensity. Finally, from 6m to 8m - 10m, there is only a 2 per cent drop in intensity. We've added an approximate set of f-stops to show how you would alter your aperture to get a good exposure as the light intensity drops away the further your subject is from the light source. Now we can put all this information together for some lighting examples. ■



$$I = \frac{1}{distance^2}$$

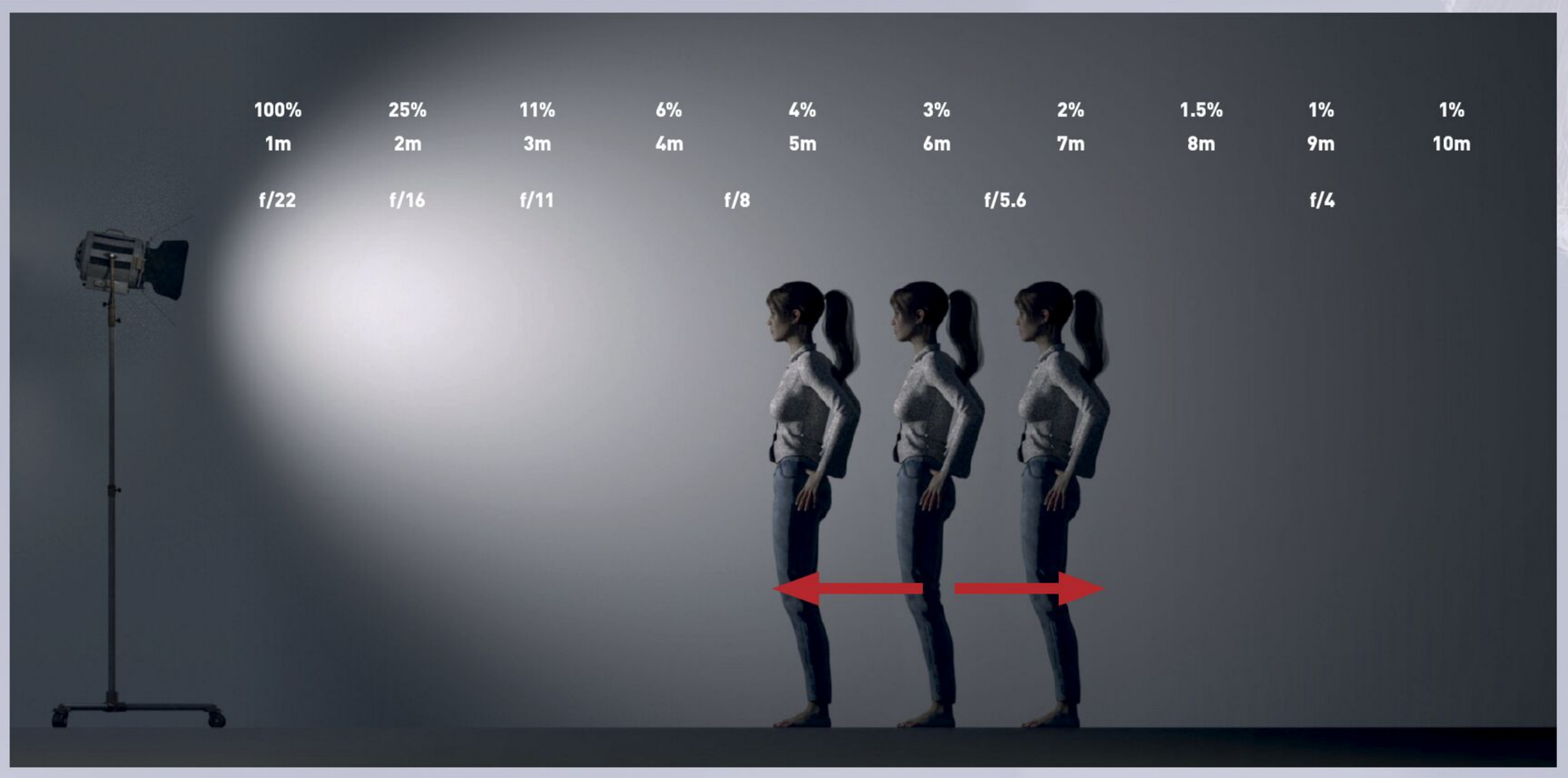


Scenario 1

Your subject is very close to the light source. If they happen to move one step away from the light, they will be underexposed by a fair margin and you will have to alter your settings to compensate.

Scenario 2

Your subject is much further away from the light source. If they move a step in either direction this time, because of the much smaller fall off in intensity this far out from the light source, you will most likely not have to alter your settings at all.



Scenario 3

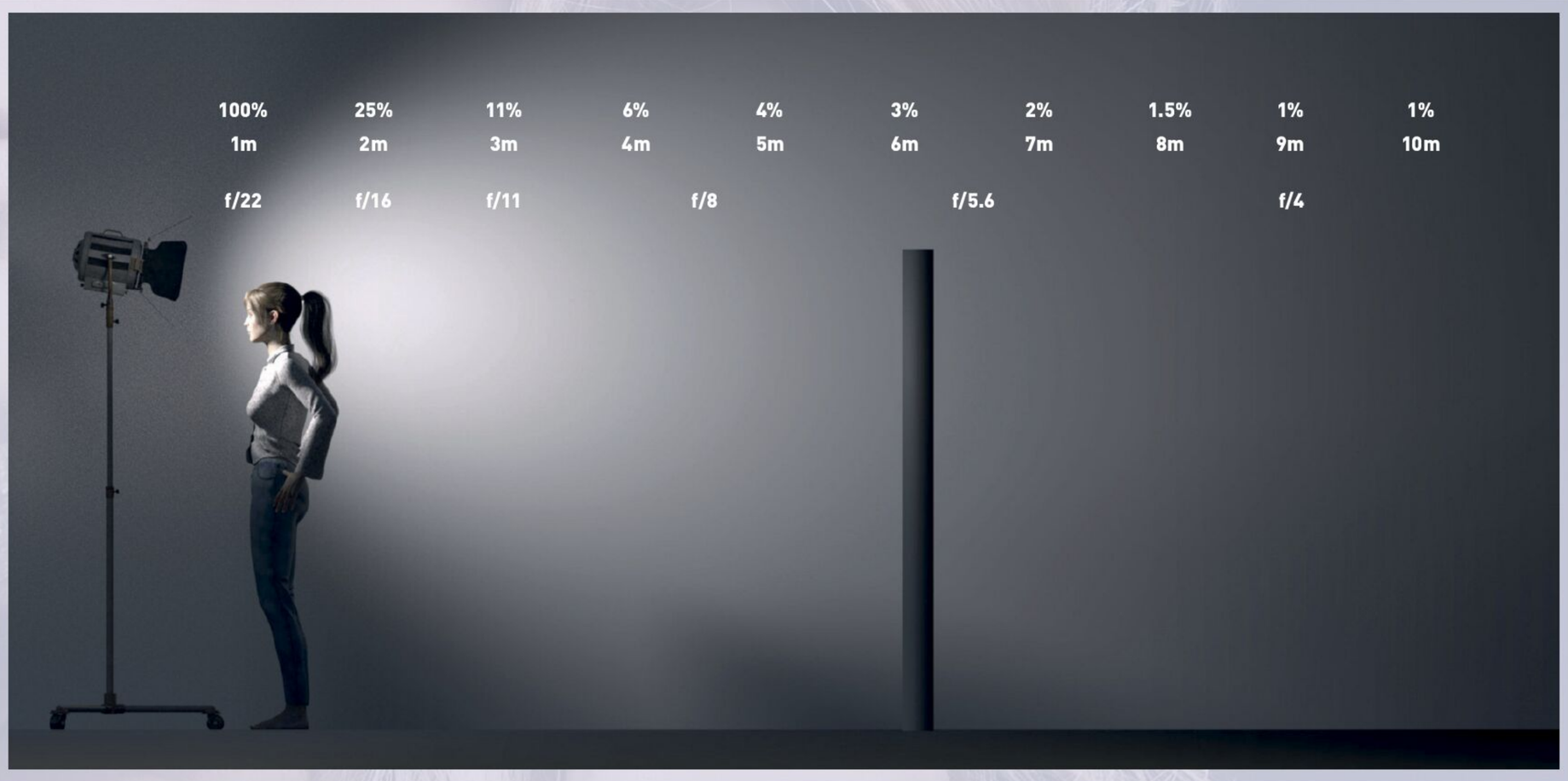
You have two subjects a very short distance from your light source, one of which is standing closer to the light than the other. The one further from the light source will be underexposed by a large margin due to the rapid fall off in the first few metres.

Scenario 4

You place your two subjects much further from the light source. At this greater distance (assuming you use a correct aperture for best exposure) both subjects will be fairly evenly lit between f5.6 and f4.

Scenario 5

When you require a subject to be correctly exposed and have a background much darker, you can keep your subject near the light source and move the background further away.



Scenario 6

If you want both your subject and your background evenly lit, you can move them both further away from your light, but keep subject and background close together.

CREATIVE PROJECTS

Unleash your creative side and learn even more techniques used by the pros

So, you've learned the fundamentals, brushed up on your theory, and armed yourself with your favourite camera gear and accessories. Now what? Well, we would say get out there and have some creative fun. Shoot, adapt, make mistakes, and learn. That is easy to say, and sometimes you need a project to get your teeth into. Something you genuinely enjoy and can use to really help you stand out as a talented photographer in contrast to one who's merely a skilled technician. It comes down to an eye for the creative and a desire to learn and do more. By learning and trying out new ideas and techniques, you can turn your photographs from snapshots into works of art that you can be proud of. Let us show you some interesting projects that we hope will inspire you to achieve greater things, explore more genres, and really get passionate about your photography. ■

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A guide to nude photography

How to shoot artistic and appealing nude photos

When you think of nude photography, chances are you're going to fall into one of two categories. There are those that consider nudes controversial and vulgar, then there are others who just see it as a creative representation of the human form. There is no doubt that if handled with respect and care to the subject matter, nude photography can yield amazing images. Of course, it is sensitive in its nature, and attention must be paid in order that it not stray into the pornographic. Since the dawn of the art form, many famous photographers have shot nude studies, and if it's something you're interested in exploring, there is no reason that you can't attempt it too. We have, in no particular order, a series of guides that can help you create artistic and tasteful nudes.

Lenses

Many photographers may have a say about what lens is best for a nude study. It obviously comes down to the photographer, the subject, and the scene. As a good starting point, the kinds of lenses you might use for a portrait shoot are also very valid for this subject too. Lenses with focal lengths of 35mm, 50mm, 85mm and possibly 100mm are considered your go to guys for this kind of work. Generally, if you want distortion-free shots of your subject, then 50mm is definitely a good place to start. Bear in mind that as you stray further into wide-angle territory, such as 24mm or shorter, shooting close up will result in your subject suffering from the greater barrel distortion present in these lenses. It is always a good

idea to have at least one prime lens, with a large maximum aperture, in your kit bag. The benefits it yields are; out of focus backgrounds to avoid distractions, and faster shutter speeds if shooting in low light conditions.

As a side note, the camera you use is probably less important than the lens. A decent 24MP DSLR, with the ability to swap out lenses, means you can be creative with your shooting. If it can handle higher ISO with less noise, that can be a bonus, especially if you are shooting in dim natural light.

"Since the dawn of the art form, many famous photographers have shot nude studies, and if it's something you're interested in exploring, there is no reason that you can't attempt it too."

Prime lenses, such as the Sigma 35mm f1.4 DG (shown on the left) and the Canon 85mm f/1.4 L (shown below), are examples of decent portrait lenses within the focal lengths preferred by photographers for portrait work. Zoom lenses are very capable too, but generally do not offer such wide maximum apertures.

As examples like this show, you don't need a modern studio full of fancy gear. A simple floor space, a black drape, or a simple coloured wall is all you need. Nude photography is often best when presented in a minimal setting, so the focus is completely on your subject.

Your model

Your first port of call is to commission a model for your shoot. To avoid any awkwardness later on, it is essential that the nature and intention of the shoot is clear. Your subject is going to be naked in your presence and you must be the very paragon of respect and consideration. It makes a lot of sense to meet up prior to the shoot and discuss what is required of them, and to go through the kinds of poses and locations they may be required to interact with. This way, you can both get to know each other a little better, helping eliminate any snags on the day of the shoot. Keep up a good dialogue with your model during the shoot, and share with them the images you've taken. Showing them what you've shot helps them see your vision and lets them know they're doing ok. This should make them more confident in both your ability as a photographer and theirs as a model.

One key point to make is that you never touch the model, unless permission has been given. This is a sensitive shoot and just reaching out to adjust an arm or a leg is not permissible unless they have consented. Alternatively, you can try mirroring the pose or indicating what part of their body needs moving. If you have access to examples on a mobile device or tablet, then show them that instead. This last point is very helpful for models who have just started out and require hints and advice about posing.

Be minimal

Many of the best nude photos are examples of minimalism. Don't worry if you don't have a state-of-the art studio, a blank wall or floor is as good a canvas as any. If you are shooting in a space at home and struggling to clear enough wall space, you can always purchase a cheap roll of photographic backdrop paper, anywhere up to 3m wide. Choose a neutral colour and you have an instant mini studio.

Light

If you are not in possession of flashguns or studio strobes, don't worry. Some of the best shots can be created with some careful use of natural light. The light coming into the room from a nearby window, diffused slightly by a net curtain, can create soft, flattering shadows. A low evening sun, with light slanting in through a window fitted with blinds, will cast patterns and shadows on your subject's body, accentuating their shape. By placing them directly in front of the window, and metering for the brightest highlights, you can drop them out to a silhouette for a very strong effect. If you can, black out the room, then you have the option to use artificial lights for more targeted effects. A simple desk lamp can be used as a rim light for very subtle and striking results. The main thing to remember is how you use light to its best advantage. Keep in mind you are using it to deliberately create shadows and highlights that enhance the shape and form of the body.

Simply lighting your subject with gelled flashes creates a stunning nude study. Using props can also work well and create cool, funny, serious, and sensuous images that are a reflection of your own creative vision.

If you have white walls, and a couple of powerful flashes, you can shoot high-key, where the image is very bright, even overexposed, and there is little in the way of shadow detail. Alternatively, you can go the other way and choose a low-key photographic approach. Using a dark background, or blacked out room, there is very little highlight detail and much of the subject is in shadow. A black velvet backdrop is an ideal method for producing a perfect black background. You can also use a black paper backdrop, but watch out for any unwanted light spilling onto the paper and reflecting back.

Using props

With nude photography, what is hidden is often as important as what is seen. Nudes do not always have to be fully naked. Composition can be greatly enhanced with the inclusion of a prop. A simple linen sheet draped across the figure's intimate areas can add a certain frisson to the image. A model, posed in a large wingback chair, or partially obscured by a wall or curtain, can elevate the shot in stunning ways. If used with care, and in appropriate ways, you can use anything as a prop. A sunflower, a balloon, a musical instrument, a bunch of peacock feathers, anything is fair game.

Posing

If they have not shot this kind of thing before it can be a challenge, for both model and photographer. There is any number of simple, but classic, poses that professional models will adopt automatically. Things such as the arched back with hands in hair pose, chilled seated pose with one knee bent and hand in hair. Then there is the lying on the bed pose with one leg drawn up and eyes cast down. Add to that the simple touch, with the lips close up, or the casual covering of the intimate areas with their hands.

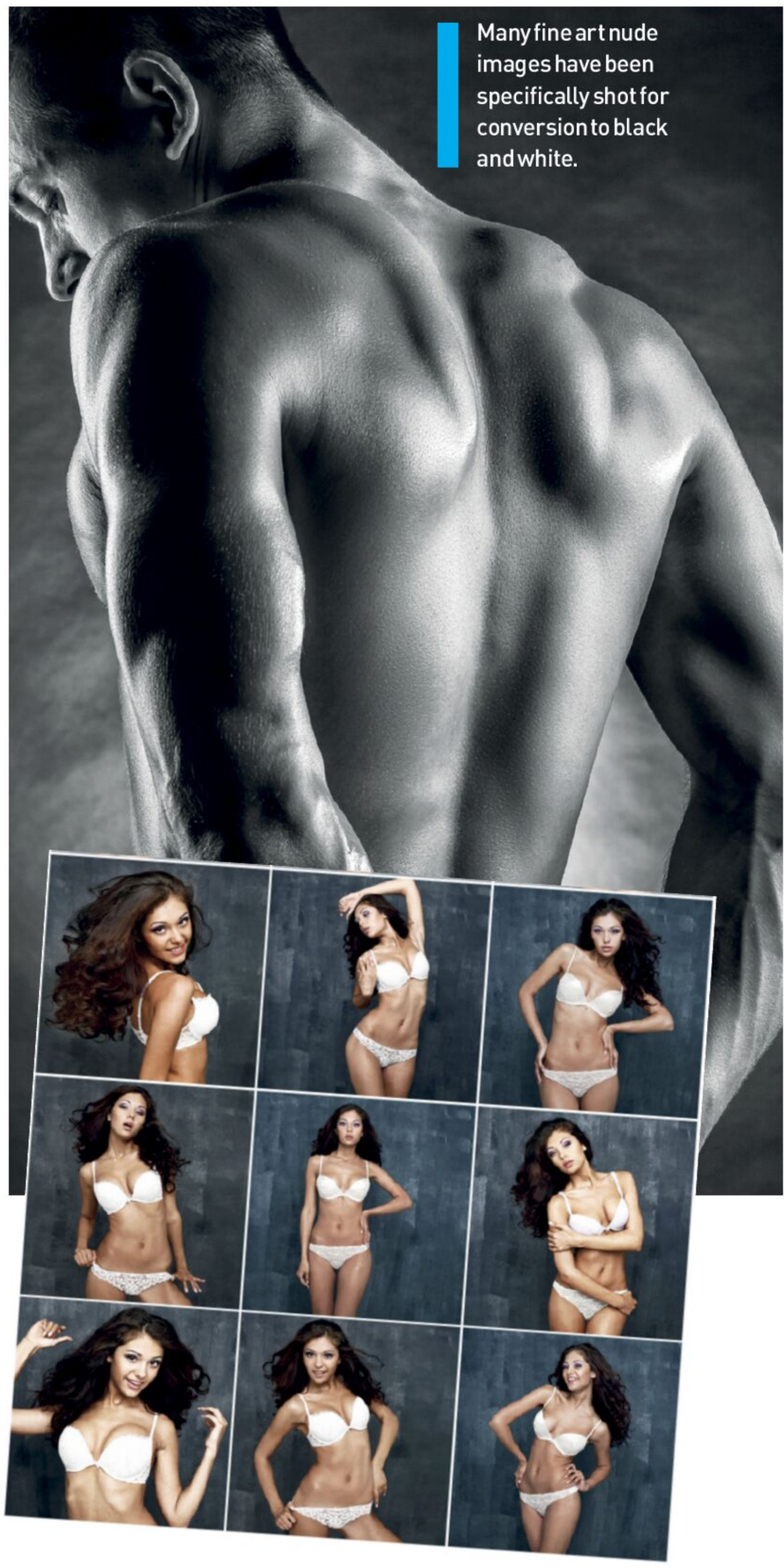
You can easily find many posing guides online, but be aware that sometimes less is more. A good, natural, nude photo can also capture an imperfect moment, a moment where the subject looks authentic and is just being themselves. The kind of moment that does not look posed at all. Sometimes a model can just be 'off the clock' and that is worth remembering.

Colour and more

Think about the use of body paints, oils, powders, even flour and bunches of flowers to add a colourful kick to your shots. Then there's the option of using lighting for a fluorescent effect by lighting your subject with two flashes, each gelled with complimentary colours. One side could be lit green and the other red. Using lights and gels gives you a creative palette of colours to really make your nudes explode with colour.

Then there is always the absence of colour to think about. Many fine art nudes have been shot with the express purpose of converting them to black and white. In monotone, you are relying solely on the shapes, forms, and textures of the nude to catch the eye. This is where careful attention to the use of highlights and shadows is essential. Black and white nudes often benefit from being as simple as possible in their composition. In many cases, photographers have used macro lenses and shot parts of the body in extreme close up with extraordinary results.

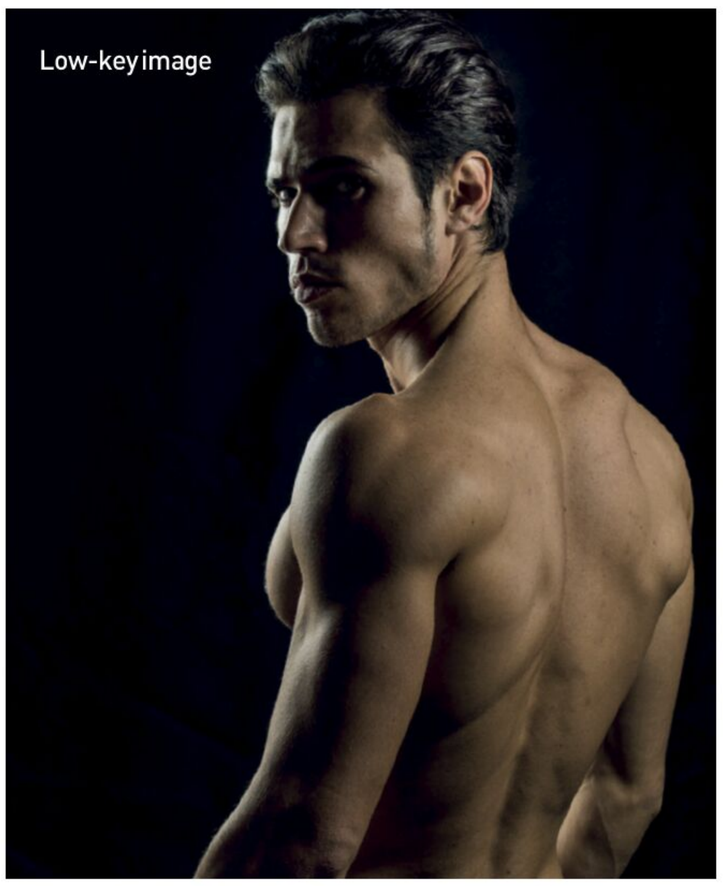
Nude photography is an amazing and artistic topic for any photographer to try. Treat it with respect and you will have some memorable images to add to your portfolio. ■



Many fine art nude images have been specifically shot for conversion to black and white.

