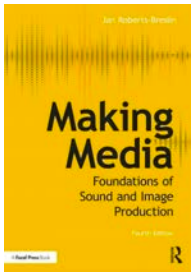
Location Sound Recording Fundamentals

David Tamés

ARTD2380 Location Sound Recording Workshop

A quick review of the homework

essential reading



Chapter 6. Sound in Roberts-Breslin's - ***Making Media*** (available online from the Snell Library)

essential viewing

- **Justin Boyd: Sound and Time** (Mark Lee Walley and Angela Guerra Walley, 2013, short documentary)
- ***The Foley Artist*** (Oliver Holms, 2015, short film)
- **Recording Sound on Location** (Lizi Hesling, CADARN Learning)
- **The Basics of Recording Audio for Digital Video** (Filmmaker IQ)
- **UCLA Post Production: How To Wrap A Cable** (David McKenna)

A quick review of the homework

Terms and concepts covered in Chapter 6. Sound in *Making Media*

ambiance (or ambience)
amplitude
attenuate
balanced audio
bidirectional
binaural hearing
bit depth
cardioid
compression
condenser
decibel (dB)
dynamic
frequency
frequency response
handheld microphone
harmonics
Hertz (Hz)
impedance
impedance
lavaliere
level meter
lossless compression
lossy compression
monitoring
mono
omnidirectional
on-axis
overmodulation
peak
phantom power
pickup pattern
pitch
quantized
radio frequency
reverberation
ride the gain
room tone
sampled
sampling rate
shotgun microphone
signal-to-noise ratio (S/N)
sound envelope
sound perspective
sound presence
stereo
streaming
timbre
unbalanced audio
unidirectional
wavelength
waves
XLR

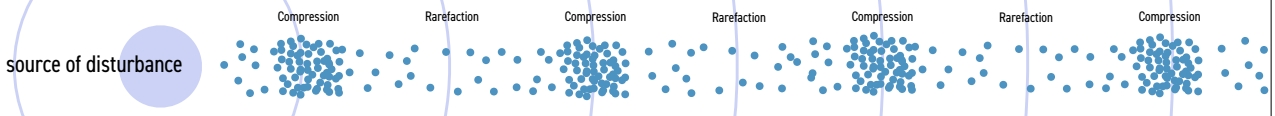
Additional terms:

16-bit
24-bit
48KHz
96KHz
boom pole
dual mono
Electro-Voice RE50
K-Tek Avalon boom pole
reporter's mic
Rycote Pistol Grip
Rycote Softie
SD card
Sennheiser MKE 600
Stereo WAV
Tram TR-50
WAV
windjammer

Review: Chapter 6. Sound in *Making Media*

What is sound?

Sound is created by physical vibrations that set molecules in motion, creating sound waves that travel through the air.



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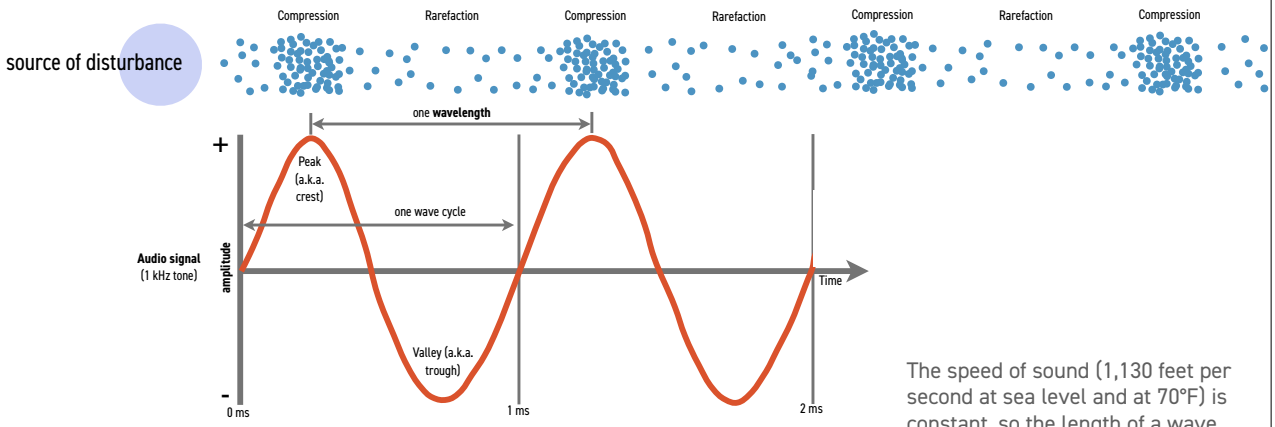
What is sound?

