

Sound Presentation Notes v.1

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This document consists of notes to accompany the “Documentary Video Boot Camp: Sound Recording” presentation (available for download at: kino-eye.com/docs/dvb/DVB-Sound-Presentation-v1.pdf). Underlined text indicates web links¹. Please direct comments, suggestions, and corrections (relating to the presentation or these notes) to the author via the web form at Kino-Eye.com/contact/ or call 617.216.1096

1. Title Slide

2. Overview

Sound is half the picture, yet most often it receives only casual attention by video makers. Viewers can't articulate what's wrong, but quite often it's the sound that either engages or distances them. This presentation presents practical techniques and a guide to the tools for recording and editing sound for video that will improve your work whether you are a beginning or intermediate media maker. Real world problems in a range of shooting situations and their solutions will be presented. Discussion topics include microphone selection and placement, recording strategies for noisy locations, improving intelligibility of dialog, mixing in music without interfering with dialog, making sure your video sounds good on a wide range of devices (including iPods, laptops, and home theaters) and doing it all in a manner that flows nicely with video editing. Special attention will be paid to working on a tight budget and getting the most out of modest gear.

3. Five Minutes Sound Recording University

In the spirit of Father Guido Sarducci (a fictional character made famous by American comedian Don Novello on “Saturday Night Live”) we're going to start out by attending Five Minute Sound Recording University.

4. Sound is half the picture

Sound conveys emotion, picture conveys information. Consider the image of a woman swimming at the beach. As far as the image is concerned, a quiet and peaceful moment. Now add the two simple notes in *Jaws*. Sound is half the picture. Sound carries the emotion of your video. Paying attention to sound, both in terms of good recording and how it's mixed

and the use of sound effects and music, can make a real difference. Even if you're doing a simple interview with dialog only, good sound makes a difference in the richness of the interviewees dialogue, not just the intelligibility of the dialogue. You will find a collection of essays by sound designer Randy Thom at www.filmsound.org/randythom/ that I highly recommend reading.

5. People expect transparent sound

I was looking at videos on Vimeo recently and I was amused by the comment on this post. No one ever apologizes for slight imperfections in video, we overlook them, but sound is different. Peter knew he had to say something about the sound issues in this piece, and reassure viewers that it would get fixed soon. Sound is that important. People expect transparent (good) sound.

6. The trouble with most amateur recordings

The problem with most amateur recordings is excessive ambient noise and low dialog level, improve your sound with the right microphone and good placement. Placement is critical for achieving good sound. In most cases, closer is better... but not too close. The sound you are recording has to be the loudest sound the microphone is picking up. More than three feet away from someone talking in a quiet room is probably too far away. More than two feet away from someone talking in a noisy environment room is probably too far away. And if the environment is really noisy, you need the microphone within a foot of the speaker's mouth. Listen and experiment to get a feel for placement.

¹ Poor typographic practice, but it's the de facto indication of a link, what might be better? Cool little icons next to the text? maybe...

7. It is critical to set levels and monitor the sound you are recording

It's critical to set proper levels to avoid distortion and monitor audio so there are no surprises in post. This is especially true with digital recording which can't recording anything beyond full scale (indicated as 0 dBfs on most meters, with numbers that look like -20, -12, -6, -3, 0. Peaks should not go over -6 in most cases. -3 once in a while is OK. Hitting 0 (which lights up a peak light in most gear) is trouble, it will sound terrible. Try it for your self. Most recorders have a LIMITER, a circuit that can automatically soften peaks. Automatic Gain Control can be used in a pinch, but it's not idea. Always monitor your audio with good headphones that provide sound isolation.

8. Shotgun myths

Shotgun mics don't "reach" farther, they don't work like telephoto lenses, sound, unlike light, is promiscuous, it travels in all directions and goes around corners. Shotgun mics are useful in noisy environments, however, they are not magic, instead of "reaching farther" they respond to off-axis sound differently (reduced level, coloration, and a null point). They might look impressive, but many recording situations call for other types of microphones. Learn about the various microphone pick-up patterns and how they differ. More on that in the expanded portion of this presentation.

9. Audio compression

Audio compression on dialog tracks can help it sound louder and cut through other sounds in the mix, but don't overdo it. A little bit goes a long way.

10. We'll fix it in post... not.

"We'll fix it in post" is a silly thing to say, if you record bad sound, it usually stays that way, it's very hard to fix sound. For example, there is no such thing as a remove reverberation filter. Get it right from the start.

11. Include sound gear in your equipment purchases.

Spend as much or more on sound gear as you spend on your camera, good microphones and mixers will outlast your camera.

12. Suggested reading

The following books provide a good, solid introduction to the craft of professional sound recording and post production for video:

- *Audio Bootcamp Field Guide* by Ty Ford (second edition) is a delightfully concise non-nonsense introduction to professional sound recording.
- *Producing Great Sound for Digital Video* by Jay Rose (second edition) an excellent introduction to audio for video with clear and easy to understand explanations. Come with a set of sample files to listen to.
- *Audio Postproduction for Digital Video* by Jay Rose provides more in-depth coverage of audio postproduction than Producing Great Sound for Digital Video, including extensive coverage of important topics like mixing, dialogue editing, and important audio processing techniques like compression and equalization. Come with a set of sample files to listen to.

13. Online resources

The following web sites provide a good start in terms of sound for video related resources on the web:

- DVinfo.net provides an excellent source of technical information on all aspects of video production and editing, it was established by Chris Hurd as a "real-names, real-information" video production discussion site, so people participate in the community as their real selves, on the site you will find a broad range of participants ranging from serious newcomers asking interesting questions to seasoned professionals sharing wisdom.
- Kino-Eye.com is my own blog covering topics like documentary filmmaking, media technology, and more, check out the reference section. Got a question you've not found a good answer for? Ask me and I'll probably blog about it.
- FilmSound.org is a site run by Sven Carlsson, a media teacher, it's an essential resource for learning about film sound (applicable to video too)

14. Graduation

Congratulations, you've graduated from Five Minute Sound Recording University, and now, just like going to school, the most important aspect of learning happens through experience. So I

encourage you to take what you learn here and practice. Record, listen, experiment, listen, etc. Try different mic placements. Mess around with various types of microphones if you can. Play with the audio tools available in your non linear editing system. Try out Audacity if your non linear editing system tools are not working for you. Do some reading, but balance reading and practice. The books by Jay Rose are good to read a section at a time, then, go out and try the techniques, listen, and reflect. 1. Read => 2. Experiment/Listen => 3. Reflect => 4. Go back to 1. Sound requires a lot of critical listening along the way. The Jay Rose books come with a nice set of sample files to listen to. And now we'll go into more details.

15. What is sound?

Sound is vibrations in air. A movement, like those of human vocal cords, creates waves in the air, much like a rock you throw in water creates waves/vibrations. These waves go in all directions, bounce off walls, travel around corners, it's very messy. It's not like camera and light. There is no edge of the frame. Sound from all over mixes in with the sound you want. When you playback the sound you recorded, the reverse process takes place, the sound you recorded, stored as a digital representation (created through sampling) is converted back to an analog signal which is amplified and in turn causes the vibration of the speaker diaphragm, which creates sound waves in the air. These are never exactly like the original, there's always something that changes in the process. There's always noise and distortion added along the way. We try to minimize that using good techniques and good gear.

16. Audio recording signal chain

Recording: something moves in such a manner to create vibrations in air, and thus you have a sound => vibrating diaphragm in microphone converted to an electrical signal => conversion of the electrical signal to a digital representation (sampling, digitization) => storage onto a digital storage medium.

Playback: retrieval from a digital storage medium => conversion to an analog signal => amplification of the analog signal => moving diaphragm speaker => vibrations in air => in turn cause ear drum to vibrate => vibrations translated as signals to the brain => perception of sound. We need not go deep into the physics to appreciate this. It is important to

understand the essence of sound, think of sound as one of the mediums you work with, you shape and mold it to create your work. It is a medium just as paint is a medium.

17. Dynamic and Condenser are two common microphone technologies

Dynamic Microphones: Sound pressure levels move diaphragm connected to a moving coil, the movement of the coil within a magnetic field translates the sound into a voltage, no additional circuitry required. Physics: movement of a coil within a magnetic field causes electricity. This is the inverse of a moving coil and magnet in a speaker moving the cone of the speaker when an electrical signal is applied.

