

Photography Group: Digital Imaging

**Flash – Theory
and Technology**

by **Stephen Jones**



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Flash Photography Basics

Guide Number

All flashguns are rated by a Guide Number (“GN”), the larger the Guide Number, the more powerful the flashgun.

The GN is normally rated (in metres) for a film/sensor sensitivity of ISO100.

aperture x flash-to-subject distance = GN

For example, with a GN of 20, you will have a correct exposure at f4 of a subject 5 m from the flashgun.

Flash Photography Basics

Guide Number

	f2	f4	f5.6	f8	f16
Guide Number of 6	3m	1.5m	1m	< 1m	
Guide Number of 10	5m	2.5m	1.8m	1.25m	< 1m
Guide Number of 30	15m	7.5m	5.4m	3.8m	1.9m
Guide Number of 50	25m	12.5m	9m	6.25m	3.1m

Flash Photography Basics

Guide Number

You can easily increase the camera's ISO sensor rating to extend the distance that your flashgun will light a subject.

		f2	f4	f5.6	f8	f16
ISO100	Guide Number of 6	3m	1.5m	1m	< 1m	
ISO200	Equivalent GN is 8	4m	2m	1.5m	1m	0.5m
ISO400	Equivalent GN is 12	6m	3m	2m	1.5m	< 1m

Flash Photography Basics

Red Eye

Red eye occurs in flash photography of people (and some animals) when the light from the flashgun is reflected back to the camera by the blood-rich retinal layer at the back of the subject's eye.



1/60th sec, f4, ISO320

Flash Photography Basics

Red Eye

Red eye occurs in flash photography of people (and some animals) when the light from the flashgun is reflected back to the camera by the blood-rich retinal layer at the back of the subject's eye.

Red eye normally only occurs when

The flashgun is pointing directly at the subject.

There is low ambient lighting.

The subject is looking directly into the camera's lens.

Flash Photography Basics

Red Eye

If you are using the on-camera flash gun, then avoid red eye by:

Use the camera's anti-red eye function.

Asking your subject not to look directly at the camera.

Turn on some lights.



1/60th sec, f4, ISO250

Flash Photography Basics

Red Eye

If you are using a separate flash gun, then avoid red eye by:

Use “bounce” flash.

Moving the flash gun further away from the lens axis.

Asking your subject not to look directly at the camera.

1/60th sec, f4, ISO640



Flash Photography Basics

Synchronisation

Modern shutters use two blinds that vertically traverse the sensor to control the shutter speed. The front blind “opens” the shutter and the back blind “closes” the shutter.