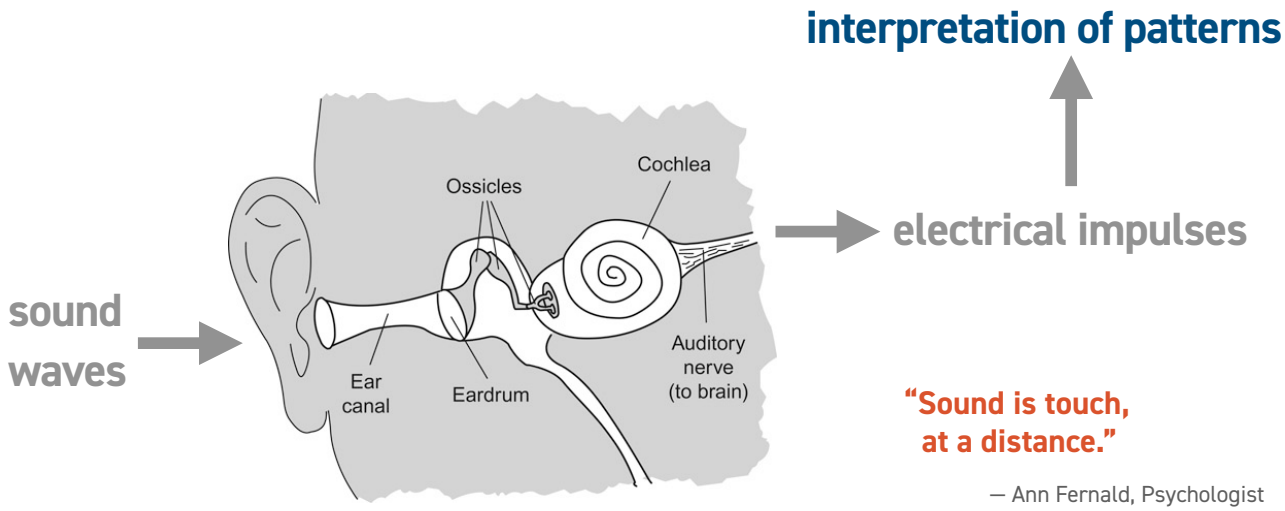
One cycle of a wave is called its **wavelength** and is related the **frequency** (number of cycles that the sound wave travels in one second).



The speed of sound (1,130 feet per second at sea level and at 70°F) is constant, so the length of a wave is related to its frequency.

Review: Chapter 6. Sound in *Making Media*

The auditory system



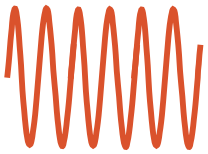
"Sound is touch, at a distance."

— Ann Fernald, Psychologist

Review: Chapter 6. Sound in *Making Media*

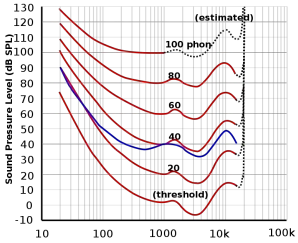
What are the terms we use to describe a sound?

Pitch



A perceptual quality that makes it possible to judge sounds as "higher" and "lower" and a major attribute along with duration, loudness, timbre and perspective. May be quantified as a frequency, but it is actually a subjective psycho-acoustical attribute.