Advantages:

- Inexpensive when compared to as condenser microphones
- More rugged than as condenser microphones

Disadvantages:

- Not as sensitive nor as accurate as condenser microphones
- Typically limited to close-proximity vocal recording applications, for example reporters microphones and vocalist microphones are typically dynamic in design, though there are some condenser reporter's microphones available

Condenser Microphones: Sound pressure levels move a diaphragm, this is translated into capacitance (the diaphragm is between charged plates) electronic circuitry and a power supply are required, often powered by phantom power, this is power that a mixer or camera provides to the mic over the same wires the signal.

Advantages:

- Typically more sensitive and more accurate than dynamic microphones

Disadvantages:

- More expensive than dynamic microphones
- More sensitive to extreme environmental conditions

The electret condenser is a less expensive variation on the condenser microphone, which uses a permanently charged plate. Fancy pro microphones often costing over \$1,000 are "true condensers" while less expensive microphones costing well under \$1,000 are electret condenser, the major difference

is the amount of noise the mic produces, “true condensers” are quieter which is critical for motion picture audio recording and recording for the new era of HD and Dolby 5.1 home audio systems. But for documentary work, don’t sweat it, a good, basic electret condenser is a reliable workhorse and will serve you well.

18. The three common types of microphones

There are three microphone types typically used in documentary video production:

- **Handheld** (typically dynamic): good for use in high-noise environments when close placement is possible, typically omni (e.g. Electro-Voice RE50) or cardioid (e.g. Sennheiser MD46)
- **Lavalier** (practically always condenser): good for use on the subject, interviews in relatively quiet environments, typically omnidirectional in terms of pickup pattern (cardioid available, but placement much trickier, only for specialized uses)
- **Shotgun** (practically always condenser): a compromise when you can’t get close to the subject, placement very critical, off axis sounds are muted and colored, available in various patterns, short shotgun, and long-shotgun patterns, a cardioid or hyper-cardioid is typically better than a shotgun for dialogue, but they do need to be placed closer, a shotgun can work a little farther away, but with all the problems that come with them of more coloration of off-axis sounds, more critical placement, and the lobar pick-up pattern.

Additional types used in video production include boundary “PZM” microphones designed to be placed on flat surfaces and head worn microphones used by performers.

19. Microphone pickup patterns

Super-Cardioid and Shotgun Microphones:

Generally not as flat as omnidirectional microphones, off-axis sound has distinctive coloration. Have varying degrees of directionality, varies based on frequency of source. Good for recording: where it is desirable to focus on a specific sound source; where isolation from unwanted sounds or noise is needed; when a greater working distance is required.

Omnidirectional and Cardioid: Generally flatter than directional microphones; Works well in close

proximity; Good for recording: hand-held stand up interview, dialogue in controlled environments, ambient sound, music sources. Not very good in high ambient noise areas.

Not pictured: Bidirectional (Figure-eight) front and back, no sides, used as Side Channel in an MS microphone design

20. Pick-up patterns and frequency response charts and discussion of dB

Pickup Pattern: Response in dB depending on position of source relative to the mic, response also depends on frequency, this multiple lines w/ different hatching

Frequency response diagram: Response in dB relative to frequency of source, the flatter the response the more accurate the microphone

The decibel (dB) is a logarithmic unit of measurement that expresses the magnitude of a acoustic energy relative to a specified reference level. It expresses a ratio of two quantities. The decibel is used for measurements in acoustics and electronics, a logarithmic scaling that corresponds to the human perception of sound and the ability to carry out multiplication of ratios by simple addition and subtraction. The full name decibel follows the usual English capitalization rules for a common noun. The definition of the decibel use base-10 logarithms.

Example: A 6dB change is perceived as a doubling of sound level, thus a sound that measures 56dB would be perceived as twice as loud as one that measures 50dB.

The decibel is commonly used in acoustics to quantify sound levels relative to some 0 dB reference. The reference level is typically set at the threshold of perception of an average human and there are common comparisons used to illustrate different levels of sound pressure.

A reason for using the decibel is that the ear is capable of detecting a very large range of sound levels. Because the power in a sound wave is proportional to the square of the pressure, the ratio of the maximum power to the minimum power is above a trillion. To deal with such a wide, unwieldy range, range, logarithmic units are used. For example, the log of a trillion is 12, so this ratio represents a difference of 120 dB. (derived from from Wikipedia).

So bottom line: It's easier to work with numbers in a range of 0 to 120 than a trillion, just remember that each plus 6dB change is perceived as twice as loud, each minus 6dB change is perceived as half as loud. So when looking at the polar chart, you can see how the audio level falls off in terms of relative dB.

21. Microphone placement is critical

Remember, sound travels in all directions, it bounces off things, and it goes around corners. Unlike shooting video, sound is messy. Light is well behaved, it (for the most part) travels in straight lines. Sound is much more promiscuous, it goes everywhere.

You are always recording three things, 1. direct sound, 2. reflected sounds, and 3. background noise. You want to maximize 1 while reducing 2 and 3 as much as possible. Move away from reflective surfaces, get the mic as close in as possible (but not too close, there's the proximity effect, bass exaggeration when sources are very close, that works well for radio announcers but is not always what you want for dialog recording). There are also issues with breath pops (wind screens help with that).

Not only does sound radiate in all directions, it also falls off so the intensity falls off quickly the farther you are from the source, or from a physics perspective, sound radiation follows the **Inverse Square Law**, which is a fancy way of saying that sound intensity from a point source of sound drops off at a rate proportional to the square of the distance. Or simpler yet, double the distance from the source, you get one fourth of the intensity.

22. Placement options for recording interviews

Desirability of microphone placement positions for recording a speaker's dialog in order from best to least preferable:

1. Directional microphone on boom from above is ideal and provides perspective and the least room noise. Get as close as you can (staying out of frame) with a hyper-cardioid or short-shotgun for a little more source to mic distance, but the ideal is the hyper, there's a reason why the Schoeps CMC 641 is the gold standard among film sound recordists and it was not until recently that Schoeps finally decided to make a shotgun mic to meet market demand, which does

provide better performance with greater subject to mic distances, but with compromises. Hyper cardioids have less off-axis coloration than short shotguns, so when you can get closer in, they offer superior sound quality.

2. Directional microphone on boom from below compromises perspective and picks up more noise from footsteps, etc. and reflections off floor, but it works. In run and gun situations I use a short-shotgun on a pistol-grip hand held just off camera, which is faster to work with than a lavalier on the subject, but it would be better with a boom, which in one person shoots is impossible. So there's the next option...

3. Omnidirectional lavalier on the subject is a good third option, works well with wireless for documentary especially with moving subjects, noise/environment perspective is tricky as subjects move, but we do the best we can with moving subjects.

4. Hand-held microphone gets the mic close to the source, good for noisy environments, but is visible so widely used for news reporting, but rarely in documentary and never in narrative, unless the subject is playing the character of a news reporter. On-camera microphone is often a necessary compromise, but rarely produces good sound unless very close to the subject. Reporter microphones are typically omnidirectional (I use the rugged and popular Electro-Voice RE50) for various reasons, primarily because omnidirectional mics are less prone to problems when the mic moves slightly off axis, however, if the people using the microphone can keep it pointed properly and you are in a noisy environment, a cardioid hand-held microphone might be better than an omnidirectional in terms of better signal (voice) to noise ratio.

24. Placing and dressing lavalier microphones

Attach clip-on lavs to center chest opening of shirt or blouse or to a necktie or attach to lapel of jacket, make sure to attach to the side most likely that speaker will turn. Bring cable up and through the hinge of the clip and then loop back down thru the jaws of the clip in order to dampen noise from cable movement, tape cable behind clothes with gaffer tape if needed. In documentary, worry more about getting good sound than hiding the microphone. Use a fur wind screen (e.g. Rycote Lavalier Windjammer) in windy conditions. The fur needs

the space provided by the foam windscreen to work properly.

25. Recording a formal interview

When I shoot formal sit-down interviews, I like to record with both a lavalier and a short shotgun on my Rycote Pistol Grip which I mount on a microphone stand (available from music stores, see next page for a picture). You have two channels, so use them both. Lav sound is often rich, but rustle or noise from the cable is sometimes an issue, the boom mic is a solid reliable option. In post you can decide whether the lav or overheard mic is best. Sometimes I mix in a little lav w/ the shotgun to make a thin voice fuller.

