

Reducing Noise

“Signal-to-noise ratio”

- *Practically*: The difference between the level of what we want to hear, and the (hopefully) lower level of what we don't want to hear.
- *Technically*: The difference between the signal level and the *noise floor*, specified in dB.
 - 70 dB is ok. 50 dB is poor.
- Noise in mixed tracks adds up! Equal levels of noise in each track add 3 dB each to the noise total.
- Hardware systems have additive noise. Individual hardware has signal to noise specified. (“s/n”)

What do we call noise?

- *Anything* in a sound that we don't want.
- Hiss from electronics.
- Hum from AC power. Buzz from an instrument amplifier.
- A fan in the background of a film dialog.
- A door slam in an interview.

Best to avoid it altogether

- Minimizing noise on a remote recording/film/video session
 - First of all, notice noises sources, and realize they will be perceived "louder" when recorded.
 - Get the mics away from the noise source.
 - Physically muffle the noise sources with padding.
 - Record a little bit of just the background noise ahead of time. (a “noise print”)
 - To use as a sample in noise reduction software.

Muffle Sources



Muffle Reflections



Best to avoid it altogether

- Minimizing noise on a remote recording/film/video session
 - Or often record a lot of it, without any dialog.
 - That way you can put it behind any ADR you do later.
 - Or get a mic with it's own track recording only the noise, and no dialog.
 - While the dialog is on another track.
 - Later, align and invert it (make it out-of-phase) in the mix.
 - It helps if you have a clapperboard to help synchronize the tracks.

Cables are a common noise source

- **Unbalanced** cables pick up noise easily. They use 2 internal connectors.
- **Balanced cables reject electromagnetic noise (like AC hum) using 3 conductors.**
 - Two wires, each carry the same signal. However one copy is flipped out of phase.
 - Receiving hardware will flip that out-of-phase copy back and combine the two copies.
 - Noise that overwhelms the cable shielding will get into both copies equally as much.
 - The receiving hardware flips one copy phase 180 degrees so that the signals now add.
 - But the noise, which was in phase, has one copy now flipped out of phase.
 - The noise cancels itself out. The wanted signal is strengthened.
- Bottom Line: balanced cables eliminate noise by phase inversion.
- If a wire or connector is defective, the balance is gone.-> Noise!

Balanced Connectors



(Headphones use TRS differently to carry stereo. They are not balanced.)

Reducing noise in postproduction

- Perception of noise is relative. People may not notice it if it is simply reduced a bit.
 - How loud does the noise have to be for us to notice it... compared to the desired sound?
Depends on psychoacoustics.
- Almost all noise reduction techniques require a compromise. Some bad comes with the good.

Reducing noise in postproduction

- We don't notice a little guitar amplifier buzz *during* the guitar notes.
 - The louder note will mask the quieter buzz.
 - But between the guitar notes is another story. We have to deal with that.
- You don't have to reduce the noise as much if there is a lot of sound from other tracks.
- But noise adds up too. 4 tracks with noise at -40 dB, add up to a noise level of only -34 dB.

Reducing noise in postproduction

- Masking is a very useful phenomenon. When two sounds are in the same frequency range, we tend to notice only the louder one.
 - Offices mask noise by putting a constant pink noise through the ceiling speakers.
 - In a multi-track mix, if a splice in one track will be audible, we put that splice "behind" a snare hit in another track.

Common tools

- Try filters? (Narrow EQ) They can work for simple tone noise.
 - But only achieve a couple dB reduction before they start to take too much good sound away.
 - And steady noises often have overtones. There may be too many harmonics in our Buzzing Bass amp. Try adding filters at octaves first.
- Best to use learned/sampled noise reduction.
 - Called a "Noise Fingerprint" - 1 or 2 seconds of only noise is enough.
- For pops? There are dedicated tools – Audacity pop/click removal
 - Set the thresholds and listen, retry until you get it.
- For occasional sound behind the desired sound, as a car honk, Adobe Audition has unique tools such as the Healing tool.

Steady-state noises: fan, hiss

- Manually cut to silence or negatively amplify (Audacity's tool to lower levels)
 - But this often leaves noticeable dropouts.
 - Ironically people might not notice the noise, but might notice the dropouts.
- Use a Gate – good for long tracks with steady but not-too-loud noise.
 - If the track level drops below your chosen threshold, it cuts the level more.
 - Often bass guitar and snare tracks are gated.
 - Also used in live mic-ing for not recording the noise in the first place.
- Using EQ more cleverly
 - Audacity > Spectrum will sometimes reveal the offending frequency.
 - It is an option in the track controls to the left of the track.
 - Note that AC 60 Hz harmonics are most often multiples, 60-120-240 Hz
 - Narrow Hz filters are the first choice, as they least affect the wanted sound.

Remember...

- *Most noise reduction tools are not perfect.
Many require multiple tries and learned skill.*
- *Don't try to reduce it to zero if doing so makes the silence stand out more than the noise did.*
- *Noise is only a problem if you notice it.
Don't work over every track.*
- *Try to get things right when recording in the first place.*

Remember...

- *Some noises require multiple passes of the same tool, taking a little more noise with each pass.*
- *Some noises, like guitar amp noise, will require a combination of treatments.*
- *In some cases, if you get rid of all the noise, it may draw attention to your processing and become a distraction.*
 - That is why, on location recording, you record a little pure location *noise*. You might need to *add it in* later if you have to replace the particular track.