Chapter 14. Meeting 14, Stereophonic Microphone Techniques

14.1. Announcements

• Need schlep crew for Wednesday: two people
  Meet in my office at 3:10
• Mix Report 1 Due Monday 9 April
• First recording session a week from Wednesday

14.2. Stereo versus Mono Microphone Techniques

• Instruments that are large or have diverse points of resonance or movement are often captured in stereo
  1. Piano, harp, percussion keybarod (marimba, xlophone, vibraphone)
  2. Acoustic guitars
  3. Leslie speaker cabinets
• Instruments and sound sources that have a focused output are often captured in mono
  1. Single drums
  2. Brass, woodwinds, and other aerophones
  3. String instruments: violin, bass, cello
  4. Speaker cabinets

14.3. Close Captures

• In general, monophonic captures are close
• Closeness offers an intimate sound and good isolation (least leakage)
• Closeness may remove or reduce reflections (ambience, reverb)
• Closeness can lead to unbalanced frequency response or irregular isolation
• Closeness can lead to undesirable air-bursts or physical contact
• Ribbons (figure eight), dynamic (cardioids), and large-diaphragm condensers (cardioids) most often used

14.4. Microphone Positioning Charts

• Indicate musician and microphone positions
• Circle + one arrow: cardioid
• Circle + two arrow: figure-eight
• Circle + cross: omni

14.5. Strings

• Close captures of strings can be very unnatural
• Often need some space for resonance and smoothing
• f-holes and sound holes offer focus of output
• Microphone diaphragm should be aligned to plane of sound board
• Radiation is in three dimensions
• Favor large-diaphragm condensors

14.6. Acoustic Bass

• For tone, focus large-diaphragm cadiod at f holes

• Possibility of too much bass with proximity effect: can increase distance or use an omni to mitigate

• Can use alternative capture of strings (above or below) for more performance articulations

• Can position under strings in bridge or nut
14.7. Vocals

- Lots of air, mouth noises, and breathing
- Proximity to nose can increase nasal sound
- Always use pop-screens to avoid plosives
- From 6 to 20 inches recommended
- Large diaphragm condensers always preferred
Images removed due to copyright restrictions.
1) Vocalist microphone is normally 0.5 to 1 meter away, Figure 13-9, in Eargle, J. *The Microphone Book*. 2nd ed. Focal Press, 2004.
2) Sound reflecting off a music stand can cause comb-filtered frequency interference with the direct sound - see Fig. 16.10 in Huber, D. M., R. E. Runstein, and D. M. Huber. *Modern Recording Techniques*. Taylor & Francis, 2001.
14.8. **Amps**

- Axis and orientation to speaker makes a big difference
- Often want to be slightly off axis of speaker cone
• The front and back of a speaker are valuable sources

• Position in relation to speaker matters

**Figure 4.2. Miking an electric guitar cabinet directly in front of and off-center to the cone.**

• Special amps (Leslie speakers, stereo cabinets, diffuse radiating cabinets) require stereo captures

• Favor cardioid dynamics, large diaphragm cardioids (with pad), or ribbon
14.9. Brass

- Huge dynamic range, potentially large bursts of air
- Dynamic microphone are effective, safe, and warm
- Favor small diaphragm condensors (with pad) or ribbon
- On axis captures are common; off axis (or post recording filtering) may give a warmer sound
14.10. Woodwinds

- Clarinets, saxophones, flutes, bassoons
- Sound eminates from all around (bell and keys)
• Point microphone toward the alignment of the keys and bell
Mic placement for alto saxophone, points just behind the bell.
• For flutes, almost all sound out of keys

• Favor large or small diaphragm condensors
14.11. Drum Kit

- At most: a microphone per drum

- At least: two overheads and a kick-drum microphone

- Problem of leakage forces very close captures

- Problem of drummers hitting things with sticks

14.12. Drum Kit: Cymbals

- Overhead stereo captures used to gather cymbals and high frequencies (discussed under stereo techniques)