26. Holding a mic during a formal interview

A Tripod style microphone stand (e.g. **DR Tripod Mic Stand**, there are others) offers a good way to support a boom mic for a sit down interview. Attach a mic support on the end, will require an adapter, since boom poles and mic supports designed for boom poles use one thread and standard mic stands use a different thread. Adapters exist, and some mic supports come with them. Get an extra one or two and keep in your kit, they have a tendency to disappear. For a stand-up interview, a larger C-Stand might be required. I use the Rycote Pistol Grip w/ my shotgun for it is very versatile, I can connect it to a boom pole, use hand-held, or connect to mic stand w/ an adapter. The Boom Boy is cool for attaching boom to a Grip Head which in turn is connected to a C-Stand or light stand. Make sure you have any adapters you might need (and always have an extra one in your kit for they go missing. Standard mic stands have a 5/8"-27 thread tip. Boom poles have 3/8" Whitworth tips. An adapter that allows you to connect accessories designed to thread on to a 3/8" Whitworth tip (e.g. Rycote Pistol Grip) to a 5/8"-27 thread tip on standard microphone stands and accessories.

27. Elements of a good sound kit

Here are some key elements of a versatile sound kit.

Reporter's microphone. Omnidirectional or cardioid. Typically dynamic, sometimes condenser. I have an Electro-Voice RE50, this is a broadcast standard, rugged, versatile omnidirectional hand-held mic. The RE50 is shock mounted to reduce handling noise and has a built-in wind screen. For

really windy days, you might want to add an additional foam windscreen. The Sennheiser MD46 is a popular cardioid reporters microphone in wide use.

Lavaliers (a.k.a. lav or lapel mic) are small (typically electret condenser) microphones, most often attached with a small alligator clip for attaching to shirt collars, ties, jacket lapel, or other clothing. The cable is typically hidden within clothes. It may run wired to a mixer or camera, or connect to a wireless transmitter, this is good when your subject is on the move or your shooting in a crowded situation where the wire would be a problem. Many lavs have a rise in the frequency response curve around 6 to 8 kHz which compensates for the loss of clarity when chest mounted. The term lavalier originally referred to a pendant worn around the neck, the original mics used in television broadcast were quite large, so they had to be hung from a chain like a pendant. Sennheiser, Audio Technica, Sony, Tram, and Countryman all make good lavalier microphones. I have a **TRAM-50 lavalier**, it was the first piece of sound equipment I purchased and have been using it for a long time, still very happy with it. It intercuts quite nicely with high quality boom microphones.

Shotgun microphone. I currently use an **Audio Technica BP4029** short shotgun microphone (see later slide on MS stereo). I often rent a **Sennheiser MKH 50** (super cardioid) or **Sennheiser MKH 60** (short shotgun) when there's budget for a sound upgrade, they offer excellent sound quality and are a step above under \$700 condensers.

Quality microphone cables (e.g. Remote Audio or Canare). Microphone cables that use 4-conductor **Star Quad** configuration are popular among professionals, they are less susceptible picking up noise from power lines and other sources of electro-magnetic radiation. Star-Quad works because of it's twisted-pair configuration in which every conductor is located the same distance from the center, thus opposing electro-magnetic interference are cancelled out. Attenuation of electro-magnetic radiation makes for a superior microphone cable. Many cable makers throw all sorts of hype at you why their cable is better, but among professionals, Star-Quad is the only thing that makes a real difference. Monster Cable should be called Monster Rip-off if truth in marketing was enforced.

Other essentials: Good travel case, tools and accessories (whatever adapters you might need, for example, an adapter to connect boom-mounted accessories on a mic stand). You will eventually want a **Field Mixer** (see next slide).

28. Why use a field mixer?

Using a portable field mixer like the Sound Devices 302 makes it easier to monitor and make adjustments as necessary, the 302 has excellent meters with a choice of ballistics, also an excellent limiter, better than in most cameras, good preamps, again, better than in most cameras, and a monitor return (you can listen to individual channels, stereo, mono mix, or the return coming back from the recorder or camera). An interconnect cable (known as an **ENG Snake** or ENG Video Camera to Mixer Cable) is available, it's designed to connect the mixer to most video cameras with a single cable. It consists of a pliable 3 channel triplex cable with double balanced audio lines with XLR connectors and a third stereo line returns the headphone feed from the camera to the monitor input of the mixer via a mini plug. The interconnect has a multi-pin quick disconnect that permits you to break-away from the camera from the mixer or connect the camera to the mixer with a single plug or unplug. When using cameras that offer off-tape monitoring (e.g. Panasonic DVX100) you have confidence you're getting a good recording, however, there's a time delay, which can be exhausting to listen to. The 302 allows you to switch between monitoring the mixer out and the camera return so you can check on the camera on occasion for confidence, but monitor most of the time without a delay.

29. Some popular shotgun microphones

There are many shotguns on the market in the under \$600 category. These are not as quiet (in terms of their inherent noise) and sweet sounding as professional microphones in the \$1,400 to \$1,800 range, but these are solid performers offering good value. Of course, if you want to spend more, there are some amazing sounding microphones to choose from, this is only the tip of the iceberg.

The **Audio Technica AT875R** (\$200) is a very economical short shotgun condenser with a length of seven inches making it ideal for mounting on a small digital camera. While off-axis rejection might not be as good as the AT897, it performs as well as longer shotguns due to its clever design. Operates

only on phantom power and does not have a bass roll-off circuit. A good value at the low end of the price scale.

The **Audio Technica AT897** (\$270) is a condenser shotgun microphone with a length of eleven inches providing more directionality than the AT875. Can operate on an internal AA battery or Phantom power and has a bass roll-off switch. Probably a better choice for boom mounted use than the 875R. This is one of AT's most popular shotguns and for good reason, it sounds good and compares well to more expensive options.

The **Audio Technica AT4073a** (\$550) is an externally polarized condenser shotgun microphone highly regarded as an excellent performer with a reduced rear lobe and less off axis sound coloration than other shotguns. A step up from the AT897 but still very affordable. Switchable 150 Hz low-cut filter and phantom powering.

The **Rode NTG-1** (\$230) and **Rode NTG-2** (\$270) are affordable newcomers to the category. The two are identical except the NTG-2 is longer due to the integrated power module. The NTG-2 can be powered with either an internal AA battery or phantom power. The shorter NTG-1 only works with phantom power. These mics do not have a bass roll-off switch. The NTG-1 and NTG-2 have become popular among cost-conscious media makers who want good performance on a tight budget. Not quite as crisp and clean as the ME66, but a very good value.

The **Sennheiser ME66 with the K6 Power Module** (\$399 for the combo) is a tried and true favorite because of its sound quality, craftsmanship, and versatility. The system is based around the K6 power module which has a bass roll-off filter, on-off switch, and can work with either an internal AA battery or phantom power. In addition to the popular ME66 super-cardioid capsule, the K6 can be paired with additional capsules: the more directional **ME67** (\$270), the cardioid **ME64** (\$260), the omnidirectional **ME62** (\$150), or the super-cardioid **ME65** (\$230) with an integral pop filter for hand-held recording. A modular system provides a cost-effective alternative to buying discrete microphones for each application.

Not pictured here but it's good to know the following exist:

Among my favorite shotgun microphones to rent when there's room in the budget for it is the

Sennheiser MKH60 (it sells for \$1,600), it has a smooth, relatively flat frequency response, a sweet sound, perfect for dialog. While the less expensive ME66 can be a tad harsh, the MKH60 offers a smoother, fuller sound, lower self-noise, works off phantom power, and has three switchable settings: low-frequency roll-off, treble emphasis, and pre-attenuation (-10 dB).

And then there's the gold standard: the **Schoeps CMC641** set (\$1,900) which includes their **CMC-6U** pre-amp and the **MK41** super-cardioid capsule (a variety of capsules are available). Unlike lesser microphones, the MK41 is not colored by reflections arriving off axis as is the problem with shotgun type (interference tube) microphones in indoor settings. This makes it a better alternative to the shotgun microphone for recording dialog indoors. This set is one of the most popular and respected microphones among professional sound recordists and for good reason. It sounds great!

30. Versatile mounting and wind protection

The **Rycote Softie** is a popular and versatile rubber shock mount and synthetic fur windshield system that performs almost as well as a traditional windshield (zeppelin with windjammer) but is more convenient to use in run and gun situations (it simply slips on and off the mic) and is more economical. Rycote also makes a variety of furry Windjammers for lavaliers, hand-helds, and camcorders. There are other good makes available in the market, but this is what I own and like.

32. Wireless microphones: freedom from wires

There are many makes and models on the market. In a range *above* the many inexpensive entry-level wireless microphones but *below* the more expensive professional standard (Lectrosonics) lies the Sennheiser Evolution wireless microphones, which are very popular among documentary filmmakers for their excellent price/performance ratio.

