Controlling the light for better images

Ok, so you can run around with your camera like the guys in camera adverts and press the button. You know – the ones where you never have to put any actual thought or effort into your pictures – and they’re all brilliant. You can use only “natural light” and shoot jpeg because anything else is fake. After a while you learn that some types of sun or moonlight look better than others for certain pictures.

Then you’ll start looking for that light, and maybe use a reflector. Sooner or later though, you’re gonna start adding your own, whether it’s from a table lamp, a torch or a simple flash-gun. Before you know it, you’ve filled your house with shiny bits of metal, lights, fog machines, umbrellas and strange black miniature tents with a hole in the top. Ok maybe that’s just me that has an attic full of studio crap, but if you’re reading this, you’ve probably started to provide your own light.
Removing the existing light

One of the main advantages of using flash in the studio, is that it is so much more powerful than any ambient or room lights (see slide 11). So we can set the exposure on the camera so that only our flash light is powerful enough to show up. In most studio settings, if we set our camera at f/8 and 1/160th of a second at ISO100, it will make black images.

This is what we want. With none of the ambient light registering on our images, we are free to start adding our own light.

A Blank Canvas
How does flash differ from constant light/ambient photography?

When photographing using constant light (daylight, lamps etc) the shutter opens, and light pours in and builds up on the sensor. Then the shutter closes and the picture is transferred to the storage card.

When you use flash, the same thing happens, however at some point during the time the shutter is open, there is a brief flash of light. As the time the shutter is open is an eternity relative to the duration of a typical flash burst, the shutter speed will not affect the flash exposure.

Fundamentals - what is flash photography
Flash power
Adjusting the amount of light the flashgun(s) output while the shutter is open will affect the flash exposure only.

Aperture
Varying the aperture will affect the flash exposure, and the ambient exposure.

ISO
Varying the ISO will affect the flash exposure, and the ambient exposure.

Shutter speed
Varying the shutter speed will affect the ambient light only.

Controlling exposure
Why do I need a separate meter – my camera has one?

The light meter in your camera is measuring reflected light: i.e. light that reflected off the subject and into the lens. What you need for accurate metering is an incident light meter.

An Incident light meter meters the light falling directly on it’s sensor. If it knows the ISO that camera is set at, it can tell you the correct aperture to shoot at for the light it has measured. This works regardless of the tone of the subject (dark or light) as the subject plays no part in the light measurement.

Measure the light using the meter, at the subject, pointing the meter back at the light. Not the camera. You are measuring the light hitting the subject remember – the position of the camera is irrelevant.

Even basic meters like the Sekonic L308S on the right can measure both ambient and flash light. In flash mode, they will read whenever a flash is detected. If you attach a radio trigger to the sync port, you can trigger the lights using the meter button.

Light meters
Your hot shoe is a data connector

Through-The-Lens (TTL) metering means the camera meters the light through the lens as opposed to through a separate light sensor window. This means there is less need to meter the light and adjust the exposure manually. This approach also works with flash light on most modern DSLRs.

The flashgun(s) will send a test pulse when you take the picture and the camera uses this to figure out the power setting for the flashgun(s), and then takes the picture.

What this means is that you can vary the distance to the subject, vary the ambient light, diffuse the flash and the camera will sort it out – every time. You can apply flash exposure compensation (up or down) in the same way as you would with ambient auto exposure modes (A,S,P)

iTTL flash
Your focal plane shutter has two “curtains”. The front curtain raises to open the shutter. The rear curtain raises behind it to close the shutter (and then the whole thing resets for the next shot).

For Front curtain sync, the flash is timed to go off just after the front curtain opens. With rear curtain sync, the flash goes off just before the rear curtain closes the shutter. In effect, you can choose whether the flash goes off at the start of the exposure, or the end.

**Front/rear curtain sync**
Types of flash light

Pop-up twinkle light on your camera
Very small light source, reaches a few feet.

Battery powered "Speedlight"
Can be used mounted on camera hot shoe, or triggered off the camera. Typically up to 75 joules of light. Light output is controlled by an Insulated-Gate Bipolar Transistor. (A “tap”).

Studio “mono-blocks”
So called because the power supply and light is in one box or “block”. Big mains powered lights typically from 200 to 2500 joules, but can go much higher. They are usually equipped with a constant “modelling” light that makes positioning the light easier as you can see the effect as you move the light around.

Big battery powered flash
Like the mono-block, but the power supply is separated into another box usually containing a high power battery, making the head itself very small and light. Typically from 200 to 1000 joules.
Traditional mono-block studio lights – Constant time

Big old mains powered lights sold by Elinchrom, Bowens, Lencarta etc. These work by charging the capacitors inside the light with the exact amount of energy you dialled in on the control panel. When the light is triggered, all of the energy in the capacitors flows to the flash tube. This always takes the same amount of time. However, the lower the power setting the shallower the graph and so the apparent time for the light to drop to nothing (around 4 stops) is a bit longer.

