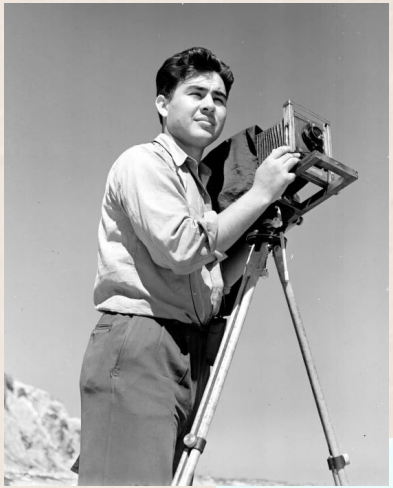
Broadcasting Equipment

An overview of what’s in the studio

Cameras

Cameras



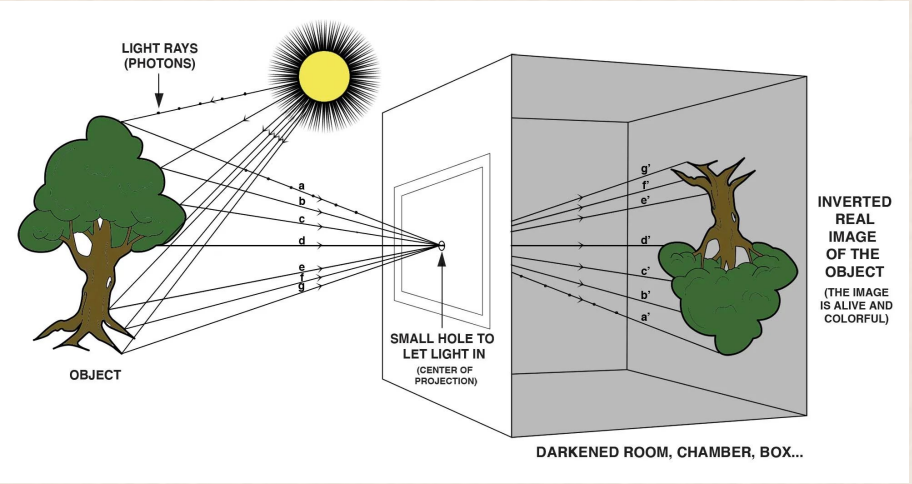
- **Camera**- comes from the latin words *camera obscura*, which means “dark chamber”, is a light-tight device that captures and stores images or video

Cameras

- The concept dates back to ancient China and Greece, with the first camera obscura being a darkened room with a small hole that projected an upside-down image

- By the Renaissance, portable camera obscuras were used by artists as drawing aids

Cameras

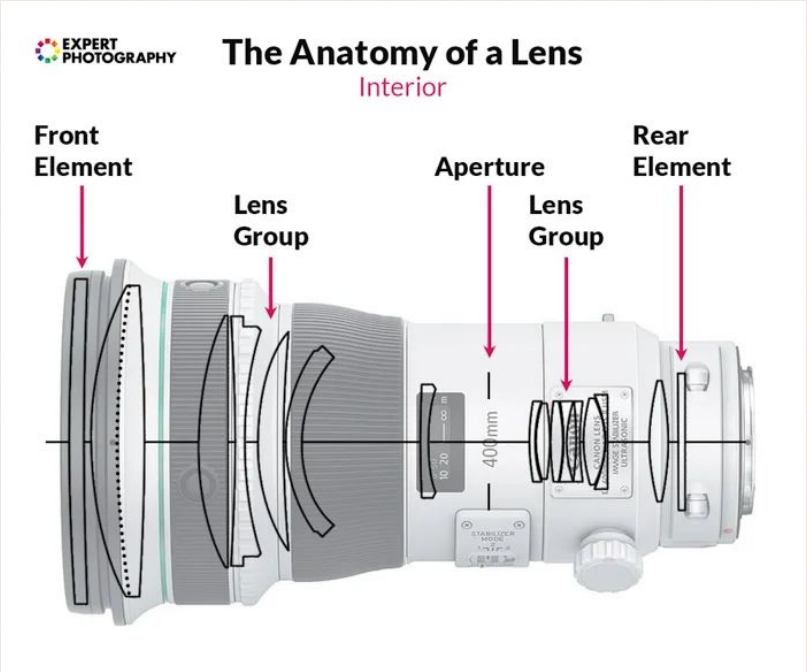


- **Camera obscura** forms images through a small hole in a dark space - smaller holes make sharper but dimmer images, larger holes make brighter but blurrier ones
- Lenses solved this trade-off by using curved glass to bend light rays, allowing both brightness and sharpness at once
- Modern cameras still use these principles but add multiple glass elements and an adjustable aperture to control focus, light, and depth of field

Cameras

- **Camera Body**- the main part of the camera/video camera that includes the shutter, viewfinder, film or sensors, and other electronics. **It's the thing you're holding when you take pictures and video**

Cameras



- **Lens**- an optical device used to bend light and form images on a fixed **focal point** where the image is recorded on either film or a image sensor that can sense light

- Elements work in groups: front elements gather light, middle groups correct distortion, and the rear element focuses the image

- **Focal length** determines field of view and is the distance from the lens to the sensor when focused at infinity

