

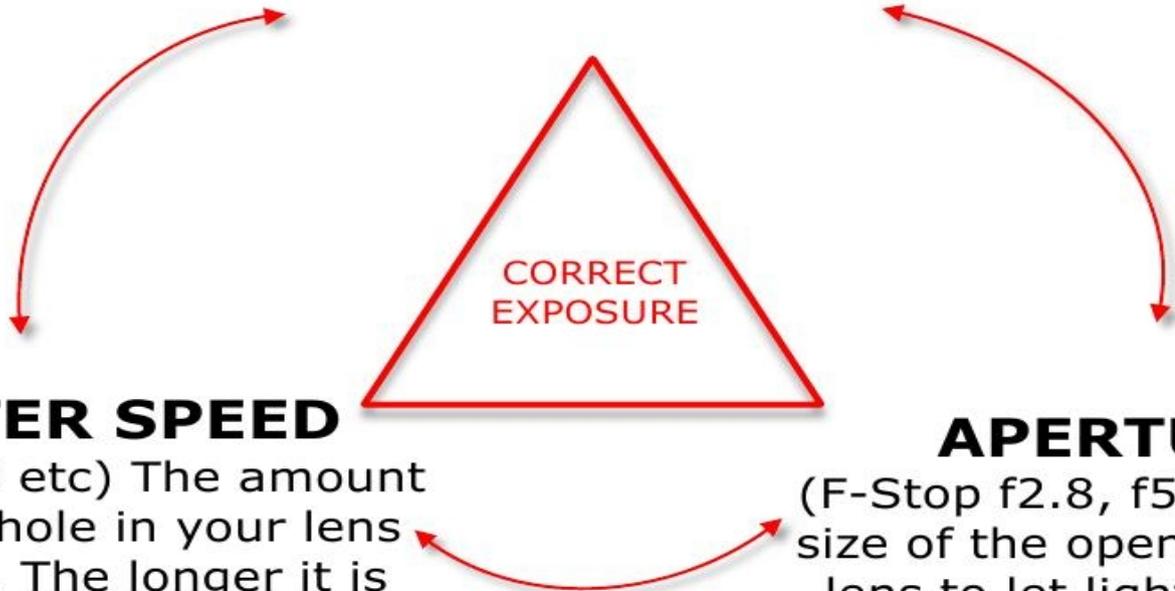
# Exposure Triangle

- ❑ EXPOSURE is the amount of light that reaches (is exposed to) the sensor.
  - Too much light and your image will be overexposed – washed out/too bright/no detail
  - Too little light and your image will be under exposed – dark/grainy/lacking detail and contrast.
  
- ❑ To get a clear, detailed image you need to have the correct exposure. In auto mode the camera takes care of this for you but good photos aren't just made by good exposures....you need the creative element that can only be found by taking the camera OFF auto.
  
- ❑ The 3 main functions on the camera that control your exposure are ISO, APERTURE and SHUTTER SPEED. Used together, these 3 functions should be able to get you **any** creative shot you desire within the cameras capabilities.

A change in any one of these will have a knock-on effect. One of the other 2 will have to change to keep the same exposure.

## ISO

(International Organization for Standardization)  
Represents your camera's sensors sensitivity to light.  
(Equivalent to film ASA)



