Topic no 027

Photography

An art or Science

Literal meaning of photography is the "drawing with light". Photo means light and graphy means light. Dividing up the world into "art" types and "science" types is a useful way to look at things. So much of what we do falls neatly into one category or another. Play music is an Art. Build a machine is Science.

On the other hand, no one exists who lives wholly in the realm of the aesthetic, just as technology alone cannot provide a full life.

Art-this topic particularly addresses aesthetics
Science–this topic is focused on technology

Camera Basics

There are **three basic camera types**:

1. **Mechanical** ***(M)***
   Older film cameras with most or all functions controlled mechanically or manually, with rotating, mechanical settings indicators.

2. **Electronic** ***(E)***
   newer film cameras with most or all functions controlled by buttons or electrical knobs, with digital readout of the settings.

3. **Digital** ***(D)***
   Similar to Electronic, except an electronic sensor replaces the film.

There are **three basic systems that operate** in all cameras:

- **Viewing System**
  The viewing system allows a human being to see, with varying degrees of ac- curacy, what image will strike the film or sensor at the time of exposure.

- **Light Gathering System**
  The light gathering system is composed of one or more pieces of glass which gather light reflected from an image and focus that light on the film or sensor.

- **Exposure System**
  The exposure system allows a precisely controlled quantity of light to strike the focal plane, where it *(M/E)* causes chemical changes in dyes and silver compounds that eventually result in a viewable image, or it *(D)* causes electrons to be stored in cells that eventually result in pixels on a electronic display.

These **basic camera types control their basic systems** using:

- **Shutter Release**

The button you push to record an image. *(E)* It also advances the film to the next frame.

- **Focus**

(M) A ring on the lens, or *(E/D)* a button or lever, that changes how sharp or fuzzy an image appears in the viewfinder.

- **Aperture**

(M) A ring on the lens, or *(E/D)* a button or knob, that changes how much light is allowed to pass through the lens.

- **Shutter Speed**

A button or knob that changes how long light strikes the *(M/E)* film or *(D)* sensor during exposure.

- **Zoom**

(M) A ring on the lens, or *(E/D)* a buttor or lever, that changes the focal length of the lens.

- **Film Speed**

(M) A knob, or *(E/D)* knob or menu selection, that determines how sensitive the imaging system (film or sensor) is to light.

- **Exposure Compensation**

Similar to film speed, a knob that changes imaging system sensitivity, typi- cally used on a per–image basis for unusual lighting.

Other controls perform supplementary functions:

- **Self Timer**

Allows you to be in the picture; also useful as a stability aid.

- **DOF Preview**

Allows you to see the effect of aperture on focus

- **Flash Modes**

Allows control of built–in flash.

- **Exposure Modes**

Allows different ways of measuring light, such as average, spot, matrix, etc

- **Exposure Lock**

Keeps exposure values from one shot to the next

- **White Balance *(D)***

Compensates for different types of lighting *(D)* Menus, Previews, Resolution, and More!

Exposure:

There can be a lot of light, or there may be very little. "Exposure" is what we talk about when we describe how the intensity of light is controlled to suit a particular film or sensor.

Art: overall exposure determines how light or dark an image is. Photographers call light images "high key" and dark images "low key," whereas artists refer to lightness and darkness in an image as "value."

Science: light is measured in terms of exposure value," which is a logarithmic absolute scale. Each increase of 1 EV represents a doubling of light.

Exposure is determined by **four variables**:

- **The amount of light illuminating the subject,**

You often don't have much control over this, but you may be able to move lights around, or to move your subject from shadow to sunlight, or to use a reflector to move light onto your subject.

- **The sensitivity of the film or imaging sensor,**

Film comes in different sensitivities, specified by their "ASA" or "DIN" numbers. Digital cameras can have different sensitivity settings per image. In either case, greater sensitivity means more "grain" or "noise," less sensitivity means longer exposure times and blurring.

- **The "focal ratio," or aperture of the lens,**

Generally miscalled the "aperture," this is actually the ratio of the length it takes to focus the image (focal length) to the effective width of the lens (focal width). It is often represented by the symbol "*f*".

- **And the length of time the film or sensor is exposed**.

Also known as "shutter speed," this is typically fractions of a second up to tens of seconds, and is represented by the letter "t".

Your camera's exposure system gives you control over the latter two and your ***(M/E)*** choice of film or ***(D)*** sensitivity setting control the second item.

For "normal" lighting situations, your camera's exposure system wants to use settings that result in mid tone gray. But this is not always what you want!

What if you are taking a picture of a polar bear in a snow- storm, or a raven in a coal mine? In these situations, you have to trick the camera's exposure system into keeping white or black.

Exposure Compensation

Most cameras have an **"exposure compensation"** control to help with such subjects.

Neither film, nor digital sensors come anywhere near being as sensitive to the wide range of light that the human eye can perceive. The range of light to dark in images is called the "scene contrast," and you often have to choose to sacrifice shadow detail in

order to get highlight detail, or vice–versa.

Perspective art:

Distant objects appear to be smaller than nearby objects. Parallel lines, like the edges of a long, straight road, converge in the distance. Looking up at a tall building makes it look like it recedes into the distance. This is artistic perspective.

In photography, perspective is manipulated by two means:

- The focal length of the lens,

This is the distance from the lens's rear nodal point and the film or sensor, and it determines both the magnification of the imaged subject, and the angle of view of the imaged scene.

- And the position of the lens relative to the film/sensor.

This is normally fixed in common 35mm and digital cameras, but is variable in large format view cameras and with some specialized 35mm lenses.