Loudness



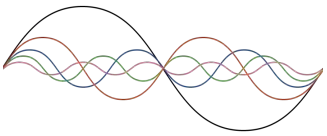
The subjective perception of sound pressure. Perceived loudness consists of physical, physiological and psychological components. Phon is a logarithmic loudness unit of level for tones and complex sounds the accounts for variable sensitivity across different frequencies.

Timbre

Harmonic Content

Attack and Decay

Vibrato/Tremolo



The subjective perception of sound that makes it possible to judge sounds with the same loudness and pitch as qualitatively different. A harmonic is a wave with a frequency that is a multiple of the fundamental frequency, also called the 1st harmonic, other harmonics are known as higher harmonics.

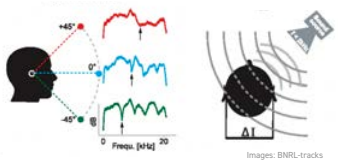
Perspective

Presence

Reverberation

Direction Binaural Perception

Movement Doppler Effect

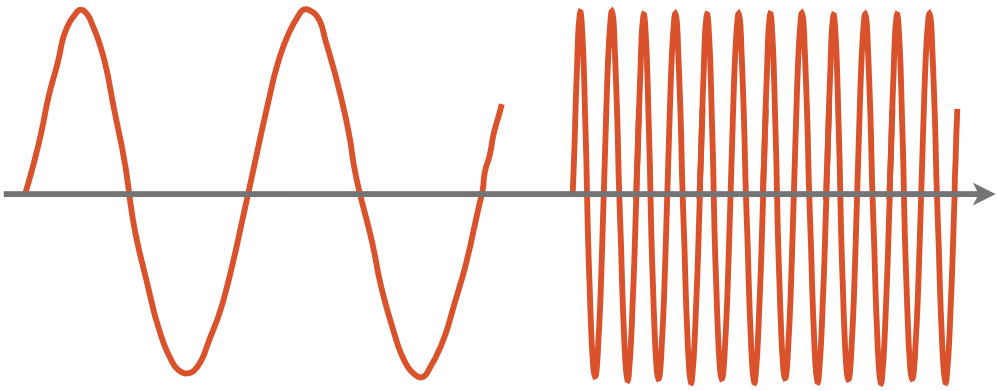


Images: BNRL-tracks

Review: Chapter 6. Sound in *Making Media*

Pitch

Frequency determines the **pitch** of a sound—how high or low it is. A human with excellent hearing can hear frequencies that range from 20 Hz to 20 kHz (the upper limit decreases with age).



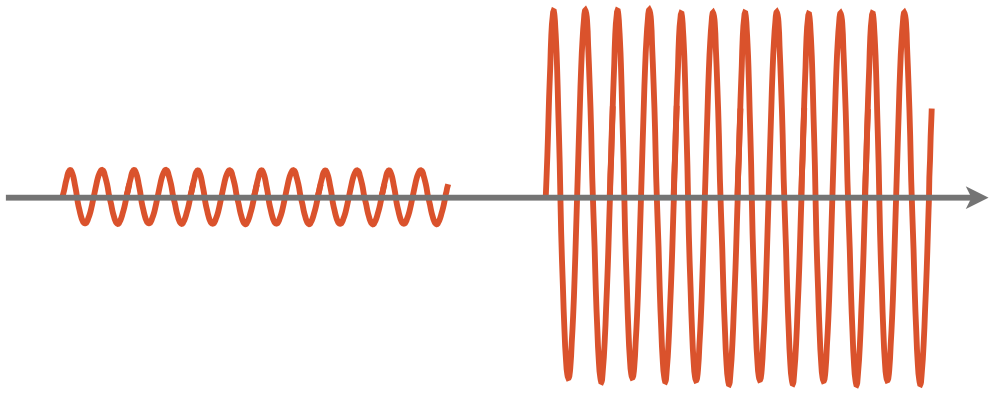
Low frequency signal (lower **pitch**)

High frequency signal (higher **pitch**)

Review: Chapter 6. Sound in *Making Media*

Loudness

The measure of the air compression is called its **amplitude** and is measured in a unit called a **decibel** (dB). These variations in pressure are perceived as variations of **loudness**.