There are plenty of posing guides to be found on shopping sites, and through many online resources.

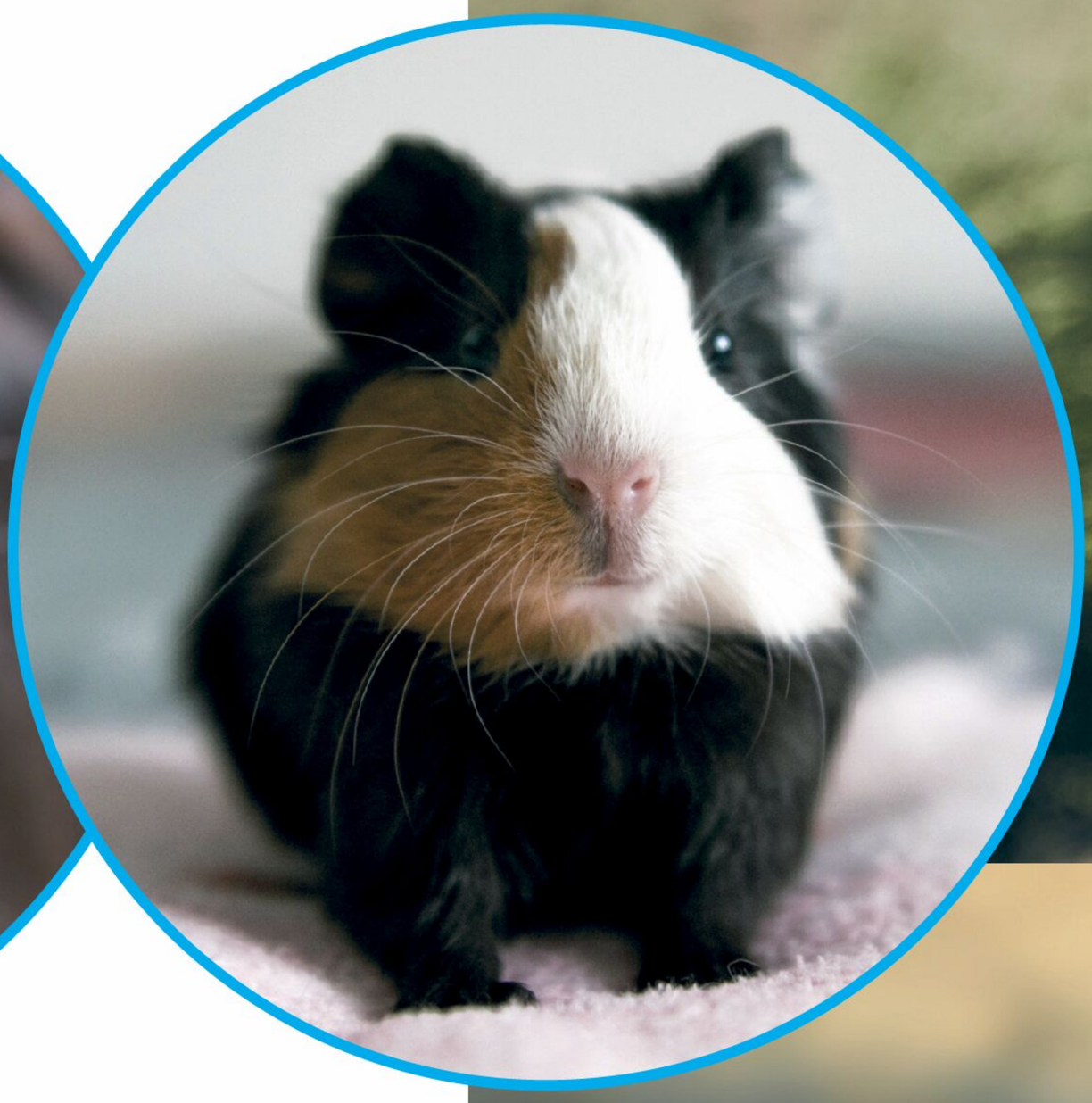
High-key image

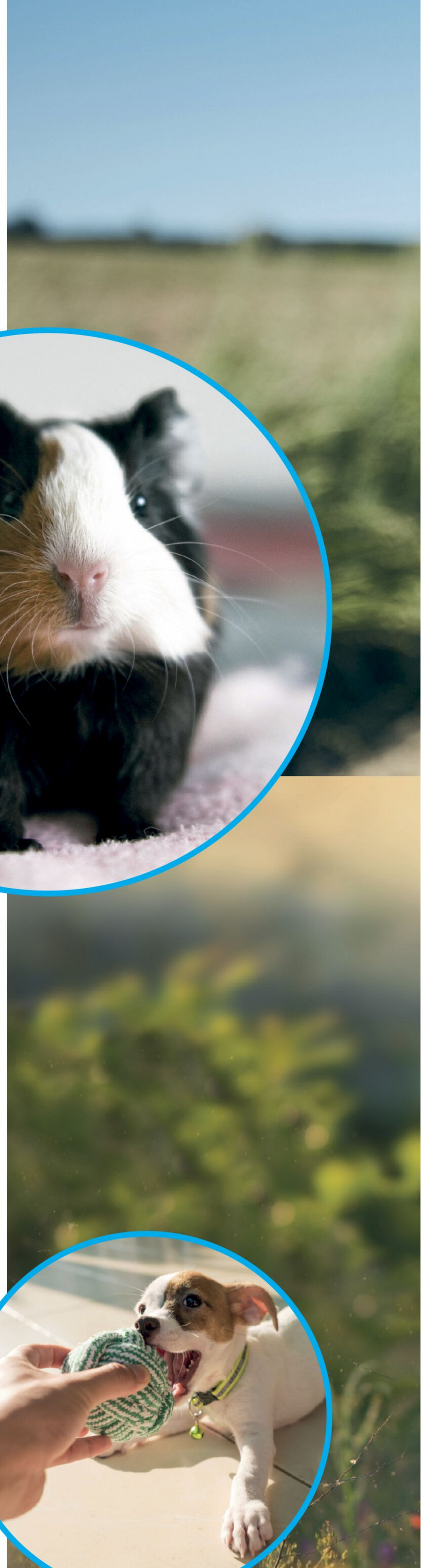


Low-key image

Photographing pets & domestic animals

Time to get our furry friends ready for their close-up





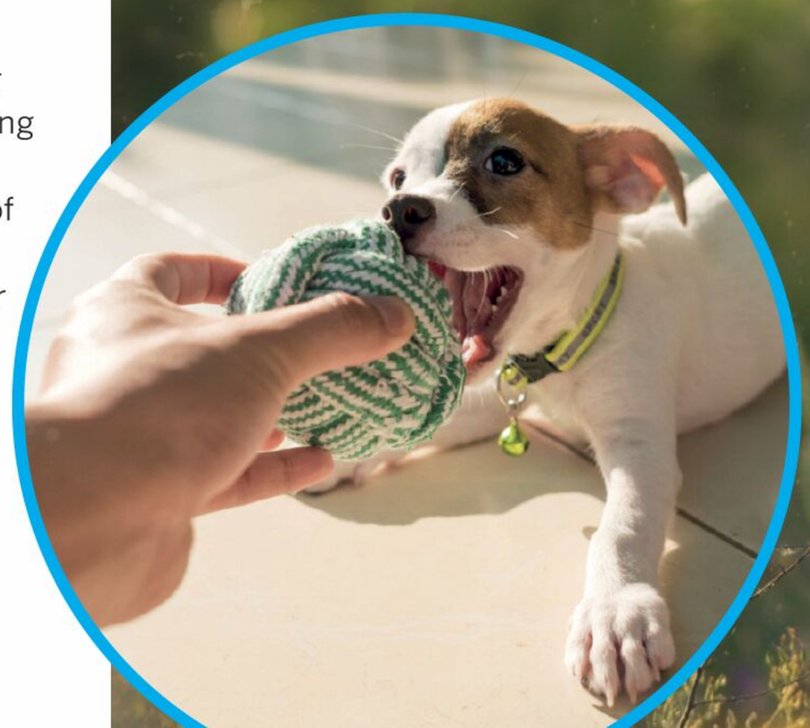
Pet photography can be more challenging than you might imagine. Animals are unpredictable to say the least and they are faster than you! These factors require you to brush up on your camera skills in order to be able to keep up with your furry subjects and create memorable photos in the process. Trying to capture animals in their natural, unpredictable state can be so tricky that a number of photographers might decide that more formal portraits are a better option. Anyone who has ever shot humans in a formal posed session would argue that even they can be tricky enough, so a hyperactive dog, for example, sitting for a portrait is going to be an order of magnitude trickier still. Basically, pets are tricky to photograph, but we have a few pointers to help you out.

Cameras and lenses

For most kind of pet photography, a decent digital camera is a good start. That's not to say you need an expensive DSLR with many lenses. A good compact camera with a decent zoom range will yield plenty of great photos. Plus, digital cameras allow you to snap away as much as you like and to view the results instantly. That's a great help when you need to be sure you've just caught the subject in the right pose, and in focus too. That said, a camera system with interchangeable lenses means you can try a number of different image styles including ultra-wide angle, telephoto, and macro. This means you can have a variety of images rather than a whole memory card's worth all in the same narrow focal length range. Moreover, a decent prime lens with a large maximum aperture will allow you to shoot your subject and use shallow depth of field to help blur out any distracting backgrounds.

Treats and squeaky toys

It is lucky for any pet owner and photographer that most domestic pets will do almost anything for a snack, treat, or a favourite squeaky toy. Apart from your camera gear, the next order of business is to make sure you have a tempting array of treats in your camera bag. A squeaker taken out of an old toy and placed between your teeth means you can set yourself up for a shot, blow the squeaker and, hopefully, get a great shot as a dog or cat looks at you inquisitively. The same squeaker might also



"It is lucky for any pet owner and photographer that most domestic pets will do almost anything for a snack, treat, or a favourite squeaky toy."

TOP TIP!
Get lots of practice in being able to track and focus on moving subjects. Using your camera's AI Servo intelligent tracking can mean you get more hits than misses.

have similar effect for a horse's portrait, since they will prick up their ears when interested. Fake mice on a piece of string will no doubt provide an alluring target for a cat, and nuts and seeds are always a good idea for exotic birds. A tennis ball or two will always go down a treat!

Getting familiar

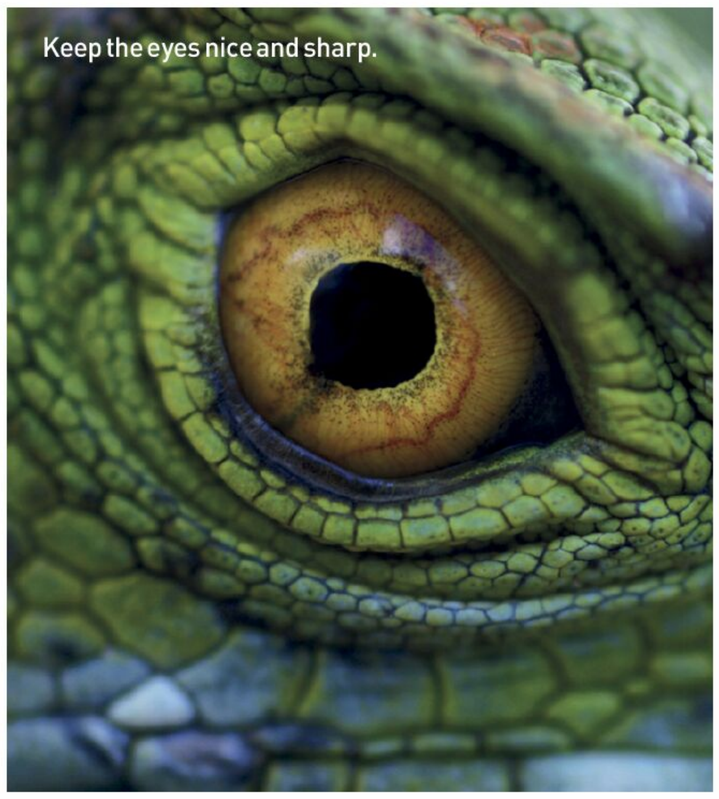
Before you start snapping away, find out about your subject's personality and habits. Where does it snooze if the sun is out? What is its favourite toy? Is it lazy, sleepy, or does it like to perch on a garden fence, or hide in the grass? Take time to chat with the owner and observe your subject to gain some insight. It's also worth spending a little time getting to know the animal yourself. Cats, dogs, horses, they all have personality, and you need to ensure they are comfortable being around you and you around them. Scaring a pet right at the outset is not going to make for a particularly happy or productive photo shoot. Also, remember that if you are nervous, then the animal is likely to pick up that vibe and they will be nervous too.

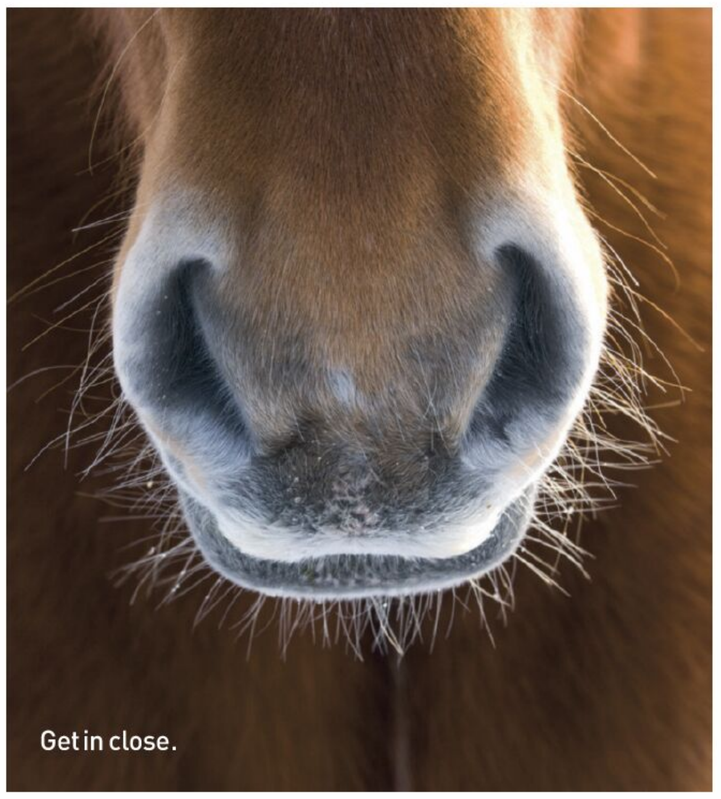
Get up close

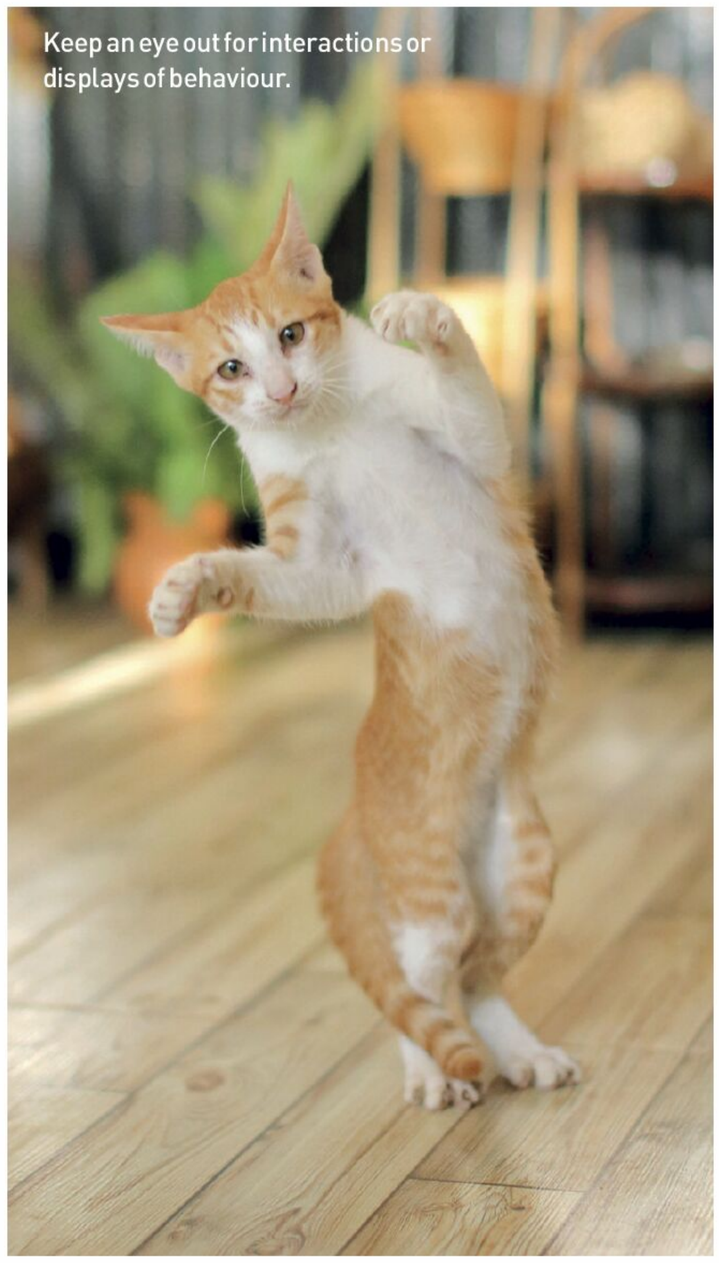
Think about getting in close to your subject. If the pet is comfortable with you, and if it isn't too skittish, fill the frame with the pet's face. Get the eyes nice and sharp. Just like humans, this is a natural point of focus, although focusing on the snout of a dog or cat can also make for an interesting image in its own right. A good portrait focuses on the subject and not the background. Yes, there are times when shooting wide can create a great environmental portrait, but make sure you get a good selection of close-ups. A macro lens is perfect for capturing details of the pet, and shooting with a wide aperture keeps any background distractions out of focus.

Obviously, if the animal is not content to keep still for more than a second, this can be a challenge. Keep snapping away; try using your camera's continuous autofocus to track the animal as it moves. If it's proving too difficult, let the animal play a while, and try again. Pets have very short attention spans, so keep it fun,

Capture funny 'moments'.


Keep the eyes nice and sharp.


Get in close.


Keep an eye out for interactions or displays of behaviour.

Try to keep background distractions to a minimum.

break it up a bit, if you have to, and always reward and fuss them when they do well. Sometimes it is worth just letting them run around and do their own thing and capturing them from afar with a long telephoto lens. Don't be afraid to bump up your camera's ISO settings to keep shutter speeds high and avoid camera shake or unwanted motion blur.

In their world

Your average dog is a couple of feet tall, cats even smaller. The average adult human is about 5' 7". If you photograph a pet while you're standing up, all you're going to see is the top of their head and their backs, not what you want for a portrait. Get down to their eye level, and see the world from their perspective. If you are able, get lower still. Try pre-focusing your camera and just holding it at ground level so you can look up at the pet. It's worth a try just for a new angle on things.

Lighting

When meeting a new animal, bring a flash and, with the owner's permission, while greeting or playing with the pet, fire a couple of test flashes away from them to see their reaction. In daylight particularly, they never seem to mind the flash at all. If they do mind, then stick with natural light and use a white or silver reflector if you need to fill in any shadow areas. Indoors, a bright continuous light may be preferable. We have a photoflood light that, rather than using old tungsten bulbs, uses three daylight-balanced energy saving bulbs. They are housed in a 22" reflector that you can cover with a diffuser to soften the light if need be. You can also try placing your subject near a window to use the natural light. If we are using flash with a willing subject then all is good. If they are wary of the flash going off then we can use cross-lighting, which avoids shooting a flash directly at them.

Keep shooting

As they say, "memory is cheap, but memories are priceless". Pets are challenging subjects, so you're just going to have to stay sharp and keep shooting. Don't be concerned about how many you take. that's what memory cards are for. Take advantage of the fact your camera can shoot anywhere up to 7 frames per second, or more, and use this to take multiple sequences of the subject as they run, jump and play. The more you shoot, the greater your chances of hitting that perfect shot! ■

Plants and flower photography

Take it easy with some relaxing plant-based still life

As your photography evolves, you will no doubt be trying out various types of subject matter and getting involved in photo shoots with people, animals, children and the like. You may also be working at larger events, functions, or even weddings, where you are herding people around and generally having to be in charge to get the shots required by your client. Having been in the thick of it, you can be forgiven for occasionally wanting something a little less wearisome. We can't speak for all photographers, but now and again, we believe it is quite therapeutic to grab your gear, head out and photograph something for yourself, just for the sheer pleasure of it. No moving targets, no groups shots, no shouting to make yourself heard at a function, and trying to catch the eye of subjects who would rather pull out their phones and tweet or talk to someone off camera, while you are trying to photograph them. To keep you sane, why not find a willing subject who will sit for you, never complain, and stay in the same position as long as you need? So it is then, that plants and flowers are your go to guys for a little photographic rest and relaxation. Don't think they are a walkover though. There is a lot of useful techniques to be learned when it comes to shooting flowers and we have some top tips to get your subjects looking their best.