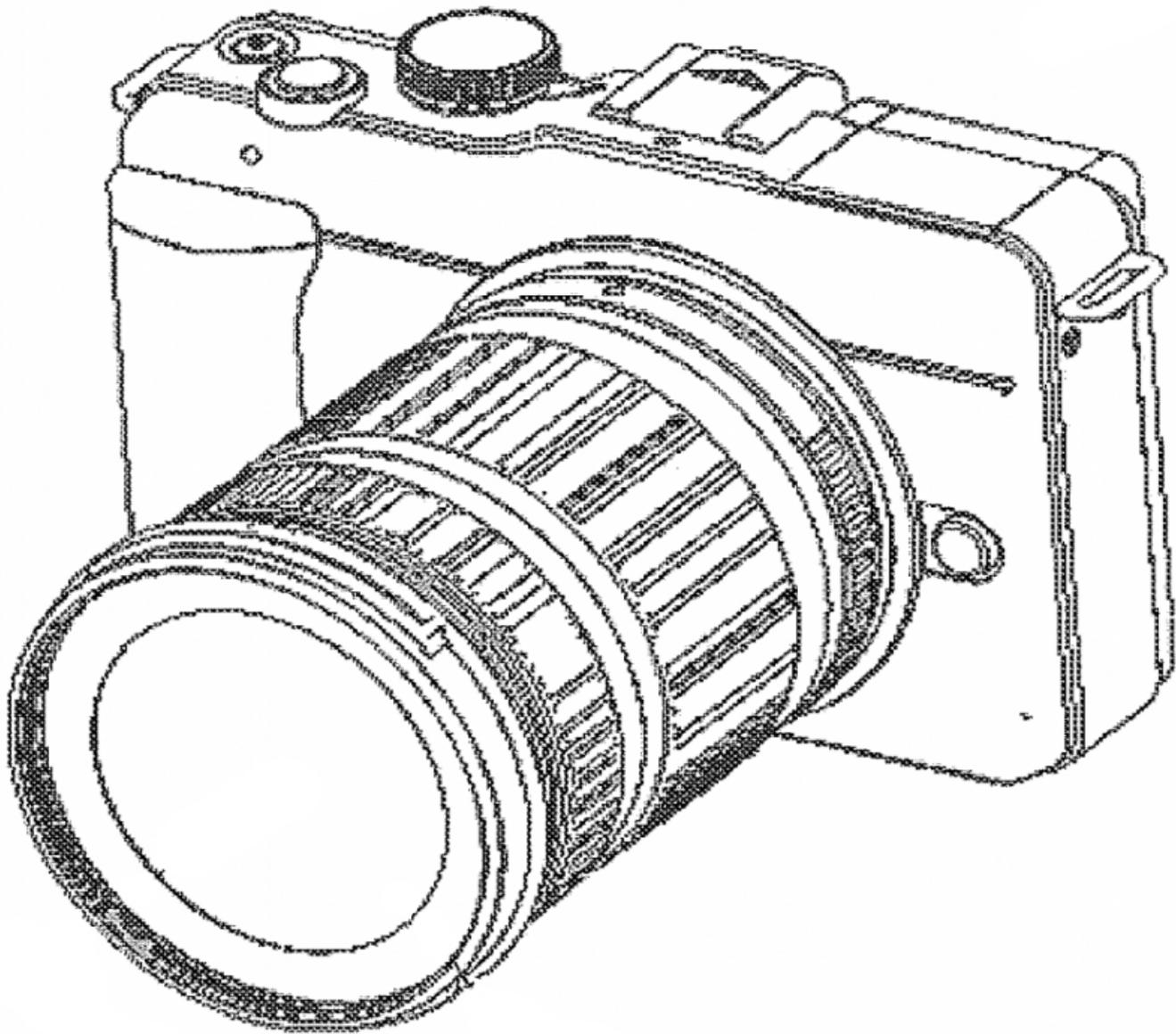
CORRECT EXPOSURE

## SHUTTER SPEED

(1/60, 1/125 etc) The amount of time the hole in your lens stays open. The longer it is open the more light it lets in. 1/60 represents one sixtieth of a second. Most D-SLRs have a max of 30 second exposure before needing a cable release remote.  
TV or S Priority Option

## APERTURE

(F-Stop f2.8, f5.6 etc) The size of the opening in your lens to let light through. Also controls your Depth of Field (DOF)  
AV Priority Option