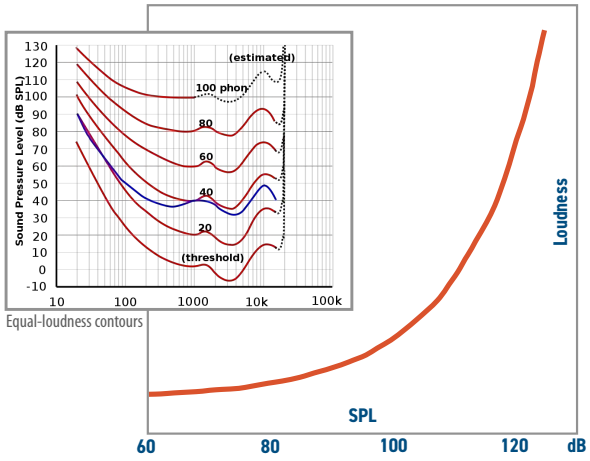
Low amplitude signal (perceived as **softer**)

High amplitude signal (perceived as **louder**)

Review: Chapter 6. Sound in *Making Media*

Loudness

Subjective perception of sound pressure consists of physical, physiological, and psychological components. **Sound pressure** is objectively measured with a logarithmic **decibel scale** related to the threshold of hearing.



Maximum Theoretical Sound (194 dB)
Jet Aircraft (during takeoff) (133 dB)
Threshold of Pain (125 dB)
Thunderclap (near) (120 dB)
Loud Rock Concert (115 dB)
Sonic Boom (110 dB)
Shouting in Ear (110 dB)
Chainsaw (104 dB)
Night Club (3' from speaker) (100 dB)
Motorcycle (98 dB)
Lawn Mower (90 dB)
Blender (82 dB)
Road with busy traffic (80 dB)

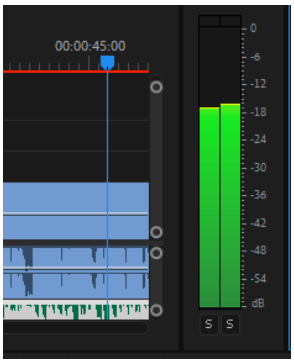
Vacuum Cleaner (75 dB)
Washing Machine (70 dB)
City Traffic (inside a car) (70 dB)
Normal Conversation (62 dB)
Rainfall (50 dB)
Quiet street (50 dB)
Quiet home (40 dB)
Bird Call (40 dB)
Soft Whisper (30 dB)
Rustling Leaves (20 dB)
Whispering (at 5') (20 dB)
Normal Breathing (10 dB)
Threshold of Hearing (0 dB)

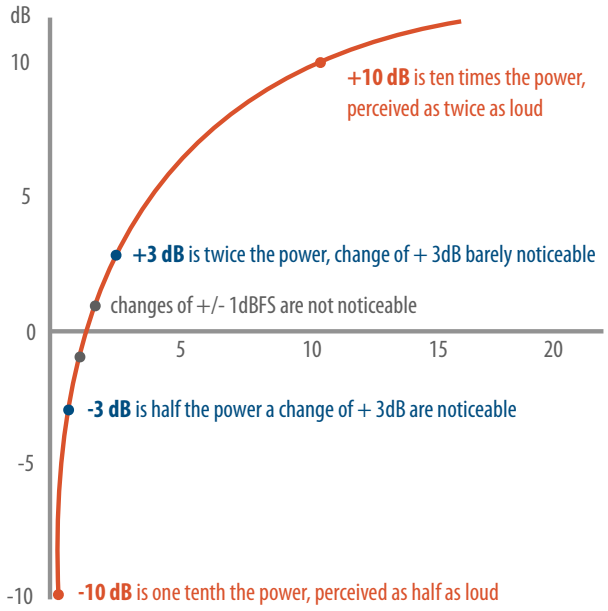
Maximum sound up to 8 hour (OSHA criteria - hearing conservation program) 80 dB