Tripod first

Normally, we would start with cameras and lenses, but in this case, we first want to talk a little more about tripods. At the risk of sounding like a stuck record, we would always recommend that after your camera and lenses, a tripod should be your next purchase. Don't risk losing shots to camera shake by deciding that the purchase of a tripod is not worth the expense. We guarantee that it will become one of your most essential bits of kit and you'll wonder how you ever managed without it. Cheap tripods may prove to be a false economy here, since you will need to get one that has legs that can unlock and spread out wide, dropping the camera very close to the ground. Even better is a tripod that has a removable centre column, which can be reversed and positioned underneath the tripod, rather than on top of it. This flexible arrangement allows you to position your camera much lower to the ground and get you that much closer to your plant and flower subjects.

> "Now and again, we believe it is quite therapeutic to grab your gear, head out and photograph something for yourself, just for the sheer pleasure of it."

Cable release

If you're thinking about tripods and why they are useful, then also consider a cable release. They let you fire your camera without the need to touch it. They can be connected directly to the cable realise port on your camera if it has one, or you can even get radio controlled options that are cable free, with a receiver connected to the camera and a transmitter that you use to fire the camera when needed. Setting up your tripod and camera with a cable release avoids the need to touch your camera and possibly cause it to shake as the shot is taken.

Camera and lens

The camera, in this case, is not the most critical aspect for successful plant and flower photography. A 12MP camera is not going to be much different to a 21MP camera if the lenses they use are not up to the task. Even humble point and shoot cameras can be just as good at shooting these kinds of subjects, if their built in lens can provide the right focal length and close focusing ability.

Luckily, modern point and shoot cameras have a macro mode that allows you to get in relatively close to your subject and fill the frame more than in standard shooting mode. It also sets up the camera to use as wide an aperture as the lens will allow, so you can eliminate background distractions. Typically, point and shoot cameras have a built in lens with a range that is roughly equivalent to a 28mm - 135mm zoom lens.

Other slightly more advanced cameras, such as bridge cameras, may still have a built in zoom lens, but you also have the option of adding macro and wide angle filters to the front element, therefore adapting the lens to more specific needs. In the case of our plant shoot, a macro filter will work well to get you closer to the subject. Even mobile phones have clip on lenses that allow you to turn that tiny fixed focal length lens into a wide-angle lens, a zoom lens, or again, a macro lens.

Once you step up to interchangeable lens systems, your choices do increase, but so, too, do the prices. Any compact system camera or DSLR will have a number of dedicated lenses covering the gamut of wide-angle to telephoto, as well as specific glass, like tilt-shift lenses and macro lenses.

You can use any number of lens types to shoot your flower photographs, depending on your creative needs. A telephoto lens will let you pick out a solitary flower, while having the aperture wide open will keep the background out of focus and reduce annoying visual distractions. A wide-angle lens will let you capture an entire meadow or forest at around the 16mm - 24mm focal length, but can still let you get in relatively close, whilst allowing a lot of the surrounding plants to still be seen in the shot, if you so wish.

If you want to get in very close and fill the frame entirely with your subject, then you will need a decent macro lens. They let you focus very close to your subject and most good macro prime lenses offer a maximum aperture of f/2.8. A 50mm macro will probably require you to be so close to the subject that your own camera and lens may cast a shadow. 100mm and 200mm macro lenses will still let you fill the frame, but you can position yourself further away from the subject.

From compact cameras using macro mode, to interchangeable lens cameras, macro filters and top of the range 200mm macro lenses. There is nothing to hold you back in the pursuit of your subject.

Use a short focal length lens and shoot wide, or grab a macro lens and fill the frame with your subject. The creative choice is yours.

Your plant and flower images can be as classic in their composition as you like, or a little more abstract if you prefer something a little more off the wall.

Pick your plant

Now you are armed with the gear you need, it's time to set off in search of some suitable subjects. In the natural world, you are spoilt for choice, but there are a few things worth bearing in mind as you search. It makes sense to pick out the best flower that represents its species. Flowers or plants with dead or rotting leaves don't make for great photos. Check for signs of predation by insects, blemishes, imperfections and any other clutter or debris that may spoil your shot. Try not to just plonk yourself down in front of the subject and shoot straight away. Look at it from different angles and move around it. Find the best vantage point before you commit. Keep and eye on distracting elements in the background as you compose the shot. Also make a note of how shadows interact with it and also the shadows cast by the subject itself.

Composition

The composition of the image will come next and it's worth taking your time over this. A key ingredient with close-up work is just how much of your flower is in focus. The urge may be to have as much sharp depth of field as possible, but at those close distances you may find you're pushing your apertures up to f/16, and greater. Your shutter speed durations will increase dramatically and, even though your camera is set up on tripod, you run the risk of the flower moving. Even the slightest breath of wind may cause tiny movements in the subject that can ruin the shot. The alternative is to open up your lens and use larger apertures. This gives you much shallower depth of field, so you need to be certain of your sharpest point of focus within the shot. Also, as a by product your backgrounds go out of focus, so you get that nice blurred effect and there are less visible distractions. Speaking of point of focus, it is recommended that once you establish the part of your subject that you want to be sharpest, putting your lens into manual focus mode will prevent it from accidentally refocusing on something else. Movement in macro shots is your enemy. Even a tiny movement will throw everything out, so keep it all locked down as much as possible.

Don't be afraid of experimenting with different perspectives. A short flower, close to the ground, could warrant a top down shooting angle. A flower or plant with a tall stem could look interesting if shot with a wide-angle lens from below looking upwards. Vary the apertures you are using and keep an eye out for any insects or other creatures that are interacting with the flowers. Bees, butterflies, and beetles can add a little visual interest to the shot. If the breeze is moving the flowers, try securing the plant with string or perhaps putting up some bits of cardboard either side to act as baffles to eliminate the wind. A cold night may result in dew forming on plants the next morning. Take yourself out at sunrise and see if there are any plants covered in dew, or the fine tracery of spider webs.

Light

The type of light in your shots will play a key role in their ultimate success as an image. The kind of hard edge shadows that occur in bright, midday sunshine are not conducive to great photography. The kind of light you encounter at the beginning or end of the day is much more flattering to plants, flowers, and humans come to that! The 45 minutes or so before sunrise, and same after the sun has set, offers much lower contrast light that can enhance the look of the shots dramatically. Many photographers will opt to shoot warm coloured plants and flowers after a particularly red sunset, whilst the cooler tones encountered before dawn can benefit flowers with blue, purple and lavender hues greatly. Cooler toned plants can also be shot on bright, but overcast days too. Try to avoid direct sunlight. Shooting in shaded woods, or using a thin white sheet to diffuse the light, will pay dividends in the final result. A piece of white card can also be used as a reflector to bounce light into shadow areas of your subject and opening them up with a bit of fill light.

The photographs above are good examples of using the right light for the right subject. Blue flowers look great in overcast or cool lighting conditions, whereas red, orange, and yellow flowers come alive in warm light.

Your turn to relax

Go on; treat yourself to a photo shoot that has no client except you. Grab your gear and just get lost in the fun of shooting what you want, when you want, how you want. Flowers and plants are always on hand to pose for you without complaint, or the need for payment and model releases. Enjoy. ■

Astrophotography with your digital camera

Some handy information about shooting the night sky

Shooting the night sky is not just the reserve of astronomers and large telescopes. Although you are not going to be imaging deep-sky nebulae and planets in extreme close-up, there is still plenty of scope for any photographer to create memorable and creative images of the night sky. It is a fascinating subject and with care, you can produce some stunning images of the heavens with just a digital camera, a tripod, and perhaps a useful app on your phone. Your options include twilight images, and photos of the sky long after the sun has set. Not only that, you also have some options to capture the stars in creative ways too. Have you ever wondered how you can capture the movement of the stars and turn the night sky into something that looks like the stargate sequence from the end of 2001: A Space Odyssey? Well, we have information that can help you on your way to capturing the majesty of the cosmos in work that looks really cool as well. With some basic equipment, and some easy to understand techniques, you too can explore the wonders of the universe and capture the moon, stars, and our own Milky Way galaxy this very night, if you wish. Let's get started and talk about cameras first.

"It is a fascinating subject and with care, you can produce some stunning images of the heavens with just a digital camera, a tripod, and perhaps a useful app on your phone."

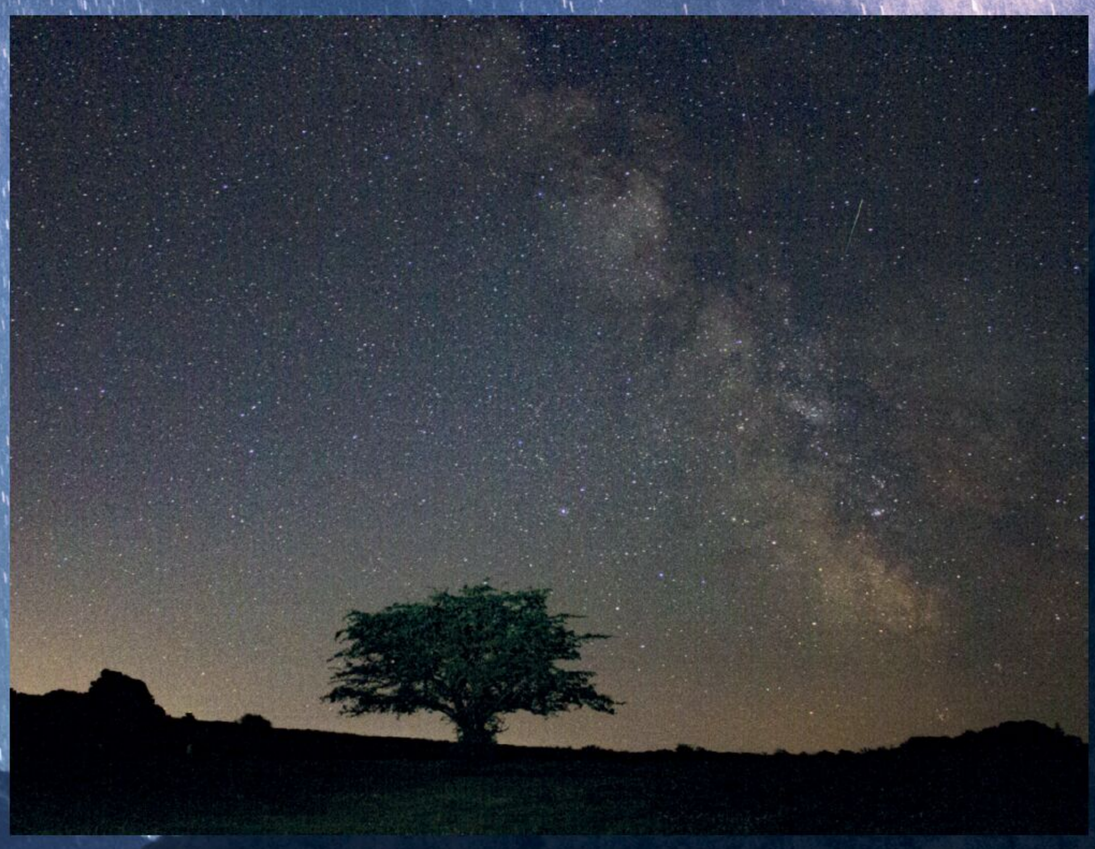
Which camera?

The gear you need is relatively simple. Your camera can be anything from a DSLR or bridge camera, down to a compact camera. You may find you need to be able to use manual settings, purely for the sake of image consistency, and it also helps to be able to shoot in Raw format although it's not a deal breaker if it can't. We mention Raw with annoying regularity but it is with good reason. Raw images, as the name suggests, is the data captured from the sensor with no compression or processing of any kind applied to it. It is literally raw and untouched sensor data. This gives you the absolute best original image quality to be working with as you get into the post-process stage of editing your photos, whether you are eking out as much detail as you can from a landscape photo or, in this case, making the night sky look its absolute best. If your camera also supports mirror lockup, then use it. Mirror lockup moves the mirror out of the path of the sensor before the exposure starts to reduce the chance of vibration causing a loss of sharpness. People do argue that it really has little to no impact on the resulting sharpness and if you are using a big, heavy tripod, that is more than likely. If however your tripod is not so sturdy, then it may still be worth using this function.

What lens?

The night sky is a big place. It encompasses from one horizon to the other and to do it justice, a wide-angle is normally the lens of choice. Wide-angle lenses in the 14mm - 28mm range are considered wide angle enough for the task. If you have a camera that has a lens with a focal length in this area, you should be good to go. Don't discount your choices if you have a compact camera with a built-in lens that has a longer focal length than this.

You could still get some great shots with an equivalent 28mm lens or longer, but your field of view would be much narrower than with its wide-angle brethren.



Sky shots generally need that wide field of view so you can capture a large amount of sky, as well as some foreground interest such as mountains or trees.

Keeping it steady

If you want great, steady, shots of the sky, you will need a tripod. You are going to be dealing with exposure times possibly in the tens of seconds. Hand-held is simply not an option. You could rest your camera on a rock, or other sturdy base, but if you want proper control over your composition, it's going to have to be a tripod or nothing. Let's face it, if you are serious about your photography, you will have a tripod anyway.

When shooting long exposures, the sturdier the tripod the better. A bigger, heavier tripod may be a pain to cart around with you, but it will keep your camera steady as a rock through those all-important exposures.

Cable release

Another useful item is a cable release. Back in the day, a cable release was a very simple affair. It was a bulb connected to a tube with a plunger at the end that you screwed into the shutter release button of older cameras. Squeezing the bulb pushed the plunger into the shutter button, firing the camera. That is where the term 'Bulb Mode' comes from when talking about using long exposures that range from 30 seconds to minutes, or even hours.

These days, cable releases are much more complex beasts. They are programmable in various ways that allow you to literally 'fire and forget'. You program what length of exposure you want, how many shots you want to be taken, and the amount of time the camera pauses in between each shot. This is much better than standing there in the dark with your finger on the shutter button, holding it down while a 2 minute exposure counts down and possibly shaking the camera in the process.

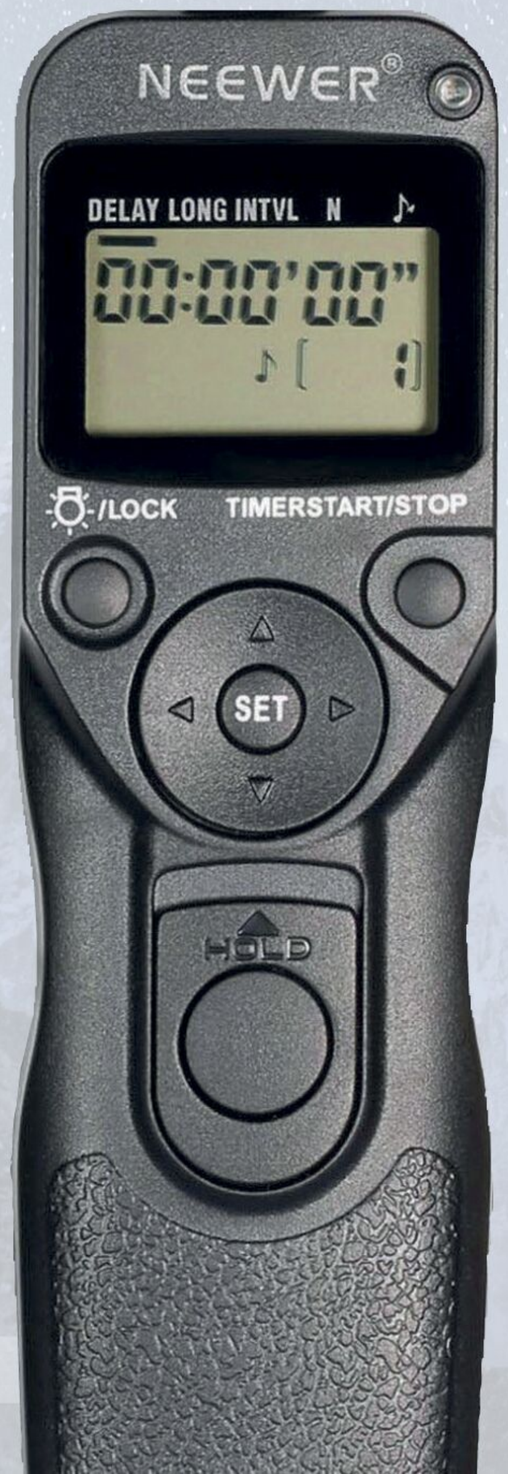
Noise reduction

Since we are talking about long exposures, a lot or current cameras offer what is called Long Exposure Noise Reduction (LENR). Exposures that last many minutes can cause the camera sensor to heat up. This heat can generate additional noise that can degrade the quality of the image. When you take a shot with LENR active, the first normal exposure is recorded, and then it shoots a so-called 'dark frame' that is the same exposure duration as the first. It records the amount of noise caused by the heat of the sensor and it uses this frame to cancel out noise in the first normal exposure. In practice, people argue that it is not worth the effort of having to wait 10 minutes for your first exposure, for example, and then wait another ten for the LENR frame to be recorded. You could literally be there all night! You may be better off keeping LENR disabled and using more effective noise reduction options at the post process stage.

Long or short exposures?

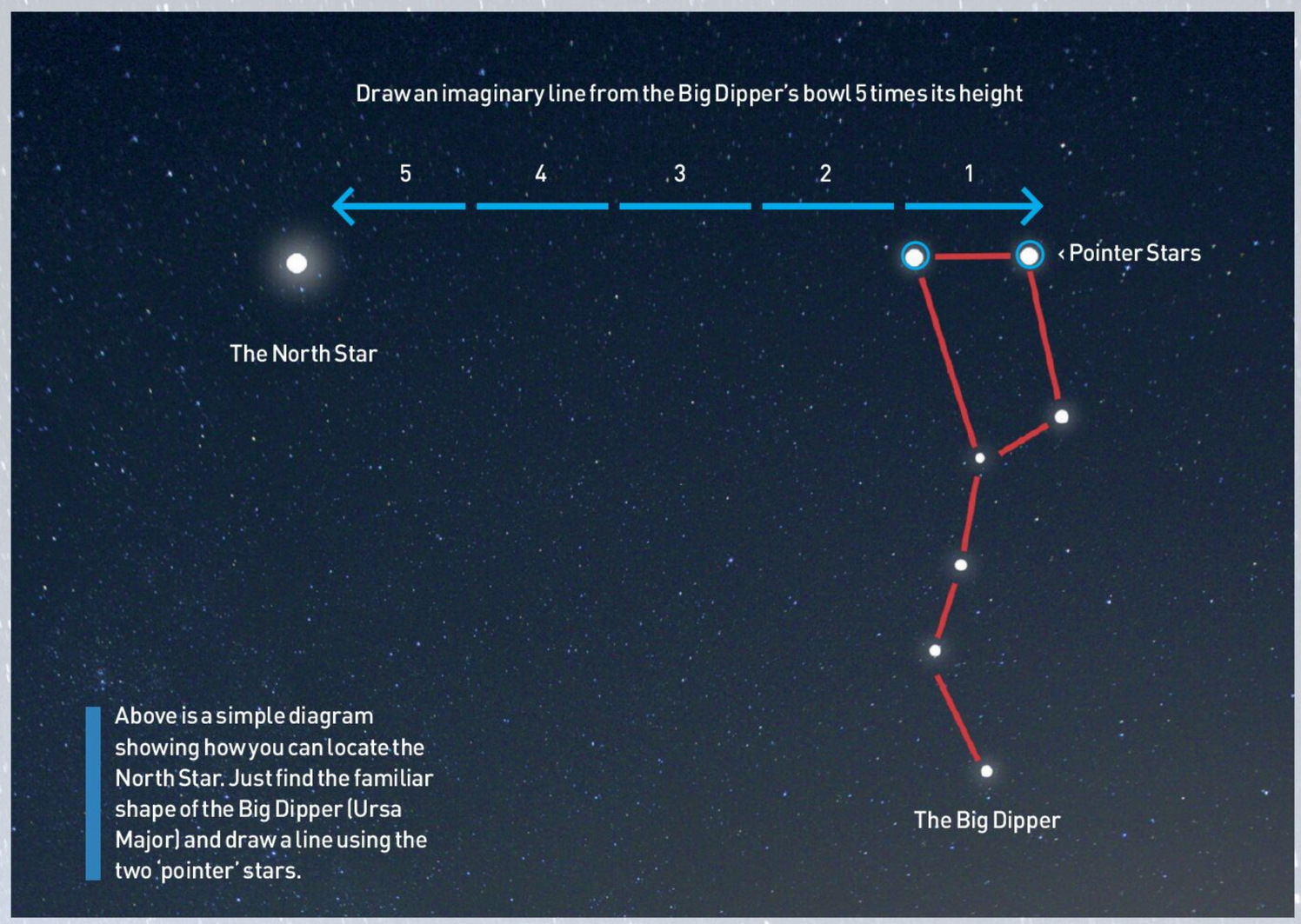
As you prepare for your shoot, one thing to consider at the outset is what kind of pictures you are hoping to capture. If you are looking to shoot the sky and keep all the stars as well-defined points of light, then you will need to shoot relatively short exposure durations so the movement of the earth does not transform the stars into smeared light trails. Of course, if the reverse is true and you do want to capture long star trails, then you are not as constrained by your exposure time. Later in this article, we have two examples of night sky images. One is a typical star trail photo and the other is a capture of the Milky Way. We will cover each one in a bit more detail shortly.

The humble cable release has evolved over time. Now, it is a small programmable device often referred to as an intervalometer. It can control your camera's exposures so you can adopt a hands-off approach.