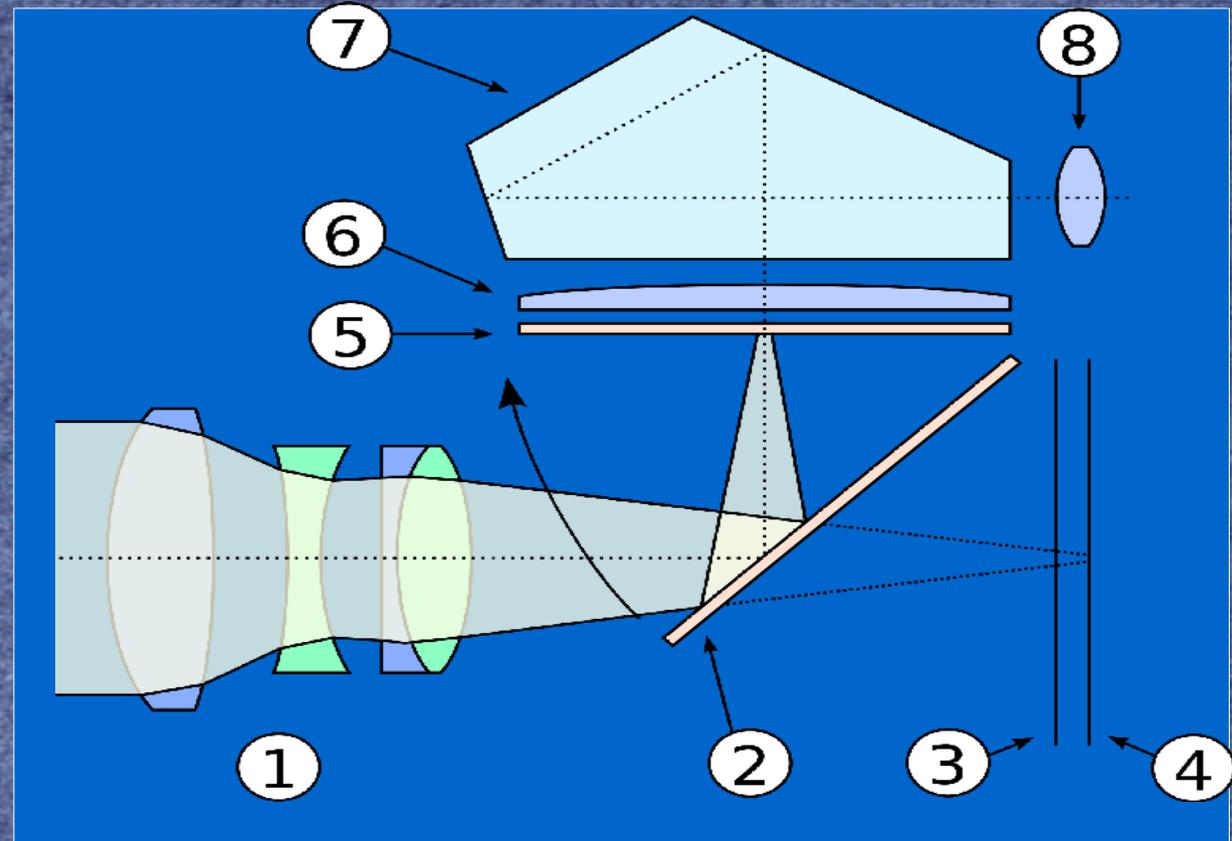


# Shutter Speed

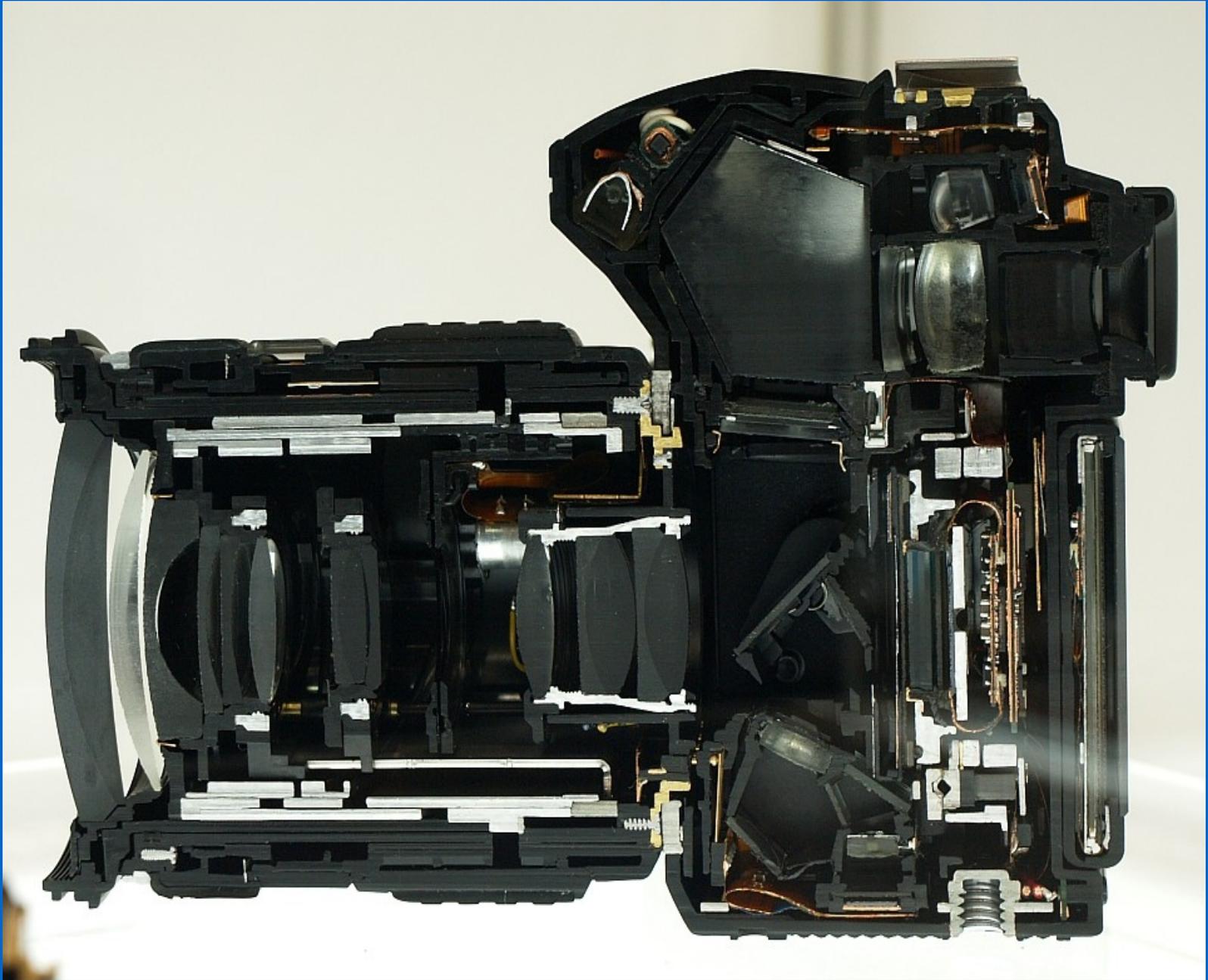
- $1/8000^{\text{th}}$  second to many minutes  $\rightarrow$  correct exposure

## Cross-section of SLR

1. Lens assembly
2. Mirror in down position (image visible in viewfinder)
3. Focal-plane shutter
4. Sensor/Film
5. Focusing screen
6. Condensing lens
7. Pentaprism or Pentamirror
8. Eyepiece



- Mirror flips out of the way when you click the shutter – why a mirror?
- May not need a mirror – why not?
- Focal plane shutter – can it REALLY open and close in  $1/8000^{\text{th}}$  of a second?