IGBT "speedlights“ – Constant(ish) power

Speedlights are so called, because they essentially have a “tap” that shuts off the discharge to control light output. They always start from a full charge in the capacitors. The blue line on the chart shows a speedlight at half power, versus a mono block at half power. The remaining energy is left in the capacitor so they recycle quicker too. The short light duration of speedlights makes them suitable for high speed photography – freezing motion.
These big curly bulbs are only a tenner!

You’ll often see the stored energy value of a flash light (speedlight or studio light) called the “power” of the light. This, like so many things in photography, is incorrect. “Power” is the rate of delivery of energy—not the amount of energy delivered.

So how does a typical 300 joule studio strobe stack up to say, a 1 kilowatt continuous light? To figure this out, we need to calculate the actual power of the flashgun, not the amount of energy delivered and to do this, we need to know how long it takes to deliver that 300 joules of energy. For most studio monoblocks this is around 1/900th of a second.

One “Watt” is equal to one Joule per second, or Energy, in joules divided by the time taken to deliver it. For our 300 joules flash gun this is 300 joules divided by 1/900th of a second (or 300 x 900) = 270,000 watts or 270 kilowatts. Our 1 kilowatt continuous light will take roughly 1/3rd of a second to deliver the same amount of light energy. Your model better hold still!

Flash light versus continuous studio lights
How fast does your shutter go?

Modern electromechanical shutters are fast but can they really cycle at 1/4000\textsuperscript{th} of a second, or even 1/8000\textsuperscript{th} of a second? Well, no. They can’t. Most modern curtain shutters can cycle at 1/250\textsuperscript{th} of a second. The number we refer to as “shutter speed” is not the cycle time of the shutter: it’s the time each piece of the sensor or film is exposed to light. At speeds above 1/250\textsuperscript{th}, the rear curtain starts to close before the front curtain has finished opening and what you get is a moving slit that passes over the sensor either from top to bottom, or side to side.

This is a problem for flash photography. Look at the top row of the diagram. No matter where in that sequence we trigger the flash, it will only affect the portion currently exposed through the slit.

“High Speed Sync” solves this problem by firing the flash multiple times as the slit moves over the sensor. Most of the flash light is wasted as it bounces off the shutter curtains. We can compensate for the loss of power by using more flash units. High Speed Sync is normally only available with OEM flash units, as the timing is critical. Very few radio triggers can handle high speed sync.
High Speed Sync is *not* flash photography

When you shoot using High Speed Sync, the flash pulses but never really drops to zero. The graph of the light output looks flat, but with a saw-tooth pattern. It is really, a continuous light – a bit like having a really bright torch.

It’s important that you realise that HSS is not flash photography, as the interaction between flash and ambient described on the first slide no longer happens. You can no longer control the flash independently of the ambient by altering the shutter speed. Altering the shutter speed in HSS mode affects all the light as your “flash” is now ambient light too.

You can, of course alter the “flash” power by adjusting the output on the lights.

So, when you see sports/action photographers using a combination of natural light and speed lights to freeze action at 1/4000th of a second – it is the shutter speed that freezes the action – just as it does for regular non-flash photography.

High speed sync
On-camera flash sucks

Yep – if you do nothing else to improve your flash photography, just having the light coming from somewhere else than down the barrel of your lens will improve your results by a factor of ten.*

With one light, create a triangle with your camera, the subject and the light. The exact relationship between these 3 points controls the style of lighting you will get, from backlit, to split lighting to Rembrandt. Short, broad and everything in between.

The distance and angle of the light together with the size of the light define the “quality” of the light. Closer makes more contrast, bigger makes softer shadows (note getting closer also makes the light bigger).

Getting the flash off the camera
Use a cable

This is the cheapest, most reliable and simplest way to trigger a remote flash. The cable simply moves the hot shoe away from the camera. You attach the flash to the cable and the cable to the camera hot shoe. It all works as if the flash were on the camera.

Use a slave cell

A light detector fires the flash when it sees other flash light (from any source)

Use the built in optical signalling system

Nikon, Canon and Sony flash systems all have an intelligent automatic lighting system that communicates instructions to multiple flash units using the flashlight mounted on the camera (or the pop-up). This relies on the master flash signals being seen from each remote flash.

Use a radio trigger

For a longer range or where line of sight between the camera and remote flashes is not available, you can use a radio trigger. Basic radio triggers carry limitations versus the proprietary optical signalling systems, however you can now buy all manner of radio triggers that will pull off all of the proprietary iTTL tricks, over radio. Canon now make flash guns that do TTL over radio; Pocket Wizard’s FlexTT5 transceivers; Yongnuo’s YN622’s; Phottix Odin and Pixel King all do the same for compatible guns.