Composition

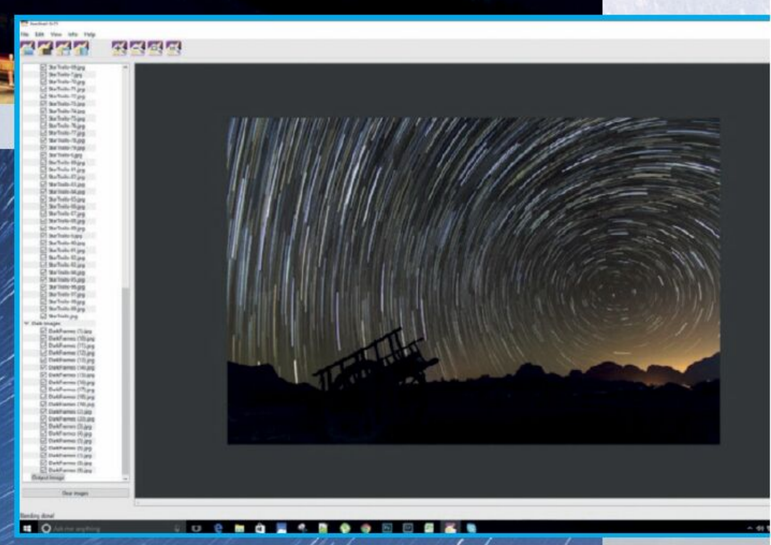
This is once again down to personal preference. Portrait and landscape orientation works equally well. Obviously, portrait orientation means you can see more of the sky vertically up from the horizon but the broad sweep of a landscape shot is just as good. The only time portrait orientation is preferred, is when trying to capture the polar star Polaris. Also called the North Star, this is the star that doesn't move through the night sky as the earth turns. Shooting a star trail with the North Star in the frame means you will capture an image that looks like a giant pinwheel, with all the other stars rotating around the one point. The North Star can be found at the end of the handle of the 'Little Dipper' (Ursa Minor). You can also use the two stars on the farthest side of the bowl of the 'Big Dipper' (Ursa Major) as pointer stars. Draw an imaginary line that connects the bottom of the bowl to the top of the bowl, and then extend that line outwards about 5 times the height of the bowl until you see a much brighter star. That is Polaris.



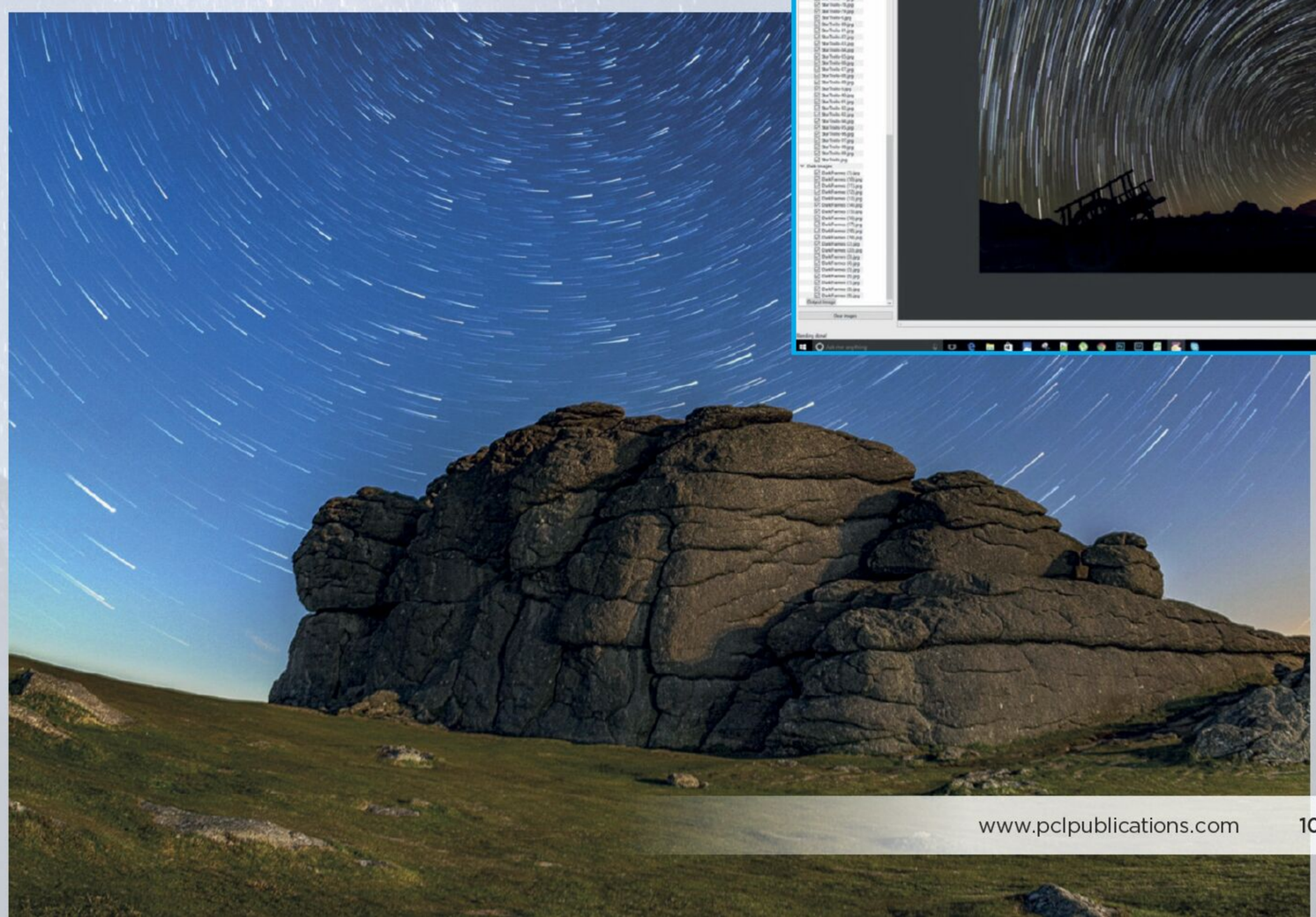
Above is a simple diagram showing how you can locate the North Star. Just find the familiar shape of the Big Dipper (Ursa Major) and draw a line using the two 'pointer' stars.

Star trails first

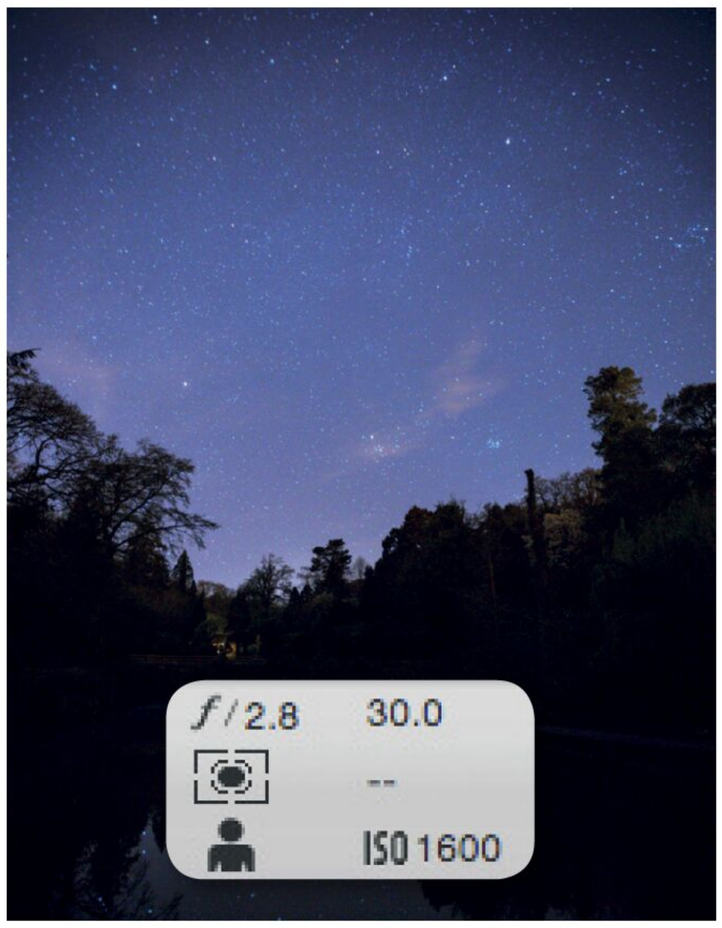
There are two methods that can be used to capture star trails. The first is to shoot one long exposure. This can range from 10 minutes up to 30 minutes, and in some cases even longer. Prevailing weather, light pollution, and the phase of the moon will have an impact on the exposure time. If the moon is bright, you'll need to be careful; it will put a limit on your exposure times as its ambient glow will start to overpower the stars. A black, moonless night will let you shoot very long exposures to capture the movement of the stars with enough starlight to illuminate your environment. Obviously, you don't want to do an hour long test shot only to find you are using the wrong settings. A great method to get a test shot, taken in a reasonable amount of time, is to bump the camera ISO up to its maximum and shoot wide open, with your lens' maximum aperture. Once you have a balanced exposure, you can use those settings to calculate how the settings should alter to keep the same balanced exposure if you take the ISO down to 100. Luckily, there are plenty of apps available for your phone that can do those calculations for you. One tried and tested app is Expositor. It has been around for a while now but it does a great job.



The alternative to shooting one exposure over a long enough period of time to register movement, is to shoot much shorter exposures with settings that capture the brightness of the stars, without showing movement, and stack these images together. You can use Photoshop to do exposure stacking or you can use software such as Image Stacker, DeepSkyStacker, and StarStaX to automate the process for you. Alternatively, the short exposure approach is different, but for many, it is the preferred way of doing things. This time you need to get some balanced settings that give you a much shorter



A clear night on Dartmoor, with the craggy rocks of Hound Tor in the foreground, provide the elements needed for another star trail image sequence. Shot with a Nikon D810 and Tamron SP 15-30mm f/2.8 lens.



Here's an example of another single frame from a star trail sequence looking across a small lake. The reflection of the stars in the water gave us an extra visual bonus. Shot with a Canon 5DMK3 and 16-35mm f/2.8 lens.

exposure time, but shows the stars clear and bright with as little visible movement as possible. This usually means an exposure time of 30 seconds or less. This is where the large maximum aperture of f/2.8 mentioned before comes in handy. It means you can get shorter exposures at f/2.8, with lower ISO settings than if you had a lens that had a max aperture of f/4 or f/5.6. With the camera settings ready, you need to shoot a sequence of images over a period of time that replicates a single exposure of, say, 30 minutes to an hour.

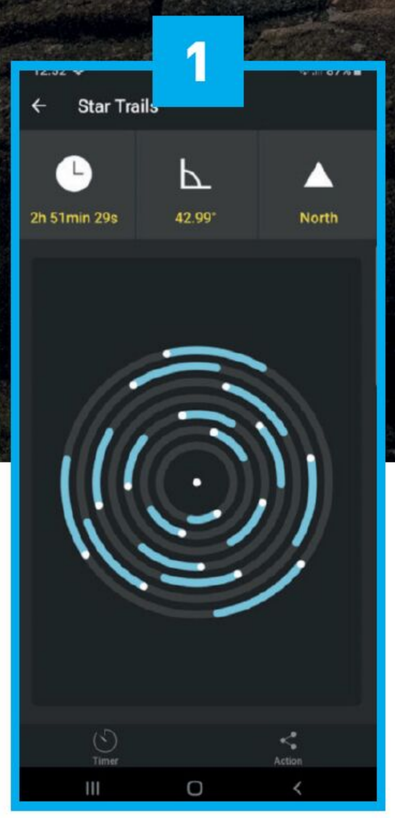
One clear evening, with no moon in view, we set out to capture some star trails. We were armed with a Canon 5DMK3 and a good EF 16-35mm f/2.8 wide-angle lens. We had a robust Manfrotto tripod and an intervalometer to automate the shooting process for us. In addition, as we were going to be trudging around at night, we had stout shoes and warm clothing including hats and gloves. Clear nights can get cold in the UK and we knew we would be sitting around for many minutes

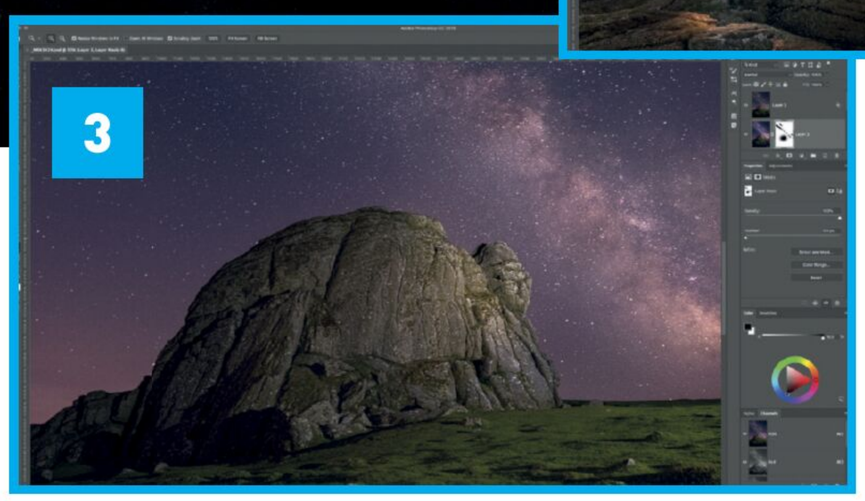
The inset image shows a basic exposure taken without the aid of any light painting to illuminate the rock. The main image below shows how the shot transforms with some simple torchlight from the right of frame.

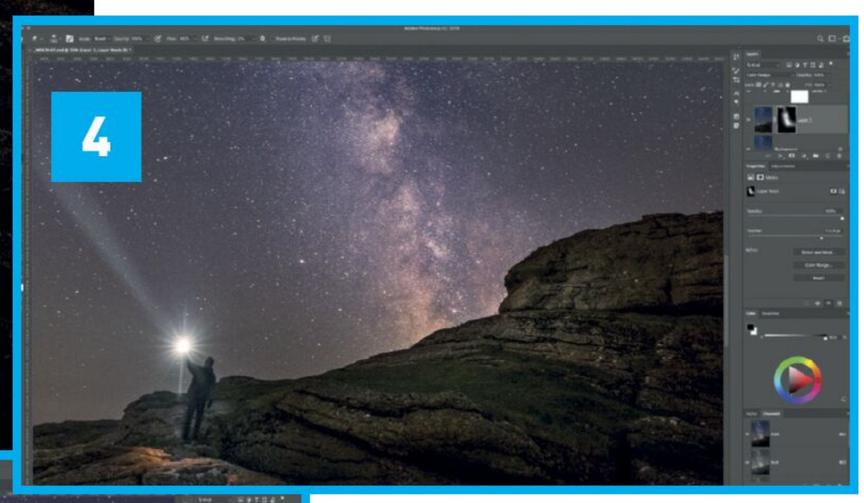
at a time waiting for the exposures to finish. Last, but not least, was a powerful head torch so we could navigate the dark environment easily. We found a spot that we knew faced due north. We found Ursa Major and used it to pinpoint the North Star. Our composition was set up to include the North Star in the shot. A few test shots revealed the best settings of aperture f/2.8, bulb duration of 30 seconds, and ISO 1000. The intervalometer was set to fire the camera and take 30 shots using those settings. The lens was manually focussed at infinity, and the button was pressed. 15 minutes later, the sequence was done. We then moved location to the side of a small lake, and set up a composition that would show the stars reflected in the lake waters. The settings were almost the same as before, apart from boosting the ISO to 1600, as it was nearly pitch black. Another 30-shot sequence was captured.

The Milky Way

Having captured some stunning star trails, it was time to try something that we had not attempted before, but had always wanted to. Getting shots of the Milky Way is not difficult, but it does require a bit of planning and forethought to get some nice examples. You need to know where the Milky Way is going to be in the sky, what elevations you are dealing with, and also what times it will be visible. Luckily, there are plenty of apps that can tell you. A personal favourite of ours is PhotoPills. It is a very feature rich app that's capable of everything from calculating hyperfocal distances and planning sunrise and sunset shoots, to exposure guides and, in this case, Night AR. This feature allows you to view a scene on your mobile







PhotoPills (1 and 2) is a great app for all kinds of photographic endeavour and anyone looking to shoot the night sky will benefit from its various features. From moon phases to star trail creation and hunting down the Milky Way, PhotoPills has you covered. Back home on your computer (3 and 4), make sure you process your images with a deft touch and try not to overdo it.

device in real time, and overlay the positions of stars, the sun and moon and most usefully for us; the Milky Way. This meant we could see in advance, where the Milky Way would be during the best hours of darkness, later that night. Therefore, we knew where and when we needed to be ready. Midnight saw us arrive at Haytor Rock in Devon with our camera kit. This time we were armed with a Nikon D810 and a Tamron 15-30mm f/2.8 ultra-wide angle lens, as well as some torches, in case we wanted to try some lighting painting too. We set ourselves up with the granite tor as our prominent foreground item and, since the sky was clear and there was no light pollution, we could easily make out the Milky Way splashed across the sky. This allowed us to set up our compositions accordingly to combine the rocky tor and the starry sky to best effect. Once the composition was set up, we needed to figure out settings to capture the stars without motion blurring them. There are a couple of equations that photographers can call upon.

The 500 and NPF rule

The 500 rule was originally developed for a full frame film camera and requires you to set your camera to ISO 3200, Aperture to f/2.8, and shutter speed to 500 divided by the focal length of your lens. For example, if you were shooting with a 50mm lens, your shutter speed would be 10 seconds (500 / 50 = 10). Many would advocate the use of the newer NPF rule which is a much more complex equation, but takes into account the better quality imaging technology on offer today. Apps are available that calculate the maths for you based on the camera you are using.

We decided to go with the easier 500 rule to begin with, and since we were using a 15mm lens, this would mean a shutter speed of roughly 30 seconds with the aperture at f/2.8 and the ISO set at 2000 for a decent exposure. Your focus for images of this nature require you to set focus manually at infinity, or to lock focus on a distant object and then set it to manual so the focus, once set up, didn't change. A few test shots showed that this was working well, and on the Nikon D810, even the ISO value of 2000 still gave good, clean, results. What was not working so well was our foreground interest. The rock looked dark and uninteresting. Since we had torches, we decided to try some of the exposures with torchlight being shone on the rock face from camera right. Suddenly the images transformed, and the granite tor looked far more interesting when lit from one side. We were able to come away that evening with some great images of the Milky Way, ready for processing back on the computer.

Post processing

So you have your sequence of images for your star trails and Milky Way shots, the next stage is to process them in your favourite Raw editing program. Adobe Camera Raw (ACR) and Lightroom (LR) are perfect for the job, but you may also have software provided by your camera manufacturer. The main thing to be aware of is to process your entire sequence all at the same time, so that you have consistency. Try not to be too heavy handed but make sure your stars are bright and clear. You can then save the sequence as a series of good quality jpegs or tiffs, ready to be stacked. The stacking sequence in Photoshop is relatively easy. You just need to load all the images as a series of layers into one document. Then make sure they are all selected and set the blend mode to Lighten. All the brightest detail will be merged and you will be able to see the path taken by the stars in one beautiful star trail.

The single Milky Way images can be processed to reveal maximum detail and then brought into Photoshop for any final finessing that you may require. With that, you now have two very different approaches to capturing the night sky. ■

Beaches, snow and very bright scenes

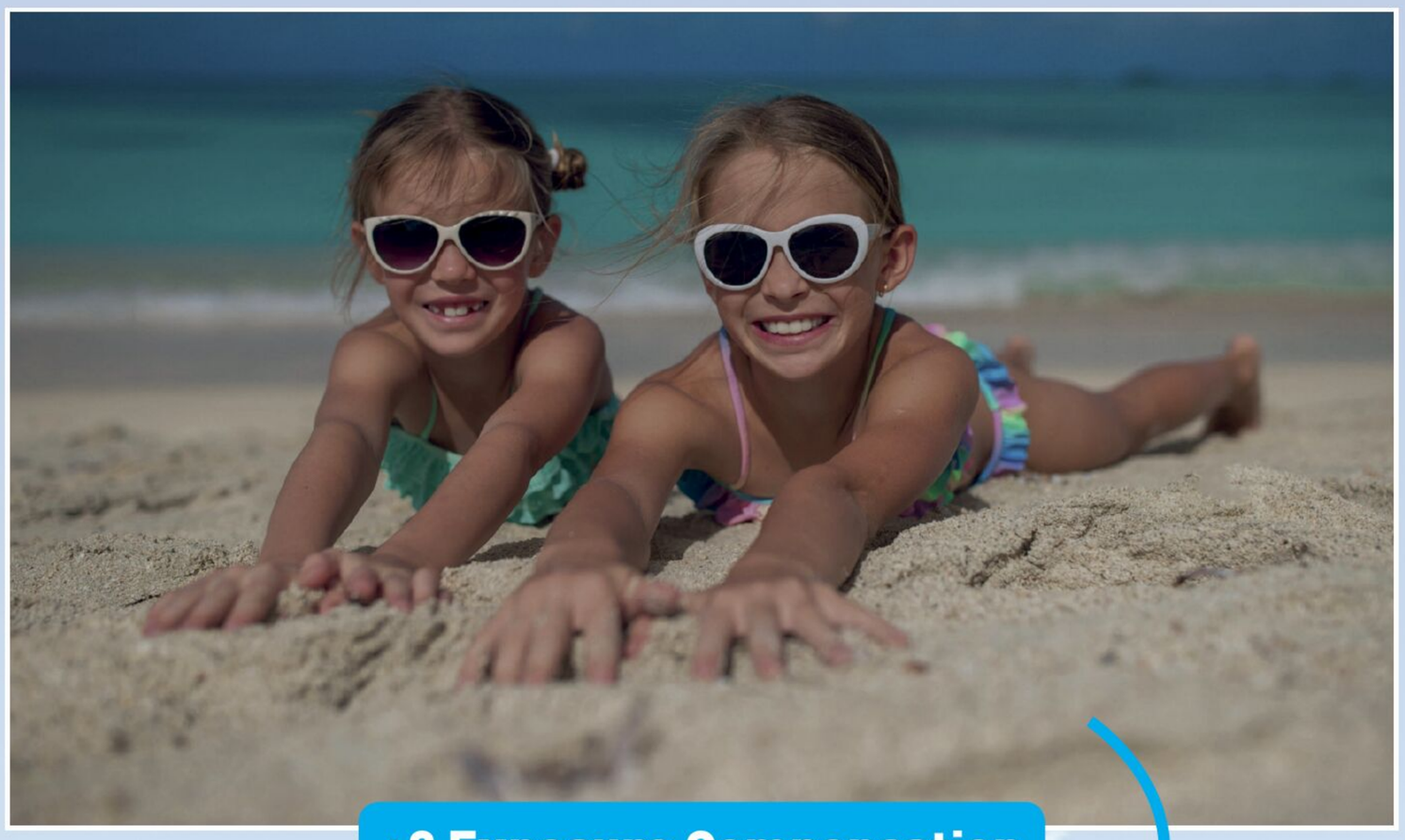
Very bright scenes can be an exposure nightmare

If you've ever taken a photo where most of the background was white snow, or bright white sand on a sunny beach, you've probably been disappointed by the results. That crisp, white snow comes out looking grey and murky, while your subjects come out looking very dark and under-exposed. There is a very good reason for this, and fortunately, it is very easy to correct.

