Sound Mixing 101 - A guide for New Producers/Directors:
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What is Sound?

Wikipedia describes sound this way. “Sound is a disturbance of mechanical energy that propagates through matter as a wave”

Someone speaks creating waves in the air, a microphone records these waves, converts the waves into signals, and the signals are recorded, transmitted, or archived. Ultimately the waves are recreated with a speaker upon playback for the ear to hear it again.

Since typical human ears can only detect a range of sounds between approximately 20 Hz and 20,000 Hz, digital audio systems only need to be able to generate sounds within this range. The Process of digitizing sound is done though sampling.

Sampling signals are usually represented by one of a fixed number of values, in a process known as pulse-code modulation (PCM). Pulse-code modulation (PCM) is a digital representation of an analog signal where the magnitude of the signal is sampled regularly at uniform intervals, then quantized to a series of symbols in a digital (usually binary) code.

The Sound Sample

Bit Depth refers to the number of bits you have to capture audio. The easiest way to envision this is as a series of levels, that audio energy can be sliced at any given moment in time. With 16-bit audio, there are 65,536 possible levels. With every bit of greater resolution, the number of levels double. By the time we get to 24 bit, we actually have 16,777,216 levels. Remember we are talking about a slice of audio frozen in a single moment of time. 16-bit audio is the most popular audio format, but 24-bit is widely gaining ground.

Sample Rate is the number of times your audio is measured (sampled) per second. So at the red book standard for CDs, the sample rate is 44.1 kHz or 44,100 sampled every second. This rate can be anywhere from 8KHz (telephone) to 192Khz (HD/BlueRay DVD).

Compression

Due to the large amount of bits that sound takes up in space on memory and hard drives, a compression theme was invented and various types are still heavily used today. The method is referred to as a CODEC or Compressor-Decompressor. A Codec is a device or program capable of performing encoding and decoding on a digital data stream or signal. Hundreds of Codec’s exist on the market today.

In most compression the overall data is looked at by an algorithm, and may have data removed and tossed out in the encoding process. The data that's removed is a balance between repeat bites and parts that the human ear cannot perceive. So these parts are removed subsequently saving huge file sizes in lue of dynamic range.

Three types of compression exist:

None - No Compression. Best Audio. Examples include .AIFF and .WAV

Lossless - The data compression is a class of data compression algorithms that allows the exact original data to be reconstructed from the compressed data. Examples include Apple Lossless and .FLAC,

Lossy - Data compression method is one where compressing data and then decompressing it retrieves data that may well be different from the original, but is "close enough" to be useful in some way. Examples include .AAC, .MP3, Dolby Digital, Mpeg-1, Mpeg-2, .WMA. Plus there's a whole host of voice only CODECS with low bit rate, optimized for speech compression schemes.

Purpose of a Sound Mixer on the Set

The purpose of a sound mixer on set is to capture as much dialog, sound effects, and ambient sounds during principal filming as suitably clear and isolated as possible.

A film camera (Super8mm/16mm/ect) does NOT have an input for recording sound, so it is up to the Sound Mixer to record these source sounds on to a field recorder. If the Camera on set is a digital camera, the Sound Mixer has the option of recording the source sounds onto the digital camera, or recording the source sounds to a field recorder.

A sound mixer is often seen on the set with headphones, and either a mobile mixer bag or mobile sound cart.

A sound mixer collects these sounds during a scene using one or more microphones attached to a mixer before going into a recording source.

The Sound Mixer is a technician and the boom microphone is the primary tool used for capturing most of the sound in the shot.

In general and even on the smallest of crews, the sound department consist of a team. The sound mixer himself, and a boom operator at the smallest level. If you're really lucky you can get a sound utility person too. Which is basically a cable wrangler.

The sound mixers job is to concentrate on the sound of the recording, and adjust as needed during this recording. The Boom operator's job is to place the microphone as close to the sound source as possible while staying out of the shot. These are two totally separate jobs, and can be done with one person at times; however, it's like the actor doing director at the same time. Sure anyone can set a camera, hit the button, then run around and start acting, but it's difficult, and you're prone to errors if you operate like this.