# Shutter – long exposure

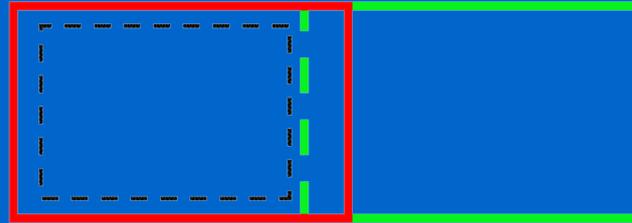


Fig. 1

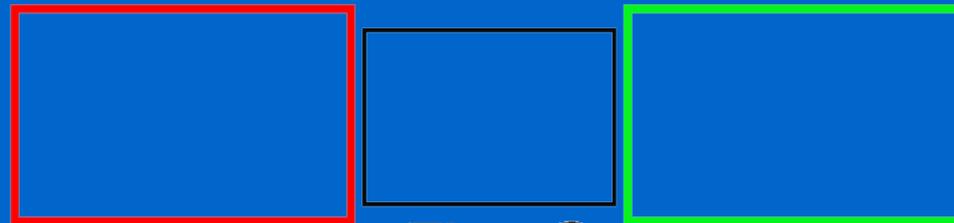


Fig. 2

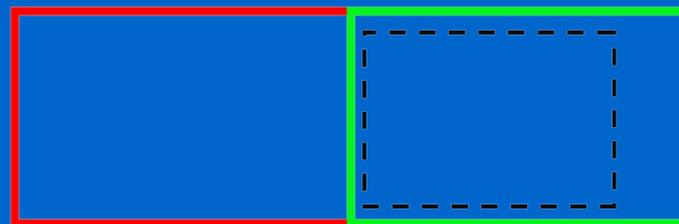


Fig. 3

# Shutter – short exposure

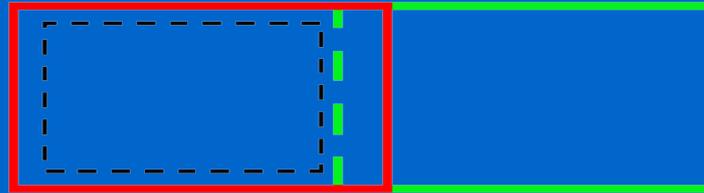


Fig. 1

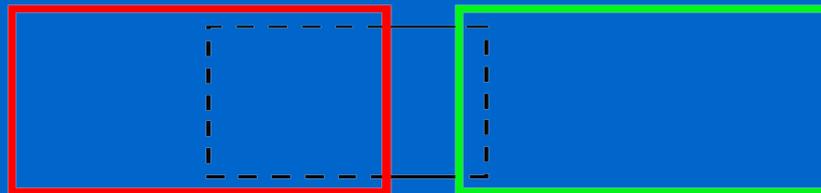


Fig. 2

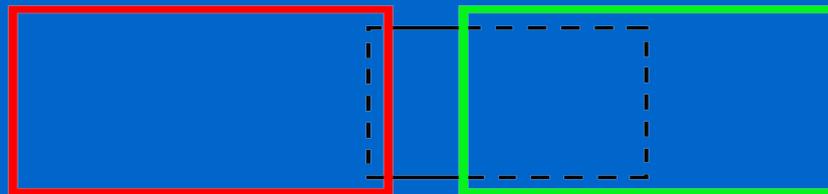


Fig. 3

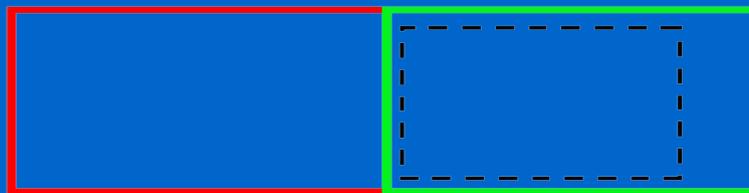
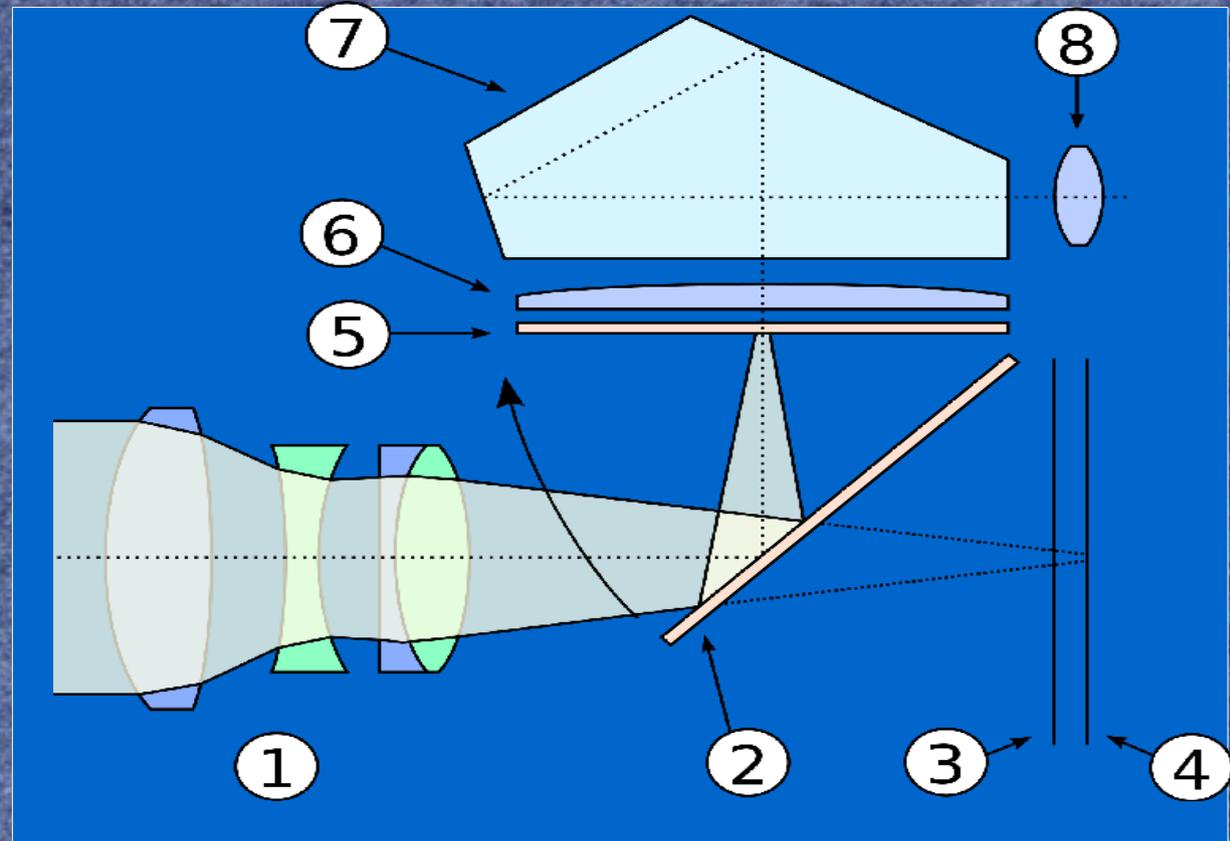