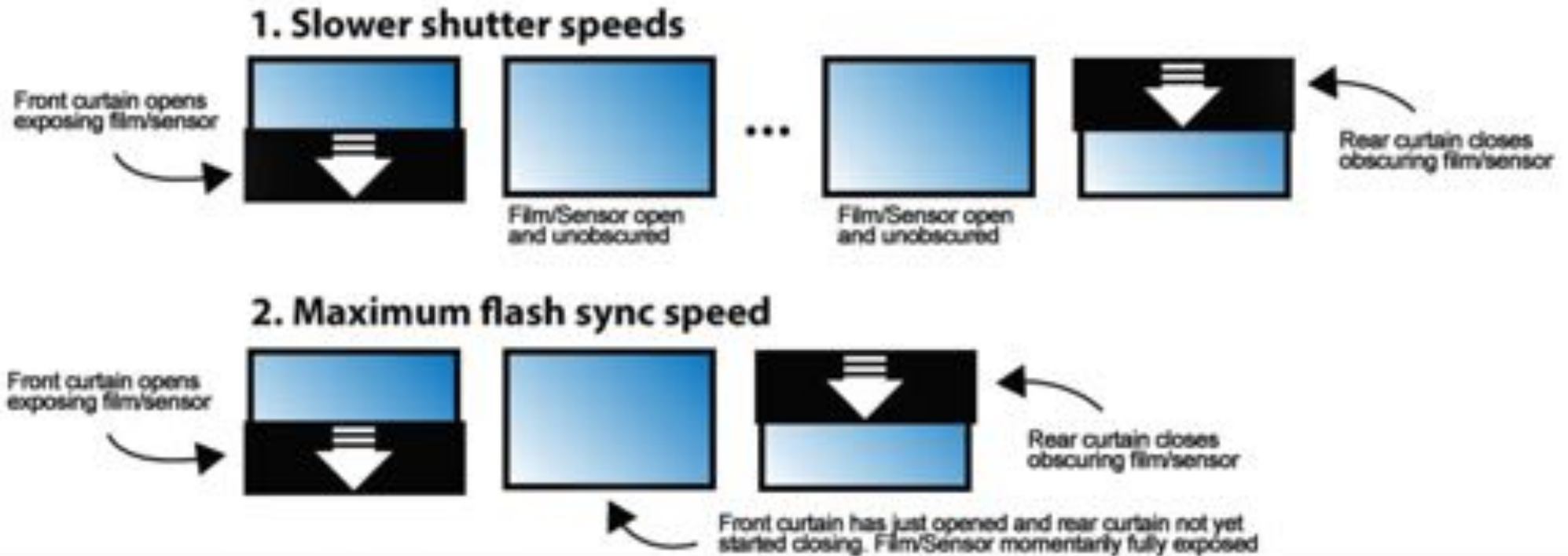
Because an electronic flash can be of such short duration (typically $1/200^{\text{th}}$ second to $1/20,000^{\text{th}}$ second), the flash must be fired at the precise moment when both blinds are wide open and the sensor is completely revealed.

This is the “sync” speed and it varies for each camera – typically between $1/100^{\text{th}}$ second and $1/320^{\text{th}}$ second.