Review: Chapter 6. Sound in *Making Media*

decibel (db)

Logarithmic unit of measurement expressing magnitude of acoustic energy (Sound Pressure Level, SPL), or magnitude of an audio signal, usually displayed relative to 0DBFS (db full scale)



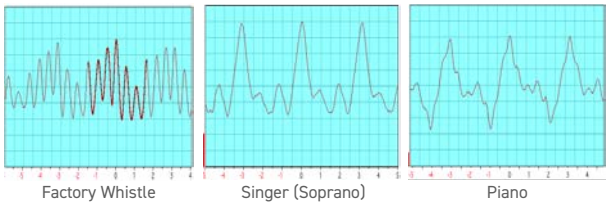


Review: Chapter 6. Sound in *Making Media*

Timbre

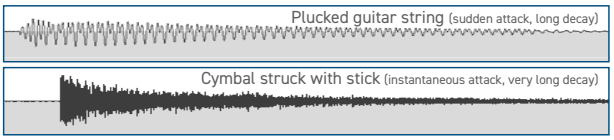
The primary contributors to the quality or timbre of a sound are **harmonic content**, **envelope**, **vibrato**, and **tremolo**.

Harmonic content is the most important of these, it is the number and relative intensity of the upper harmonics present in the sound. A sound wave consists of a fundamental frequency and a series of harmonics (an integral multiple of the frequency of the same signal). The auditory system can recognize these patterns and we use it to differentiate sounds. While sounds may have the same pitch and loudness, they will sound different based on their harmonic content which determines the waveform of the sound signal when displayed as a function of time.



Factory Whistle | Singer (Soprano) | Piano

Envelope refers to the attack and decay of the sound; attack is characterized by a rapid rise to its peak amplitude and decay is long and gradual in comparison to attack. The auditory system is sensitive to attack and decay rates and helps us identify sounds.



Vibrato refers to periodic changes in the pitch of the tone, technically frequency modulation.

Tremolo refers to periodic changes in the amplitude or loudness of the tone, technically amplitude modulation.

Images Courtesy of Carl R. (Rod) Nave, HyperPhysics

Review: Chapter 6. Sound in *Making Media*

Perspective

Contributors to the "perspective" of a sound include **presence**, **reverberation**, **direction** and **movement**.

doppler effect

The apparent change in frequency of a sound moving in relation to an observer; an example is the change of pitch heard when a train horn approaches and recedes; received frequency is higher during the approach, identical passing by, and lower during the recession.

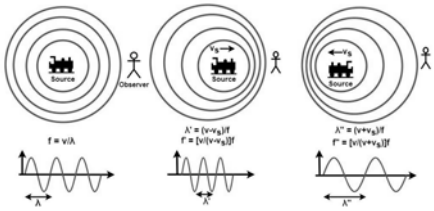


Image courtesy of Geeks for Geeks

reverberation

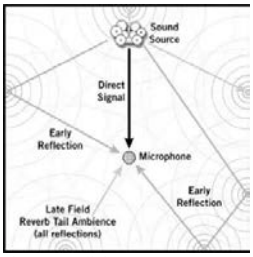


Image courtesy of Ledgernote

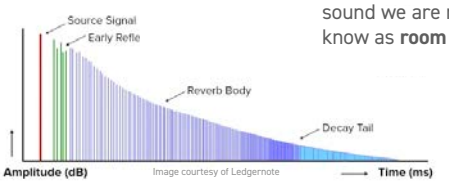
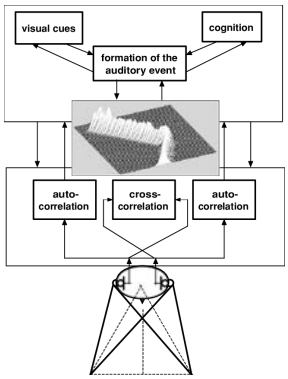