Fig. 4

# Shutter

## Cross-section of SLR

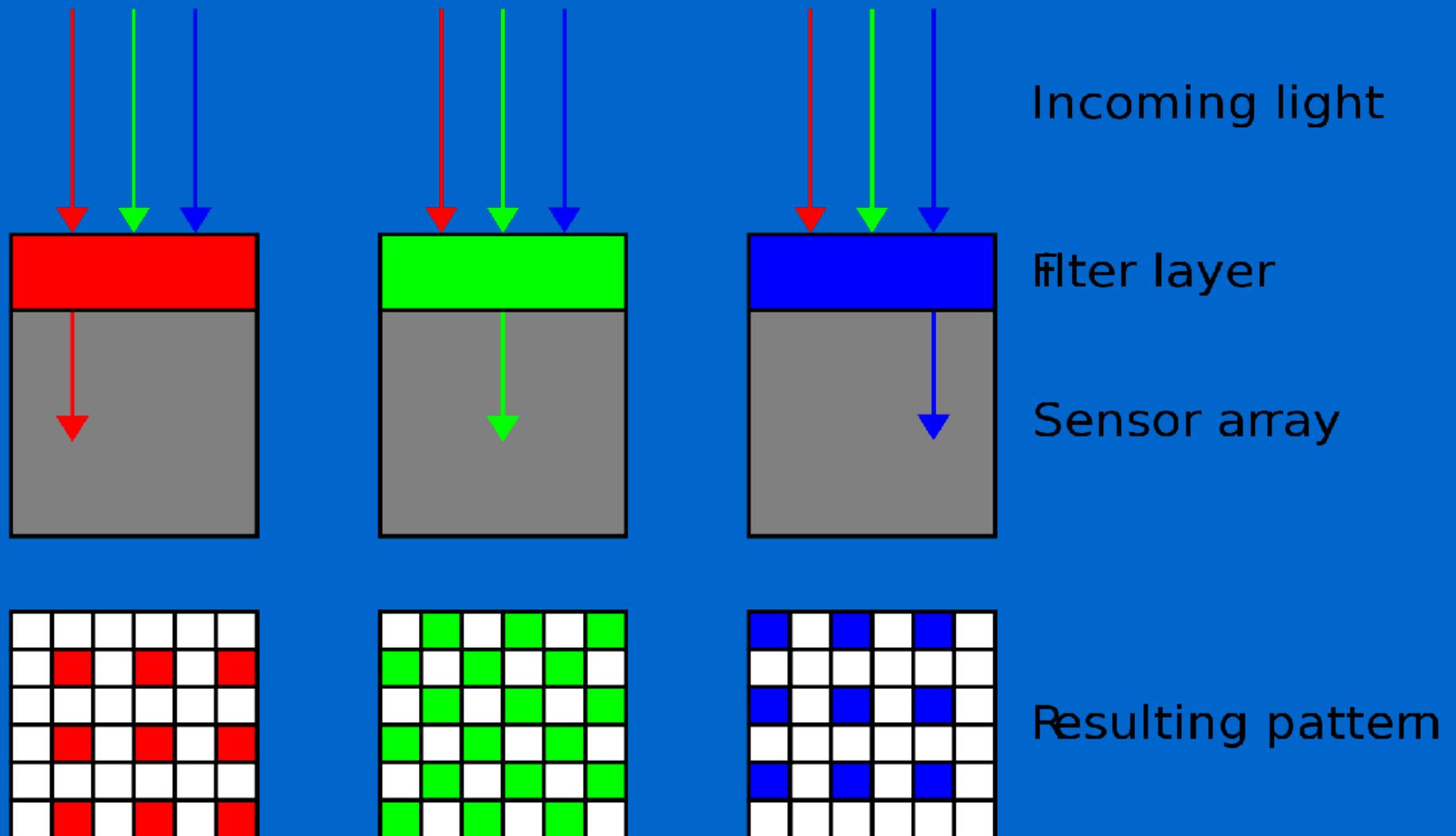
1. Lens assembly
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So if we got rid of the mirror and the focal-plane shutter, what else do we lose?