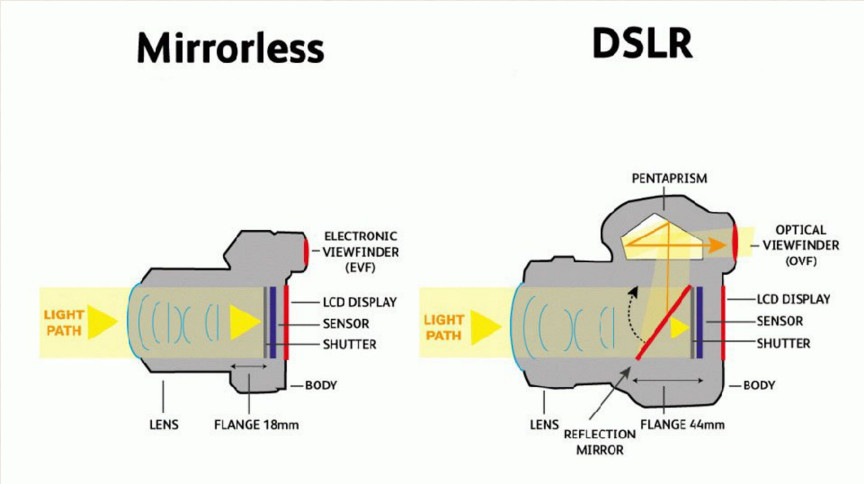
Cameras

- **Aperture**- the part of the camera, typically on the lens, that opens to let light in.
- "**Faster**" (wider, eg. f/1.4 or f/2.8) apertures also allow for selective focus (narrow depth of field), while "**slower**" (smaller, eg. f/8 or f/22) apertures allow for greater depth of field.
- **F-stop**- the size of the aperture opening, also known as the f-number. The f-stop, or f-number, is the measurement of how open or closed the aperture is. A small f-number means the aperture is open more. A larger f-number means it's open less. For example, f/1 lets in much more light than f/6.

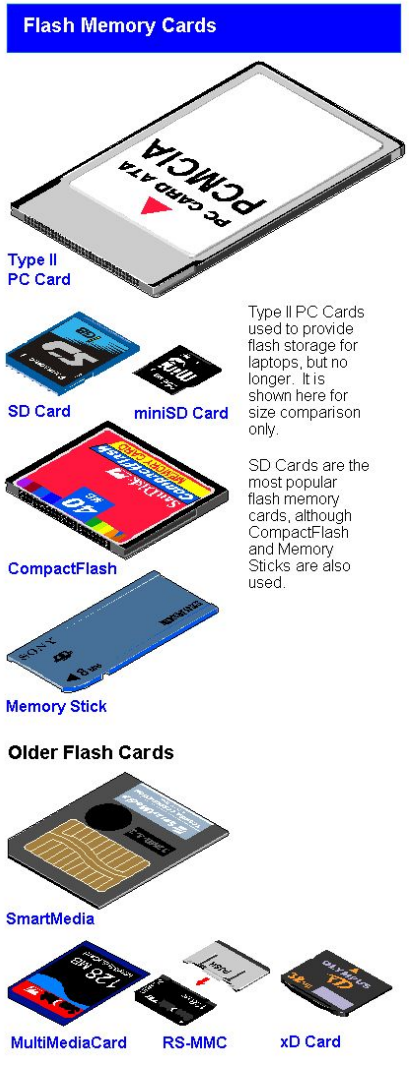
Cameras

- **Shutter**- a mechanism in the camera that opens and closes to control how long light hits the film or image sensor
- **Shutter Speed**- how long the camera's shutter is open and the sensors inside are exposed to light
- Expressed in fractions of a second (1/1000, 1/250, 1/60) or full seconds
- Fast shutter speeds are used for freezing motion and capturing sharp details
- Slow shutter speeds are used for showing motion and creating artistic effects like long exposure photography

Cameras



- **Viewfinder**- what the photo/videographer looks through to take a picture/video.
- With mirrorless cameras the electronic display shows direct sensor feed with exposure preview
- With DSLR cameras the mirror reflects light up through pentaprism for direct optical view
- Both types overlay exposure data, focus points, and composition aids



Cameras

- **Memory Card**- a memory card is a removable device used in digital cameras to store the image data captured by the camera.

- There are several different types of memory cards available including *CompactFlash*, *SmartMedia*, *SD/SDHC/SDXC*, *XD*, and others.

Types of Cameras

- **Film Camera**-a camera that exposes photographic film to light in order to take a picture
- **Digital Camera**- a camera that uses an electronic image sensor to create still photographs and record video

Types of Cameras

- **Single Lens Reflex Camera**- a camera that uses a single lens for both viewing and capture
- Uses light-sensitive film to capture and store an image, requiring chemical development
- Limited shots per roll, but different types of film offer unique color and tone qualities

Types of Cameras

- **Digital Single Lens Reflex Camera**- a digital camera using single lens for both viewing and capture
- Combines traditional mirror mechanism with modern digital sensor
- Name breaks down key features:
  - *Digital* = electronic light capture
  - *Single Lens* = one lens for viewing/capture
  - *Reflex* = moving mirror system

Types of Cameras

- **Mirrorless Camera**- a digital camera that doesn't have a reflex mirror. In a mirrorless, there isn't a an optical viewfinder. Instead, the imaging sensor is always exposed to light

- The camera's electronic viewfinder (EVF), which is often an LCD screen on the back of the camera.

Types of Cameras

- **Professional Video Camera**- a high-end camera designed for capturing high quality video footage with advanced features and capabilities that allow for greater control, customization, and flexibility.