Perspective is divided into **three categories:**

1. **Wide Angle**

These lenses enhance perspective — close objects appear much larger than normal, far off objects appear much smaller than normal.

- Normal

These lenses correspond to the perspective we are used to seeing with our own eyes.

- Telephoto

These lenses reduce or compress perspective — close objects and far objects are closer in size to each other than our eyes perceive them.

Perspective comes from the ratio of focal length to the diagonal measure of the film or sensor. This is why 35mm cameras (with a diagonal measure of 50mm), have a different focal length for a given perspective than cameras with other sized film or sensors.

In particular, digital cameras generally have smaller sensors, so the perspective for any given focal length is greater than
It would be with most film cameras' lenses of the same focal length.

The focal length is the primary thing that is changed when you "zoom" a lens, so most people are familiar with its operation. But most people use zoom for "lazy composition," rather than for purposeful manipulation of perspective.

If you want a subject to be closer, without changing the relationship between the subject and its surroundings, get closer to the subject!

Practice using zoom strictly for manipulating perspective; telephoto settings reduce perspective, wide–angle settings enhance perspective.

Science:

- Wide angle lenses correspond to human "circle of perception," the angle at which we can sense objects.

- Normal lenses correspond to human "circle of attention," the angle of the fovea, an area of the retina that has an expanded number of cones.
- Telephoto lenses correspond to human "circle of detail," the area upon which we concentrate when we examine tiny objects, such as text.

MOTION CONTROL:

Much of the time, you want your images to be nice and sharp, as though frozen in time. You control this by having an appropriate shutter speed.

However, once you master sharp images, you may find it interesting to indulge in purposeful, controlled blurring. If the desire is to impart a feeling of motion, purposeful blurring is usually more effective than frozen action!

Science:

Human "Persistence of vision" is an effect by which quickly moving objects appear blurred. It is how movies and television are able to create the illusion of continuous motion, when they're actually a sequence of quickly changing still images.
The eye cannot perceive changes that happen in less than about 1/10th to 1/15th of a second, so if you want motion to appear as you see it, choose such a shutter speed.

Motion is controlled through a variety of ways:

- **Shutter speed**
  Is how you control how long it takes to form a latent image on the film *(M/E)* or how long photons are collected by a sensor *(D)*.

- **Camera motion control**
  like a tripod, is how you keep camera motion from impacting the exposure as it is in progress.

- **Subject motion control**
  Like telling the child, "Sit still!" is how you keep subject motion from impacting the in–progress exposure.

The first technique, shutter speed, is the first to come to mind, but it rarely can have much impact without other considerations. It depends on several other items:

- **Lighting**
  If possible, choose bright lighting to stop action, dim lighting to purposefully blur action. A flash also stops action.

Film sensitivity
Determines how fast a shutter speed you can use for a given lighting situation.

- **Maximum aperture**
  Of a given lens also impacts shutter speed. A lens with a large maximum aperture ($f2$ or larger) is often called a "fast" lens, because it enables faster shutter speeds for a given lighting situation than a "slow" lens ($f3.5$ or smaller) does.

Many techniques enable camera motion control:

- **Tripod**
  Is essential for serious photography! But don't simply leave it in your closet
  — A lightweight tripod may get used more than a more expensive, sturdy, heavy one!

- **Cable release**
  If you use a tripod, you need a cable release! Pushing the shutter button, even when on a tripod, may move the camera.

- **Self–timer**
  Set your camera on a stable surface, compose your shot, and then use the self–timer to capture the image. This can be used instead of a cable release.

- **Carful hand–holding**
  Make yourself into a human tripod!

You often have more control over subject motion than you imagine:

- **Plane of action**
  Shoot into the motion of travel

- **Peak of action**
  Shoot when the subject has the least relative movement.

Light

This is it. This is what photography is all about. Without light, there would be no photography.

Basic qualities of light:

Light has **six basic qualities**:

1. **Intensity**
   (Amplitude, brightness, value) how bright or dim the light is

2. **Color**
   (Frequency, spectrum, temperature) warm, cool

3. **Direction**
   (Angle, vector) front, top, bottom, side, back

4. **Contrast**
   (Size & shape) soft, harsh

5. **Polarization**
   Invisible to the human eye, but manipulable for special effects

6. **Number of sources**

Multiple light sources, each of which will have their own set of the five characteristics above

The ***intensity* of light** is largely negated by your camera's exposure system, which guides you in choosing shutter speed and focal ratio such that the average light reflected from the subject will result in proper exposure.

But by manipulating intensity, we can indirectly control other factors:

- The expression of time, via motion–control techniques,
- The sharpness of objects, via DOF techniques.

The ***color* of light** has a lot to do with the emotions your images evoke in the viewer. Warm light often conveys feelings of well–being, cool light can invoke tension or angst.

***Directionality* of light** is perhaps the most taken for granted. Yet it is primarily responsible for how "unusual" an image looks.

We see top light every day — it comes from the sky, ceiling fixtures, etc. Front light has become popularized by camera– mounted flash.

Other directions lend drama and impact to images, whether via artificial lighting, or via sunrise or sunset.

Contrast of light:

The most poorly understood quality of light is *contrast.*

1. **A high contrast light** source has a small angular size, such as the sun. It tends to produce sharp, hard–edged shadows.

2. **A low contrast light** source has a large angular size, com- pared to the subject, such as the entire sky on an overcast day. It tends to produce soft, fuzzy–edged shadows.

Polarized *light* has all its waves lined up in the same direction. With polarizing filters, you can selectively produce or view certain polarization angles, while filtering out others.

Rarely will there be exactly one light source! *Multiple sources* come not only from multiple lights, but also from reflections from other objects and surfaces.