And how do we see the image!!!!

# Sensor



# Sensor

A number of factors affect the sensor's usefulness.

- 1) How large is each “pixel” site?
- 2) How sensitive is the “pixel” site?

So the site is like a container with a weighing device beneath it.

The wider the container, the more it can catch in a given shutter speed.

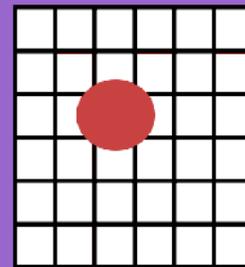
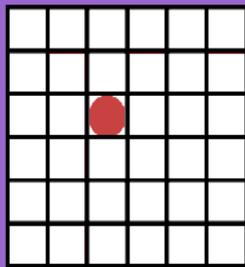
The more sensitive the device, the smaller the amount it can measure.

# Sensor

The wider the container, the more it can catch in a given shutter speed.

- Sensors are a fixed size. Therefore more pixels -> a smaller container.
- Typical may be 10 – 20 megapixels in a 22 x 15 mm sized sensor.
- A megapixel race is self-limiting....

Also, can your lens actually focus light down to a single pixel site?



# Sensor

The more sensitive the device, the smaller the amount it can measure.

The sensitivity is a measure of the ISO rating of the sensor.

Changing the ISO for an image is normally done by adjusting the amplifier gain for the pixel site. You magnify the amount that was collected.

BUT: the more you amplify the amount, the more you amplify any noise associated with the “pixel” site. So technology comes into it. Low noise sensors.

So ISO ratings for a camera don't really mean anything by themselves. Any camera can go up to ISO 12,000,000 BUT any noise will also be magnified.....

# Sensor

So higher ISO -> better to record in the dark

BUT picks up noise from sensor.

Longer exposure for a dark scene means more accumulated noise regardless of ISO.

And some pixels get “hot” and contribute to noise. In a dark scene, these come out as pixels of white or coloured noise. :?()

Many cameras will have the ability to do dark Frame Subtraction:

The scene is photographed, and then the focal plane shutter is closed and a Dark frame is “taken”. The hot pixels are then subtracted from the original image!