- The four main types of professional cameras are **studio cameras**, **electronic news gathering** (ENG) **cameras**, **electronic field production** (EFP) **cameras**, and **cinema cameras**.

Types of Cameras

- **Studio Camera**- primarily used in enclosed TV studios and production sets, they are small and light enough to be handheld, but they don't have their own recorder and are connected by cable.
- They can also be mounted on a tripod, dolly or crane, making them more versatile.
- They also have a tally light that indicates when the camera is live.

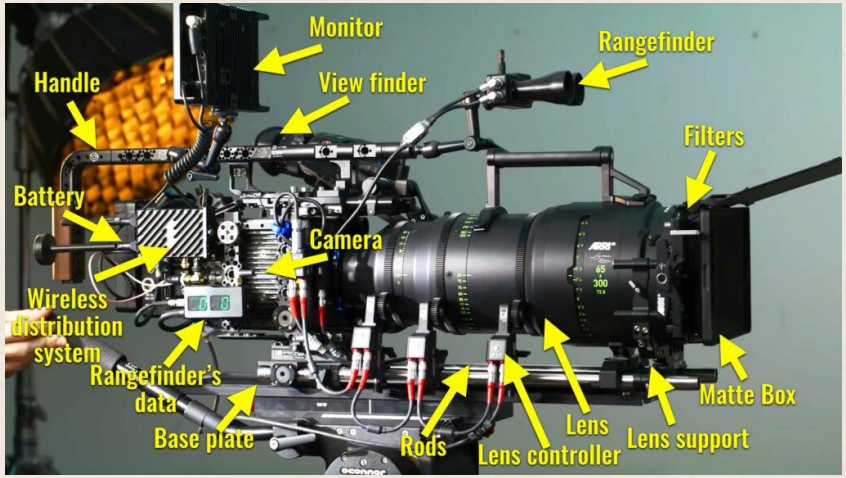
Types of Cameras

- **Electronic News Gathering Camera**- a type of video camera that is used to record news and other events.
- Originally designed for news camera operators, ENG cameras are traditionally built to be carried on the shoulder of the cameraman.
- They are easy to operate solo and usually have just a viewfinder.

Types of Cameras

- **Electronic Field Production Camera**- these are similar to studio cameras but are designed for environments outside the studio like concerts, sports, and live news coverage of special events

Types of Cameras



- **Cinema Camera**- Modular design (swappable lenses, can attach and connect to many different accessories) to support different shooting scenarios

- High dynamic range (**HDR**) sensor with RAW recording means it can capture extremely bright and dark areas (multiple f/stops) simultaneously, while RAW format preserves all image data for post-production flexibility

Types of Cameras

- **Cinema Cameras** also have professional inputs/outputs built-in: timecode (for syncing multiple cameras), XLR ports (for high-end audio), SDI connections (for professional video monitoring)

- Advanced features for movie production: built-in Neutral Density filters (for controlling bright light), high frame rates (120+ fps for slow motion), sophisticated color science (for matching different cameras and achieving specific looks)

Camera Accessories

- **Hot Shoe**- standardized mount for accessories on camera body
- Provides electrical contacts and mechanical lock
- Supports flashes, microphones, and other add-ons

Camera Accessories

- **Camera mounted flash**- Portable light source that attaches to camera's hot shoe mount for additional lighting
- Can automatically match camera settings for correct exposure, work with fast shutter speeds
- Can point flash at ceiling/walls to create softer lighting, or use wirelessly off-camera

Camera Accessories

- **Tripod**- is a portable, three-legged stand or frame that supports the weight of the camera
- Fluid head allows smooth camera movements
- Essential for long exposures and video work

Camera Accessories

- **Dolly**- a wheeled cart or similar device used in filmmaking and television production to create smooth horizontal camera movements.
- The dolly allows the camera to move forward, backward, or alongside a subject.

Camera Accessories

- **Pedestal**- a heavy-duty wheeled camera mount for studio use
- Hydraulic/pneumatic column enables smooth height adjustments
- Designed for precise movements on flat surfaces with steering wheel control, with newer models being fully robotic

Camera Accessories

- **Jib (also called a Crane)-** a long arm that moves camera through vertical and horizontal space
- Counterbalanced design enables smooth camera movement from ground to overhead shots
- Remote head options allow camera operation from ground level

Camera Accessories

- **Camera Rig-** Supports camera system with mounting points for accessories - from simple handheld to complex shoulder mounts
- Adds stability and ergonomic control through handles, pads, and counterweights
- Integrates power distribution, monitor mounts, and follow focus systems

Camera Accessories

- **Teleprompter**- a screen or mirror that allows the speaker to read a script while speaking
- Allows eye contact with camera while reading script
- Essential for broadcast and video presentation