Flash Photography Basics

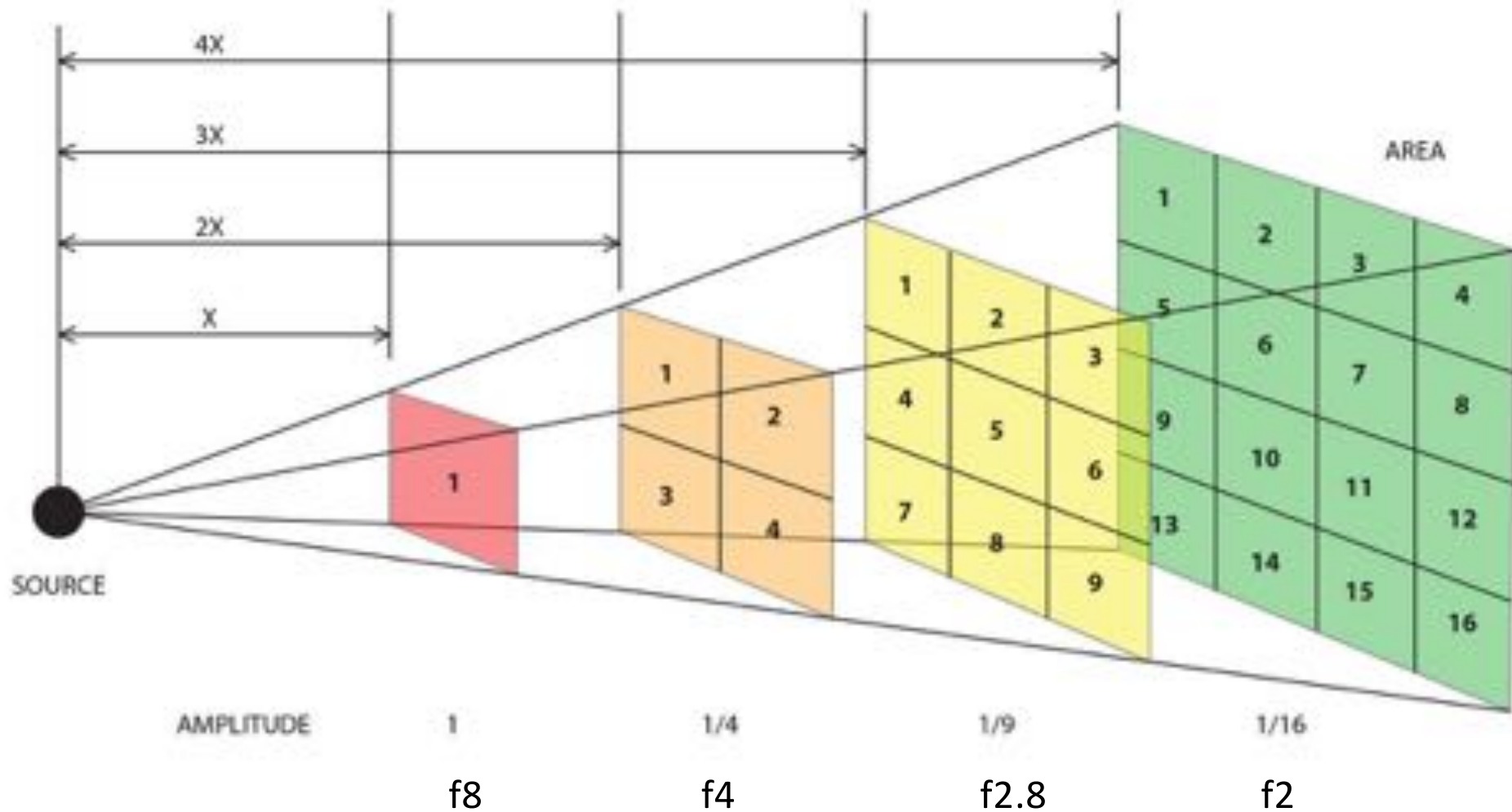
Synchronisation

Focal Plane Shutters



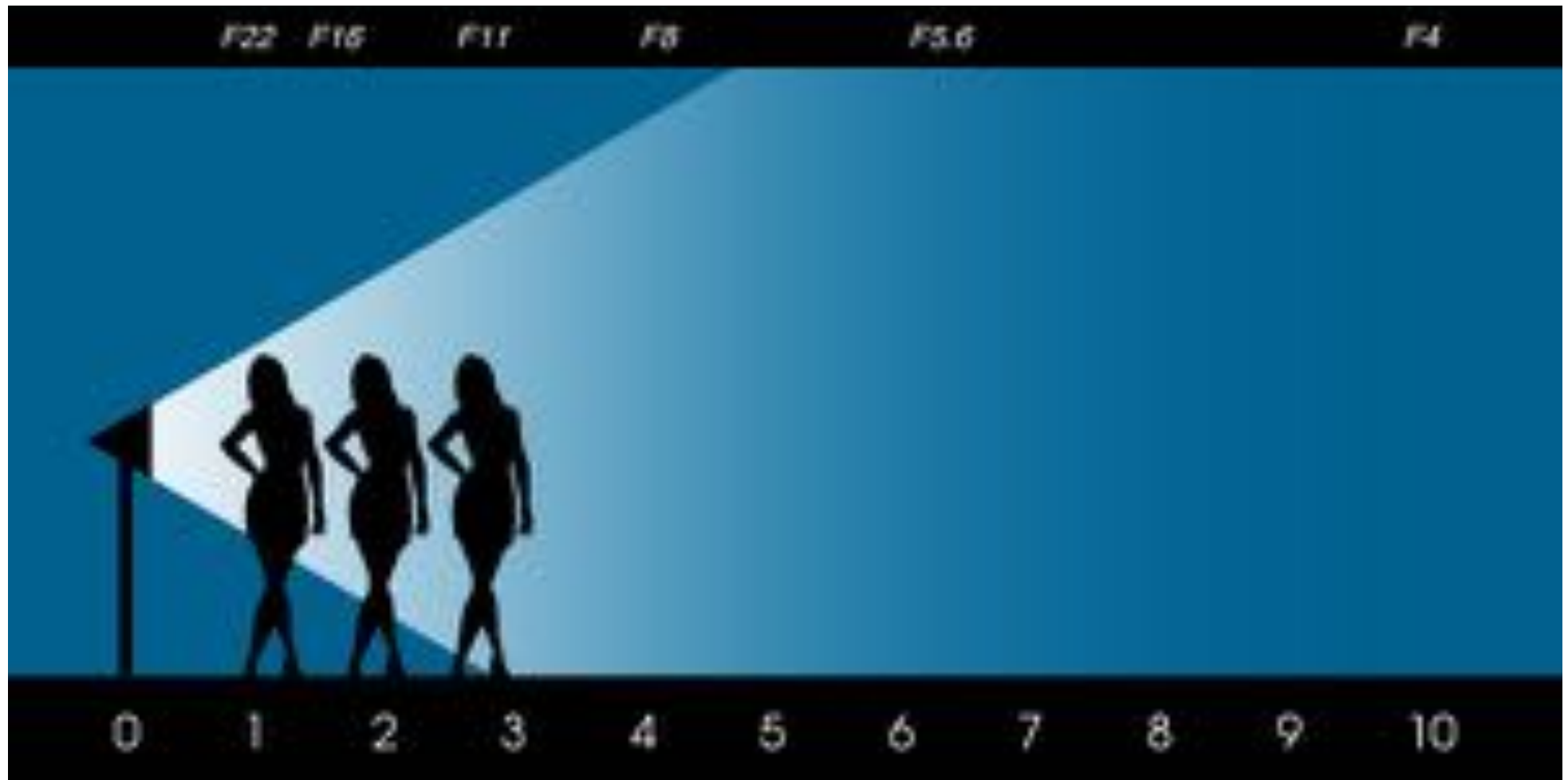
