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Audio and Video Editing

Microphones & Audio Recording

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Audio Recording

- Sound recording is a process that requires knowledge of the basic laws of acoustics. In order for the sound to be recorded well, it is necessary to know in what conditions it will be recorded (e.g. studio, open space, hangar, factory). According to the shooting conditions, the appropriate equipment is selected.

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Microphones

- Microphones can be divided in different ways.
- Thus, according to the construction, they are divided into electrodynamic, capacitor, electret and piezoelectric.
- According to the size of the membrane, they are divided into microphones with a large membrane and microphones with a small membrane.
- They can be divided according to the characteristic of orientation into non-directional (omnidirectional), directed (unidirectional) and two-directional (bidirectional).

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Microphones

- **The dynamic** microphone is sturdy, robust and ideal for recording loud sound sources, such as concerts or drums. Due to its construction, it is less sensitive and better at repelling unwanted noise from the environment.
- The **condenser** microphone is more sensitive, captures more detail, and is used in studios, podcasts, and for voice-over. It requires a phantom power supply (48V) and produces a cleaner, more natural speech sound.
- In practice:
    - Dynamic microphone: field, noise, reports.
    - Condenser: studio, narration, quiet ambience.
- Proper microphone selection improves sound quality and reduces the need for editing.

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Microphones

- The electrodynamic microphone has a membrane connected to a coil located within the field of the permanent magnet. The movement of the coil, under the influence of sound pressure, leads to induction of current in the coil and the occurrence of voltage at its ends. Due to its weight, the coil reacts more slowly to sudden changes in pressure and thus relieves them.

- Electrodynamic microphones are most often used to record loud sound sources. Due to their construction, natural compression of the signal peaks occurs during sudden changes in sound pressure, i.e. sound level.

Microphones

- The condenser microphone operates on the principle of a capacitor with one movable plate which is a membrane and one fixed. Under the influence of sound pressure, there is a movement of the membrane and a change in the capacitance of the capacitor, which leads to a change in the voltage at the ends of the capacitor. The capacitor must be loaded with nominal voltage, so that a change in capacitance could cause a change in voltage. The voltage required to operate the microphone is 48V and is called phantom power.

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Microphones

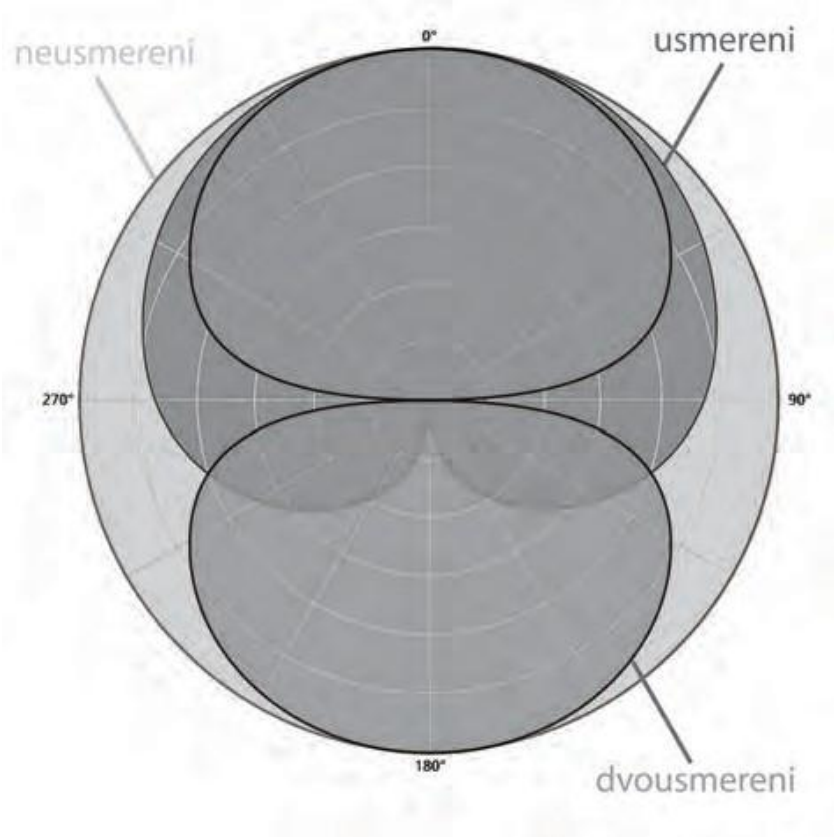
- Condenser microphones are most often used to record voice and music in studio conditions. In addition, in the variant " shotguns microphone " are used outdoors, if it is necessary to record sound from a greater distance (e.g. outside the frame). Condenser microphones have an extremely sensitive membrane that, almost instantly, reacts to changes in sound pressure and therefore most faithfully converts sound into electrical voltage. The condenser microphone requires phantom power.
- **Electret** microphones are a subtype of condenser microphones in which the fixed plate of the condenser is coated with a layer of electret. Electret is a material that has the properties that once charged, it "permanently" remains in such a state. Therefore, these microphones do not require phantom power, but usually only require DC voltage to power the accompanying electronics.

Microphones

- Microphones with **a large** membrane and microphones with **a small membrane** differ in that microphones with a large membrane better transmit longer wavelengths, i.e. lower frequencies.