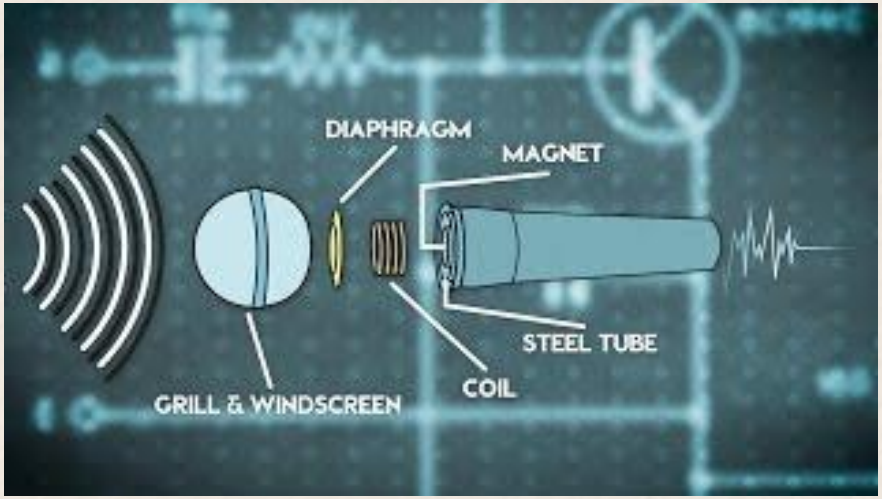
Camera Accessories

- **Video Switcher**- a device or software program that selects between multiple incoming video signals from various sources and directs one of those signals to a single output

- The output could be a streaming device, video recorder, or a display device

Microphones

Microphones



- **A Transducer-** a device that converts one type of energy into another
- **Microphone**- a transducer that converts sound into an electrical signal for the purpose of transmitting or recording that sound.
- There are three main types of microphones: dynamic, condenser, and ribbon.

Microphones

- **Dynamic microphones** are passive devices requiring no power source, known for their versatility and durability
- Best suited for capturing loud, strong sounds in live settings
- Limited frequency response, with weaker reproduction of high and low frequencies

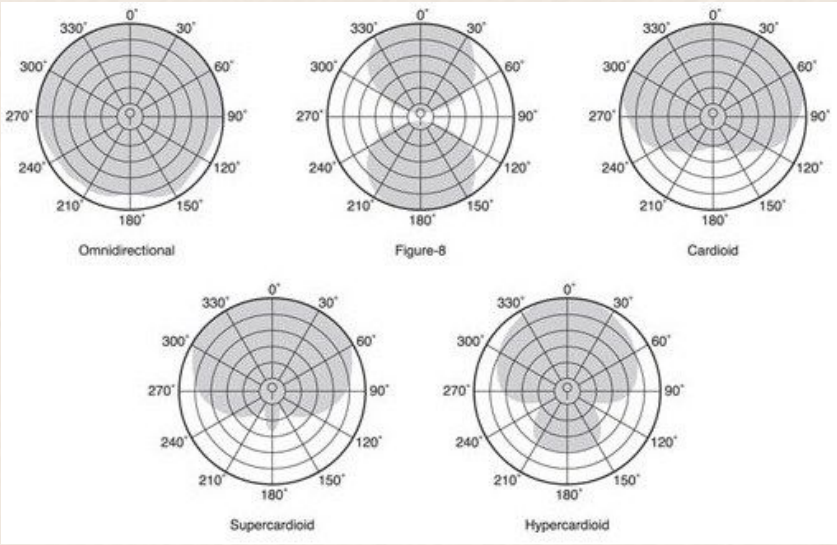
Microphones

- **Condenser microphones** offer higher sensitivity and excel at capturing vocals and high frequencies
- Require external power to operate, unlike dynamic microphones
- More fragile and expensive than dynamic mics, unsuitable for loud sound environments

Microphones

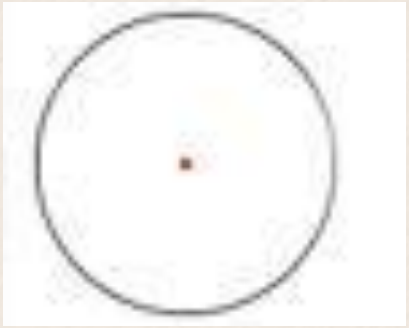
- **Ribbon microphones** deliver exceptional sound quality with rich frequency response, ideal for vocals and acoustic instruments
- Particularly well-suited for recording woodwind, brass, and string instruments
- Extremely delicate design requires careful handling despite superior sound capture ability

Microphones



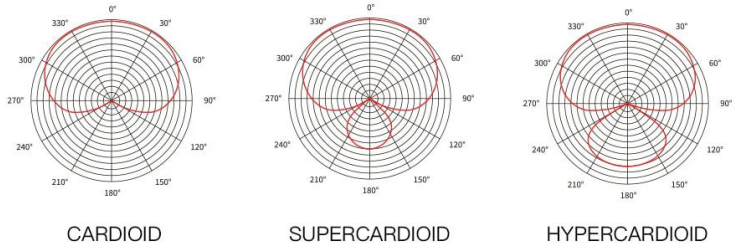
- **Polar Patterns** describe how sensitive a microphone is to sounds coming from different directions
- Understanding polar patterns helps in selecting the right microphone for specific recording situations
- Polar patterns are represented by diagrams showing the microphone's sensitivity in a 360-degree field