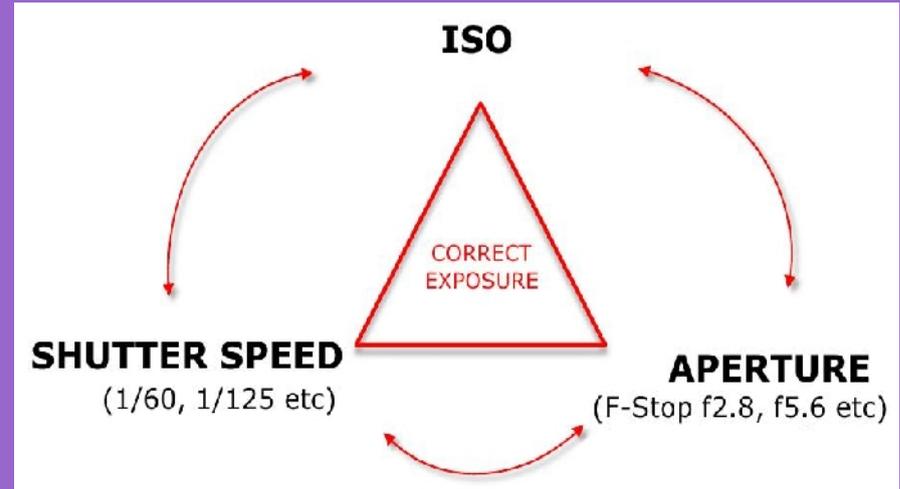
# Sensor

In the past, lower ISO -> better grain in a photo == resolution.

I once did a life size image of myself using BW Agfapan 25 ASA

BUT: resolution is fixed on a camera and lower ISO may give you no gain. There may be an optimal ISO for your camera. Check.

Notice: we are moving around the Exposure Triangle. These things are entwined.





# Aperture

It is obvious that the Aperture controls how much light comes in and adds to the amount in each “pixel” site. So like the shutter speed, it will control the exposure. As does the sensitivity of the sensor. So we have this Triangle of Aperture, Shutter Speed and ISO. We can move around this triangle, but the combinations for a correct exposure are FIXED. We cannot get the benefits of all put together. For example:

- High ISO gives us a fast shutter speed so we can reduce the aperture size BUT we get noisy images.
- A wide open aperture lets more light in, but we lose Depth of Field (if required) and we must use a faster shutter speed, so we cannot blur action shots (if required).

We must learn how to use the best combinations to give us what we want. How do we choose?

# The modes of your camera

- Choose APERTURE PRIORITY (A on your dial) when depth of field is most important in the shot
  - ie: Landscape requiring small aperture of say f16/f 22 or portrait with a blurred out background say f4.0 or f5.6
- Choose SHUTTER PRIORITY (S on your dial) when blurring or freezing movement is most important to that particular shot.
  - ie: Action shot, capturing a car speeding past 1/500th of a second or capturing a waterfall turn you want the water to have that blurred, dreamlike quality 1/10th of a second.

Remember: you will have chosen an ISO, and with each of these modes the camera will choose the other setting for correct exposure.

# Camera Modes

But Wait! There's more!!!

- Manual Mode – I don't recommend this to start with.
- Program Mode – I think this is very useful. Why?

You are **learning** to take **Photographs**.

- 1) You can take OK photographs in program mode.
- 2) You can see what the camera would choose via the viewfinder.
- 3) You can change the Aperture or Shutter Speed and still get a good picture – you are learning to move around inside that Exposure Triangle.
- 4) You can (probably) also deliberately under or over expose in Program mode to get mood....

# The set of Steak knives...

<http://www.workshopcameraclub.org.au/Documents/Cam-Sim.php>  
Or from the "Tech Talk" link on the home page: A Camera Simulator



The screenshot shows the 'WORKSHOP CAMERA CLUB' website interface. At the top, there is a navigation menu with links: Home, Club info..., What's On..., Galleries, Newsletter, Links, Tech Talk, and Member Login. Below the menu is a large central image of a young girl in a pink shirt holding a purple pinwheel, with a camera viewfinder overlay. The viewfinder shows a green '125' (shutter speed), a green '8' (aperture), a battery level indicator, and 'ISO 200'. Below the image are various camera settings: Lighting (Mostly sunny), Distance (7.5 ft), Focal Length (43 mm), ISO (200), Aperture (f/8), Shutter (1/125 sec), and a 'Snap photo!' button. There are also radio buttons for 'Aperture Priority', 'Shutter Priority', 'Manual', and 'Tripod'. At the bottom, it says 'Powered by CameraSim | Embed this'.