The **Sennheiser Evolution 100 G2** is a complete UHF wireless system for \$600 consisting of a bodypack transmitter, an omnidirectional lavalier (with clip and windscreen), a plug-on transmitter that can be attached to any metal-body low-impedance dynamic handheld microphone (like the Electro-Voice RE50 or Sennheiser MD46), and a camera-mountable receiver. The performance is

surprisingly good considering the price and is among the best values in a camera mounted wireless system. This is probably the best wireless mic for budget-conscious documentary makers.

If your looking for the best performance and have the budget for it, then consider the Digital Hybrid wireless systems from Lectrosonics, who makes some of the most widely used professional wireless systems. Other brands include: Nady (low end), Sony (mid-range), Audio-Technica (mid-range), and Zaxcom (high end).

32. Portable audio recording

Carrying a portable audio recording kit along with your camera (or everywhere you go for that matter) opens up the possibility of recording double-system sound as well as capturing sound whenever you have the chance without being tethered to a camera. While several high end pro recorders are available, the sub \$600 collection of recorders from M-Audio, Marantz, Samson, etc. all do a very good job. They are not as reliable as professional recorders, but we're taking thousands of dollars in terms of their difference in price.

In terms of high end professional audio recorders, I love the Sound Devices 722 (\$2,500) two channel recorder (timecode and four channel versions are available for more buckaroos), it's beautifully designed and engineered, can record to hard drive and compact flash at the same time, but they are much more expensive than the little guys, but surely more reliable, it all comes down to a trade-off between technical requirements and budget. If you make your living recording sound in the field, the Sound Devices recorders are serious contenders, albeit more expensive and heavier than the other portable recorders mentioned.

The **Sony MDR-7506** headphones are the professional standard for field monitoring, offering good acoustic separation from outside sounds, a clean, flat frequency response and a slightly exaggerated low-end response which makes it easy to pick up audio problems like low-frequency rumbles (from air conditioning systems or passing trucks), bumps of the boom, and more.

33. A super compact video interview setup

This is a super compact kit for shooting video interviews that brings together quick and dirty

point and shoot video aesthetics and pro quality audio aesthetics, it works very well together. If the audio is good, the less than perfect video will work better. Sony MDR-7506 headphones (and a pair of ear-buds for super lean shoots); Giant Squid Audio Lab Omni Mic, stereo pair (a nice pair of microphones that can work with plug-in power [consumer version of phantom power] which most small recorders and consumer cameras with mic inputs can provide); Electro-Voice RE50 (good for use close-to-subject in high-noise environments); M-Audio M-Audio MicroTrack (the Roland R-09 is a good alternative and does not have a built-in LiIon battery, the Achilles heel of the MicroTrack, on the other hand the MicroTrack has a nice limited and balanced line/mic TRS inputs with +48V phantom power); Canon PowerShot TX1 still & 720p video camera (cute, but does not maintain synchronization, it drifts while shooting, so it's a pain in post as every minute or so I have to re-sync, good for quick and dirty, but a real video camera will maintain sync while recording (i.e. run a constant speed without variation so video can be matched with sound in post and sync up).

34. Double system sound recording

Tiny video cameras can shoot great video, but the audio leaves something to be desired. Excellent, small audio recorders are now available (Samson H2, Samson H4, Microtrack, etc.) which can be used to record audio. When audio and picture are recorded separately, it's called Double System Sound. Term comes from the old days of film, professional film cameras did not record sound, so sound was recorded separately, on film sets in the old days you always saw a NAGRA recorder in use, engineering wonders of the analog age, but I digress. In post the audio and picture would be synched up. When you sync the audio to the video clips, keep the original audio around in case you need to fix slipped sync. Your NLE should allow you to link video to audio tracks and keep the original tracks (which you can mute) and edit them as a single "linked" clip. It works in Final Cut Pro, I've not tried it in other editors. We can do the same with digital video and digital audio. It works wonderfully in most cases, since audio recorders and DV cameras use pretty accurate crystals to control their speed. Some cameras drift, but for short takes (I've shot as long as 25 minutes w/ a Sony Handicam w/ no Sync issues) it works well most of

the time. Experiment with your combination of gear to see if it holds sync. Your mileage may vary. Clearly it's more complicated, but the advantages are much better sound, especially when the small camera can't be where the mic needs to be. Another way of using this technique is as an alternative to a wireless mic, an option some videographers use is to combine a lavalier microphone and a portable digital recorder that the speaker either wears or carries with them. In some ways this is more versatile than using a wireless and less prone to interference, though you are unable to monitor the audio while you're recording. Later in post you sync the audio recorded with the portable recorder with your video, which is easy to do with most NLEs. There's no need for the old fashioned clapper board, as long as you're still recording sound on the camera, you have a guide to easily synchronize the audio. Find a click, pop, or T sound to match the camera audio with the audio recorded on the digital recorder, and you'll be able to easily synchronize them with within your NLE.

35. Inexpensive shotguns for consumer camcorders

Little shotguns (e.g. Sennheiser MKE300, Rode VideoMic, Sennheiser MKE400, Azden ECZ-990) offer improvement over the built-in microphone on consumer camcorders, but the problem remains, on-camera placement is not a good mic position unless you're shooting with a very wide lens and your speakers are close to the camera. Windy days still call for a windshield (a.k.a. windjammer or dead cat) either home made (from artificial fur w/ foam interior) or store bought, available from Rode, Lightwave, Rycote, and others.

36. Connecting professional microphones to consumer camcorders

A range of Beachtek adapters are available starting around \$180. Some models even provide phantom power for pro microphones that need phantom powering (many pro models don't have built-in battery powered power supplies). These adapters provide attenuation, convert balanced to unbalanced, and filter out the plug-in power on many cameras. The use of balanced cables will allow longer cable runs without noise problems. To preserve the advantages of balanced cables, you need to use the right adapter. Why all the hoo-la-la over XLR mic cables and professional microphones? First

of all, pro mics do sound better. Take a listen. The thing about pro mic cables is that they use balanced wiring. So how do you plug in a microphone that uses balanced wires into a consumer camcorder? Here you go.

37. Advanced Technique: Using an MS microphone on-camera for vérité documentary shooting (1 of 2)

An MS stereo microphone consists of two microphones in one, the Middle capsule being a hyper cardioid or short-shotgun and the Side capsule being a figure-of-eight pattern microphone.

Scenario 1: Using a single short-shotgun on the camera is the most common technique for hand-held documentary shooting without a sound recordist. While having the shotgun on a boom or pistol-grip is ideal, often when working alone there's no choice. Another option is using a single mic on a piston-grip for more flexibility in placement from moment to moment. For shooting in tight quarters a hyper-cardioid is often better than a short shotgun.

Scenario 2: Sometimes sound-obsessed camera people (like yours truly) will indulge in using a two-mic technique: a short-shotgun on the camera, and a second short shotgun hand-held in a pistol grip. This allows maximum flexibility in capturing both on-camera and off-camera subjects with the best clarity possible. For shooting in tight quarters a hyper-cardioid is often better than a short shotgun. Not only is the two mic technique hard work, it makes it hard to be in the moment and it's harder to blend into the scene.

38. Advanced Technique: Using an MS microphone on-camera for vérité documentary shooting (2 of 2)

Scenario 3: One solution is to shoot with an M-S Stereo mic, which is a combination of a directional microphone capturing the middle (M) and a figure-eight microphone recording the sound coming from the left and right(S). The M-S technique was designed for recording stereo that would collapse to mono without phase problems. But you can use it another way: in post-production you can extract just the left, just the middle, or just the right channels as needed to focus on a specific subject. This creates additional work in post-production, but it simplifies the process of recording multiple speakers in the field and dialog by additional

subjects to the left or right of the camera sounds much better. It's an excellent audio recording technique for observational documentary shooting styles.

I use a **Audio Technica BP4029** (\$700, formerly AT835ST) is a short shotgun M-S stereo microphone that resembles a mono shotgun so it's easy to use with standard camera mounts, shock mounts and windscreens. This phantom powered microphone features independent line-cardioid and figure-of-eight condenser elements in a single housing along with a switchable low-frequency roll-off. The mic offers three output modes: narrow or wide stereo with internal matrixing or discrete M-S output that can be processed in post. Other M-S microphones available include: Sennheiser MKH418S (\$1,500), Sure VP88 (\$700), and also models from Sanken and Neumann.