Right before the shot, the boom operator can ask the DP or cameraman where the frame line is also know as the safe area. This aids the boom operator to know exactly how close he can get the microphone to the sound source without getting in the frame. Aiming the microphone between 2 and 4 feet away from the sound source is ìthe sweet spotî. The mixer uses every chance to let the boom operator know if he needs to try and get in closer or a different angle or if they are in the shot. Each shot is unique and requires an analysis of the current situation. Sound mixing is somewhat of an art. It's perceptual, and each person hears differently as well as perceives good from bad or what they think is good and bad.

Before each shot, the AD yells "Sound", the Sound Mixer turns on the record (or checks the output), if he's satisfied yells out "Sound Speeding" and keeps going till the director yells ìCutî. After each take the Sound Mixer documents each take (Scene/Take) and if there were any problems or not. It's very important for the Sound Mixer to keep communication open to notify the director (or AD) of any sound problems during the principle filming.

Tools Used (Basic List)

Microphone ñ Picks up sound. A short gun interference tube microphone, High sensitivity and Increased directivity work best for isolating. Super-cardioid pick-up pattern with a frequency response about 40ñ20,000 Hz. Work best for getting good voices. Phantom powered 48 ± v. Professional microphones have an industry-standard 3-pin "XLR" type plug that snaps in place. This is called a "balanced" connection and allows cable runs of several hundred feet without any significant loss or interference. Microphones come in a huge variety of styles and types. To help you figure out which type of microphone can meet your needs, you would take a look at the Pickup Patterns.

Microphone Patterns

Omni directional: Picks up equally in all directions.

Cardioid: 'Heart-shaped' pattern that offers maximum rejection (null) at the rear of the microphone.

Hypercardioid: Has a narrower pickup pattern than others, but also has more rear pickup than most other microphones.

Shotgun: microphones are the most highly directional.

Boom Pole - Holds microphone to the action during the shoots. 12foot+, extendable with inside or outside XLR cable. The XLR connector cable connects the microphone to the mixer.

Microphone mount - Attaches the microphone to the boom pole. Shock mounting involves isolating the microphone from the mount using rubber rings to hold the microphone in place. A Blimp (also know as a Zeppelin) cover, and be used to further protect the Microphone. A furry cover (also called a wind sock) can be used for windy conditions outside if needed.

Mixer - Allows the sound person to monitor and adjust sound levels from each input source going into the recording. Limits can be placed on each input, sound is balanced and not too ëlowí or ëhotí, and each sound can be sent to different tracks as needed.

Recorder - This is a device that can be either a hand held recorder such as a DAT, Tape, Hard Drive or Flash Memory or a Digital Video Camera can also be used as a recorder.

Cables - These are what connects the Microphone to the Mixer to the Recorder.

Headphones - The headphones are used for the mixer to evaluate the sound being recorded. Quality closed-in headphones are essential. A second set can be given to the boom op to aid in his job, and I personally like to give a set to the Director and Script supervisor too.

Wireless - Wireless Lavaliere microphones are a small form microphones, and can be placed near an actor or scene without being seen by the camera. They are especially useful in wide shots where it's difficult for a full microphones to read into. They have a small battery operated base transmitting unit, and the receiver unit is connected to the mixer.

Setups

Recorder - Since there's no audio track on a film camera, you'll have to capture sound via a recording device such as Tape, DAT tape, or Flash card recorder if the production is using Film. These recording devices come in a variety of features covering from low budget to high budget. One track to Multitrack, and bit rates from 32Khz/8bit to 192Khz/24bit. But, also keep in mind that any and all TAPE methods are obsolete now, and are giving way to digital recording via Hard Drive, Camera Track or Flash Cards.

Digital Camera Track – I've worked on films from $3,000 DV cameras to $20,000 cameras and most all of these have one thing in common. Inputs for stereo sound recording about 16bit/48Khz onto the video tape at the same time the picture is being

captured. It's better quality then a CD, and if you place the audio on the same time code as the visual it saves the editor many many hours of film sound syncing. Of course if you want better than 16bit/48Khz stereo in a higher dynamic range, you'll have to go with the recorder, which can capture audio as high as 24bit/192Khz.