The problem lies with your camera's light meter. It is designed to measure the light and set the exposure for an average scene and, under average conditions, it will normally do a very good job. This is because an average scene has an unusual property; it reflects approximately 18 per cent of the light falling on it, equivalent to a mid-tone grey. It doesn't matter if it's a landscape of rolling fields, a city street, or your own living room, the average amount of light reflected is always around that magic 18 per cent figure. Your camera's light meter is calibrated to take account of this fact, which is why it will produce the correct exposure in any normal situation. In fact, professional photographers will often use a special 18 per cent grey card to help make very accurate exposures. They will have their model hold the card, or place it in the scene to be photographed, and take a spot meter reading from the card.

"However good your light meter is though, it will start to have problems whenever it tries to measure a scene where the light reflection is different from the average."

You could be forgiven for wondering why scenes like the examples shown here could possibly give you exposure problems. The problem, as it turns out, is not the scene but your camera's metering system, as we will show you.



+2 Exposure Compensation

A bright beach scene is a typical example of the kind of conditions that can fool your camera. The top example would have been taken with a default meter reading. Adding +2 stops of exposure compensation brings the next attempt up to a more accurate representation of the actual conditions at the time.

Compensate

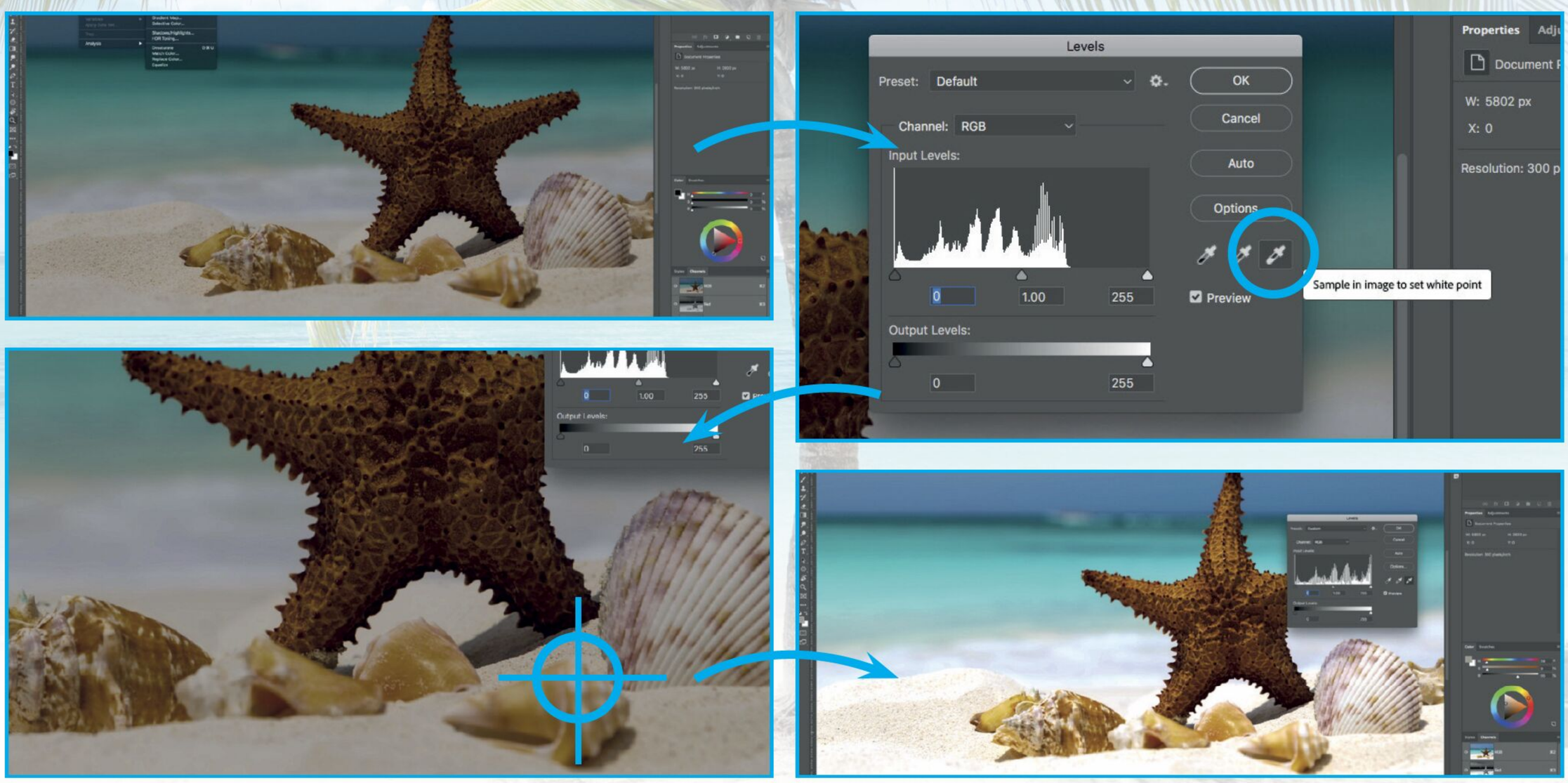
However good your light meter is though, it will start to have problems whenever it tries to measure a scene where the light reflection is different from the average, and snow/beach scenes are a prime example. The bright surface reflects much more than the usual 18 per cent of available light, but your camera meter doesn't know this. The light meter measures the light reflected by the scene, and assumes that it is supposed to be the usual 18 per cent. As a result, what was supposed to be white comes out as a mid-tone grey, and any non-white elements in the scene will be very under-exposed. We can correct this, to some extent, by using the exposure compensation feature found on all digital cameras. By adjusting it to +2 or +3, we increase the exposure and the brightness of the image, restoring the white background to white, and ensuring that our subjects are now correctly exposed. Increasing the exposure does have two potential drawbacks however. First, it usually means using a much longer shutter speed, which increases the risk of camera shake. If your camera has image stabilisation make sure it's switched on, and if you have a tripod or monopod, use it. The second problem is that of over-exposure, which could result in the snow or sand being completely burned out, leaving a plain featureless area of white in your picture. This is always a risk, so if your camera has exposure bracketing it is a good idea to make use of it.

+3 Exposure Compensation

Very bright conditions, such as those encountered in sunny, snowy environments, will require even more exposure compensation. An example like this might even require up to +3 stops of adjustment to get a more accurate idea of the brightness in the scene.

Spot metering

Another good way to avoid this problem is to use spot metering, if your camera has this feature. It is a little more complicated to use than the normal multi-zone metering, but the results will often be much better. For most cameras, the way to use spot metering is to aim the centre-spot of the frame at the subject's face, half-press the shutter button to take a light reading, and then keeping the button half pressed, compose your picture and take the shot.



What if?

But what if you've already taken your photo, and it looks grey and dull as described above? Fortunately, it is quite easy to fix this using image editing software, especially a good package such as Adobe Photoshop, Photoshop Elements, or Corel Paint Shop Pro. The tool that can correct this problem is Levels, which makes fine adjustments to the brightness and contrast of an image. In Photoshop it can be found by using the keyboard shortcut CTRL + L (Cmd + L on a Mac), or in the Image > Adjustments menu. The levels dialogue includes three buttons for setting various tone points in an image, one of which is used to set the white point. Simply click on this button, and then click on any part of the image that is supposed to be white. The program will then adjust the brightness histogram to make that point white and, in the process, brighten up the whole image.

If you are feeling a bit more creative you can achieve much more accurate results, with usually less loss of detail, by manually adjusting the levels sliders. Move the left (black) slider to the right, and the right (white) slider to the left to equalise the histogram, then carefully adjust the mid-point slider to lighten or darken the image until the snow or sand is mostly white but with some visible details.

Shoot with confidence

Now that you have some insight into why certain photos always turn out different than expected in very bright lighting conditions, you can now approach these scenes with a little more confidence and get the shot right first time, every time. ■

HDR photography

We shed light on this multiple exposure technique

High Dynamic Range or HDR photography is the technique by which a much greater dynamic range of luminosity can be captured by a digital camera that more closely resembles what the human eye can perceive. Rather than taking one shot, a sequence of shots at different exposure values are captured instead. Later they are processed using software to extract the best tone and detail from each shot and combined into a final image that is converted into a low dynamic range image (LDR) that can be viewed on standard monitors or reproduced by inkjet printers.

Brig upon the Water. Taken by Gustave Le Gray in 1856. An early example of high dynamic range techniques to capture as much tonal range in an image as possible.

Use of HDR

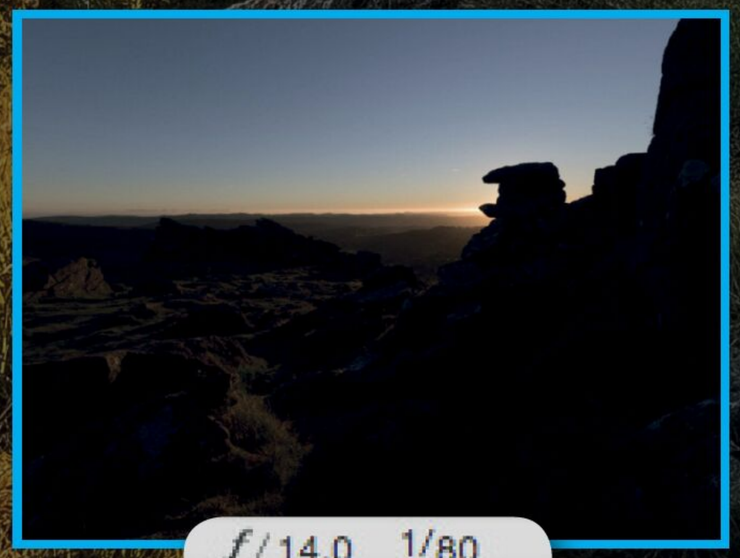
HDR has been with us for some time. It may be a surprise to learn that HDR imaging was being used as far back as the 1850s. Early pioneer Gustave Le Gray used to photograph seascapes where the tonal difference between sea and sky was too extreme. He would achieve the final image by exposing two separate negatives. One exposure would be balanced for the sky on one negative and a longer exposure for the sea. The two negatives were then combined to create a final print. Although those images were captured more than 160 years ago, the basic photographic techniques have not changed.

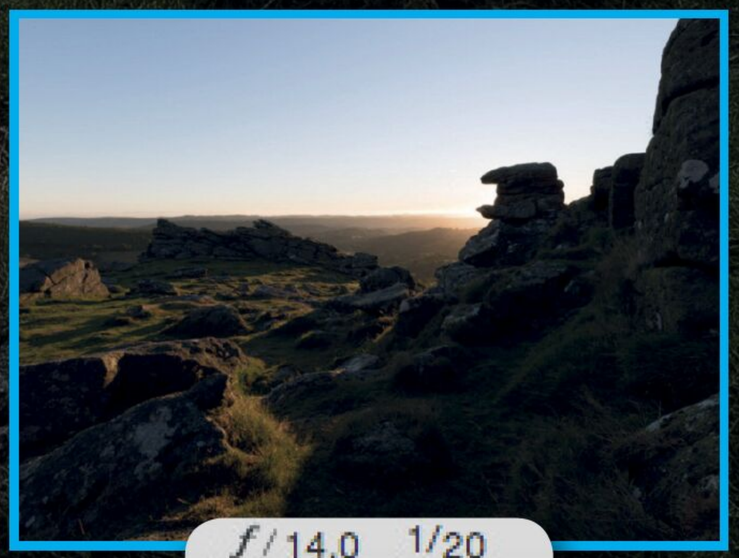
Technical limitations

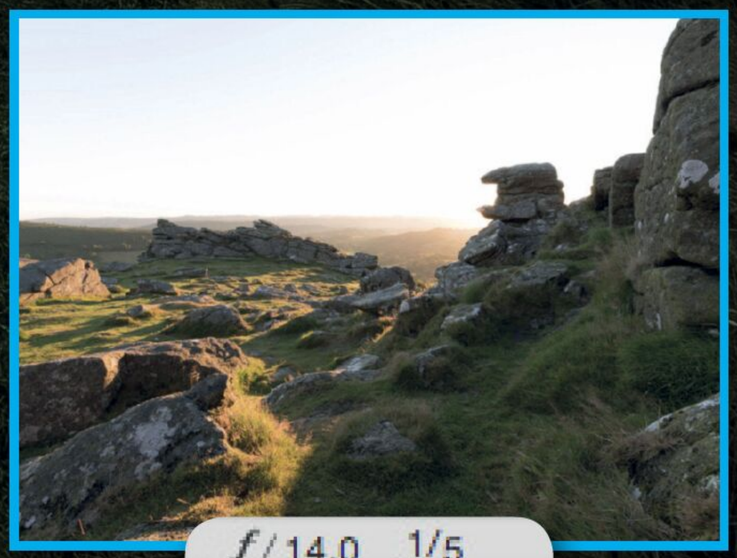
Even the most modern cameras can only capture a certain range of tones between pure white and pure black present in a given high contrast scene. Dynamic range is measured in stops and digital camera manufacturers may quote the maximum dynamic range that their cameras can resolve using that unit of measurement. A stop is essentially a doubling or halving of the amount of the light level recorded in a scene by a camera.

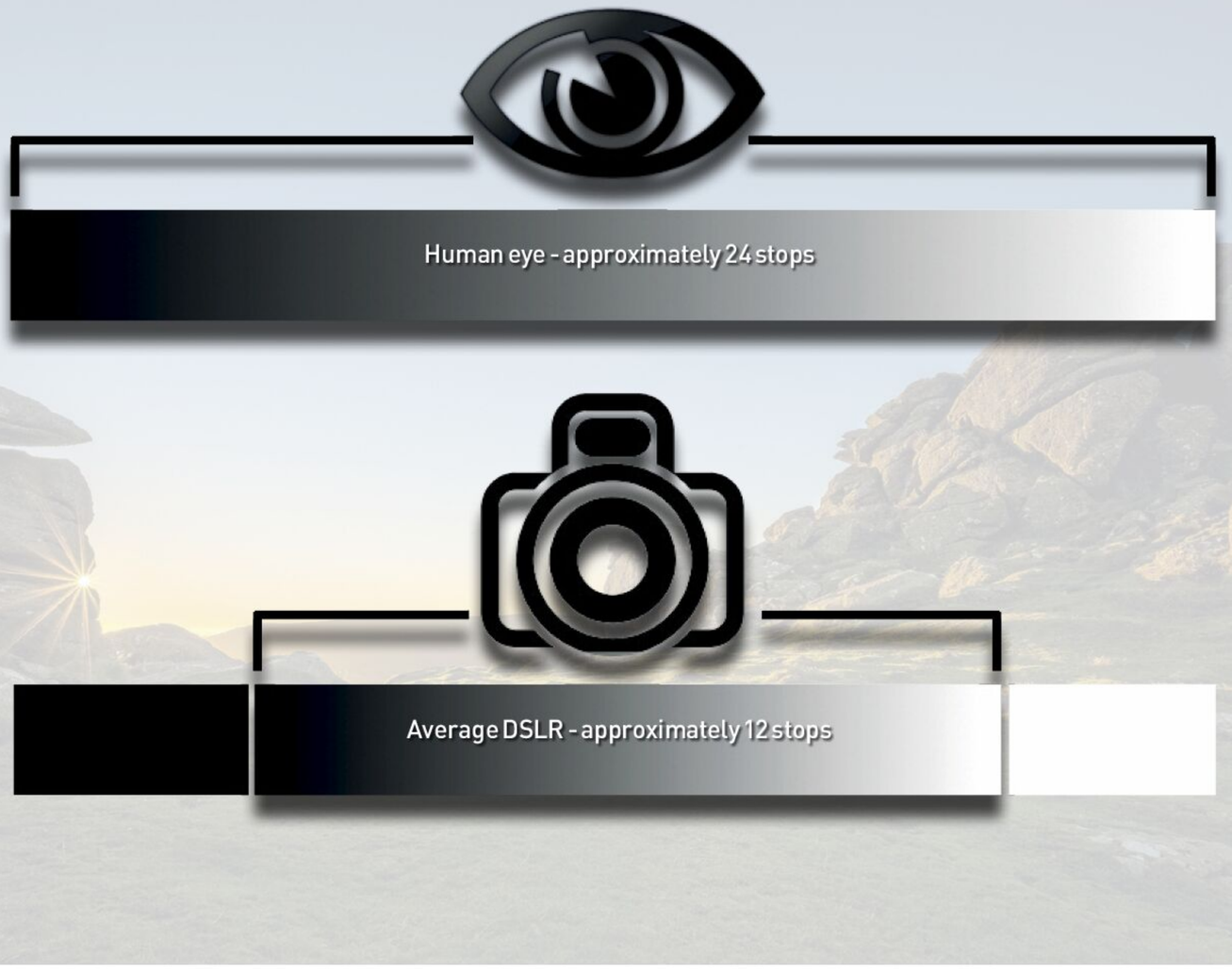
"The human eye can perceive around 24 stops of light from darkest black to brightest white. Most digital cameras can only capture approximately 12-14 stops."

A standard 3 shot sequence, 2 stops apart, was used to create the final image you see on this page. The only setting that was altered during the sequence was the shutter speed.









This image shows you a simple comparison between the dynamic range that can be seen by the human eye, versus the average DSLR camera.

See what the eye sees

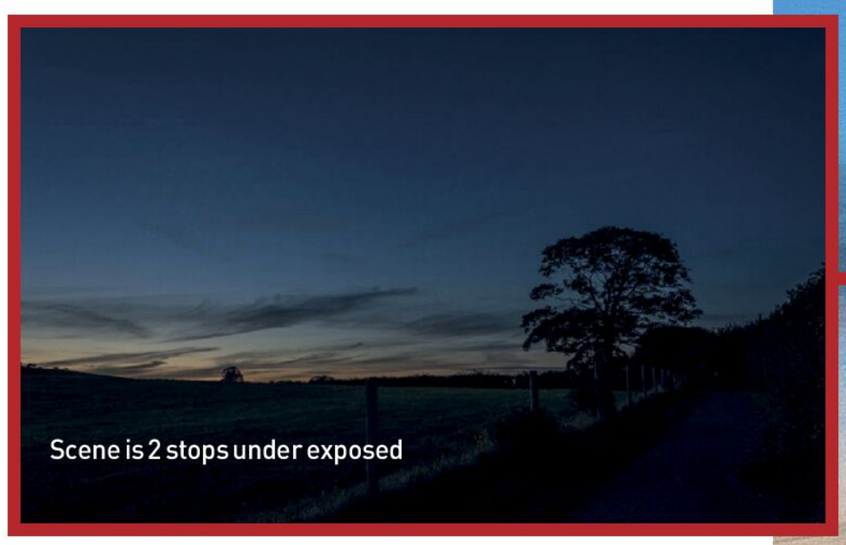
The human eye can perceive around 24 stops of light from darkest black to brightest white. Most digital cameras can only capture approximately 12-14 stops. Currently, cameras like the Nikon D810 and D800E have some of the best dynamic range around. Even this is not enough to fully capture all the light available in the scene like the human eye does. The trade-off will be that you have to take a shot that retains the brightest areas of the shot at the expense of losing details to solid shadow; or you retain detail in the darkest areas and face the prospect of the brightest areas blowing out to pure white and losing detail that way.

An example

A lovely sunrise or sunset image with a silhouetted foreground object is a typical example of how much light goes unseen by a camera. Although the sky may look beautiful and well exposed, the foreground object is in silhouette, purely because the contrast between them is far too great for the camera to accurately record. Set your exposure to reveal detail in the foreground object and the result will be a sky that blows out to pure white with complete loss of detail that no amount of processing would be able to recover.

Bracketing exposures

To capture the scene in all its glory, you will need to take several shots of the same scene but with different exposures. This is referred to as Auto Exposure Bracketing (AEB). You'll need one exposure sufficiently underexposed to capture the brightest parts of the scene, such as the sky, correctly. Next is an average exposure of


Scene is 2 stops under exposed

Scene average exposure

Scene 2 stops over exposed

A good sturdy tripod is essential for HDR photography. You want your shots as rock solid as possible with no movement between exposures. Hand held images are possible but even slight movement between shots can lead to ghosting in the final processed image.