Triggering your flash
Many flash units for more power & shorter durations

Dave Black seen in the picture on the right regularly uses 8 Speedlights strapped together to shoot action. In this shot he was using them to shoot surfers 150 yds away

Multiple flashes to light different parts of the image

Of course you may just want multiple light sources. For example, when shooting a portrait, you may add another light behind the subject to give edge light, or accent the hair and so on. Here’s one of Joe McNally’s lighting setup’s from the Nikon USA web site.

Using multiple flashes

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Build the light one at a time

For a portrait for example, you will almost always start off with your “key” light. This is the main light. The one that is going to illuminate most of the subject’s face.

Once you have the key light at the right power, angle, distance and so on and the images are looking right, you may want to add a hair light to provide edge lighting on the hair. When you add a new light, turn off the other lights and get the new one right. Then do another test shot with the rest of the lights turned on.

You might then add more lights for the background, maybe some fill and so on. Building the light one at a time like this allows you to set the power output of each light relative to the key light (eg 1 stop below, or 2 stops above etc.)

If you are using iTTL flash, you can actually express it like this. If you are setting flash power manually, you will need to use an incident light meter to measure the light from each flash, from the part of the image it will illuminate.

More on this in part III

Lighting different parts of the image
It’s not the colour or the quantity.

When we talk about the “quality” of light we mean how fast does it fall off in intensity? How soft or hard are the shadows and the “rotation” from light to dark.

Light reduces in intensity in proportion to the square of the distance away from the light source, or the intensity is inversely proportional to the square of the distance. Think about what this means if we move the light closer to the subject: the light is now falling off much more rapidly (it’s on the left hand side of the graph). For the image below, the light was 2 inches away from the model. The dark, left hand side of the image was constructed afterwards in Photoshop.

Light from a small source generates hard shadows. The sun, from our point of view, is a small source and so generates hard shadows. We can control the quality of the shadows by altering the size of the light source – from the subject’s point of view.

To make the shadows softer then, we can move the light closer, or make it bigger or a combination of both

Quality of light

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Modifiers

Diffusion dome
Softbox
Umbrellas
Reflcctor dishes
Grids
Snoots
Standard Reflector
These usually come with your studio lights. They’ll give a fairly wide circle of sparkly light.

Wide Angle Reflector
Or “beauty dish”. These give a wider circle of even crisp light. The light is nice and even, because of the little deflector in the middle that blocks direct light from the flash tube. These dishes come in silver or white for an even creamier quality of light. You can also fit a diffusion sock, creating a small round soft box.

Long Throw Reflector
Or “maxi-light” is a parabolic reflector that generates a more focussed bright circle of light with harder edges.

Reflectors
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Making the light source bigger

This is the primary job of the soft box. A big light source gives soft roll-off into shadow and a very even light, directional light. More directional than say an umbrella which will throw light everywhere.

Soft boxes come in lots of sizes. Always buy soft boxes with the front diffuser set into the box – not wrapping around the edges. This will give you control over the shadow edge. Also, look for soft boxes that come with fabric grids to control the angle of light. Buying the grids separately is very expensive – for reasons that no-one understands.

Softboxes
Softboxes come with 2 diffusers – inner and outer. You can play around removing one or the other for different quality of light. Or remove both and use it as a giant reflector dish.

Twin soft box setup

The big octa-box provides a nice even light with fall-off down over the model. Note how close the key light is to get this high fall off – I have removed it in post. The strip-box to camera right provides an edge on the right of the model. It is further away and thinner and so provides a harsher shadow line.

Softboxes

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Specific shapes of light
The strip box is a rectangular soft box. A good size is around 180cm x 40cm or thereabouts. Make sure it has a grid. With this modifier you can create a light the will light up the entire length of a full-length figure, in a very controlled way. You can keep the light off of everything else – especially with the grid fitted.
Reflectors

Simple light
These usually come with your studio lights. They’ll give a fairly wide circle of sparkly light. The smaller the source appears from the model’s position, the sharper the shadows will be.
White background
Key light directly overhead, a beauty dish or soft box. A reflector or another soft box used below to fill in the shadows. If another light is used, dial in 1 stop less than the key light. The background light needs to be 1 or 2 stops higher than the key light. You can use your mid-grey background – just throw 2.5 stops more light on it than your key.
Mid-grey vinyl
Grey provides a contrast both with the black hair and pale skin and a classy look to your portraits. Soft light from a large source, positioned a reasonable distance away provides even light with a soft shadow fall off. Another soft box, smaller and nearer gives a crisper edge. If you want your background darker – turn up the lights on your model.