Microphones



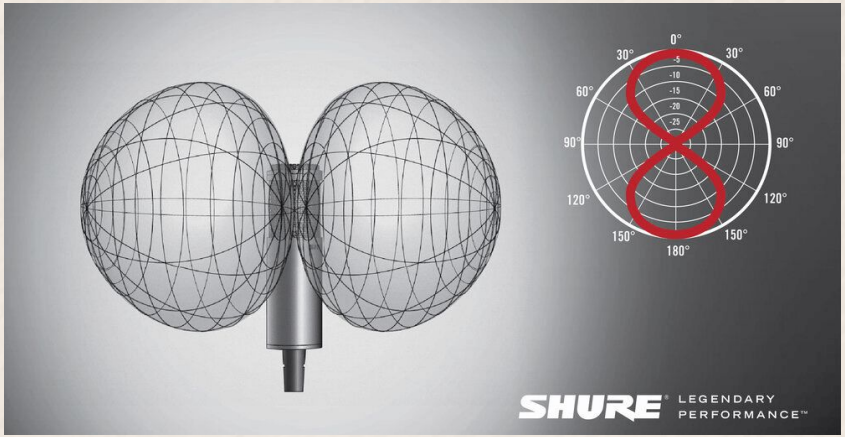
- **Omnidirectional** microphones have equal sensitivity at all angles (omni = all; all-directions)
- This feature is useful especially with Lavalier microphones (clip on lapel)
- A disadvantage is that an omni cannot be aimed away from undesired sources such as loudspeakers which may cause feedback

Microphones



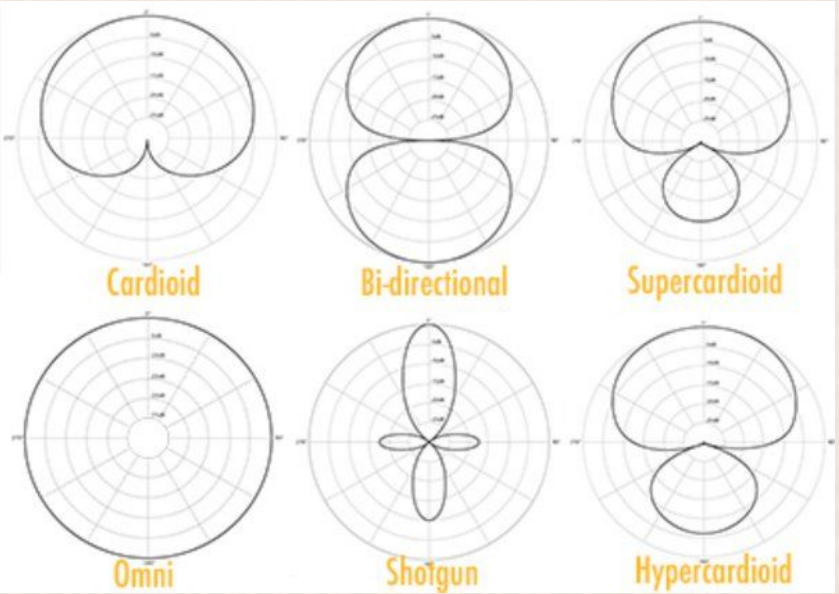
- **Unidirectional** or **cardioid pickup patterns** are most sensitive to sound produced on the front side of the microphone
- **Super- and hyper-cardioid** pickup patterns have a greater sensitivity than cardioid pickup patterns
- The sides of the microphone are less sensitive but will still pick up a usable sound at a closer range, while the rear of the microphone is entirely out of range

Microphones



- **Bidirectional** or **Figure 8** pickup patterns are sensitive to signals emanating from the front and back sides of the microphone while rejecting sounds from the left and right sides of the microphone capsule

Microphones



- **Switchable** pickup pattern microphones are hybrid microphones that can be switched from one pickup pattern to another for all-in-one flexibility in different environments

Microphone Accessories

- **Preamplifier:** An electronic device that converts a weak signal into a stronger signal
- It boosts the signal of a microphone or instrument to the standard operating level of recording equipment
- It is essential for recording, broadcasting/streaming, and live sound reinforcement; improving signal quality and prevents distortion in audio setups

Microphone Accessories

- **Amplifier**- An electronic device that adds power to the signal, increasing volume without distorting the original sound

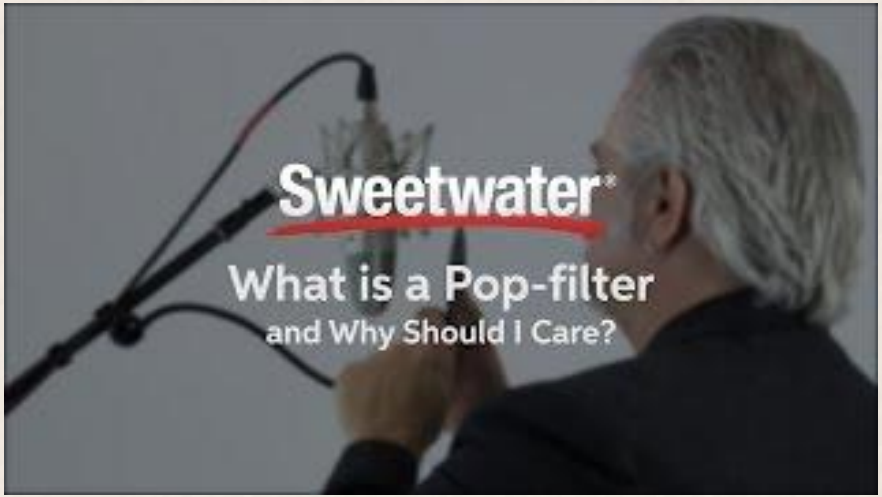
- It's main functions are: **Impedance matching** (ensuring proper amp-speaker interaction), **signal amplification** (making the signal louder), and **tone control**

- **Tone control**: Ability to adjust the balance of high, mid-range, and low frequencies in the audio signal

Microphone Accessories

- **Audio Mixer**- a device that takes multiple audio signals and mixes, balances, and combines them to route them to a common output for recording or amplification