Dynamic Microphones:	Condenser Microphones:		Ribbon Microphones:
	Small Diaphragm	Large Diaphragm	
			
Shure SM58	Sennheiser e614	Neumann TLM 103	Royer 121
Dynamic micr perfect for live use. Commonly used on vocals and guitar cabinets.	Small diaphragm condensers perfect for recording acoustic guitars and strings.	Large diaphragm condenser perfect for recording vocals.	Ribbon mics are perfect for recording guitars and miking up guitar cabinets.

Microphones



Microphone Orientation

- Directionality is a feature of the microphone that more strongly "accepts" sound from a particular direction.
- **Non-directional** microphones transmit sound equally well from all directions, from the entire spatial angle, and are therefore most often used to record ambient sound.

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Microphones

- **Directional** microphones can be: cardioid, hypercardioid and supercardioid. These microphones are most sensitive to sound from one direction. This is usually the direction of the front – normally to the membrane.
- **Two-directional** microphones have a membrane open on two sides and are most sensitive in the direction of the membrane axis, on both sides equally.
- The cardioid captures the most of the sound from the front, making it ideal for interviews and narration.
- The supercardioid and hypercardioid have a narrower focus and are used with shotgun microphones for film and documentaries.
- The omnidirectional microphone captures sound evenly from all directions and is suitable for ambient recording.

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Indoor Recording

- If the sound for a movie or television is recorded independently of the image (dialogue, sound effects, music), it is most often recorded in an acoustically treated space – studio.
- In this case, it is not important that the microphone is hidden in the frame, and it is possible to use recording methods that give the highest quality sound, which implies the use of quality studio microphones in the most optimal place in relation to the sound source. In order to eliminate plosives (onsonants that produce strong bursts of air when spoken, such as p, t, k, b, d, g), a pop filter is used in front of the microphone.
- The signal from the microphone via the microphone preamplifier and the A/D sound card converter enters the computer and, using the appropriate software, is recorded on the hard drive. After the processing process, the sound is synchronized with the image.

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Indoor Recording

- The sound quality depends on each part of the path that the signal passes from the microphone to the Premiere Pro.
- The microphone sends a very weak signal that passes through the preamp that amplifies it. The A/D converter converts the analog signal to digital (44.1 kHz, 48 kHz, 96 kHz).
- It is recommended to use XLR cables because they provide balanced transmission and less noise.
- If part of the chain is bad (bad cable or preamp), the quality of the recording cannot be fully repaired later.

Indoor Recording

- In a TV studio, the microphone can be in or out of frame. Most often, tie microphones are used to record speech, the so-called *lavalier*, which are usually electret type.
- If the microphones should be out of frame (this is mandatory in filmmaking), microphones with high directionality, "microphone rifles" are used.
- When it comes to a live program, the signal is forwarded to the broadcast without recording via an audio mixer, and when the program is recorded, the sound is written to the output media together with the image. If audio is recorded for a movie, then it is usually recorded on a standalone digital recorder or hard drive.

Outdoor Recording

- For outdoor sound recording, it is necessary to plan the power source for all devices (e.g. phantom power supply for capacitor microphones, power supply for recorder). If the camcorder has a microphone input, audio can be recorded to the camera, and if audio is not recorded directly to the camera, attention should be paid to synchronization. Sound and image synchronization is performed with the help of a clap.

- A clapboard is a wooden or plastic board that serves to identify each frame and synchronize sound and image. The clap marks the beginning of the recording of each frame and on it is entered the information important for the identification of the frame and subsequent editing: scene, *take*, etc. The clapper arm produces an audio marker when it strikes the main part of the slate, and the diagonal black-and-white stripes on the arm and the adjacent edge improve the visibility of the exact moment they meet.

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Outdoor Recording

- For some digital devices, synchronization is achieved using synchronization protocols (e.g. LANC (Control-L), Control-S, Control-M, etc.).
- It is very important to protect the equipment from the weather, such as rain and wind.
- Wind protection is also a very important factor for the quality of recorded sound. The use *of Zeppelin* eliminates wind gusts on the shotgun microphone membrane. When the wind is too strong, it is necessary to use additional textiles protectors - *hairy cover.*
- On a classic microphone, windshields are used to eliminate wind gusts.

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Recording in a High Noise Environment

- When recording in a noisy environment, it is necessary to isolate the useful sound from unwanted noise. Microphones must be positioned as close as possible to the sound source and should be extremely directional. In these cases, contact microphones that receive sound via vibration may be used.
- Several common real-world examples from practice:
  - live field reporting (construction sites, highways, intersections, tunnels, train station),
  - recording interviews in the factory or producing a documentary about manufacturing,
  - recording conversations backstage at concerts and music events,
  - interviewing a coach near the field or recording a sports event for YouTube or TV shows (sports halls, stadiums, fan zones).

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Recording in a Highly Reverberant Space

- When recording in a highly reverberant space (with strong echo), speech intelligibility can be significantly reduced.
- Spaces with pronounced reverberation—such as large sports halls, churches, empty classrooms, tunnels, or indoor pool areas, can significantly reduce speech clarity. In such environments, sound reflects multiple times off the walls, ceiling, and floor, creating a prolonged echo.
- The only effective solution is to place the microphone close to the sound source. Reverberation cannot be removed in post-production without severely degrading the audio quality.

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Questions & Answers

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