Grey is the new white
Black background

Black is about 4.5 stops below mid-grey. You don’t need a black background to make the background in your shots black. In fact you don’t need a background at all. Just make sure that there is 4.5 stops less light back there than on your model.

Black is the new black
Getting from nice to great.
If we light up the subject with lots of bright light, as we would for a beauty light, we get great even illumination, with maybe some nice but discrete shadows, everything is nicely balanced, the skin tones are “correct” and so on. This is absolutely the right light for say a cosmetics advert, or fashion shot. However, there’s only so many times you can do this before your brain shrivels up.

So how do we get something more dynamic? There are a number of elements we can introduce:-

• Styling & Expression
• Movement
• High contrast lighting
• Fog
• Other suspended particles – water, flour etc
• Fabric
• Lasers (!)
Getting away from the standard lighting

The light tends to get more dramatic, the further around to the sides and then towards the back of the subject it gets. You can get punchy front lighting – with a maxi light, ring flash or gridded reflector, however side and backlighting can produce some spectacular results.
Multiple flashes
This shot is all done in camera. The flashes suspended above the stage flash 5 times per second during the manually timed exposure, freezing the dancer in a new position each time.

Freezing motion
A fast (short) flash duration freezes the movement. The shutter speed is a relatively slow 1/160th of a second, however the flash light only lasts 1/2000th of a second. This enables us to see moments in time. The more extreme the movement, the faster the flash needs to be.

Capturing Movement
Showing motion

Using continuous light such as the stage lights, with a slow shutter speed (1/2 a second here) will produce a motion trail. Adding a flash at the end of the exposure (rear curtain sync) stamps the image of the subject in place.

Combining both

Lighting one zone in the image with fast flash, and another with continuous light will freeze the flash part and allow blur in the continuous light zone. In this image the fabric is lit with continuous light.

Capturing Movement

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Fire cloth!
The light from B continues to light up the fabric during the $1/5^{th}$ of a second exposure, as it falls through the frame, producing a nice fire-like effect. The dancer is frozen by the strobe.

Combining both
Light A is a studio strobe – $1/900^{th}$ of a second. Light B is a red-head (tungsten) light – continuous 800 watt light. It has barn doors fitted to keep it off the dancer. Light A is in a gridded softbox to restrict its action freezing light to the dancer only and a strip of background behind her.
Studio fans are expensive. Not because they are particularly powerful, but because they are quiet. Noise, is not a problem for still photographs.

Office fans are pretty useless to be honest. The lack of an enclosed casing means most of the air goes around the blades rather than being pushed forward. You can work with these, however they must be very close to move even hair.

A reflector, plus assistant can provide some breeze in a pinch – big wafting motion and time your shot right.

Leaf blowers provide a lot of punch and are directional. This one is battery powered so you can aim it anywhere and use it outside on location. They are noisy though.
Fog is useful for adding drama, atmosphere, making a diffuser, showing up beams of light from strobes, or lasers. It also hides all the rubbish in the back of your set (light stands, cables...). It works best backlit or side lit, but experiment with it. You can blow it about with a fan. If you need it more even, waft it about and wait a few minutes.

It does take a while to disperse completely, so use fog when you have everything else sorted (lights, pose, movements etc).

You do not need a massively powerful machine for photography as you only need short bursts. These machines cost around £40 for a 900w unit.
Note: This is fog, not smoke. It’s a vapour, usually water and perfectly safe. It will not normally set off atomic decay smoke detectors like the ones in your house, although it may trigger photoelectric detectors and other types. These machines are regularly used in clubs and theatres so you are usually ok to use them in most studios.

You cannot colour the vapour. If you see coloured smoke in a picture, it was either done with gels, in post, or it really is smoke. Do not try and use actual smoke inside. Outside you can use smoke bombs, or smoke pellets like the ones used by heating engineers to reveal air flow or test flues and chimneys. These are around £30 for 100 pellets. Do not breathe in real smoke. Do not let it engulf the model, only light them on a fireproof surface (metal bucket, stone etc) and have a bucket of water or extinguisher on hand.
Coloured pieces of plastic film to place over the front of your lights. Colour Correction gels are specific colours designed to match other lights sources (fluorescent, halogen etc). Then there are artistic or theatrical deep colour gels like the red used here.

It is easier to attach gels to a reflector than try and cover a bare flash tube. I use a clamp popular in the movie industry called a “C-47” to attach the gels. These are nothing more than wooden clothes pegs turned inside out. £3 for 50 from Sainsbury’s. Turn off the modelling light when using gels.
Reflectors
Diffusers
Light stands
Booms
Clamps
Backgrounds

Other kit
Gaffer tape