Hard Drive - more and more Mixing setups are now including laptops as part of the mixing gear. Add in a Firewire mixer, and an external hard drive and you have a full mobile recording studio! Depending on your hardware, you can have 8+ channels of 24bit/192Khz audio going straight to hard drives. Why is this better? Because of Higher fidelity and isolation of each channel. Isolating each mic into its own high dynamic channel gives the post sound designer the best source he can get. And this can be done at a fraction of the cost then it used to cost. After the shoot is done, burn off a CD/DVD for the production, and you're off to your next job.

Hire a Sound Mixer/Boom Op?

Hire One or a Team? - A Sound team consist of at least two people. The sound mixer and the boom op. Ideally if the budget allows you hire both, and let the sound mixer pick who he works with. If it's a very very low budget, the team could be a sound mixer and a production assistant (boom op in training).

Equipment - Unlike camera, most all production sound mixers have and like to use their own equipment. Equipment can be a touchy subject, and my personal believe is that I don't want to show up on the set the first day, and spend hours trying to figure out why something is not working right and going though equipment your unfamiliar with. Most Sound mixers simply like to provide a one two punch and take care of everything such as equipment needed for sound. Keep in mind that the sound mixer might require an equipment rental if he has a rental source. Sound Rental Gear could run between 150 /per day and 400 /per day.

Salary - I do most of my work for low budget producers and it is difficult to give you an accurate income figure, because it's greatly dependant on the job. In general a boom operator will make at least $150 a day (minimum) and the production Sound Mixer (on non union projects) makes at least $500 per day (minimum). Although this can very greatly depending on a lot of factors such as total amount of hours in a day, weekdays or weekends, IMDb credit, equipment needed for the shoot, student films, rain, travel, and so forth. For example, I do massive discounts for student weekend shoots. I get to work with a fresh new crew, meet interesting students, and network a bit.

Craigslist.org as well as Mandy.com have become a great tool for finding and hiring Sound Mixers, Boom Operators, and other crew members. Don't insult people by posting jobs paying nothing, and then demand experience.

Networking - There is no such thing as a demo real with a sound guy. There are sound samples of your work, but who's to say what this can entail. Your going to have to

struggle possibly in hiring someone that you trust, but like anyone in this business, you'll make contacts, work with various people that you like, and get references, so get his or her card, and build your network or teams as your experience grows.

Word of Mouth - Since filmmaking is such a collaborative effort, and the sound of a film is such an integral part of the picture, the director works closely with the sound person during the principle filming. He or she relies on that sound mixer to let them know if they think they got the sound right, or not. It is this reason that once a director finds the right chemistry in a working relationship with the sound person, they will shout their praises from every mountaintop. I have several directors whom I regard as close friends, and even a few that will not film unless Iím there. These relationships are very important for your next job.

What's so difficult?

Non-perfect conditions - Despite the fact that you have all the perfect conditions for capture, certain areas are simply just NOT controllable. Such as traffic, air noise, conditioning humming, or acoustic problems. These are times that you just have to do your best, and communicate the situations with the director and note it on the sound report. Despite your best efforts, you'll be blamed for the bad sound recording.

Actors - that step on lines. Granted, its not my place to tell actors what to do, and in the heat of an argument scene, sometimes it's not possible to not step on lines, however if you can, communicate with an actor and let them know that stepping where one actor talks over one another can be avoided on some takes. And if your real lucky a director will have one actor run though the scene without the other actor. This gives you a perfect time to get those nice lines. Be careful here though, this is totally the directors job in coxing the actors. This is where a repore with the cast and crew comes in.

Record everything - Take the time to record everything. Digital is cheap. Even when the director says, "donít worry about the sound here, there's no dialog". Record it anyway. You never know what you pick up on those MOS shots.

Strength - While the sound mixer requires good ears, the Boom Operator requires raw physical stamina. Holding an extended boom poll out over actors heads during a long scene, requires an endurance of a different kind. Iíve seen some of the strongest guys simply just start shaking after a couple of minutes after the director yells action. Try doing this over and over again and again.. You'll learn a different kind of strength.

Ear Rot - This is a condition in which after long periods, we simple tune things out. For example, there might be a dog barking in the background. If you concentrate on listening to something else, after a while you simple don't hear the dog any more.

Thank less job - No recognition. If the sound person did his job right. You'll not even notice.

Good luck, and I hope too see you all on the set!