

## Audio recording equipment survey

Arienne M. Dwyer & Yoshi Ono

[anthlinguist@ku.edu](mailto:anthlinguist@ku.edu), [tono@ualberta.ca](mailto:tono@ualberta.ca)

30 June 2008

An earlier version of handout was originally used in Arienne Dwyer's *Linguistic Data Processing* seminar, last taught at the University of Kansas during Spring 2007. May be freely reproduced or excerpted as long as it is cited. Note that equipment information and prices date quickly. Please see the references for more details on techniques. Comments and corrections welcome.

**Aim:** to make the highest possible quality recordings, but consider:

- limits of budget, equipment, and training
- Whatever your budget, get the best you can possibly buy and operate.
- comfort of speaker/singers
  - keeping a crowd quiet may stop a storyteller's flow
  - large or multiple microphones may be threatening
- naturalness of linguistic/cultural setting
  - in situ
  - often includes crowd noise, interruptions, doors slamming, chickens, drumming, etc.

### **Equipment and Planning**

**1. Do an informal site survey** – What power is available? What microphones and devices would be most appropriate?

#### **2. Power**

##### **2.1. Electricity**

- National power supplies: 220v, 110v, or something else?
- Wall AC Outlets: bring adaptors
- Availability: 24 hrs? Certain times of day?
- Quality: “brown”? (irregular, surging power, lots of spikes)
- Power and your hosts:
  - excessive burden on electrical grid?
  - compensate if excessive (e.g. if using video lights)

##### **2.2. Batteries**

- Nonrechargeables
  - Alkaline
  - Lithium (more expensive, but much longer-lasting and lighter)  
(may be subject to restriction on airlines to/from/within the U.S.)
- Rechargeables (economical, but (1) shorter time and (2) have "memory effect", need to be regularly discharged – we recommend using a recharger/discharger)
  - Ni-Cad (Nickel-Cadmium)
  - Ni-Mh (Nickel-Metal Hydride) less memory effect than Ni-Cad  
Newer Ni-Mh (no memory effect e.g., Sanyo Eneloop)

2.3. **Tape selection and preparation** (Not recommended; skip this if you don't use a tape-based recorder, e.g. if you use a CF/SD/minidisk/mp3 recorder).

- do not record on the first and last 30 seconds of a tape
- wind and rewind each tape once (the night) before recording
- avoid analog tapes over 90 mins long (they're prone to stretching)
- analog: use professional quality and/or CrO<sub>2</sub> if possible, if not, "high."

## Microphones

### *General Characteristics:*

- Mono vs. Stereo
  - mono - one channel
  - stereo - two; from stereo mic or two mono mics
- Dynamic vs. Condenser
  - Dynamic - durable, need no extra power
  - Condenser – have own battery, plug-in power or phantom power; more sensitive but more fragile.
- Internal vs. external
  - Internal: avoid them (all pick up handling noise)
    - In older devices, they pick up machine noise.
    - In newer devices, ok, but not as good as external
      - External: plug in with cable and mic jack
      - T-microphone: small (5 cm) attachment to recorder
        - Picks up machine/handling noise.
        - OK if you have nothing else. (ca.US\$15-50)
  - Wired vs.wireless
    - Wired: connected directly to a recorder
    - Wireless: unconnected, signal via radio frequency(Wireless mikes can have *dropouts*, or signal obstruction, but allow freedom of movement and are therefore a good choice with e.g. children)
  - Directionality: Omni vs. Unidirectional
    - a. Omnidirectional: operates equally well in all directions
    - b. (Uni)directional: receives signal more efficiently from a single direction than from all other directions

### *Microphone types:*

#### Directional microphones:

- **Cardioid** (heart-shaped pickup) – very useful overall functionality; Also Hypercardioid, Supercardioid
- **Shotgun** (US\$50-\$3000 and up)

A highly-directional microphone with a narrow oval/tubular pattern and extremely reduced pickup from the sides and rear.

- **Lavalier** (clip-on) (\$50-350)

A miniature microphone that is usually worn fastened to clothing somewhere near the user's mouth. Also referred to as a lapel (or clip-on) microphone. But so-so sound. Often used in pairs to record conversation between two speakers. Can seem invasive to speakers.

- **Headset** (\$60 and up) - Worn with a headset

*Advantages:* Makes excellent quality recordings, as it follows the speaker's movements

*Disadvantages:* Can seem invasive for speakers.

- **Eight/Figure 8** (\$400 and up)- records in front and in back, at 0 and 180 degrees

*Advantages:* mid-range price, unobtrusive. OK for two (groups of) speakers facing each other and recording lectures.