39. Three tools you should add to your post workflow

Even though sound post-production is a highly specialized field and is best left to a professional for productions with a budget for a sound designer who can take you through to the final mix, often, especially in documentary, we are forced due to our lean and mean budgets to do the work ourselves. Here are three post-production techniques you should master if you're going to do your own sound post (of course, there's more, but start with these):

- **Compression** (not to be confused with data compression) helps keep the signal level constant, even though the input varies. It has the effect of helping dialog sound louder and cut through the mix and sound better on portable devices. (see Jay Rose, [Audio Postproduction for Digital Video](#), Chapter 13)
- **Equalization** lets you cut or boost specific frequencies (see Jay Rose, [Audio Postproduction for Digital Video](#), Chapter 12)
- **Dialog editing techniques** can help you remove words and shorten sentences in a seamless manner (see Jay Rose, [Audio Postproduction for Digital Video](#), Chapter 9)

40. Free audio post tools can compliment your video editing software

Sometimes it's hard to do audio work in the clip-based environment of video editing software, here's a place to start as you venture beyond your video editor... [Audacity](#) is a free and open-source

application for recording and editing sound for Mac, Windows, and Linux. *The Levelator* is a utility that will automatically adjust audio levels within your audio file for variations from one speaker to the next. When you're working in quick and dirty mode, this will save you hours of work.

41. Audio compression (1 of 2)

Adding compression judiciously to dialog can increase loudness of dialog in the mix to better maintain consistent attention from the viewer/listener over sound effects and music. Compression is used to increase the clarity of dialog so it "sits" in the mix with music and sound effects better and therefore maintains consistent attention from the viewer/listener. The amount of gain reduction is determined by a ratio. The point at which it kicks in is known as the threshold. The time it takes for the compressor to respond to changes in input level is the attack. How quickly the compressor returns to no gain reduction once the input level falls below the threshold is known as the release. For example, with a ratio of 4:1, when the input level is 4 dB over the threshold, the output signal level will be 1 dB over the threshold. The gain (level) has been reduced by 3 dB. When the input level is 8 dB above the threshold, the output level will be 2 dB; a 6 dB gain reduction. A limiter is a compressor with a higher ratio, and generally a fast attack time. A ratio of 10:1 or more is considered limiting. Soft and hard limiting are a matter of degree: The "harder" a limiter, the higher its ratio and the faster its attack and release times. A related processing technique is Automatic Gain Control (AGC), it reduces the gain as the average signal level increases, tends to make the quiet passages louder and the loud passages quieter, reducing the dynamic range and quality of the recording.

42. Audio compression (2 of 2)

Experiment with compression ratios. For dialog, usually 2:1 is good, 3:1 better in some circumstances, and if you add something like 4:1 or more, it usually starts to sound unnatural. Experiment and listen. A subtle fix is often better than a wholesale change. Your ears fatigue. Before making final audio decisions, go do something else, then come back and listen again.

43. Questions? Need audio gear?

Contact me at: kino-eye.com/contact/ if you have any questions about this presentation.

This document and associated files are available online at: kino-eye.com/reference/dvb/

Professional sound vendors (in the Boston area):

- **Talamas** (Sales & Rentals) 617-928-0788
talamas.com
- **The Camera Company** (Sales) 781-769-0210
cameraco.com
- **Rule** (Rentals & Sales) 617-924-5599
rule.com

An out-of-town source for professional equipment (online):

- **B&H** (Sales) 800-859-5252
bhphotovideo.com

It's good to shop locally with vendors that cater to the professional community that can provide post-sales support and rental houses help professionals solve problems every day.

Glossary

A

AC-3. See Dolby Digital.

Acoustics. The science of sound wave transmission. In general the term is used to refer to the characteristics of rooms, theaters, auditoriums, and studios in terms of their design and audio characteristics.

AGC (Automatic Gain Control). A method available on some audio recorders and the audio section of video cameras in which audio levels are automatically controlled. On quiet passages the camera raises the gain (raising the noise floor), and on loud passages it will reduce the gain. You can hear this "pumping" of the gain in the sound track. In a pinch it's acceptable to use AGC, however, set levels manually whenever possible. If your camera offers a limiter option, that is often a better way to deal with unexpected peaks. See ALC.

ALC (Automatic Limiter Control). A circuit available on Panasonic DVX and HVX series cameras. It starts attenuating incoming audio signals around -6 dB and then limits peaks to -4.5 dB. With ALC you still need to adjust the overall levels manually, since transitory peaks will still cause distortion, however, this is preferable to automatic methods. See AGC.

Ambient noise. The total sound in an environment which is unique to that environment. Also known as room tone. Plays an important role in making seamless audio edits, which requires that the “silence” between words and sentences contains ambient noise that matches the environment in which the dialogue takes place.

Amplitude. The strength of an electronic signal as measure by the height of its waveform.

Analog. A signal that varies continuously in relation to some reference. In contrast, a digital signal varies in discreet steps.

Analog-to-Digital Converter (ADC). A device used to convert analog electrical signals (e.g. from a microphone or analog mixer) to digital data that represent the level and frequency information contained in the original analog signal.

Analog recording. A means of recording audio or video whereby the recorded signal is a physical representation of the waveform of the original signal. VHS is an example of an analog video formats. Whenever a copy is made of a recording in an analog format, the copy exhibits additional artifacts not in the original.

Artifact. An audible effect caused by an error or limitation in the system.

Attenuate. To reduce signal strength. See Attenuator.

Attenuator. A device that reduces signal strength. For example, line levels need to be attenuated before they can be fed into a device that only accepts microphone level signals, so you would use an attenuator in this situation.

Audible spectrum. Sound waves in the frequency range between 20 and 15,000 Hz that move through the atmosphere and produce an audible sensation in the average human.

Audio Sweetening. See Sweetening.

B

Background. Term used to describe the ambience in a scene or to relative volume, “put the cracking sound in the background.”

Background music. See Non-diegesis music

Balanced signal. An audio circuit with 3 wires, two carry the signal, and the third provides the ground. Compared to unbalanced circuit using a single signal wire and a ground, balanced signals are much less susceptible to picking up interference.

Therefore, professional sound recording equipment is usually designed to work with balanced wiring.

While XLRs are the most widely used connectors with balanced wiring, a particular connector does not guarantee the existence of balanced wiring.

Better camcorders provided balanced XLR connectors for audio input.

Bandwidth. The amount of information that can be passed through a system at a given time. Typically, the greater the bandwidth the better the audio quality, however, the compression techniques (if any) used also influence this, since some compression formats allow for a reduction of bandwidth while maintaining very similar audio quality.

Beat. A periodic variation of amplitude resulting from the addition of two frequencies that are slightly different.

Beep. 1. A tone placed in a particular position on a sound track in post-production in order to establish a sync point. The tone is used to align the audio track with the picture for precise synchronization. A fool proof method that is often used as a backup even when time code is being used. For example, your composer might give you audio tracks and place a beep two seconds prior to the start of picture so you can line up the music with your project. 2. Sound made by the Roadrunner.

Bit. 1. A single element (1 or 0) of digital representation of information. 2. A minor role in which an actor may speak only a few lines of dialog. Also known as a bit part.

Bit rate. The amount of data transported in a given amount of time, usually defined in Mega (Million) bits per second (Mbps).

Black box. A term used to describe a piece of equipment dedicated to one specific function.

Blip tone. See Beep.

Boom. A pole used to extend a microphone above the subject or actor you want to record, permitting sync sound recording without interference with the subject or actor’s movement. Boom poles are available in a range of lengths, materials (aluminum or super-light carbon fiber), and with or without internal wiring.

Box rental. A fee paid to a crew member for providing their own equipment or other specialized gear for use in a production.

Breakaway cable. See ENG Snake.

Broadcast quality. An nebulous term used by marketing people to describe their products.

Bus. A network that combines the output of two or more channels on a sound mixer.

Byte. 8 bits. A common unit of digital information.

The combination of 8 bits into 1 byte allows each byte to represent 256 possible values. (see Megabyte, Gigabyte, Terabyte).

C

C-Stand. A versatile stand used to support equipment on the set. Usually outfitted with a grip head and a gobo arm. Can be used for hanging sound blankets or holding a Boom Baby (accessory for holding a boom pole that connects to a grip head mounted on a C-Stand or light stand). See Grip head, Gobo arm.

Capacitance. The ability of an electrical component to store electrical charges. Condenser microphones work on the principle of capacitance.

CBR. Constant Bit Rate. An audio compression technique where the amount of compression does not change. For example, MP3 files can be either Constant Bit Rate or Variable Bit Rate.

CD (Compact Disc). A digitally encoded audio storage format containing over an hour of music digitized with a sampling frequency of 44.1 KHz and a bit depth of 16 bits. The data is read from tiny pits on the surface by a laser beam.

CD quality. An nebulous term used by marketing people to describe audio products.