Image courtesy of Ledgernote

presence

The subjective closeness listener feels to the sound; every location has a distinct presence created by the position of the microphone in relation to the space boundaries; usually we match sound presence with shot size; the sound of a space without the sound we are recording is know as **room tone**.

binaural hearing



Adapted from Blauert, 1983 by Simon Haykin and Zhe Sage Chen

Review: Chapter 6. Sound in *Making Media*

reproducing sound

is changes in air pressure over time, energy flowing as a wave from a point at which a physical disturbance caused the **vibration of air particles** (it's not a sound until we perceive it)

transforms the vibrations of a diaphragm in response to sound waves transformed into an electrical signal in which the changes in voltage over time represent the changes in air pressure over time

conducts the flow of the electrical signal from mic to recording device (a critical link since it may pick up interference or contribute to noise to the signal)

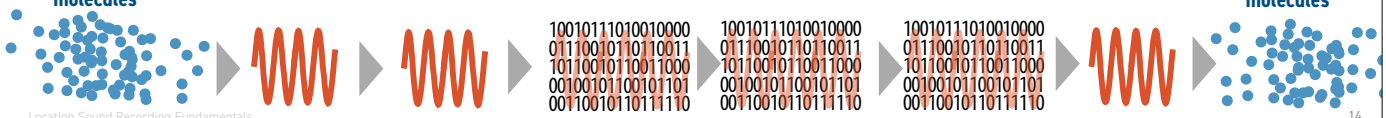
amplifies the audio signal and then passes it off to a **D/A converter** that **transforms** the audio signal into a stream of digital data, which in turn is **stored** in a digital file on a digital storage medium

during the post-production process we **edit**, **process**, **sweeten**, and **mix** a variety of sounds in the digital domain in order to create the soundtrack of our video project; an audio interface **converts** the digital stream back into an analog signal for playback through speakers or headphones

transform an amplified audio signal back into the physical disturbances (sound waves) that we perceive as sounds

will be **perceived** as similar, but never the same, as the original sound that was recorded with a microphone

vibrations of air molecules | analog audio signal | digital audio signal | analog audio signal | vibrations of air molecules



Review: Chapter 6. Sound in *Making Media*

there are two common microphone transducer technologies we use

Photo source TBD

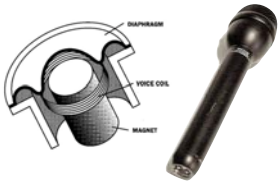


Photo courtesy of Free to Use Sounds

dynamic microphones

condenser microphones

Moving-coil transducer design	⟷	Charged-plate transducer design
Less complicated and inexpensive	⟷	More complicated and expensive
Usually rugged	⟷	Delicate
No external power required	⟷	Requires power source (battery or phantom power)
Low sensitivity (requires close proximity, less sensitive to wind noise)	⟷	**High sensitivity (provides greater working distance, more sensitive to wind noise)**
Typically limited to hand-held microphone designs	⟷	Typically used in in a variety of designs including hand-held, lavaliere, and directional microphone designs

Mic diagrams source TBD

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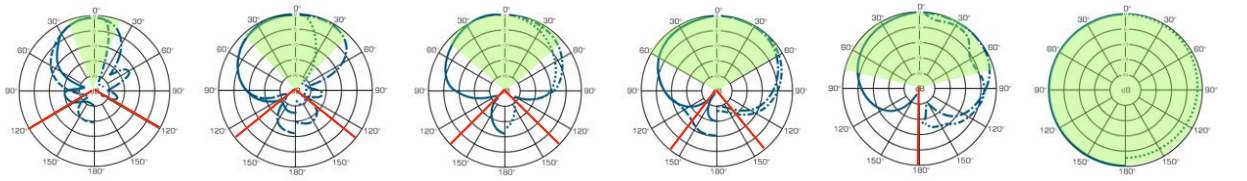
microphone pickup patterns