*Disadvantages:* questionable sound quality.

- **Binaural** (\$80 and up)

Two microphones spaced apart and angled to imitate human ears, set on a mike stand.

- **Boundary** (not often used for linguistics, \$50 and up)

Easy to use, durable, noninvasive, good for multiple speakers (e.g. talk around a table)

## **Microphone accessories**

- filters: foam, 'fake fur' - use them
- Grips (holders) - also essential. One with threading in the base can be screwed onto a tripod; otherwise, use a tripod clamp.
- Cables: stereo/mono, various lengths (e.g. 1 and 3 metres); long non-XLR cables can create noise

## **Audio recorders**

Note: recommended these days are *Solid State Recorders* (ii.4 below)

*not recommended:*

**Analog Audio Recorders** (sound waves converted to electrical signals, which are continuously variable)

2. **Reel-to-reel** (Uher, Nagra, Stellavox)

*Advantages:* very robust, tape can be cut to edit, long-lasting for archival purposes

*Disadvantages:* machines are big, heavy, and hard to obtain these days, as are RTR tapes

*Comment:* nearly obsolete.

*not recommended:*

3. **Cassette tape** (Mostly out of production, e.g. Sony Walkman WMD6, Marantz CP430, Sony D5M)

*Advantages:* machine and tapes inexpensive, machine is often repairable in the field; speaker communities are likely to have tape players and recordings on cassette tapes.

*Disadvantages:* mediocre recording results, degradation of sound after copying, poor archiving potential.

*Comments:* If you use these, get professional quality tapes; semipro models (e.g. Marantz, Fostex, Tascam, but also even the Zoom H4) have XLR mike inputs.

**Digital Audio Recorders** (electronic or electromagnetic data transmitted via a finite set of numbers, usually binary (bits))

*not recommended:*

**Minidisc, Hi-Minidisc (HiMD)**

*Advantages:* inexpensive; easy to use; small

*Disadvantages:* Data reduction through ATRAC compression; many recorders do not have a digital out; unknown archival reliability; sometimes copy-protected

*Comments:* is often a good compromise when speakers/singers must wear the recording device. Useful also for background interviews, but these days, an MP3 recorder (with a digital out) is a better solution. (Sony) HiMD is an *uncompressed* format (much better than regular MD!); but they likely will stop supporting it soon.

*not generally recommended:*

**MP3-Recorder (incl. iPod) [\$50-250]**

*Advantages:* extremely small, inexpensive, could be used as a backup recorder.

*Disadvantages:* data reduction, mediocre sound quality, sometimes copy-protected.

*Comments:* Some newer models (incl. iPod Gen 5) can record at acceptable 44.1 kHz stereo; if you do, make sure the device has a lossless digital output.

*Excellent, but not recommended (nor for sale) any more:*

**DAT (Digital Audio Tape):** Sony PCM-M1, TCD-D7/D8/D10/D100, Tascam DA-P1, Fostex PD-4

*Advantages:* high recording quality without compression

*Disadvantages:* relatively expensive (tapes + transfer cable); harder to use; still requires time-consuming capture; dust- and moisture-sensitive; unknown archival reliability

*Comments:* Close to obsolete.

*User groups:* e.g. DAT-Heads ([www.eklektix.com/dat-heads](http://www.eklektix.com/dat-heads))

*Strongly Recommended:*

**Solid State (memory card) recorders** (\$250-2000),

Small: e.g. Edirol R-09HR, Olympus LS-10, Sony PCM D50, Marantz 620; Zoom H4

Medium sized: (\$400), Fostex FR-2LE, Marantz PMD660

*Advantages:* High quality recording with easy data transfer

*Disadvantages:* May be hard to get repaired (like other digital devices)

*Ambivalently recommended:*

**Direct-to-computer recording (laptop)**

Need an *external* sound card (e.g. the Edirol FA-66 (ca. US\$260), UA-1EX (\$80)) and a good mic.

*Advantages:* Can be high quality recording without having to mess with tapes; can (with powerful computer and a microphone placed far enough away) type notes while recording)

*Disadvantages:* takes up computer space; older models often pick up laptop noise; under many field conditions (dusty, rainy, jostling children etc.) one may not want an open laptop; bulkier/heavier than a digital recorder.

**Direct-to-computer recording (desktop)** with any linear sound card

*Advantages:* Can be high quality recording without having to mess with tapes

Some, e.g. Terratec, have controls *on front* of computer

*Disadvantages:* rather expensive; fine for studio recording, but unsuited to fieldwork.