Flash Photography Basics

Light – The Inverse Square Law



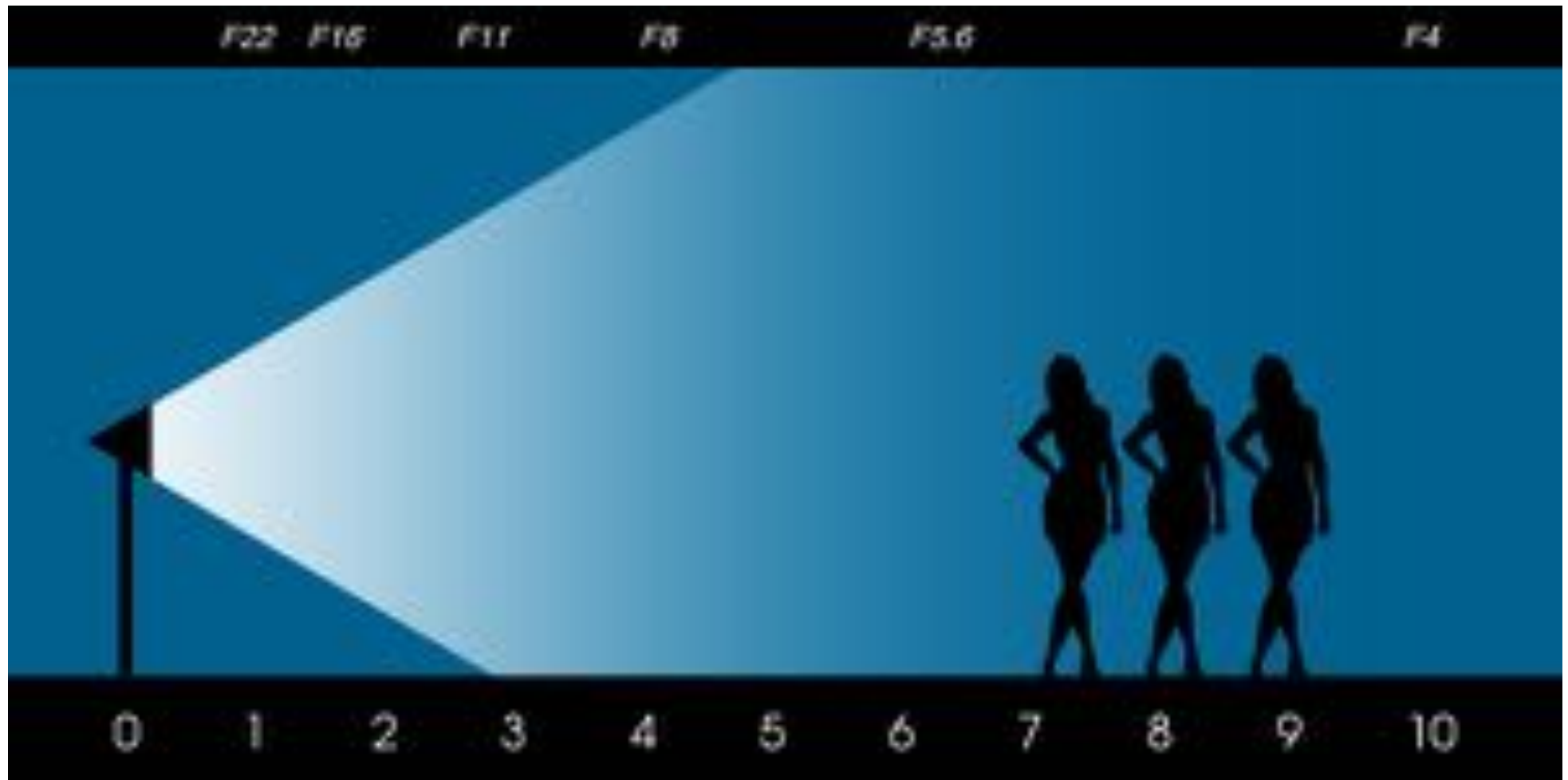
Flash Photography Basics

Light – The Inverse Square Law



Flash Photography Basics

Light – The Inverse Square Law



So, why use flash ?