Long Shotgun (lobar) | Short Shotgun (lobar) | Super-Cardioid | Hyper-Cardioid | Cardioid | Omnidirectional



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mics are also characterized by their usage and form factor

shotgun / directional

(cardioid and hypercardioid condenser mics are widely used and are not technically shotguns)

Photo by Sam McGhee

handheld

(handled mics are available in both dynamic and condenser designs as well as with omni or cardioid patterns)

Photo by Dennis Mojado (Wikipedia)

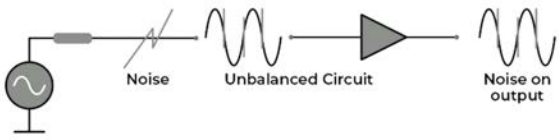
lavaliere

(omnidirectional condenser lavs are the most common but cardioid condenser lavs are also available)

Photo courtesy of Gillespie Productions

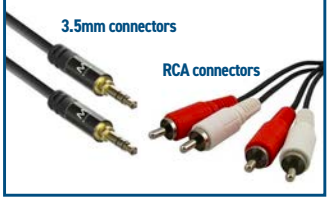
Review: Chapter 6. Sound in *Making Media*

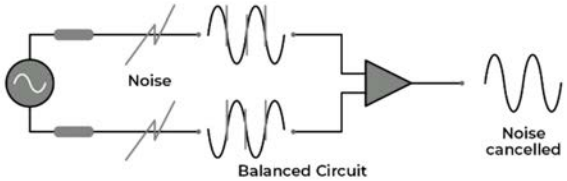
balanced vs. unbalanced lines



Unbalanced Cables have only one conductor per channel and a ground and therefore are highly susceptible to picking up noise.

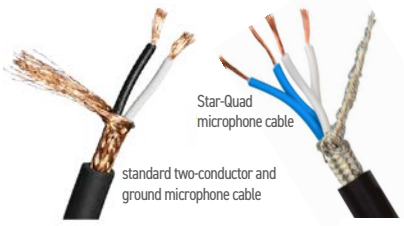
Consumer and prosumer audio gear typically uses 3.5mm connectors for microphone level signals and RCA connectors for line-level signals.





For a technical explanation of how this works, see "What's the Difference Between Balanced and Unbalanced?," Aviom Blog, https://www.aviom.com/blog/balanced-vs-unbalanced/

Image from "Balanced vs. Unbalanced" MASTERED BLOG



Balanced Cables have two conductors per channel and a ground. Devices with balanced lines have circuitry that filters out noise. The best cables have twisted pairs for each conductor for improved noise rejection, often referred to as "Star-Quad" cables.

Most professional audio gear uses **XLR connectors**, although 1/4-in. connectors are commonly used in music production.

Review: Chapter 6. Sound in *Making Media*

analog to digital conversion: sampling rate and bit-depth

Analog audio signals are digitized, a process of quantizing a continuous analog value taking samples at a particular frequency (**sampling rate**) converting the analog values into a discrete values using a 16-bit or 24-bit fixed point binary number (**bit-depth**).