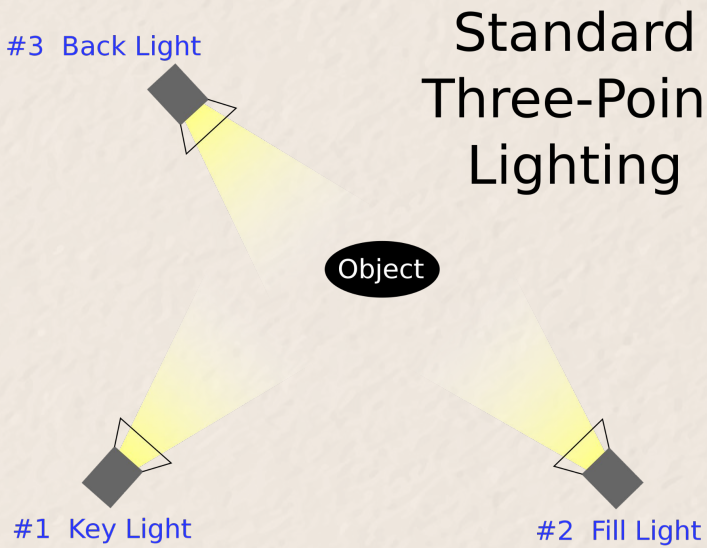
Microphone Accessories



- **Pop Filter**- Placed in front of the microphone to reduce plosive sounds (such as "p" and "b" sounds) improve audio quality

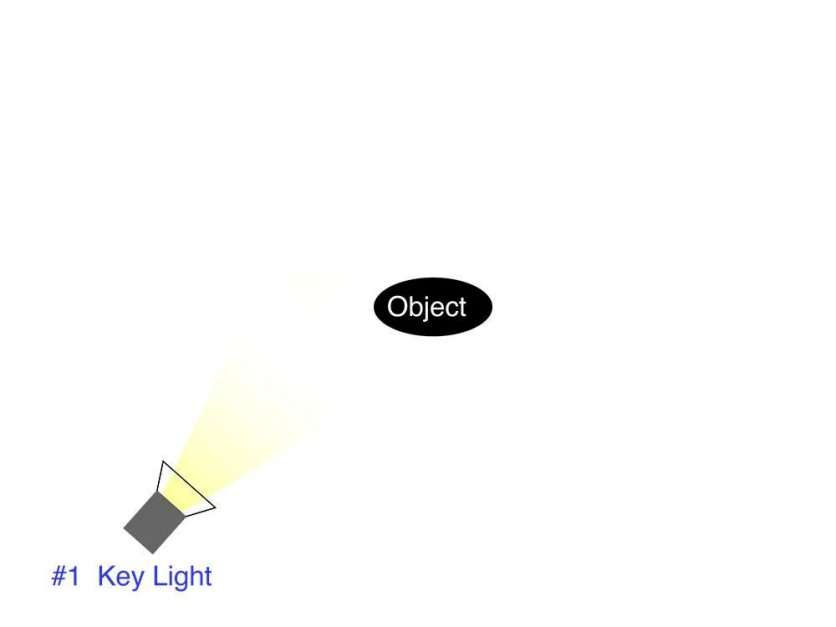
Lights

Lights



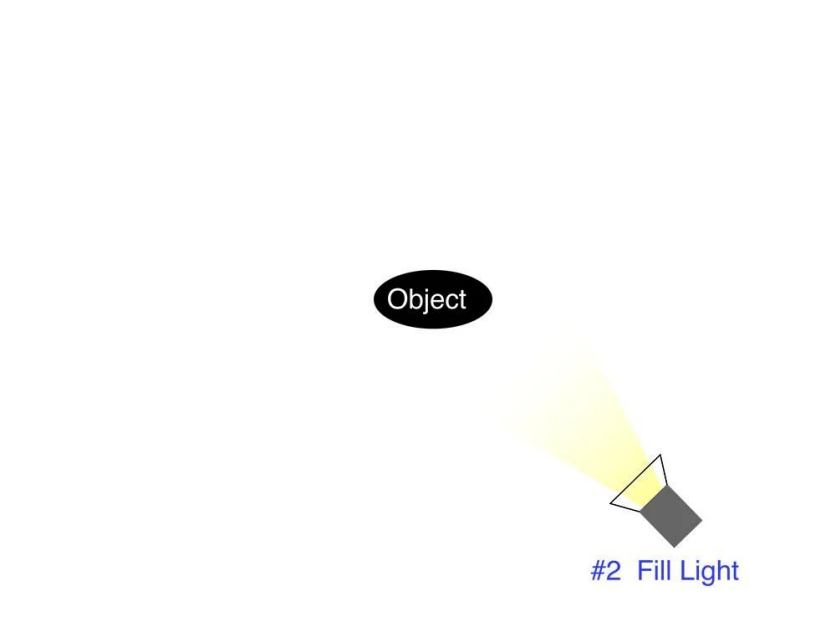
- **Three Point Lighting**- uses three light sources placed in three different positions
- It is the standard form of professional lighting in video production and still photography
- The three lighting sources are known as the **Key**, **Fill**, and **Back Light**