- High-hat often given a close capture: small diaphragm cardioid condensor or dynamic

- Different sounds from the bottom and the top
- Bottom may offer more snare tone
- Off axis capture preferred

- Mixing top and bottom may create phasing distortion
- Cardiod or super-cardiod dynamic microphones are common (SM-57 is popular)
• Small diaphragm condenser microphones (with high SPL handling or pads engaged) may be used


• Top will have more stick sound than bottom
• Mic-per tom gives best isolation and stereo presentation
• One microphone might be used for two rack-toms
• Often more on-axis than snare microphones

Images removed due to copyright restrictions.
Mic placement for rack tom (aka mounted tom).

• Cardiod dynamic microphones are common
• Small diaphragm condensor microphones (with high SPL handling or pads engaged) may be used
14.15. Drum Kit: Kick

- Both low and high frequency ranges are critical
- Inside and outside captures are often used

Figure 3.1 Microphones inside the kick drum

- Can focus sound outside of drum
14.16. Stereo Recording: Common Applications

- Can be used for both close and distant captures
- Pianos, acoustic guitars, keyboard percussion, drum set (overheads)
- Ensembles, sections

14.17. Localization

- Two sources of localization information
- Timing differences: a single sound arrives to our ears at different times
- Amplitude differences: a single sound arrives to our ears at different amplitudes

14.18. Stereo Recording: Common Directional Pairing

- Pairs of cardioids
- Pairs of omnis
- Pairs of figure-eights
• Mid/Side: cardioid and figure-eight (will discuss next meeting)


• Coincident pairs: X-Y, M-S
• Near-coincident pairs (ORTF, NOS, Faulkner)
• Spaced pairs: A-B

14.20. Cardioid and Figure-Eight Coincident Pairs

• Timing is identical; localization is due to amplitude differences
• Common approaches use cardioid or hyper-cardioid pairs; coincident omnis will have minimal differentiation
• Consider which sound sources that are off- and on-axis
• Small diaphragm condensors are preferred if less off-axis coloration is needed (Holman 2008, p. 74)
• Matched pairs (with very similar frequency response) are used to reduce the chance of sound-image movement at different frequencies
• Splay from 60 to 120 degrees
Variable crossed cardioid patterns.
Figure 14-6 in Eargle, J. *The Microphone Book*. 2nd ed. Focal Press, 2004.

- Blumlein array (1931): coincident crossed figure eights
  Works best in a wide room, with minimal side-wall reflections (Streicher and Dooley 1985)
14.21. Cardioid and Figure-Eight Near-Coincident Pairs

- Localization is due to both amplitude and timing differences
Results in good localization with a sense of depth (Streicher and Dooley 1985)

- Front material is less off axis than with coincident pairs
- Not used for close captures: small movements of the sound source can produce large image shifts
- Office de Radio-Television Diffusion Française (ORTF): 6.7 inches (17 cm), 55 degrees from forward

  Frequently voted best stereo capture (Holman 2008, p. 85)

- Nederlandsch Omroep Stichting (NOS): 11.8 inches (30 cm), 45 degrees from forward
- Faulkner array: two bi-directional mics, 7.9 inches (20 cm), facing forward

- Diagrams
14.22. Spaced Omni Pairs

- Localization due to both amplitude and timing effects
- Best used for distant captures combined with closer captures

Extremely distant sounds can present negligible directional cues to the listener (Streicher and Dooley 1985)
• Omnis have more extended low frequency response and lower noise floor (Homan 2008, pp. 73-74)

• Spacing too close together results too little stereo distinction: coincident omnis are nearly monophonic

• Spacing too far results in audible echos between channels

Vague center imaging (Streicher and Dooley 1985)

• Common approaches: 2 feet (.6 meters) close to performers; 10 to 30 feet used in front of large ensembles (Holman 2008, p. 79)

• Can use subcardioids for a bit more directionality

• Examples

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