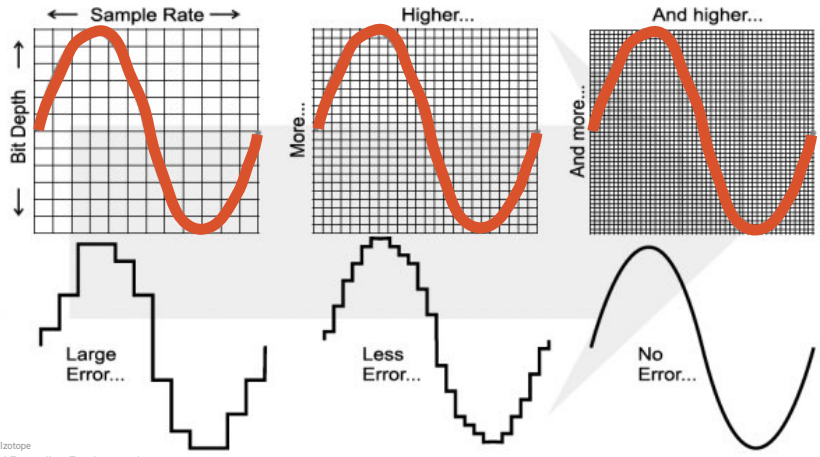


Image courtesy of Izotope

48 kHz / **24-bits** is the video production audio recording standard.

96 kHz / **24-bits** is often used for sound effects recording; the higher sampling rate allows for manipulation of the audio in post with less artifacts.

WAV is an uncompressed audio file format commonly used in professional audio; **polyWAV** (multi-channel WAV) and **BWAV** (broadcast WAV) variations add multiple channels and additional metadata, respectively.

Review: Recording Sound on Location

Recording Sound on Location
(Lizi Hesling, CADARN Learning Portal)

Notes based on "Recording Sound on Location" can be downloaded from Canvas

Review: Recording Sound on Location

What are the three Cs of good location audio?

Review: Recording Sound on Location

Three Cs of good location audio

1. **Clear:** you can clearly hear the sound that you're supposed to be hearing;
2. **Clean:** there aren't any unwanted or distracting noises affecting the quality of the audio; and
3. **Consistent:** the volume and quality don't keep changing unless the story or visuals call for it.

Photo courtesy of Free to Use Sounds

Review: Recording Sound on Location

What are five principles of good location sound recording practice?

Review: Recording Sound on Location

Five principles of good location sound recording practice

1. Assess the environment to avoid noise as much as possible
2. Always monitor your audio with good headphones
3. Know thy microphones
4. Get close to the source
5. Get your levels right

Photo courtesy of Free to Use Sounds

Review: Recording Sound on Location

Five principles of good location sound recording practice

1. **Assess the environment to avoid noise as much as possible**
2. Always monitor your audio with good headphones
3. Know thy microphones
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Review: Recording Sound on Location

Five principles of good location sound recording practice

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Review: Recording Sound on Location

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Photo courtesy of Free to Use Sounds

Review: Recording Sound on Location

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Review: Recording Sound on Location

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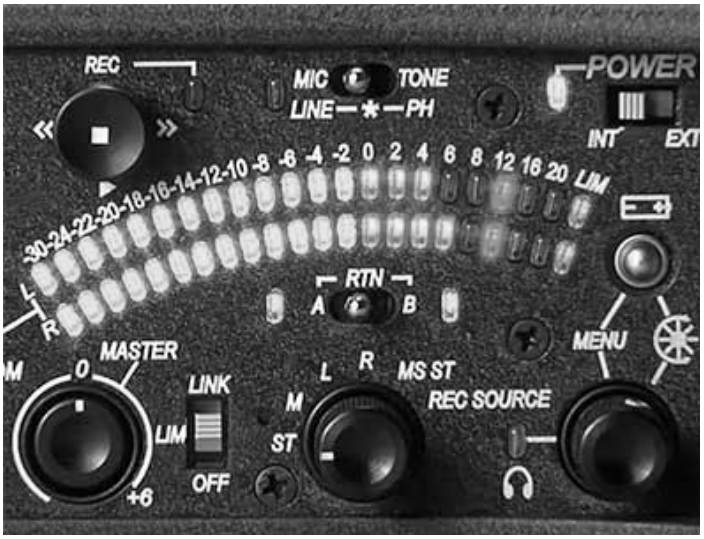

Photo courtesy of Sound Devices

Review: Recording Sound on Location

Questions and answers