Lights



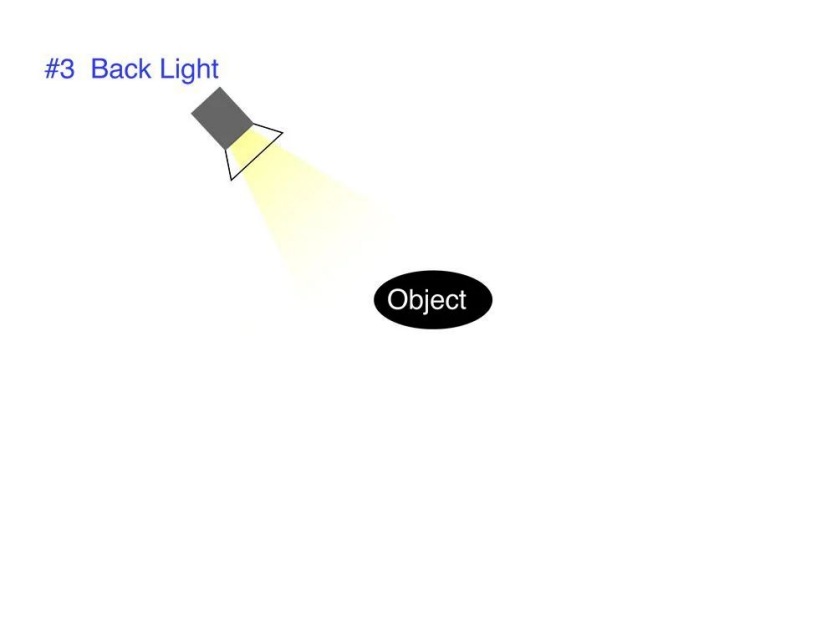
- **Key Light**- Can be the sun or an electrical light source, it is the main, brightest and strongest source of light that gives a scene its overall exposure
- Typically positioned 15 to 45 degrees off to the side of the camera and the front of the subject
- This creates shadows on the subject's face, giving it dimension and depth

Lights



- **Fill Light**- The second light source that is softer than the key light
- Placed on the opposite side of the camera as the **key light**
- The fill light (which can be a reflector or an electric light) crosses the **key light** to "**fill**" the strong shadows created by the key light
- Together with the key light, the fill light determines the mood of a scene

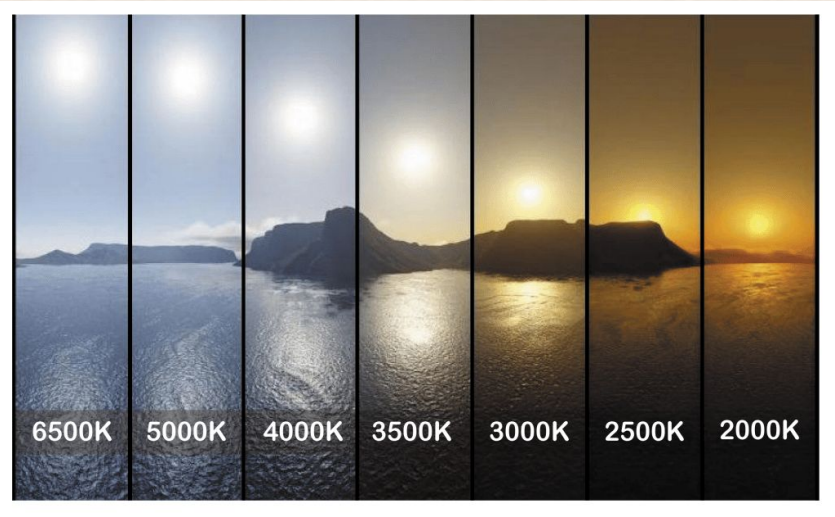
Lights



- **Back Light**- also known as the “rim” or “hair” light, the backlight is used to separate the subject from the background

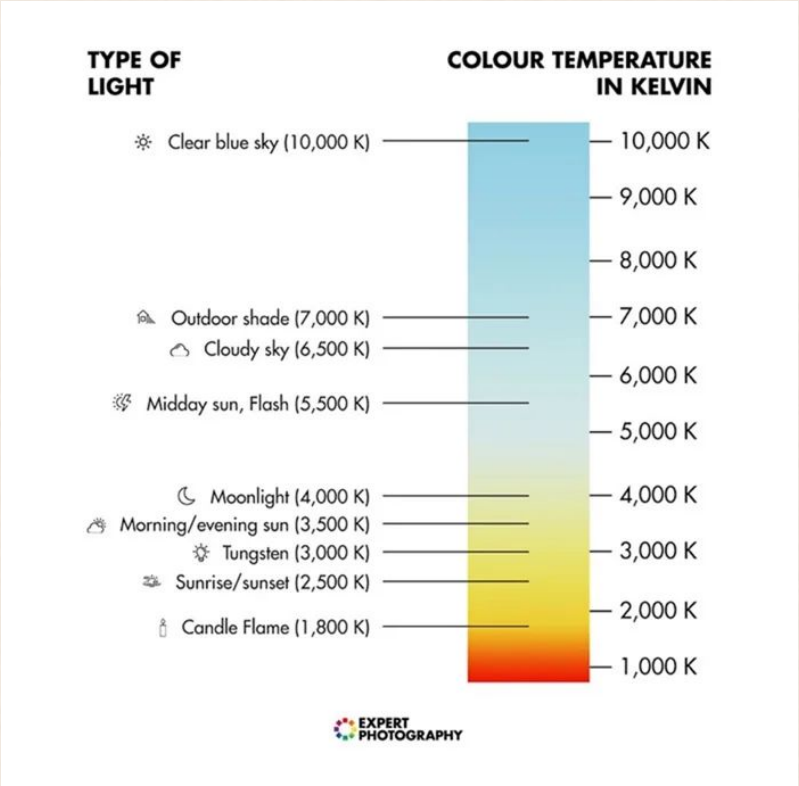
- It makes the scene look more three-dimensional by creating a rim of light or outline around the head of a subject that pushes the subject away from the background and gives a sense of depth