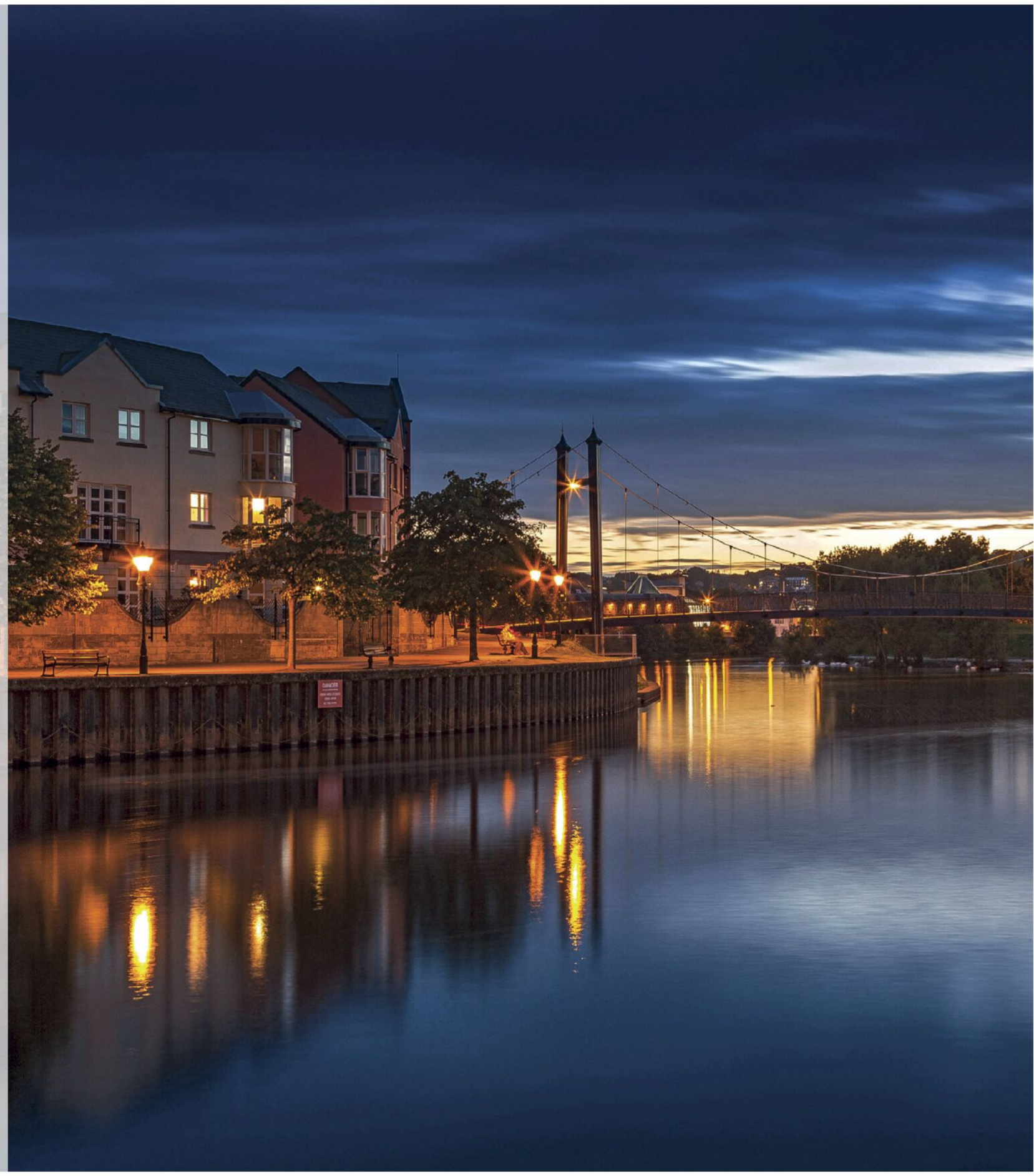
The Nikon D810 has impressive dynamic range but even it can't compare to nature's greatest camera, the human eye.

the scene and finally, an overexposed shot that records the darkest areas of the shot in sufficient detail. The set up to do this is fairly simple. There are just a couple of things to be aware of before you start shooting.

Things to bear in mind

You will be shooting multiple exposures of the same scene and will need to set your camera up on a tripod, so that it is held securely with no chance of camera movement. If you try to shoot hand held, even the slightest movement between each shot could ruin your final HDR image because of image mismatches.

Wide angle lenses such as the Sigma 10-20mm f/3.5 for crop sensor cameras or the Canon 16-35mm f/2.8 are great choices for HDR photography where you want to capture large environments that are the staple of photographs taken with this technique.



Remember also that certain scenes are not suitable for HDR. Any shot that contains a lot of movement, such as trees swaying in the wind, will result in final images having many ghosted areas, as things have moved between each of the exposures. Nice static scenes work best, although things such as flowing water can sometimes work quite well if you have long enough exposure times to render it soft and fog-like.

It is also generally held that HDR images work to their best effect, if you shoot using an aperture as small as possible for maximum depth of field and acceptable sharpness throughout the scene. Shots with very shallow depth of field can sometimes come out with banding and image artefacts once processed into a final HDR.

The choice of lens to use is very subjective but generally speaking the main subjects for HDR images are landscapes or cityscapes that require a large field of view to take in the scale of the scene. Any lenses that fall within the 16mm - 35mm zoom range for full frame sensors or 10mm - 20mm for APS-C sensors will do the trick but it is entirely up to you.

Getting set up for HDR

Make sure your camera is set up to shoot Raw. We say it time and again but it rings true with techniques like this where you want to squeeze every last pixel of usable data from your images. The technique will still work with JPEG files but if you can, use Raw. Shooting Raw also means you don't have to worry about making sure you set things like White Balance to manual rather than auto in order to keep the white balance consistent across the exposures you take.

Make sure your ISO sensitivity is set as low as possible so that there is as little image noise as possible. Remember that higher ISO values result in more image noise. Most cameras will let you set ISO 100. Some let you go down to ISO 50, although there has been debate as to whether this results in a small loss of dynamic range at this lower ISO setting. Set your metering mode to Matrix (Nikon) or Evaluative (Canon). This measures brightness and contrast in the scene and determines what the exposure should be to give a good overall average. Then make sure your camera is in Aperture Priority mode. This means you can select which f/stop you use and the camera will work out the other settings. F/11 is a good starting point. Locking down the aperture for each exposure is important to keep the sharpness consistent in each capture.

Next, you will need to select Manual Focus. As a very rough guide, you can focus one third of the way into the scene to get as much front to back sharpness as possible. Manual Focus also means you are able to determine the point of focus rather than the camera deciding for itself. You can use your camera's live view function if it has one, to determine whether the area you want is in sharp focus. If you have a particular object that you want to be the absolute point of focus, then use your camera live view to get that in sharp focus.

Almost there

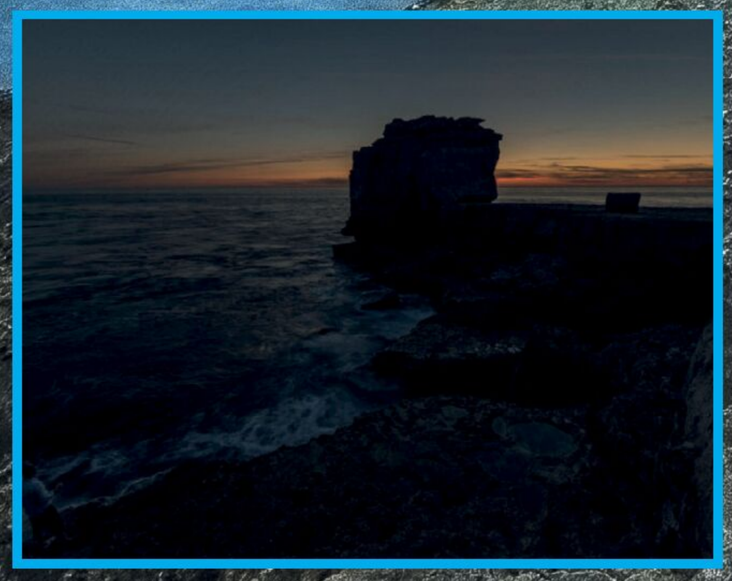
Then comes the key to getting the exposure range required. You will need to turn on your camera's Auto Exposure Bracketing function. You may need to dip into your camera's manual if you haven't used it before and locate the AE Bracketing function. Here you can specify the sequence of shots your camera takes and just how much underexposure and overexposure will be applied to the shots. Depending on your camera model, you can shoot a 3 shot sequence. Other models allow you to shoot 5, 7 or more shots as part of your capture sequence. You can also specify how many stops of exposure separate each shot. For instance, a 3 shot sequence 2 stops apart will result in a bracketed sequence that runs: -2 (2 stops underexposure), 0 (averaged exposure), +2 (2 stops overexposure). A 7 shot sequence 1 stop apart would run: —3, 2, -1, 0, +1, +2, +3. Generally, the more you can capture the better.

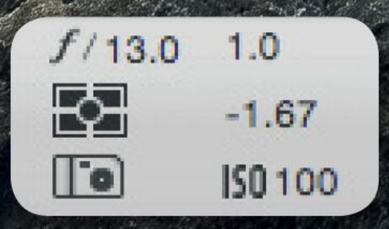
Here are a couple of bracketing sequence examples. One is a 7 shot sequence where the exposures are 1 stop apart. The other is a 3 shot sequence where the exposures are 2 stops apart.

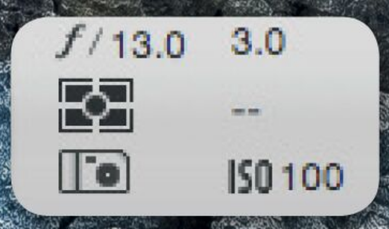
Nikon D5500 screens

Canon 5DMK3 screens

It is worth remembering that shooting a multi-image HDR sequence calls for static subjects. Having people, cars or trees moving between each shot will only create ghosting artefacts in your final image when you come to process the HDR image. An exception to the static image rule, is where your exposures are so long, it renders things like clouds or water silky smooth. These blend together reasonably well when you combine your images.







Capture the sequence

When you're ready to take the shot, you have to press the button three, five or more times to get your sequence. This can introduce unwanted movement into the equation. Most cameras can be controlled with a cable release. Better still, have a built in timer or continuous shot function that allows you to just press the shutter release button to make the camera count down for a few seconds, and then fire off the sequence with no intervention required by you. Again, for individual camera models, you may need to find this self-timer function in your manual.

No AEB?

If your camera doesn't have an Auto Exposure Bracketing function, you can still shoot an HDR sequence. You will be shooting in Manual Mode and physically touching your camera to alter the shutter speed but as long as you have a sturdy tripod, it's worth giving it a go. As an example, if you are set up and ready to shoot a three shot sequence that is 2 stops apart in Manual Mode, your average exposure for the scene results in settings of: aperture f/11, shutter speed 1/100 and ISO 100. You can take that shot, then alter your shutter speed to 1/25 for a 2 stops overexposed shot and then alter the shutter speed again to 1/400 for a 2 stops underexposed shot. It's a little more involved and hands on but it will produce your image sequence.

It is images that have been processed like this that give HDR a bad name. One can only imagine why people would want their images to look this way. The colours are super saturated, there is too much micro contrast and it is full of noise and image artefacts.

Make or break time

So you have captured your sequence. What next? You have a number of options. You will need to process your sequence of images in your favourite program. If you have Photoshop, you will also have Adobe Camera Raw (ACR). ACR is not as advanced as Lightroom but it still has a great feature set that is perfect for getting the most out of your images. You can save them as high quality 8 bit JPEG files or 16 bit TIFF files and use a third party program like Photomatix Pro or HDR Efex Pro 2 from the Nik collection. You can also use Photoshop's own Merge to HDR Pro function.

Whether using Photoshop's own HDR toning methods or the third party apps, this is where you make or break your image. HDR has something of a bad reputation because a lot of the HDR examples you see online are awful in the extreme. Many images are so badly over-processed that they look like a bad psychedelic nightmare with over-saturated colours and a very heavy-handed approach to micro contrast. The key to a good HDR image, is that it should look natural with a good range of tones. HDR images should be beautiful, not capable of giving you a migraine.

Now you can enjoy capturing and processing your HDR images and start producing photos capable of restoring the good name of this amazing technique. ■

> “ The results are surreal and there is an infinite amount of variation each time you do it.”

Liquid flow photography

Create amazing ink and paint sculptures and abstract images

This project is a great indoor photographic project. If the weather outside is not playing ball and you fancy trying something a little different, then liquid flow is the way to go. In essence, liquid flow is the capture of the movement of paints, dyes and other viscous liquids dropped, or injected, into a small body of water. The results are surreal and there is an infinite amount of variation each time you do it. Every liquid flow shot is unique. At its simplest, you can shoot with a compact camera, a strong single light source and a glass of water if you wish. For this tutorial, we’re going to show you a standard setup for capturing these intricate liquid formations using a camera, flash, a small fish tank, small glass vase and a wineglass.

The materials

First you'll need a glass container of some description to hold tap water. Everything from a wine glass to a fish tank is fair game. It just needs to be clean, clear glass, so you can see the action going on inside. Next, you'll need some coloured inks or dyes to drop into the water. Standard water based inks are great and easy to source. The downside is that when dropped into water, the colours can be quite translucent and disperse very quickly. That's no problem if that's what you're after but for more interesting liquid structures, something like acrylic inks and paints are much more dense and hold their shape for longer in the water. Alternatively, you could even try adding food colouring to single cream. When mixing either the acrylics or the cream, you need it to be fairly viscous but not so dense that when it hits the water, it just clumps together. You may have to experiment to get the right balance. What you are after is a density of liquid that allows it to disperse into a tight cloud without thinning out too much early on. If you're working in a fish tank, you might want to do some test runs in a glass of water first. The delivery method is down to personal preference. You can just put your liquids into the water tank or you can use a pipette for more droplet control. The other option is to use a syringe in order to direct jets of coloured liquid into the water. Like all the options, it is best to experiment before moving to full-scale.

A small cheap aquarium was the first container we used for the initial shots. Then we started to down size to a small square vase and then a wine glass.

There are plenty of coloured liquids to choose from. Inks, paints and dyes are perfect. If you want your liquids to be as dense as possible though, consider acrylics and even household single cream with a few drops of food colouring in it.

Syringes are perfect for accurately delivering small amounts of paint into your tank but pipettes will do just as well. Most coloured ink bottles come with droppers built in anyway.

Camera and lens

The beauty if this kind of photography, is that at its simplest, it doesn't require anything too special. You could set up a wineglass, light it with an LED torch, then drop some ink into it and capture it on a small compact camera. If you are using a continuous light source such as a lamp or torch, you may be working with shutter speeds slow enough for your moving liquids to show up as motion blurred images. You would need a tripod to eliminate any chance of camera shake with a large aperture and high ISO sensitivity to keep the shutter speeds high enough to freeze the action. We are going to use a Canon 5DMK3 and a trusty 24-105mm medium zoom lens on a tripod.

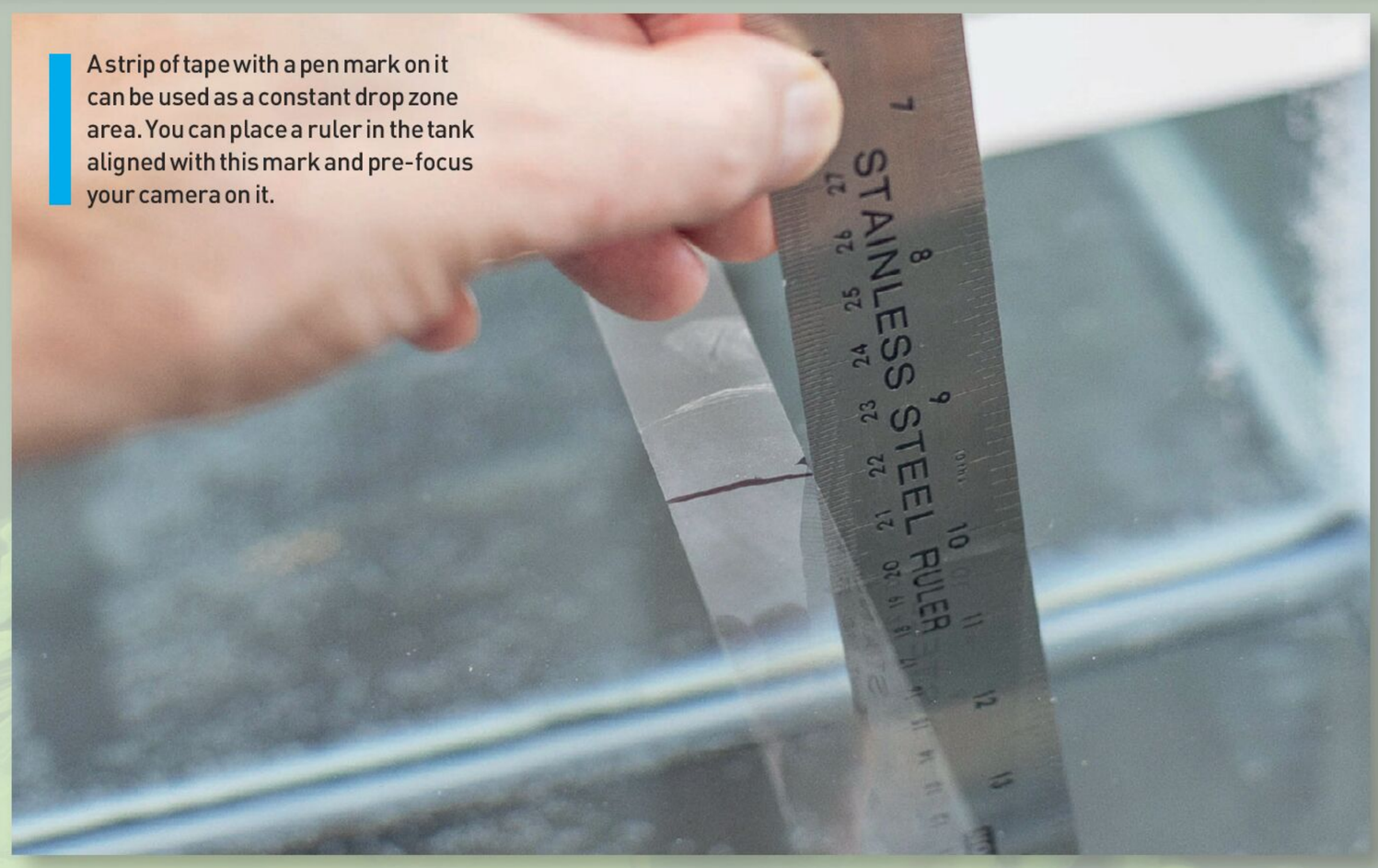
Light sources

As mentioned before, you can use a bright LED torch or two to illuminate your setup. Here, a pair of flashes controlled remotely by a wireless trigger is being used. This way you can keep things loose and move the lights about as you see fit. The flashes won't have to be used at very high power settings since they are right next to the tank of water. This is a very helpful situation since at low power, the flash duration is very short. In a completely dark room, this brief pulse is the only light that will be recorded in the shot, so the flashes effectively freeze anything they light up. More on this later.

The basic setup is shown here, with the white backdrop in place and one flash positioned to bounce light off it.

Setting it up

Our fish tank was set up in the dining room on a large black sheet of card which could be curved up to create a black backdrop for the tank. We also had a sheet of white paper which we could place on top to turn the backdrop white if needed. The tank was filled with water and allowed to settle. If you find that bubbles form on the glass, you'll need to brush these off or they will be visible in the shot and very distracting. Next you'll need to place a piece of sticky tape across the centre of the tank. Mark a line in the centre of the tape so you always have a consistent drop zone for your coloured liquids. The flashes were set up either side of the tank on tiny cheap tripods. The camera and lens were set up on the tripod in front of the tank glass and the wireless trigger was attached to the hot shoe. Our coloured liquids consisted of acrylic paints which had been thinned down with a little water and each colour was in its own syringe to avoid contaminating each colour.



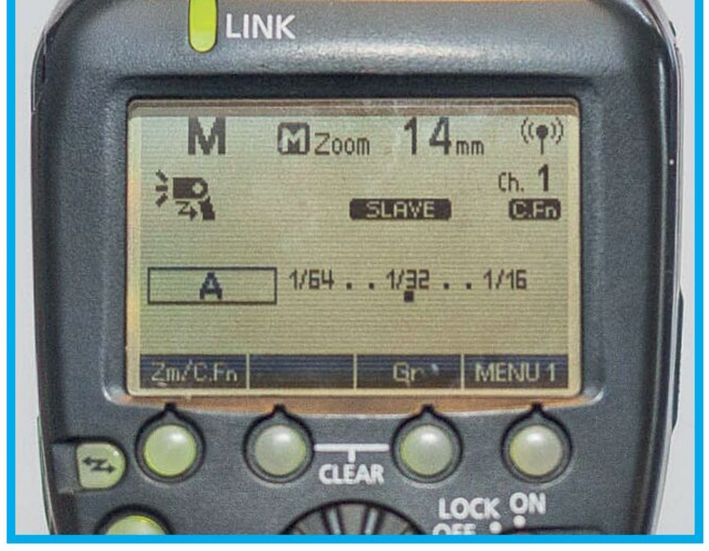
A strip of tape with a pen mark on it can be used as a constant drop zone area. You can place a ruler in the tank aligned with this mark and pre-focus your camera on it.