Cinéma vérité. In French, literally, “cinema truth.” A style of documentary filmmaking in which the filmmaker captures real people in real situations with spontaneous use of hand-held camera, naturalistic sound recording, and with participation on the part of the filmmaker, for example, *Chronicle of a Summer* (1961, Jean Rouch & Edgar Morin, French title: *Chronique d'un été*). Also called direct cinema, however, direct cinema sometimes refers to a different style that was dominant in the United States in the 1960s and differed in terms of much less filmmaker involvement, for example, *Salesman* (1968, Albert & David Maysles).

Clapper board. See Slate.

Click track. A prerecorded track of metronomic clicks used to ensure proper timing of music to be recorded. Used in music scoring sessions.

Clipping. When an input signal exceeds the capability the equipment to reproduce the signal, clipping occurs. In an analog recording system the results are audible distortion, however, in a digital system you end up with incomprehensible noise.

Compander. An audio device or software filter that compresses an input signal and expands the output signal in order to reduce noise.

Compression. 1. Audio: The reduction of a span of the greater amplitudes in an audio signal for the purpose of limiting the reproduction of those particular amplitudes with the effect of reducing the difference between peak amplitudes and average amplitudes, making the overall signal sound louder when some gain is added (since peaks will no longer over modulate). 2: Data: A method for reducing the bitrate of a digital representation of an audio signal in order to reduce the storage requirements of the representation. Methods like MP3 involve the use of psychoacoustic models to discard portions of the audio signal that people will not notice, but always results in artifacts. For professional audio recording, always work with uncompressed audio file formats (e.g. WAV or AIF).

Compression ratio. The ratio of the amount of data in the original video compared to the amount of data in the compressed video. The higher the ratio the greater the compression.

Condenser microphone. A microphone design in which sound causes the movement of a plate (diaphragm) in relation to a fixed backplate. This movement causes a change in capacitance (electrical charge) which is translated to voltage by an amplifier. Therefore, condenser microphones require electrical power to operate. Microphones designed for video production can usually be powered using phantom power from a camera or mixer. Some condenser microphones have an onboard power supply and thus require the use of a battery.

Crossfade. The gradual mix of an incoming and outgoing sound. Typically a software effect that simulates the simultaneous manipulation of two or more mix console faders or a simple transition effect in an editing system. With non-linear editing

Crossover. The frequency at which an audio signal is split in order to feed separate parts of a loudspeaker system.

Crosstalk. This is the amount of audio signal bleed between channels measured as separation (in dB) between the desired sounds of one channel and the unwanted sounds from the other channel.

Cueing. A term with a broad range of uses meanings depending on the context. For Voice-Over Narration or Dialogue Replacement, the marking of the cue point in a way which will permit a signal to be given to the talent to begin each element of dialog at the appropriate time. In general, any system used by a person to signal another person that recording should begin.

D

DAW (Digital Audio Workstation). A computer-based system used for recording, editing, processing, and mixing sounds. Originally referred to expensive workstation-based systems, today many software-based DAWs are available that run on common hardware including Pro Tools, Soundtrack Pro, and Digital Performer.

Dead cat. See Windshield.

Dead spot. An area within a location in which sound waves are canceled by reflections arriving out of phase with the desired signal thus creating an area of reduced audibility.

Decoder. A device or software component that reads a signal and turns it into some form of usable information. For example, an MP3 decoder takes audio that was compressed with an MP3 encoder and converts it to sound data that can be played back on a computer or iPod. The same goes for H. 264 video.

Dialogue. Synchronous speech in a film with the speaker usually, but not always, visible.

Decibel (dB). A unit used to describe sound levels. The decibel quantifies sound levels relative to some 0 dB reference. The reference level is typically set one of several ways: 1. when referring to sound pressure levels (SPL) the reference is set to the threshold of perception of an average human; 2. In digital recording, you set the level in a recording system relative to as 0 dBfs where fs refers to “full scale,” or the strongest signal that can be recorded without distortion, digital level meters read in negative numbers from left to right like -20dB, -12dB, -6dB, -3dB, 0dB; 3. when adjusting audio levels in audio clips in a non-linear editing system, typically 0dB for each clip is the normal level and you go plus or minus in terms of dB in order to make the clip softer or louder. Decibels are actually ratios. The ratio of the sound pressure at the threshold of hearing to the limit that ears can hear without harm is above a million. Because the power in a sound wave is proportional to the square of the pressure, the ratio of the maximum power to the minimum power is above one trillion. To deal with such a range of numbers, logarithmic units are useful: the log of a trillion is 12, so this ratio represents a difference of 120 dB. It’s easier to deal with numbers between 0 dB and 120 dB to talk about the dynamic range of sound rather than a trillion. We typically work with sound adjustments in 3dB (tiny change) and 6 dB (noticeable change)

increments. Even though an increase of 3 dB represents a doubling of the intensity of the sound, we don’t perceive it that way. Perception studies have shown that a 3 dB change in sound level is barely noticeable. Most listeners don’t report a significant change unless it’s 6 dB and it requires a big change of 10 dB before the average listener hears a “doubling” of the sound.

Dialogue track. A sound track which contains sync dialog. Typically while editing dialog tracks are kept separate so they can be processed differently from ambience, music, and sound effects tracks.

Diegetic. Typically refers to the internal world of the story (the diegesis) that the characters themselves experience and encounter including those not actually shown on the screen but referred to in some way within the story. Thus, film elements can be “diegetic” or “non-diegetic.” The term is most often used in reference to sound, but can apply to other element in a film. For example, titles, subtitles, background music, and voice-over narration (with exceptions) are non-diegetic elements.

Diegetic music. Music from a source within the film scene, such as a “live” orchestra or a radio playing. See Non-diegetic music.

Diegetic sound. Sound originating from a source apparent within a film scene.

Diegesis. See diegetic.

Digital. A representation format in which data is translated into a series of ones and zeros. Numerical data (base 10) is translated into binary numbers (base 2). Symbolic data is translated according to codes (for example, the ASCII code system assigns binary numbers to characters so they can be encoded digitally). Audio and images are sampled. See also sample, sampling rate.

Digital recording. A method of recording video (or audio) in which samples of the original analog signal are encoded on tape or a file as binary information for storage and retrieval. Unlike analog recordings, digital video (or audio) can be copied repeatedly without degradation. Digital recording has pretty much replaced analog recording techniques for most image and sound applications.

Digitizing. The act of taking analog audio and converting it to digital form. The term is often used synonymously with ingest or capture, which is the process of transferring a digital audio format into a non-linear editing system (it’s already digital, so you are simply capturing or ingesting, you’re not

actually digitizing). See capture.

Dimmer. A device using to reduce the voltage in order to dim incandescent lamps which causes electromagnetic interference, often with the effect of annoying the sound recordist. See filament buzz. 2. A function of some HMI and fluorescent lighting ballasts that allow them to be dimmed (they can't be dimmed with a standard dimmer).

Directional characteristic. The variation in response at different angles of sound incidence.

Distortion. The addition of artifacts to the original audio signal appearing in the output which was not present in the input.

Dolby Digital. 1. A multi-channel audio format that is standard for DVD, Blu-ray, and HDTV broadcast. Consists of five channels (left, center, right, left surround, right surround), and one low-frequency effects (subwoofer) channel, thus the designation, 5.1. Widely used on professional DVD movie releases. Also known as AC-3. 2. A similar cinema sound system that encodes the digital information between the sprocket holes of a 35mm print.

Dolby Stereo. 1. The analog predecessor to Dolby Digital. Widely used on professional VHS and DVD movie releases (on the analog stereo tracks). In post production a Dolby Stereo encoder left, center, right, and surround channels into a stereo track that is compatible with stereo equipment, but when passed through a Dolby Stereo Decoder results in left, center, right, and surround channels. See Dolby Digital. 2. A similar cinema sound system that replaces the traditional optical track with a Dolby encoded optical track.

Double-system sound. The technique of recording sound and image using separate recording devices. In film production this is the normal methodology since film camera can't record sound, however, it is sometimes used in video as well when mobility is required by the sound recordist who may want to avoid running wires to feed the video camera with the audio signal.

Dub. 1. A verb describing the action of making copy of an audio recording. 2. A noun describing a copy of an audio recording. 3. The looping process.

Dubbing. Adding sound to a film after shots have been photographed and edited. Also, to insert foreign language dialogue into a film after it has been shot.

Dynamic range. The difference in decibels between

the loudest and quietest portions of audio that a system is capable of processing.

E

Echo. A sound wave that has been reflected and returned with sufficient magnitude and delay as to be perceived as a wave distinct from the wave that was initially transmitted.