Color Temperature



- **Kelvin**- based on absolute zero, it is the base unit of thermodynamic temperature
- In terms of **color temperature**, Kelvin describes only the color of light emitted by a light source
- **Color temperature** is a scale measuring the visual appearance of light, ranging from warm (yellowish) to cool (bluish) tones, quantified in degrees Kelvin (K). Lower numbers indicate warmer light, while higher numbers represent cooler light

Color Temperature



- This concept is crucial in various fields, including photography, film, interior design, and digital displays, as it affects mood, perception, and visual comfort

- The scale spans from approximately 1800 K (candlelight) to 10,000 K (blue sky), with familiar reference points:

    - Candlelight: 1800 K (warm, intimate)
    - Incandescent bulb: 2800 K (soft, yellow-white)
    - Daylight: 5500 K (neutral, balanced)
    - Overcast sky: 6500 K (cool, slightly blue)
    - Clear blue sky: Up to 10,000 K (very cool, distinctly blue)

Color Temperature

- In visual arts, color temperature is a powerful tool for creating mood and atmosphere
- Warm colors (2000-4000 K): Evoke comfort, intimacy, nostalgia
- Cool colors (5000-10000 K): Suggest detachment, clarity, futurism
- **White Balance**: In camera setting that ensures that white objects appear truly white in images, regardless of lighting conditions

Color Temperature

Light Accessories

- **Diffuser**- Semi-translucent material placed between a light source and a subject

- It scatters light beams to soften light, make it look more natural, and reduce glare and harsh shadows

Light Accessories

- **Reflectors**- Reflectors are used to reflect, or bounce, light back onto your subject, eliminating shadows

Cables

Common Cable Terminology

- **Male connectors** are the "plugs," while **female connectors** are the "sockets"
- **Pins** within connectors transmit signals and can vary in number and configuration
- Gender changers and adapters enable the connection between different types of connectors.

XLR Cables

- **External Line Return** cables were introduced for balanced audio connections, a necessity for professional audio recording
- Widely used in microphones, speakers, and audio mixers due to their ability to minimize interference and noise
- XLR connectors come in various configurations (3-pin, 4-pin, 5-pin) to accommodate different audio (or power) needs
- Distinguished by their rugged construction and locking mechanism, ensuring secure connections in studio environments.

AUX Cables

- Gained popularity with portable audio devices, such as Walkmans and portable CD players
- Now widely used for connecting smartphones, tablets, and laptops to speakers, car stereos, and audio interfaces
- Standard connectors include the 3.5mm (1/8-inch) and 1/4-inch (6.35mm) TRS (Tip-Ring-Sleeve) variants
- Renowned for their versatility and compatibility with consumer audio equipment

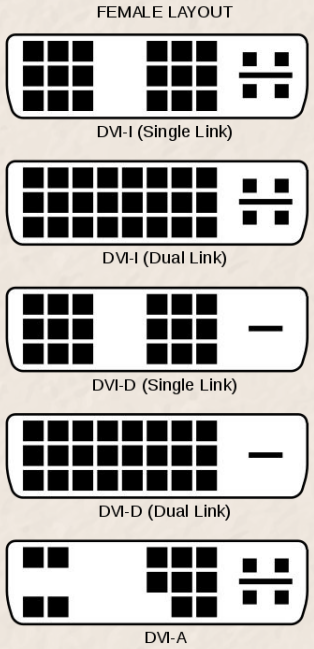
RCA Cables

- **Radio Corporation of America** cables were introduced as a versatile solution for analog audio and video connections
- RCA connectors, typically red and white for audio and yellow for video, are prevalent in home entertainment setups
- Found in home theaters, audio systems, and older video equipment
- Recognizable by their distinctive color-coding and simple plug-and-play design

VGA Cables

- **Visual Graphics Array** connectors emerged in the late 1980s as the standard for analog video connections
- Ubiquitous in connecting computers to monitors and projectors in classrooms and corporate settings
- VGA connectors feature 15 pins arranged in three rows, delivering RGB video signals
- It’s usage is fading with the transition to digital video technologies

DVI Cables



- **Digital Visual Interface** cables were introduced to meet the demand for digital video connections
- Found in connecting computer monitors, projectors, and high-definition displays
- DVI connectors come in several variations, including DVI-D (digital only) and DVI-I (digital and analog)
- Distinguished by the number of pins and the absence of color-coding

HDMI Cables

- In the early 2000s **High-Definition Multimedia Interface** connectors revolutionized A/V connectivity with high-definition digital video and audio
- Essential for connecting modern TVs, monitors, gaming consoles, and Blu-ray players
- HDMI connectors come in standard, mini, and micro sizes to suit various devices
- Distinguished by their compact size and support for advanced audio and video formats

SDI Cables

- In the late 1980s and early 90s **Serial Digital Interface** gained prominence in broadcasting and live production due to their reliability
- Commonly used in video cameras, broadcast studios, and professional video production environments
- SDI connectors, typically BNC (Bayonet Neill–Concelman), ensure secure and lockable connections
- Distinguished by their ability to transmit high-quality video and audio over long distances without signal degradation