## Connectors (Plugs/jacks)

1. **Mini-plug** usually 3.5 mm, available in both mono and stereo
  2. **XLR** - most common in professional audio
- For balanced audio cables, particularly for microphones, the 3-pin versions, male and female, are most often used.

## Cables

1. Isolated/non-isolated
2. Coaxial vs. optical

Coax -Designed to conduct radio frequency, consisting of an inner conductor, a tubular outer conductor and an insulating material in between the inner and outer conductor. The outer conductor is usually a woven copper braid covered by an outer layer of protective plastic.

Optical – signal sent via fibre optics. Cable more delicate.

**Tripods** – useful with microphones and with recorders

## Test equipment and practice using it!

1. when new (to you), test in the comfort of your home
2. the night before using it, re-test it.  
(as well as the rest of the equipment, if it is new to you)

1.

**2. Some techniques** (for more details, see References)

1. Use a directional mic if possible and appropriate (e.g. sole speaker)

2. Keep mics close to speaker/singer

Use foam filter to prevent pops from mouth close to mic

to record amplified sound: “for vocal mics, aim the null of the polar pattern at the floor monitors. The null (st pickup) of a cardioid is at the rear of the mic: 180° off axis. The null of a supercardioid is 125° off axis; cardioid, 110°.

Use a directional microphone, place to avoid phase cancellation

Frequency response caused by mixing the outputs of two microphones which are picking up the same sound but out of phase. For example, this can occur when two microphones are placed near each other, but still with space between them; they do not stand next to each other. Also referred to as acoustic phase interference.)

the **"3:1 Rule"** ("3-to-1 Rule") A ratio for the minimum distance mics should be spaced apart ("3 times X"),  
the sound source ("X").  
kHz and up

or power to some preset value to protect signal or equipment. )

ve or other software like SoundForge)  
e (usually with "RCA" jacks)

the appropriate cable; launch your favorite audio capture software (e.g. Audigy) and "record" the media as a

<http://www.hrelp.org/archive/advice/microphones.html>

Audio Field Recording Equipment Guide (itself with excellent references)

[http://www.vermontfolklifecenter.org/res\\_audioequip.htm](http://www.vermontfolklifecenter.org/res_audioequip.htm)

Audio Technology tutorial: <http://www.historicalvoices.org/oralhistory/audio-tech.html>

On Metadata:

- Open Language Archives Community (OLAC)  
<http://www.language-archives.org>
- IMDI (Probably different URL) ; international Standards for Language Engineering  
<http://www.mpi.nl/ISLE>

Reviews of Audio hardware (recording devices and microphones):

- Vermont Folklife Center  
[http://www.vermontfolklifecenter.org/res\\_audioequip.htm](http://www.vermontfolklifecenter.org/res_audioequip.htm)
- University College London  
<http://www.phon.ucl.ac.uk/resource/audio/recording.html>
- <http://www.transom.org/tools/index.php>

Training in recording techniques, audio signal processing, and archiving:

- Audio/video recording techniques:  
<http://www.bbctraining.co.uk/onlineCourses.asp>
- EMELD – a “School of Best Practice” in many aspects of language documentation, including recording techniques and software:
  - Audio: <http://emeld.org/school/classroom/audio/index.html>
  - Software: <http://emeld.org/school/toolroom/software/index.cfm>
- Sound Directions – a very exacting guide to high-quality audio archiving  
<http://www.dlib.indiana.edu/projects/sounddirections/papersPresent/index.shtml>

For software:

- Transcriber and others: Linguistic Data Consortium: <http://www ldc.upenn.edu>
- Many types: <http://audacity.sourceforge.net/>
- Praat: <http://www.fon.hum.uva.nl/praat/>

Audio archives (partially browsable)

- Pacific And Regional Archive for Digital Sources in Endangered Cultures in Australia (<http://paradisec.org.au/>).
- Indiana University Archives of Traditional Music <http://www.indiana.edu/~libarchm/>
- Documentation of Endangered Languages <http://www.mpi.nl/DOBES>
- SOAS Endangered Lang. Documentation Programme: <http://www.hrelp.org/archive/>
- Archive of Indigenous Languages of Latin America: <http://www.ailla.org/>

Places to buy specialized audio equipment

- For Edirol R-09HR, all the big dealers carry it: Amazon, B&H, J&R Photo, the Sound Professionals, etc.
- US dealers who know about digital audio and microphones: Oade Brothers, Full Compass Systems