Effective output level. The sensitivity rating of a microphone defined as the ratio in dB of the power available relative to sound pressure.

ENG (Electronic News Gathering). Designates equipment designed for portable field use, typically for the purpose of video journalism.

ENG snake. A cable designed to connect the output of a field mixer to a video camera. It usually includes two channels of balanced audio, a headphone return, and a quick release connector on the camera end (thus it's also known as a breakaway cable) in order to allow the camera to move independent of the cable when needed.

Envelope. The shape of the graph as amplitude is plotted against time. The envelope of a sound includes the attack, decay, sustain and release.

Environmental sound. General sounds at a low volume level coming from the action of a film which can be either synchronous or non-synchronous.

Equalization. The modification of specific ranges of sound frequencies for a specific purpose, e.g. to improving the clarity of speech or removing a frequency range with unwanted noise.

F

Filament buzz. Some incandescent lamps will buzz when the voltage is lowered using a dimmer. A great annoyance to sound recordists. See Dimmer.

Fluorescent lighting. A gas-discharge lamp and ballast used to illuminate sets and to create noise in order to annoy sound recordists.

Foley. Creating sound effects by watching the picture and mimicking the action, often with props that do not exactly match the action but sound good. For example, walking on a bed of crushed stones in order to simulate walking on the ground.

Foreground music. See diegetic music.

Frame line. The line that designates the top of the frame. When using a boom microphone, the boom operator communicates with the camera operator to understand where the frame line is in order to avoid getting the boom in the shot.

Frequency. The number of times a signal vibrates per second. Expressed in Hertz (Hz), which is the number of cycles per second.

Frequency response. The sensitivity of a given microphone or sound recording and playback system in terms of frequency and a variation, e.g. 20 to 15,000 Hz +/- 3 dB.

G

Gain. 1. In video, an adjustment in the voltage of the video signal expressed in decibels (dB). When it's increased, the image is brighter, along with more visible noise; 2. In audio, how much the input signal level is increased, expressed in decibels (dB); 3. In audio post-production, how much the audio signal of a clip or audio track is adjusted, expressed in decibels (dB).

Gigabyte. 1 Billion bytes.

Grip arm. See Gobo arm.

Gobo arm. A grip head mounted on the end of a 5/8" diameter, 30" long arm used as a device for holding sound blankets and other equipment. See Grip head, C-Stand.

Gobo head. See Grip head.

Grip head. A fully rotatable, adjustable clamp usually mounted on the top of a C-Stand and used to support a Gobo arm, equipment, or a sound blanket. Its core component is a gobo head, which accepts the pin on a flag or a 5/8-in. gobo arm. See Gobo arm, C-Stand.

H

Hard disk. An electro-mechanical data storage device with internal spinning disks. Used for storing video, audio, sound effects, documents, media archives for back up.

Harmonic distortion. Audio distortion characterized by undesirable changes between input and output at a given frequency.

Hertz (Hz). A unit for specifying the frequency of a signal, formerly called cycles per second (cps).

High-pass filter. An electronic or software audio filter used to attenuate all frequencies below a chosen frequency, thus the name, "high pass."

Hiss. Noise that is caused by normal imperfections in the surface of analog recording tape. Also known as asperity noise (literally, roughness noise).

I

Impedance. As long as you stick with microphones and mixers designed for video production, you will

not have to worry about impedance matching. The nominal load impedance for a microphone indicates the optimum matching load which utilizes the microphone's characteristics to the fullest extent. Impedance is a combination of DC resistance, inductance and capacitance, which act as resistances in AC circuits. An inductive impedance increases with frequency; a capacitance impedance decreases with frequency. Either type introduces a change in phase.

Import. The process of transferring digital audio files from the storage media used by a recording device into a non-linear editing system. See also Capture.

Inductance. The resistance of a coil of wire to rapidly fluctuating currents which increases with frequency.

Intermodulation distortion. An amplitude change in which the harmonics (sum and difference tones) are present in the recorded signal.

Inverse square law. Sound from a point source falls off inversely to the square of the distance. Or, put another way, if you double the sound source to microphone distance, you end up with only a 1/4th of the original sound energy.

J

Jet. 1. An type of aircraft that sometimes flies over the set in order to provide interesting sound problems. 2. To leave the set quickly after the shoot.

K

Kilobyte. One thousand bytes. Actually 1,024 bytes because computer storage is measured using base 2 (binary) number system with each digit's value based on a power of 2 (1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1,024) rather than base 10 based on powers of 10 (1, 10, 100, 1,000) which is our everyday number system.

L

Lavalier (Lav). A small microphone designed to work attached to the subject's chest or placed near the neck. The can be placed over or under clothing. Because of their small size, when combined with a wireless system, they are excellent for shooting "walking and talking" subjects. Don't forget to pair them with a lavalier windscreen on a windy day.

Layback. Transfer of the finished audio mix back onto the edit master.

Level. The ratio of an acoustic quantity to a

reference quantity, usually a measurement of audio signal amplitude in decibels (dB).

L-Cut. An edit in which the in (or out) points of the video and audio are different. This is often done to have audio lead the video, in other words, you hear someone start to talk before you see them.

Lip sync. Dialogue or narration that is precisely synchronized with the lip movements of a character or narrator on the screen. See Synchronization.

Location shooting. Filming in an actual setting with all sorts of noise problems, either outdoors or indoors, rather than in a quiet, controlled motion picture studio.

Looping. The process of having actors dub lip-sync sound to scenes which have already been photographed. Also called ADR for automated dialog replacement or additional dialog recording. Called looping because in the old days a film loop of the scene would be put on the projector with cue marks on the film so the director and actor could see the scene while they were looping and multiple takes would be recorded.

Lowpass filter. A filter that attenuates frequencies above a specified frequency and allows those below that point to pass.

M

Masking. A phenomenon whereby one or more sounds “tricks” the ear into not hearing other, weaker, sound that is also present.

MB. Acronym for Megabytes; the equivalent of 1,024 bytes.

ME track (Music and Effects track). Refers to the music and effects tracks split apart from the dialogue tracks for use in dubbing (foreign language re-recording of a film or video).

Megabyte. 1 million bytes.

Mickey mousing. Creating music that mimics or reproduces a film’s visual action, as, for example, in many Walt Disney cartoons.

Mini connector. 1. A 1/8” TRS connector that is typically used for connecting headphones to cameras and mixers, however, some mixers have a 1/4” TRS headphones connector, so it’s always good to have an adapter in your kit; 2. Some consumer cameras used a 1/8” TRS connector for microphone input. Sometimes these inputs provide 5V plug-in power, the consumer equivalent of phantom power.

Mix. To combine sound from two or more sources onto a single sound track. Also called sound mixing.

Mixer. See Sound mixer.

Monologue. A character speaking alone on screen or, without appearing to speak, articulating her or his thoughts in voice-over as an interior monologue.

MOS. Shooting image without recording sound. Lots of colorful stories have evolved in an attempt to explain the origin of this curious term: one story suggests that a famous Hollywood director from Germany used to say “mitt-out-sound” while other explanations are technically oriented, suggesting it means “minus optical stripe” (since some old sound recording systems recorded the audio signal as visual variations on light sensitive film), or it could simply mean “motion omit sound,” but no one really knows the origin of this term.

M-S (Mid-Side). A stereo microphone technique in which two microphone elements (a middle element with a cardioid or hyper-cardioid pattern and a side element with a bidirectional pattern) are incorporated into a special configuration for recording. Offers the advantage over other techniques in that it offers excellent mono compatibility without phase cancellation issues.

Musical. A film genre that incorporates song and dance routines into the film story. Also called musical film.

N

Narration. Information or commentary spoken directly to the audience rather than indirectly through dialogue, often by an anonymous “voice of god” off-screen voice. See voice-over..

Noise. 1. Electrical interference or other unwanted sound introduced into an audio system (i.e. hiss, hum, rumble, crosstalk, etc.)

Non-diegetic music. Music in a film which does not have an apparent source within story world. Often called background music. See diegesis.

Non-diegetic sound. Sound in a film which does not have an apparent source within story world. See diegesis.

Non-linear editor (NLE). A video editing system characterized by digital storage and random access. Final Cut, Avid, Premiere Pro, Vegas, and even iMovie are examples of non-linear editors.

Non-synchronous sound. Sound whose source is not apparent in a film scene or which is detached from its source in the scene; commonly called off-screen sound. See synchronous sound. .

O

Octave. The interval between two sounds having a basic frequency ratio of 2 to 1.

Off-screen sound. See non-synchronous sound.