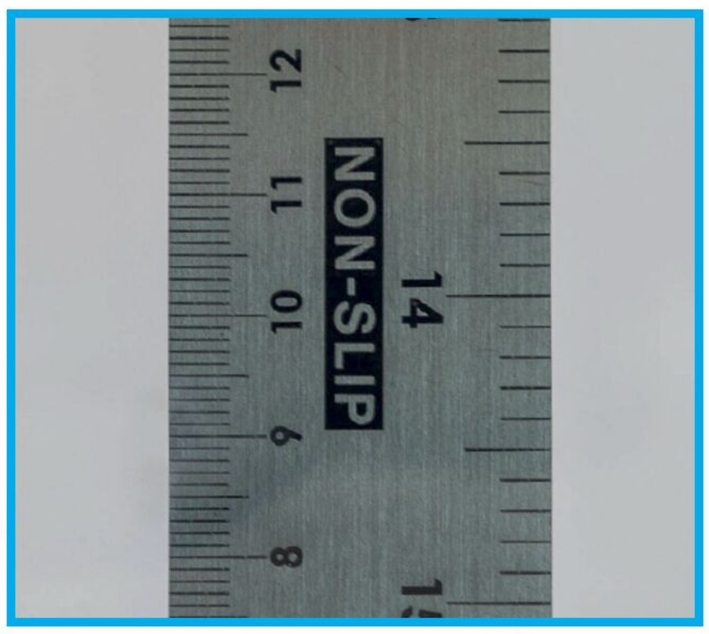
The EF 100mm f.2.8 macro and the EF 24-105mm f4 L Series were the two lenses used to capture the images you see here. The 24-105mm is a great all-rounder with a close enough focusing distance to make the tank shots possible. The EF 100mm macro lens is perfect for getting in even closer, particularly if scaling down the size of tank you're working with.

The Canon 5DMK3 was our camera of choice for the shoot. Although a few years old now, it still is a firm favourite with pros and enthusiasts alike.

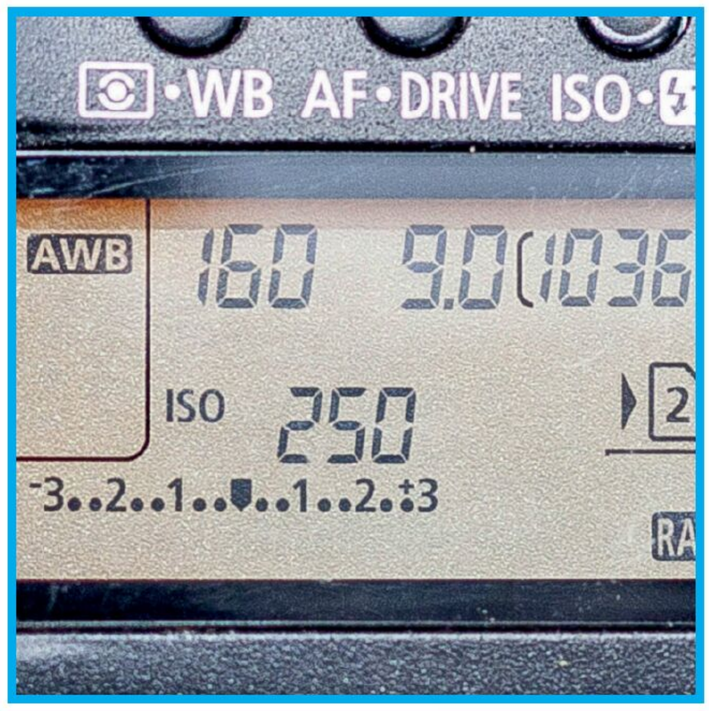
Camera settings

Now it is a case of getting the settings for the camera and the lights correct. Set the flashes at 1/32 power. At this level, the flash duration would be about 1/8000s which is more than enough to freeze the action. Then set the camera to manual focus so it doesn't alter during the shoot. Place a ruler in the tank of water in line with the drop zone mark on the sticky tape and pre-focus the camera on that. We used the white backdrop first, with one flash pointed at the backdrop and the other pointing at the drop zone area in the tank itself. Curtains were drawn in the dining room to lower the ambient light level. After a little trial and error with a static object placed in the water as a temporary target (a banana in this case as it's all we had), we arrived at settings of aperture f/9,





ISO 250 and the shutter speed was up near the flash sync speed at 1/160s. If a shot was taken with the flashes turned off, it would capture a shot that was totally black. This was perfect. Only the 1/8000s pulse from the flashes would be recorded whilst the shutter was open for that 1/160s duration. Take some test shots and look out for unwanted reflections or any stray bubbles in the tank.



Camera drive settings

This is purely optional but remember that each time you inject more and more liquid into your tank, the water will eventually be useless to you and you will need to flush it out and start again with fresh clean water. To give us the best chance of capturing plenty of liquid flow as it unfolded, the camera's drive setting was changed to Low Speed Continuous. What this means is that when you fully press the shutter release button, the camera will keep taking shots until you release the button. On the 5DMK3, this meant we could capture about three frames per second and since the flashes were only working at 1/32 power, they could be relied upon to keep emitting pulses for each frame that was shot.

First attempts

We used the red syringe first. It was placed in the water at the drop zone and gently injected into the water directly downwards. At the same moment, the shutter button was pressed and we captured a continuous sequence of about twelve shots that showed the red cloud expanding outwards from the injection point. A quick review of the shots on the camera monitor screen showed it had worked well. Now we could have some fun.

Low Speed Continuous mode was used to shoot a sequence, rather than relying on capturing a single shot.

Go with the flow

What followed next was a series of shots with different colours being used in the tank until the tank required flushing and setting up again. On the second run, we removed the white backdrop so it would be totally black and proceeded to take more shots. We tried injecting two colours at once for more variety and built up a nice collection of images.

Two syringes are injected into the water at the same time to create this fun dinosaur B movie effect.

What was becoming clear though, was that the tank was a pain to reset every time the water became too cloudy. Next, we opted to use a smaller square glass vase. We replaced the 24-105mm lens with a 100mm macro so we could get in nice and close to the action. We also decided to add some props to the water for some visual interest. We tried a bottle of nail varnish, a watch and a rubber dinosaur. The liquids were injected downwards and it was eerie to see how it slowly enveloped the props in shrouds of colour. The dinosaur was particularly funny, since it looked for all the world like a scene from a bad B movie horror film.

Last shots and processing

After these images, we downsized even more until we were shooting a wine glass. After the session was done, we loaded the shots onto the computer for a closer look. Inevitably, there were the odd groups of bubbles and particles suspended in the water but with some careful processing to boost the blacks, contrast and saturation, we could crop the images into a great little collection of liquid art and surreal images.

The liquid flow photography is a great indoor tabletop project to get your teeth into. No image is ever the same and you can have some fun into the bargain. ■

Shallow depth of field and bokeh

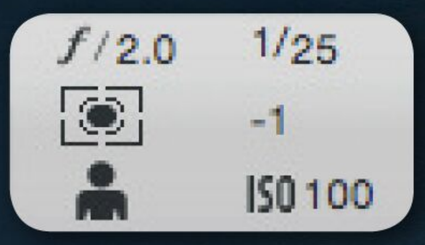
Making blur beautiful

If you have ever shot a subject with a lens that has a very wide maximum aperture, you have no doubt noticed how the out-of-focus background has an aesthetic quality to it. Bright highlights are transformed into 'orbs' of light by this blurring effect. This blurred out quality is referred to as Bokeh, usually pronounced "boh-ka", but the jury seems to be out on a final definitive pronunciation. The bright, soft, orbs of light are a by-product of the out-of-focus light being shaped by the aperture blades within your lens. If your lens has an 8 blade aperture configuration, then your bokeh shapes will be octagonal as well, although the shape will become less well defined as the aperture opens up to its maximum. It has been known for some photographers to choose a lens specifically for the shape the aperture blades make at different aperture settings. They will often opt for lenses where the diaphragm blades are curved to ensure the bokeh is a purely circular as possible. It is probably less well known that you can be in full control of your bokeh by following some simple techniques.

> "It has been known for some photographers to choose a lens specifically for the shape the aperture blades make at different aperture settings."

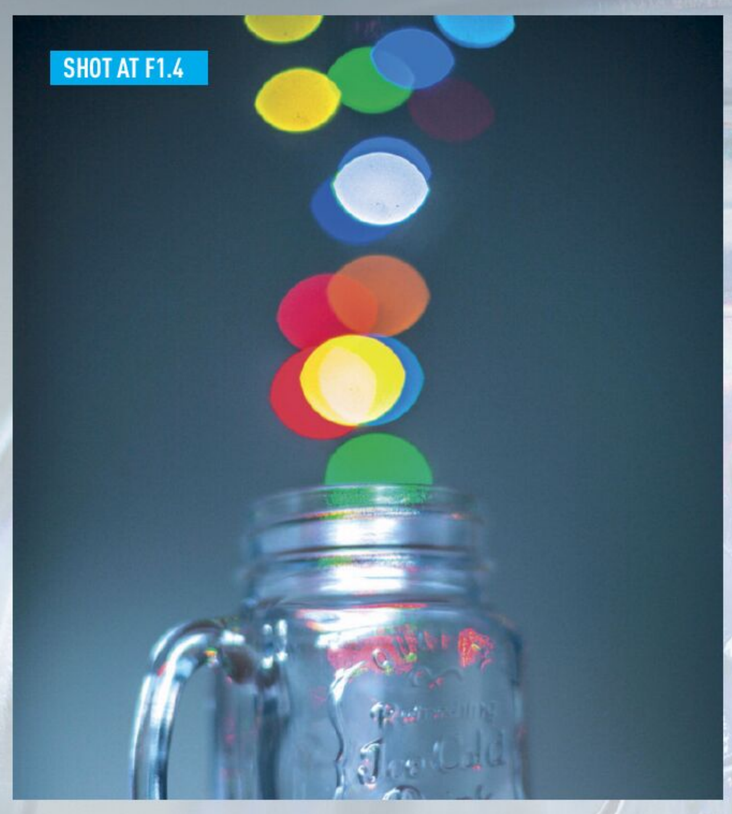
Bring out the bokeh

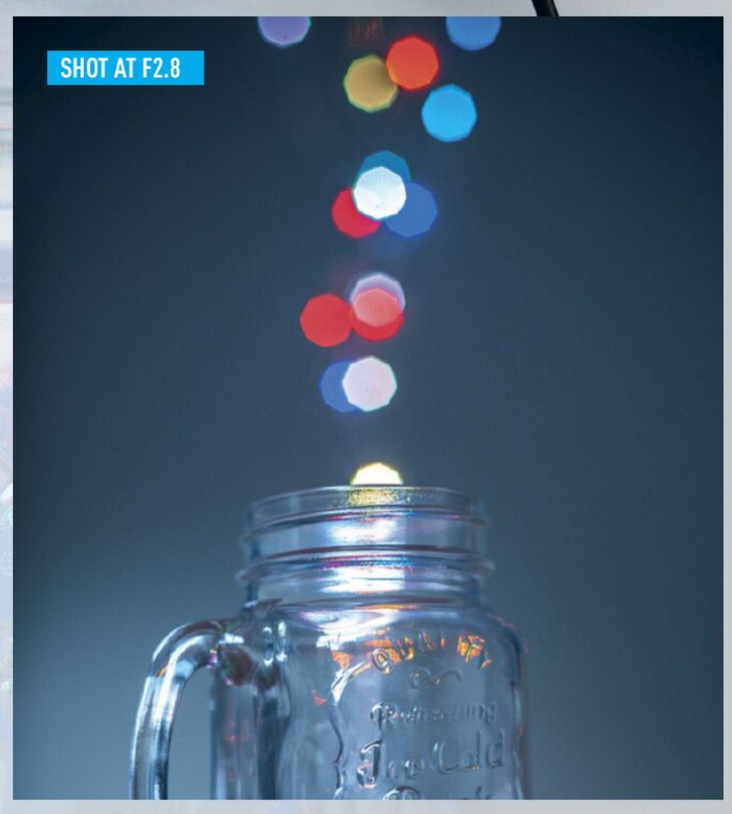
There are several techniques applicable to how you can create and improve the quality of your bokeh. First and foremost is the shallow depth of field required to generate it in the first place. Lens choices, as we've mentioned are key a factor as well as the techniques you use to actually create your own custom shapes and how they relate to your foreground subject matter. Bearing in mind that the out of focus area of your shot is the only place where bokeh can be generated, a wide maximum aperture increases the amount of your image that is out of focus and creates greater bokeh. Shorter focal lengths found on wide angle lenses for instance, increase depth of field. Longer focal lengths develop shallower depth of field. If you have a lens with a very wide maximum aperture of f/1.4 for instance, you may be tempted to just open it up to f/1.4. Watch out though, as sometimes you can overdo the blur to a point where you cannot make out any detail in the background whatsoever. Allow a small amount of detail to show through. Remember that the closer both you and your subject are to the background, the less blur you will be able to achieve. Keeping a distance between subject and background is another way to control how much bokeh is present.

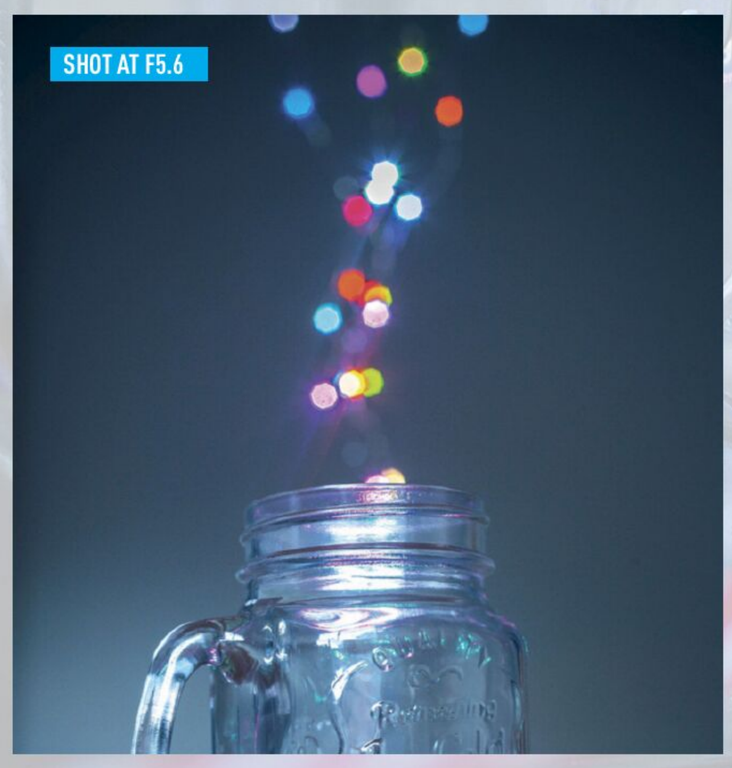

f / 2.0
1/25
-1
ISO 100

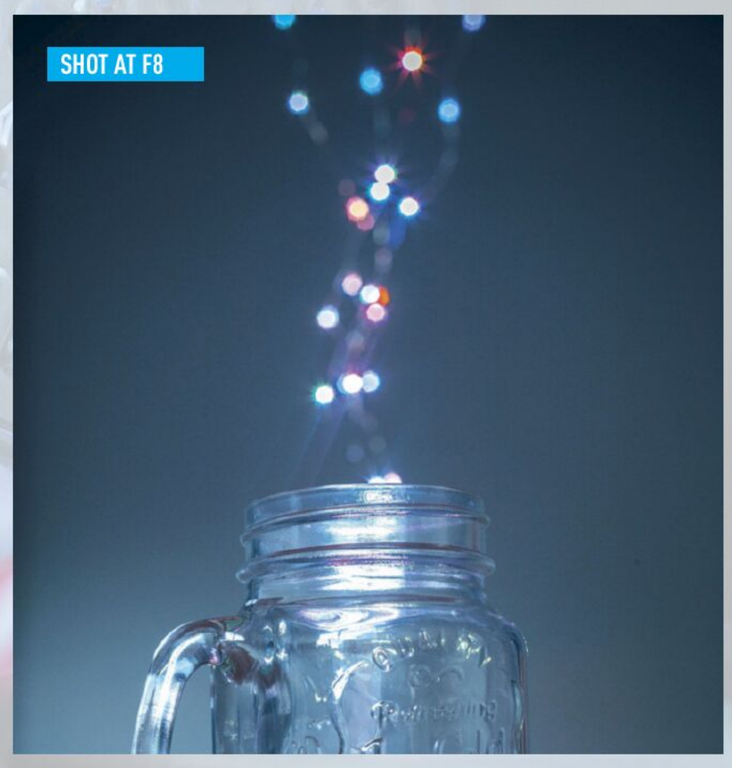
Try interactions

Why not try using bokeh to your creative advantage. Normally, the background is just that, something that happens to be sitting behind your subject. However, it can be great fun to somehow get your foreground subject and the background bokeh to interact in interesting ways, rather than just being some random blurry background. Setting something up at home so you can control exactly how it all comes together is a great little desktop project worth having a go at. A darkened room, some cheap LED coloured lights and your foreground subject and you are ready to go. We have a camera on a tripod with a 50mm f/1.4 lens. Our subject is a glass container that the bokeh will appear to come out of. We have some light to illuminate our foreground subject, but the LED lights, strung from a light stand further back in the composition, will provide their own glow when switched on in the darkened room. The lights need to be strung in such a way that when you view them through the viewfinder of your camera, the framing shows them suspended in a tall but narrow group above the glass. Pre-focus your camera on the glass manually, since everything is static, you can safely leave it set where it is and nothing will change. The settings we started with were an aperture of f/1.4, shutter speed 1/25s, ISO100 and we were using -0.67 to -1 exposure compensation. We did a series of examples at f/1.4, f/2.8, f/4, f/5.6 and f/8. For our particular setup, with the lights about 1m behind the main subject, an aperture of f/2 delivered the most favourable results. At apertures above f/2.8, the wires that held the led lights together started to become visible.









Custom bokeh

The aperture blades within your camera lens are responsible for creating the shapes of the bokeh you normally see in your shots. We can however, have our own say on what shape they will be. There is a very simple way to shape the bokeh to suit your creative requirements. You aren't limited to the the shape defined by your lens. In this guide, we will show you how you can quite literally customise the shape of the bokeh recorded by your camera's sensor. It's nothing more complicated than a piece of card with a hole cut in it! You will need: your camera and a prime lens with a wide maximum aperture (f/2.8 or wider is recommended to give the best results); an old UV filter to fit your lens, which helps keep the surface of your prime lens clear from dirt or fingerprints; some reasonably stiff black card; a pencil and ruler; a maths compass for drawing the circle to fit your lens; and a craft knife. Then,some led lights if you are going to be shooting indoors; if you are shooting outdoors, you'll need to find somewhere at dusk that has lots of external lights: maybe car headlights passing by on the road, even an amusement arcade or maybe a visiting fair.

First you need to inscribe a circle on your black card to match the diameter of your UV filter/lens [1]. It needs to be the same width as the inner edge of your UV filter/lens, so it will cover it and not have any gaps. Because we were using an old UV filter on the lens, the card can be cut to fit this.

You can simply trace around the circumference of the filter with a pencil onto the card. Alternatively you can measure the width of your lens and use a compass to describe a circle which you can then cut out with scissors or a craft knife.

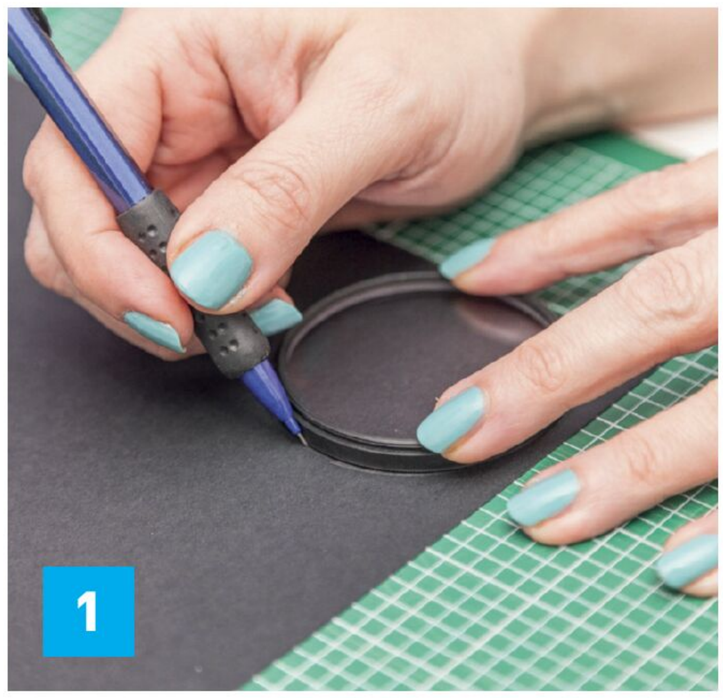
Now, in the centre of the circle, draw a shape that you want your bokeh to resemble [2]. Strong simple shapes are best to start with. Make the shape about 1/3 to 1/4 the width of the circle. Here, we have used a love-heart.

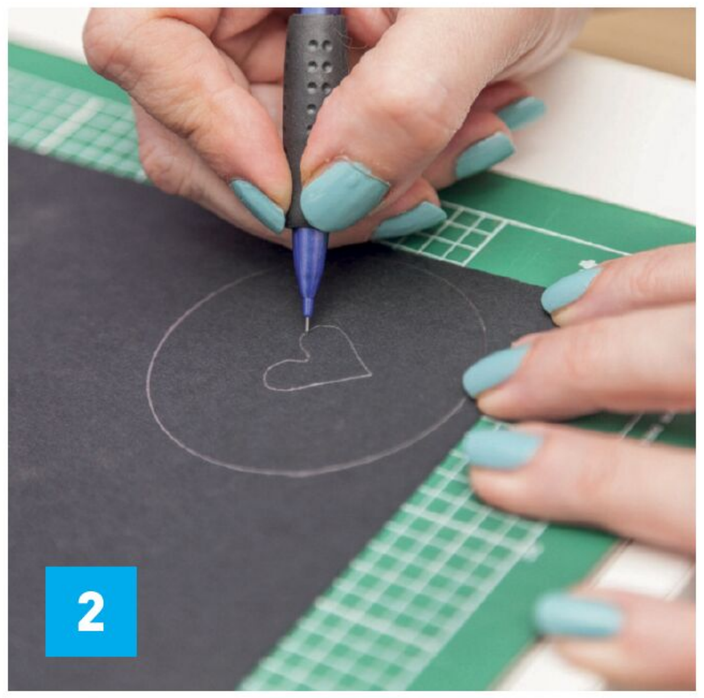
Carefully cut out your shape from the circle with a sharp craft knife [3]. Then you can cut out the main body of the circle [4].