- i. Provide light on the subject



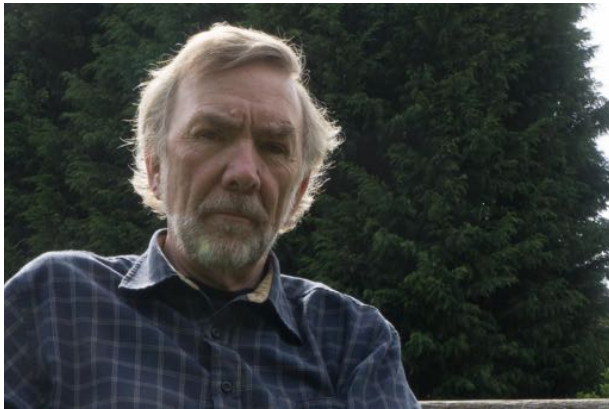
f6.7 @1/125th sec, ISO100



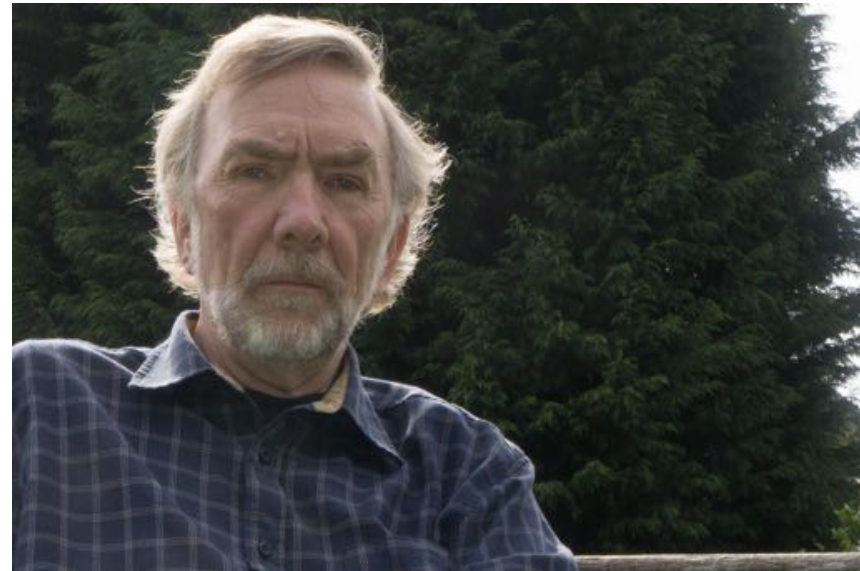
f6.7 @1/125th sec, ISO100

So, why use flash ?

- i. Provide light on the subject



f11 @1/125th sec, ISO200



f11 @1/125th sec, ISO200

So, why use flash ?

- i. Provide light on the subject
- ii. (Allow use of a faster shutter speed)
- iii. (Allow advanced set-up of shutter speed and aperture)
- iv. Control colour temperature of a close subject

So, why use flash ?

iv. Control colour temperature of a close subject



f6.7 @1/125th sec, ISO100



f6.7 @1/125th sec, ISO100

So, why use flash ?

- i. Provide light on the subject
- ii. (Allow use of a faster shutter speed)
- iii. (Allow advanced set-up of shutter speed and aperture)
- iv. Control colour temperature of a close subject
- v. Isolate a close subject

So, why use flash ?

- v. Isolate a close subject



1/10th sec @ f8, ISO200



1/60th sec @ f8, ISO200

Correct Exposure

Available light photography: to take a well exposed photo, the photographer must consider:

1. Aperture
2. Shutter Speed
3. ISO sensitivity (film speed)

Flash photography: additionally the photographer has to take account of:

5. Flashgun to subject distance
6. Flash intensity (flash power)

Flash Photography

1. Aperture

f4



f5.6



f8



f11



f16



f22



All photos were taken with the flash in “manual” mode and all were taken at the same 1/250th shutter speed and ISO100 sensitivity.

Aperture controls the amount of flash light.

Flash Photography

2. Shutter Speed

1/250



1/125



1/60



1/30



1/15



1/8



All photos were taken with the flash in “manual” mode and all were taken at the same f4 aperture and ISO100 sensitivity.

Shutter speed does NOT control flash light, but it controls ambient light.

Flash Photography

3. ISO sensitivity (film speed)

The sensor will react to all light – flash and ambient

Increase ISO to reduce the flash power,
(which in practice means that the flash recycling time is reduced and you don't burn up as much battery).

Increase the ISO and you can use a smaller aperture

Flash Photography

3. ISO sensitivity (film speed): increase ISO/reduce flash power



1/8 power, ISO200
1/125th, f4



1/16 power, ISO400
1/125th, f4



1/32 power, ISO800
1/125th, f4



1/64 power, ISO1600
1/125th, f4

Flash Photography

3. ISO sensitivity (film speed): increase ISO/reduce flash power

Flash Power	1/8	1/16	1/32	1/64
ISO	200	400	800	1600



1/125th sec, f6.3, ISO400



1/15th sec, f11, ISO200



1/90th sec, f8, ISO100, (note the shadow of the lens hood !)



1/125th sec, f5.6, ISO200



1/125th sec, f5.6, ISO400



1/60th sec, f4, ISO500



1/15th sec, f4, ISO1250



1/4th sec, f4, ISO640



1/200th sec, f5.6, ISO200