Over-modulation. Feeding a sound signal with an intensity greater than the levels a system is designed to accept. Digital systems can't tolerate over-modulation, when your audio is too loud it will sound like raspy unintelligible noise. Avoid over-modulating audio just like you avoid over-exposing video.

P

Petabyte. 1,000 Terabytes, or 1 million Gigabytes. Today Terabyte drives are common, someday...

Phase. The timing relationship between two signals.

Phase shift. The displacement of a waveform in time. When various frequencies are displaced differently, distortion occurs. Cancellation of the signal may occur when two equal signals are out of phase.

Pitch. The frequency of audible sound.

Phantom power. A method of powering the preamplifier in condenser microphones by sending the voltage through the audio cable in a manner that does not interfere with the audio signal. Most professional cameras and mixers provide the option of supplying +48V phantom power to microphones.

Phono plug. See RCA connector.

Pick-up pattern. A polar diagram showing how a microphone responds to sounds from various directions. Usually these diagrams also show how directionality varies based on the frequency of the sound. Common patterns include: omnidirectional, cardioid, hyper-cardioid, super-cardioid, and shotgun (lobar).

Pink noise. An audio test signal that has an equal amount of energy per octave or fraction of an octave.

Playback. A technique of filming music action that involves playing the music through loudspeakers while performers sing, dance, play instruments, etc.

Post-production. The phase in a project that takes place after the production phase, or "after the production." Included in post-production is picture editing, sound editing, scoring, sound effects editing, sound design, motion graphics, titles, color correction, sound mix, mastering, etc.

Post-synchronized sound. Sound added to images after they have been photographed and assembled; commonly called dubbing.

Production value. A nebulous term used to describe the visual quality or professional look of a movie. A significant component of production value is the quality of the sound.

Production sound. The activity of recording and/or mixing sound on location during a shoot. Typically recorded to dedicated digital recorder (double system) or directly to the video camera (single system). See Single system, Double system.

R

RCA connector. A common connector used as a video or audio interconnect. Typically color coded as yellow for video, white for audio channel 1 (left), and red for audio channel 2 (right). In most cases, cables with RCA connectors are interchangeable. Some consumer equipment uses RCA connectors for analog component video. Also known as a phono plug.

Reverberation. The presence of additional sound in a recording due to repeated reflections from walls, ceilings, floors, objects, etc. Reverberation is impossible to eliminate in post-production. See Sound blankets.

Room tone. See Ambient noise.

Run and gun. A style of video and audio production that is fast, unpredictable, and often involves covering action in multiple locations in a short amount of time. A great deal of documentary and broadcast journalism is done in this manner.

S

Sampling frequency. The number of sample measurements taken from an analog signal in a given period of time. These samples are then converted into numerical values stored in bytes to create the digital signal.

Score. Original music composed specifically for a film and usually recorded after the film has been edited.

Selective sound. A sound track that selectively includes or deletes specific sounds.

Shotgun. The term used to describe an interference tube (thus the name) microphone with a lobar-super-cardioid pickup pattern. Typically used for recording dialog outdoors and in environments with high ambient noise levels due to their rejection of off-axis sounds. For recording dialog in quiet setting, hyper-cardoid microphones provide better sound, since interference tubes not only reject off axis sounds, but also colors these sounds.

Sibilance. Exaggerated hissing in voice patterns.

Signal. The variation over time of a wave whereby information is conveyed in some form which could be acoustic information (vibrations in air) or electronic voltages (representing sound).

Signal to noise ratio (S/N). The ratio of the desired signal to unwanted noise in an audio or video recording system.

Single system sound. A method of recording sound and picture on the same device, typically this is the way it's done in video production. See double system sound.

Slate. 1. A device used to place an identifier in front of the camera at the beginning of a take. When shooting double system sound, the clapping motion and the clapping sound is used to synchronize the audio to the picture in post production. 2. A good roofing material that can last well over a hundred years and will never become part of the landfill problem.

Snake. 1. A multi-channel audio cable intended for use with microphone and/or line level signals. See ENG snake. 2. Producers who don't treat their crew honestly and with respect.

Sound effect. A recorded or electronically processed sound that matches the visual action taking place onscreen in some interesting, creative manner.

Sound mixer. 1. A device for taking multiple sound inputs and routing them to (typically) a stereo output bus. May include signal processing features like a limiter. 2. Another term for sound recordist. See Sound recordist.

Sound bridge. Sound which continues across two shots that depict action in different times or places, thus providing an audio transition between the two scenes.

Sound designer. A sound specialist responsible for the development of all sound materials in a film and ultimately in charge of the entire sound production.

Sound effects (SFX). Any sound in a film that's not dialogue, narration, or music.

Sound recordist. The person responsible for recording sound on location, they determine the right microphones to use and how to place them. They sometimes work in conjunction with a boom operator, on smaller productions the sound recordist and boom operator are one.

Soundtrack. 1. The music contained in a film. 2. The entire audio portion of a film, including dialog, effects, and ambience.

Source music. See background music.

Speed of sound. Sound travels through air at about 770 miles per hour, which varies depending on ambient temperature and air pressure.

Spotting. In scoring and sound effects editing the process of spotting is used to identify the specific scenes or points where music cues or effects cues take place.

Standing waves. A deep sound in a small room caused by low frequency (long waves) with short reflection patterns.

Stereo sound. Sound recorded on separate tracks with two or more microphones and played back on two or more loud speakers to reproduce and separate sounds more realistically.

Synchronization. A precise match between image and sound. Also called sync.

Synchronous sound (sync sound). 1. Recording sound in synchronization with recording image. Can be single or double system. In single system sound recording the camera records sound and image, with double system sound recording, the camera is used to record images and a separate sound recorder is used to record sound. 2. Sound whose source is apparent and matches the action in a scene. See non-synchronous sound.

Sweetening. Enhancing the sound of a recording or particular sound effect with equalization or other signal processing techniques.

T

Temp dub. A preliminary mixing of dialogue, music, and sound effects, usually so that a first cut may be viewed with all the elements incorporated.

Terabyte. One trillion bytes. Equivalent to a heaping amount of video or an insane amount of audio.

U

Underscore. Music that provides atmospheric or emotional background to the primary narration or dialog.

V

VBR. Variable Bit Rate. A video compression method in which the amount of compression is varied to allow for minimum degradation of image quality in scenes that are more difficult to compress. For example, when encoding MP3 audio, you can choose to encode it as VBR or CBR. See Constant bit rate.

Voice-over. 1. A narrator's voice accompanying

images on the screen. 2. Any off-screen voice.
VU meter. A meter designed to measure analog audio level in volume units which generally correspond to perceived loudness. The meters do not show peaks, peaks are typically indicated with a separate peak light. Still found on professional analog recorders and some consumer gear trying to look impressive. Digital meters behave in a totally different manner.

W

Walla. Background ambience or noises added to create the illusion of sound taking place outside of the main action in a picture.

Wave. A regular variation in signal level or sound pressure level.

White noise. A signal having an equal amount of energy per Hertz.

Windshield. A device placed over a microphone that reduces the effect of wind noise on the microphone. There are two main types of windshields, modular systems and integral slip-on systems. A modular system (often called a blimp or zeppelin) consists of a flexible grey plastic netting tube (thus the name) with a screening material and a suspension system for the microphone (e.g. Rycote Modular Windshield). A furry synthetic fur cover, often called a windjammer, can be placed over the zeppelin for additional wind noise attenuation. In documentary and ENG applications one-piece slip on windshields consisting of a cellular foam base surrounded by synthetic fur are quite popular (e.g. Rycote Softie Windshield). The foam wind screen that comes with most microphones is only good to prevent wind noise due to movement of the microphone, outdoor shooting requires a windshield. Furry slip on systems or windjammers are sometimes called a dead cat. Some folks refer to a blimp's windjammer attachment as a Wookiee since they are typically larger than dead cats.

Windjammer. See Windshield.

Wild sound. Audio elements that are not recorded synchronously with the picture. It's a good idea to record wild sound wherever you go. These wild tracks of the environment can be used to build ambient sound beds or fix audio problems in dialog when you need to fill gaps of empty track.

X, Y, Z

X-Y Pattern. A pair of cardioid microphones or elements aimed in crossed directions which feed two

channels for stereo pickup.

XLR. A widely used connector for sound applications typically having three conductors (but can also have more, e.g. five for a stereo connection) plus an outer shell which shields the connectors and locks it in place. The connectors are either male with pins or female with sockets. Microphones and mixer outputs have male connectors; mixer inputs and camera inputs have female sockets.

Zeppelin. See Windshield.

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Colophon

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