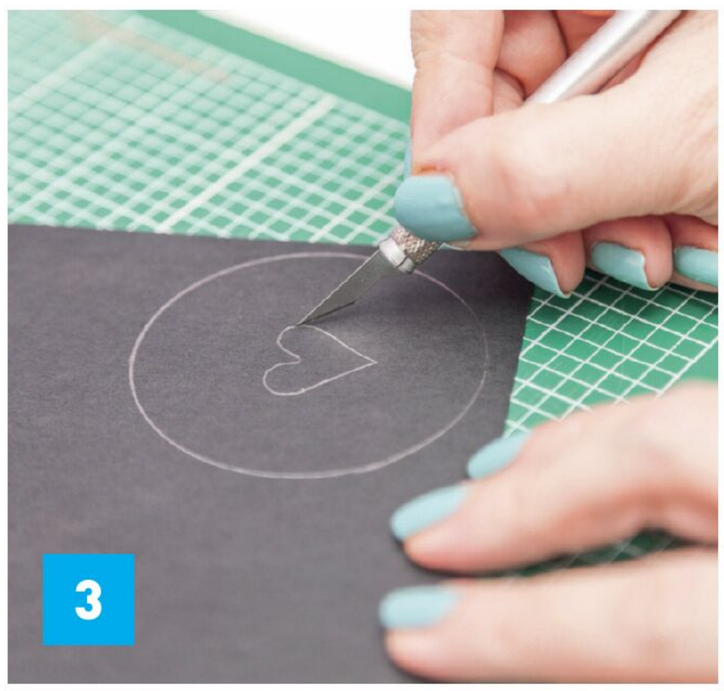
You should be left with a card circle with your custom shape cut out from the centre [5]. Test fit the card circle in your UV filter or lens [6]. Trim if necessary but try to avoid any large gaps that might let light through.

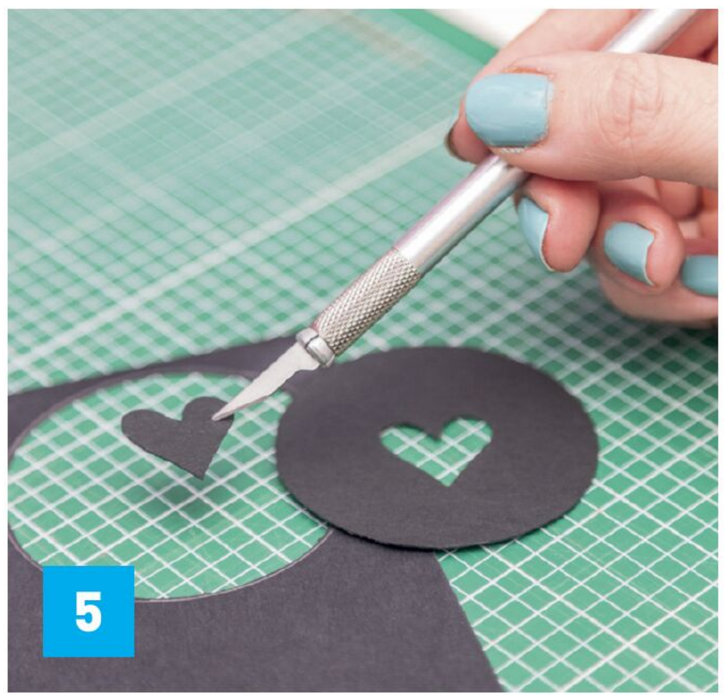
Using small pieces of masking tape or tacky putty, secure your card circle in place on the filter. If securing directly to your lens, take care not to get the front element dirty [7].

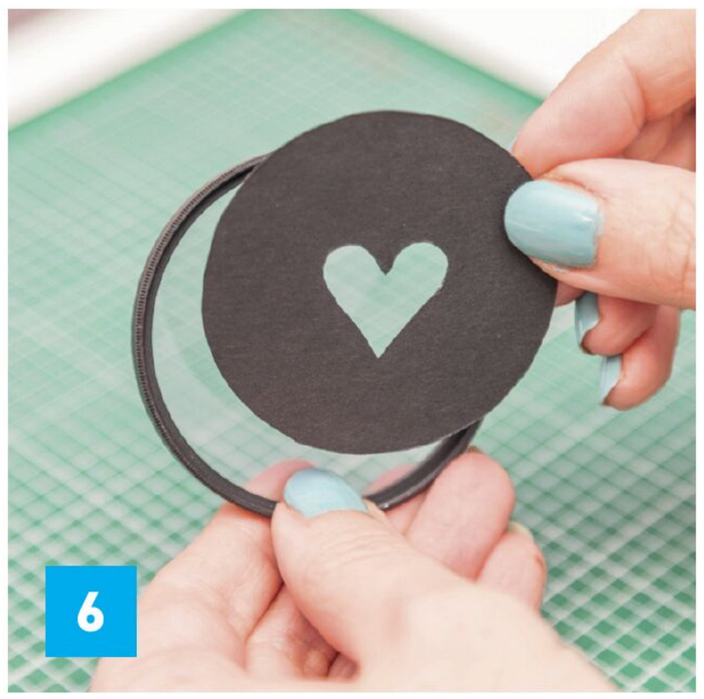
Your new custom bokeh filter is in place. Just fit it to your lens and camera and you are ready to start shooting with your very own custom bokeh [8].

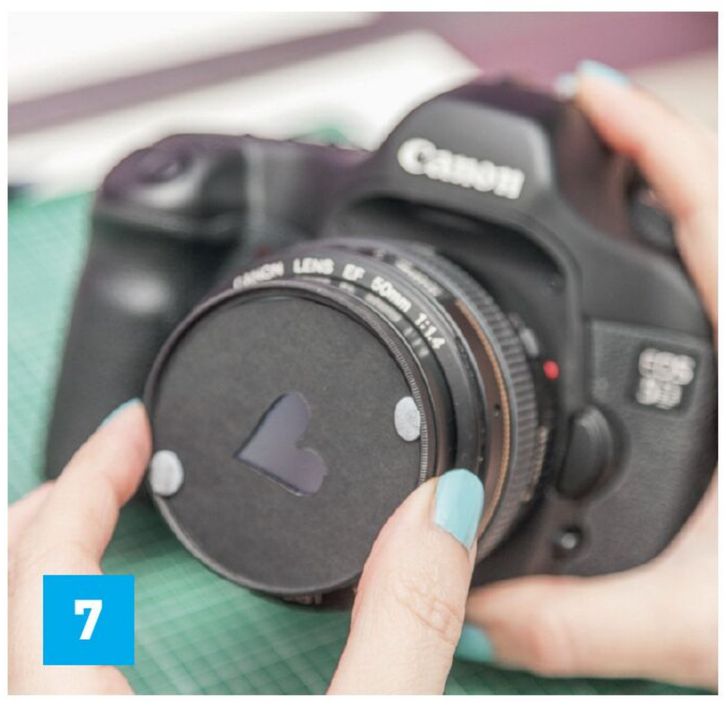












Canon
EOS-1
Ds

Shooting your custom bokeh

It is best to start without your bokeh filter on your lens. Compose your shot and take a test image to confirm that the background is as out-of-focus as it needs to be. Be aware that adding your custom bokeh filter is going to act like a second aperture and will have an impact on the depth of field in the shot by increasing it by a small amount. The smaller you make the custom shape, the more depth of field you will have. A tripod may be a good idea if your shutter speeds are slow. Additional illumination on your subject with a flash is fine as long as it doesn't overpower your background lights.

In our example here, the test shot without the bokeh filter on gave us settings of aperture f/1.4, shutter speed 1/50s and ISO 100. It was at the lens's closest focusing distance to the subject (about 0.5m) and the lights were suspended 1m away. A quick look at the results showed the lights were nicely blurred.

Now it's time to attach your custom bokeh filter. You will probably notice a couple of things. First, your exposure settings will have changed and you may notice some dark vignetting around the perimeter of your shot. Both are by-products of adding what is essentially a second aperture to your camera. It is shaping the light certainly, but it will also reduce the amount of light getting to your camera's sensor, requiring a longer exposure time or an increase in ISO sensitivity to compensate. The vignetting, depending on how strong it is, will be something you can correct at the processing stage or just simply crop it out. You will also see that your circular orbs of light have now become hearts, or whatever shape you chose.

Now, our settings are aperture f/1.4, shutter speed 1/8s and ISO 100. As we are shooting what is basically a still life and we're using a tripod, those settings aren't an issue. Now you can take the new shot, et voila! The bokeh has been reshaped and is now yours to control. ■

f / 1.4
1/30
-0.67
ISO 100

Glossary

Here is a list of some general terms you may encounter in the world of photography

Aperture
Behind the lens of your camera is a movable circular iris which opens and closes to control the amount of light falling on the sensor. This is usually controlled by the camera's light meter, although some cameras have a manual aperture control. Altering the aperture also changes the depth of field.

Aperture priority
This is one of the semi-manual exposure options found on some cameras. The user sets the aperture according to the depth of field they require, and the metering system sets the shutter speed to obtain the correct exposure.

Artefacts
When an image is stored in your camera's memory it has to be compressed to fit, usually into a JPEG file, and in the process some information is inevitably lost. When the image is uncompressed for viewing, noise creeps in and appears as angular blocks in the image, which are known as artefacts.

Autofocus
Almost all digital cameras have automatic focusing. There are essentially two types; contrast detection, used in compact cameras and most CSCs, uses the camera's main sensor and works by detecting the borders between high-contrast areas and trying to make them as sharp as possible. Phase detection AF is used in digital SLRs and some CSCs, and uses a separate sensor. It is usually faster and works better in low light.

AE lock
Stands for Auto-Exposure Lock, a function found on most advanced digital cameras. This enables you to take a light meter reading from a particular part of the image and then hold that setting while you compose the image.

Back lighting
Backlighting occurs when your subject is brightly lit from behind, such as somebody standing in front of a sunlit window. Unless you adjust the exposure to compensate for this, your subject will appear as a dark silhouette against the bright background.

Barrel distortion
Barrel distortion occurs when a lens, usually wide-angle, distorts an image so that it appears slightly spherical. If you take a seascape with a wide-angle setting and notice that the horizon seems to curve, this is barrel distortion. It's most noticeable when there are straight lines near the edge of the frame. In digital images barrel distortion can be corrected in image-editing software.

Bokeh
The visual quality of the out-of-focus areas of a photographic image, especially as rendered by a particular lens.

Bracketing
Bracketing shots is where a photographer takes the same shot three times or more, each at different exposures. This increases the chance of getting an ideally exposed image. Also, it's possible to combine the shots in software to increase the light and shade within the image, which is how HDR works.

Burst mode
Many cameras offer a burst mode, which means they can take several images in rapid succession, just as you'd get with a motor-wind on a traditional film camera. The number of shots that can be taken is limited by the speed of the camera's image capture and processing systems, as well as the size of the internal memory buffer. You'll typically get about three frames per second from a standard digital camera in burst mode.

Centre-weighted metering
This is when the camera takes an average light reading from the whole frame, but pays more attention to the centre of the image where the subject normally is. This has been largely superseded by multi-pattern metering, which is better able to cope with unusual situations.

CCD
Stands for Charge Coupled Device. This is the light sensor behind the lens of your camera that records the image when you take a photograph. It consists of a grid of millions of tiny light sensors, one for each pixel of the image. The size of a CCD is measured in megapixels, and the higher the megapixel rating, the better the image quality.

Chromatic aberration
Coloured fringes that appear around objects, often toward the edges of the frame. Caused by light rays of different wavelengths coming to focus at different distances from the lens.

Circular Polariser
A filter that is placed in front of the camera lens in order to darken blue skies, manage reflections, or suppress glare.

CMOS
Stands for Complimentary Metal-Oxide Semiconductor. A chip-manufacturing technology used to produce the sensors in an increasingly large proportion of digital cameras. Cheaper but with better tolerance than other methods.

Depth of field
When you focus your camera on a subject, some detail behind and in front of the chosen subject will also be in focus. The distance between the nearest and furthest in-focus objects is known as the depth of field. It is changed by altering the size of the aperture; the smaller the aperture, the larger the depth of field.

Digital zoom
Some cameras give you the option of zooming in on the centre part of an image by expanding it in the camera. Although the zoomed area looks bigger, it still contains the same number of pixels as it did originally, so it will appear blocky and will lack resolution. Not to be confused with optical zoom, which is far superior.

Dynamic range
The difference between the lightest and darkest areas of an image. If a camera can simultaneously capture shadow and highlight detail then it has good dynamic range. Few cameras can do both.

DPI
Stands for Dots Per Inch. The sharpness of an image produced by a printer is defined by how many dots of ink per inch of printed paper its print head can produce. A figure of 1,200dpi or higher is usually required for photographic-quality results, although most modern printers are capable of this.

Effective pixels
Although your digital camera may claim to have 13.6 million pixels on its CCD, some of that number will not be used for taking the picture. Usually, some pixels around the edge of the sensor are painted black to provide a colour balance, while others fall outside the range of the lens.

Electronic viewfinder
Some cameras have a viewfinder containing a miniature LCD monitor showing you what the camera sees. This usually uses less battery power than the LCD screen on the back of the camera, but can be a strain on the eye and difficult to focus.

Exposure
When you take a picture, the light meter in the camera determines how long the shutter should be open for and how wide the aperture should be, thus obtaining the correct exposure. If a picture is too dark, it is underexposed, whereas if it goes the other way and is too light, it is overexposed.

External flash
This means that the camera has a connection, usually a hot shoe, that enables you to use a flashgun other than the one built into the camera. This allows a lot more creative freedom and control over lighting, because the flash can be positioned further away from the camera. This feature is only usually available on more expensive or professional-quality cameras.

EXIF
The Exchangeable Image File (EXIF) format is used by nearly all digital cameras that output pictures as JPEGs. It enables information, such as the GPS co-ordinates, date and time the shot was taken, plus exposure and other camera information, to be stored in the image file alongside the normal picture information.

Fixed focus
Cheaper cameras have fixed-focus lenses, which means they cannot be adjusted. Instead they rely on a very narrow aperture to make everything appear in focus, from a few feet in front of the camera out to infinity. They are fine for snapshots at average distance in good light, but are not so good for creative photographs where focus can be used to produce unusual effects.

Focal length
In brief, this term describes the magnifying power of the camera's lens. The longer the focal length, the greater the magnification. Conversely, the smaller the focal length, the more wide-angle the lens. Most digital camera zoom lenses can vary between short and long focal lengths.

f-number
This is the number which describes the ratio of the aperture of a camera's lens to its focal length. Generally, a higher quality lens will have a smaller f-number, which bizarrely means a wider maximum aperture, and thus more light entering the lens. See also 'Depth of field' for more information about focusing.

Forced perspective
This is a technique which employs optical illusion to make an object appear farther away, closer, larger or smaller than it actually is.

HDR
A rather over-used technique whereby several shots at different exposures are combined to produce one image capturing a very wide range of contrast, or dynamic range. Useful for high-contrast lighting and night-time shots, but can be over-used by art students who've just discovered it.

Histogram
A histogram is a graph of brightness.
It ranges from black through grey to white along the horizontal axis, while values in the vertical axis represent the number of pixels at the appropriate brightness. It

provides a means of checking the exposure of an image. If too many pixels are present at the left-hand side of the histogram, the image is underexposed, while if it's weighted to the right, then it's likely to be overexposed.

Hyperfocal Distance
This is the distance between a camera lens and the closest object which is in focus when the lens is focused at infinity.

Infrared
Infrared (IR) light is the part of the EM spectrum that people encounter most in everyday life. It is invisible to human eyes, but people can feel it as heat.

Interpolation
Some cameras and image-editing software can increase the size of a digital image by adding extra pixels in between the original ones. They take an average of the pixels around the new one and attempt to match the colour and brightness to create a seamless image. Some systems give better results than others.

ISO
Stands for International Organisation for Standardisation. In conventional photography, the ISO number is a measure of the light sensitivity of photographic film, and this has been carried over into digital photography as a way of expressing the light amplification of the CCD.

JPEG
This file type stands for Joint Photographic Expert Group, and is the most commonly used system of image compression. Using a sliding scale between file size and picture quality, it enables digital cameras and computers to squash a large picture into a small amount of memory. Be careful when compressing files, though, because too much compression will reduce the quality of your image.

Landscape mode
A program exposure option found on many mid-priced cameras, this function automatically selects the best exposure settings for taking landscape photographs, usually a longer shutter speed and the narrowest possible aperture to maximise depth of field. It can also refer to holding the camera horizontally, which is usually preferred for landscape shots.

LCD
Stands for Liquid Crystal Diode, a display technology first developed in the 1970s, and in widespread use today. Most cameras have an LCD monitor screen mounted on the back for viewing photographs. Some also have an LCD electronic viewfinder, and some DSLRs also have a separate LCD data display panel.

L-ion
Stands for Lithium Ion. This is the latest kind of rechargeable battery, superior even to Ni-MH. It can hold more power, and does not suffer from 'memory effect', where a partially charged battery, when recharged, will only register the additional charge rather than its full capacity. However, L-Ion batteries are quite expensive.

Macro mode
Refers to a lens that can focus closer than its designated focal length, but these days it is used to describe any facility for taking extreme close-ups.

Manual mode
Found on higher-end cameras, this is for experienced photographers only. It gives you full control over both aperture and shutter speed, enabling you to experiment with exposure and depth of field. Essential for creative photography.

Megapixel
Megapixels are a measure of the size and resolution of the pictures that a digital camera can produce. Mega means one million, and in this case a million pixels, or more accurately a million individual light sensors on the camera's CCD. The more megapixels, the better.

Memory card
Most digital cameras store your pictures on removable cards full of computer memory. They come in a variety of sizes and there are several different types, including CompactFlash, SD and MicroSD cards as well as Sony's own Memory Stick format.

Metering system
This is how the camera measures the amount of light being reflected by whatever you are trying to photograph, to determine the correct exposure for that particular scene. There are many different types, including spot metering, multi-pattern metering and centre-weighted metering.

Monobloc
A monobloc is a self-contained flash unit usually found in a photographic studio.

Multi-pattern metering
This is a sophisticated means of determining the correct exposure of a photograph. The camera takes light readings from several different areas of the frame and compares them to its pre-programmed data.

Night-time mode
A program exposure mode that compensates for low light by setting the aperture to maximum. This lets the most available light into the camera and gives the fastest possible shutter speed under the circumstances.

Optical zoom
With recent advances in lens manufacturing technology, many digital cameras now have small but powerful optical zoom lenses. This means they can be adjusted to magnify the image (zoom in) or to capture a wide-angle shot (zoom out). Because the image uses the full capabilities of the CCD this is preferable to digital zoom.

Pixel
Short for Picture Element. If you enlarge a picture on your computer, you will see that it is made up of tiny squares of a particular colour and brightness called pixels. A pixel is the basic building block of a digital photograph, and there can be several million of them in an image. The higher the pixel count, the better the quality of the photograph.

Portrait mode
This is a program exposure mode that optimises the camera for taking classical portrait shots, widening the aperture to minimise the depth of field. This ensures that only the subject is in focus, while the shutter speed is increased to minimise camera shake.

Processor
All digital cameras have an image processor, which takes the data from the sensor and turns it into the finished JPEG image that you see on the screen. A faster processor means larger resolution images can be processed more quickly, improving the camera's performance.

Program exposure
Found on most digital cameras, program exposure is an automatic setting where the camera's metering system selects an appropriate aperture setting and shutter speed in an attempt to get the best exposure and performance out of the lens.

Raw
Raw mode is found on most high-end digital cameras. It is an option which stores the uncompressed raw data from the sensor, which can then be processed on a computer using software such as Adobe Camera Raw, Bibble etc. Raw files contain more information than JPEGs, and take up more memory. Raw is actually not an acronym and so shouldn't be all capitals; it should really be written simply as "raw".

Resolution
The more pixels there are in an image, the larger that image will be. This is the resolution of the picture, and is usually expressed as two numbers representing the height and width of the image in pixels, such as 3,872 x 2,592. Multiplying these two figures gives you the effective megapixels, in this case 10.03MP.

Shutter
The shutter is a device behind the lens of the camera which is normally closed, but opens for an instant when a picture is taken to allow light into the camera and onto the CCD. The length of time the shutter is open for is determined by the metering system, and is known as the shutter speed.

Shutter priority
This is a semi-manual mode that enables the photographer to specify a shutter speed while the camera's metering system sets the aperture for the correct exposure.

SLR
Stands for Single-Lens Reflex. A mirror or prism reflects the light coming in through the lens to the viewfinder, so when you look through it you see exactly what the camera can see. A DSLR is simply a camera that combines this with a digital imaging sensor.

Spot metering
Found on the more expensive cameras, this metering mode enables the photographer to take a light reading from a small area in the middle of the frame, usually marked in the viewfinder. This is the best way of dealing with difficult lighting conditions such as backlighting, and is normally used in conjunction with auto-exposure lock.

Time lapse
We've all seen films of flowers opening at incredible speed, or the sun and clouds racing across the sky. This super-fast motion technique is called time-lapse photography, whereby a stationary camera takes several successive shots at time intervals of a few seconds, minutes or even hours. The images are then played back rapidly, giving the impression of continuous motion.

VGA
Stands for Video Graphics Array, and refers to an image size of 640 x 480 pixels. This was once the standard size of a computer monitor output, but these days even mobile phones have larger displays. VGA is still sometimes found as an image size mode, particularly in the video recording modes of some cheaper cameras.

White balance
Most modern digital cameras automatically adjust the colour balance of the picture to compensate for any tints in the ambient light, such as sunlight, fluorescent strip lights or normal light bulbs. This is called a white balance, and means you can take a picture indoors without that orange tint you get with a film camera.

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