

Chapter 1. Meeting 1, The Tools of Audio Engineering

1.1. Announcements

- 21M.380: Music Technology: Recording Techniques and Audio Production
- Foundations, practices, and creative techniques in audio recording and music production, including microphone selection and placement, mixing, mastering, signal processing, automation, and digital audio workstations.

1.2. Overview

- Contexts and Tools
- Listening
- About this course

1.3. Aural Photography and Aural Sculpture

- Photography and Sculpture: two extremes of what we do when we record and produce audio
- A photograph: capture a “natural” space, time, and sound
- A sculpture: a synthetic re-working of other materials
- A wide range between these two extremes; how do we decide?

1.4. Aural Photography and Aural Sculpture Today

- This endeavor used be limited to a few
- Tools are more accurate
- Processors are more powerful
- The necessary technologies are inexpensive
- Relevant to all working in sonic crafts

1.5. The Training of an Audio Engineer

- Listening and ear training
- Musical knowledge and performance experience
- Practical, hands-on experience with hardware and software
- Knowledge of historical and current trends
- Theoretical knowledge of sound, psychoacoustics, and electronics
- Experience working with changing and limited resources
- Willingness to experiment and innovate

1.6. Three Large-Scale Audio Production Processes

- Tracking (recording, overdubs)
- Mixing (editing, processing, producing, composing)
- Mastering

1.7. Tools of Tracking

- Space: acoustics, baffles, absorption, and reflection
- Transducers: microphones and speakers
- Pre-amps: the first stage of amplification, optimize level to the medium
- The recording medium: disc, tape, digital
- Monitoring: providing pre-recorded signals back to the performer

1.8. Tools of Mixing

- The channel strip
 - Adjust level in relation to other channels
 - Adjust panning, or spatial position
 - Apply filters (EQ)

- Process dynamics (compression, limiting, gating, expansion)
- The mixer
 - Combine channels into groups (busses)
 - Route channels or busses for processing (reverb, delay)
 - Automate changes in channel or processor parameters

1.9. Tools of Mastering

- Prepare and optimize mix for the distribution medium
- May use filters, dynamics processing, or speciality processors

1.10. Hardware Tools: MOSS

- MOSS: The MObile Sound Studio for Teaching and Learning at MIT

- Any space is a recording space
- Support for 16 channel recording
- A variety of microphones and preamps
- A variety of monitoring tools

- All will be required to help move before and after class

1.11. Software Tools: DAW

- The digital audio workstation: combines roles of mixing and processing into a single software unit
- Some add feature for MIDI production with virtual instruments and loop based music production
- All students are required to obtain a full-featured DAW immediately

Recommended DAW for Mac and Windows users is Ableton Live Intro, version 8 or better (\$99):

<http://www.ableton.com/live-intro>

- Acceptable alternatives include: ProTools, Logic (Pro or Express), Cubase, Reaper, Digital Performer, Sonar, or FL Studio
- Contact me if you anticipate a problem with this

1.12. Software Tools: Waveform Editor

- The software tool for editing a single audio file
- Usually destructive editing with minimal (if any) mixing functionality
- Free waveform editor for Mac, Windows, and Linux users is Audacity:

<http://audacity.sourceforge.net/>

- Alternatives include: Peak, Adobe Audition, Wavelab
- Download, install, and test ASAP

1.13. The Most Important Tool

- Your ears
- Listening like an audio engineer
- Hearing the production separate from the music

1.14. Mix Graphs: Basics

- Structured listening and analysis of recordings

- Steps
 - Select a piece of music
 - Listen carefully to the music; using headphones is recommended
 - Isolate each audio source (may be more than one within a track)
 - For each audio source, evaluate fundamental attributes
- Report must be posted in the class Forum under the appropriate topic heading
- Students are encouraged to read and comment on others reports

1.15. Mix Graphs: Fundamental Attributes of a Mix

- Isolating each audio source
- Tracks, channels, and audio sources
 - A track is one or more channels bundled together for uniform audio processing (represented as a single unit in a DAW)
 - A channel is a single isolated audio stream (one simple or complex waveform)
 - An audio source is a distinct sound or timbre group (which may be captured with one or more channels)
- Perceived relative loudness can be measured between 0 and 1
- Perceived stereo position between -1 and 1
- Estimated frequency response between 20 and 20,000 Hz (more on this next class)

1.16. Mix Graph: Example 1

- Blackalicious: Aural Pleasure (audio)

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Mix Graph 1

Artist: Blackalicious
 Album: Blazing Arrow
 Date: 2002
 Song: Aural Pleasure

SOURCE	VOL	PAN	FQ (Hz)
Kick Drum	.8	0	80-100
Bass	.85	1	60-100
Snare/Clap	.85	-.2, .2	800-2000
Shaker	.7	.8	1000-2000
Tambourine	.85	-.4, .4	2000-4000
Electric Gtr	.75	-.6	800-6000
Horns	.7	-1, 0, 1	900-4000
Female Voice	.9	-1, 1	1000-6000
Male Voice	.95	0	600-2000

Notes: Snap and snare clap double each other. Exact composition of horn section not clear. Tambourine alternates between left and right.

1.17. Mix Graph: Example 2

- John Coltrane: Naima (audio)

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Mix Graph 2

Category: jazz or experimental instrumental ensembles

Artist: John Coltrane

Album: Giant Steps

Date: 1959

Song: Naima

SOURCE	VOL	PAN	FQ (Hz)
Sax	.95	-.7	1000-4000
Piano	.8	-.9	600-5000
Bass	.8	.7	60-120
Snare/Cymbals	.7	.9	1000-6000

Notes: All sources seem to be monophonic.

1.18. 21M.380: Objectives and Prerequisites

- Gain a critical understanding of, and hands-on experience with, the equipment and practices of modern recording techniques and audio production
- Develop practical and creative approaches to creating, processing, and mixing recordings and improvisation
- Understand the historical, aesthetic, and social contexts of audio recording
- No prerequisites

1.19. 21M.380: Course Meetings

- Two types of meetings

- Topic meetings: focused on material in readings, listening, and themes, combining lecture, discussion, demonstration, and listening
- Workshop meetings: hands-on projects, full recording sessions
- Lecture notes

1.20. 21M.380: Assignments: Reading

- One book:

Eargle, J. 2004. *The Microphone Book*. 2nd ed. Boston: Focal Press.

- Numerous carefully selected articles and chapters:

1. Dooley, W. L. and R. D. Streicher. 1982. "M-S Stereo: A Powerful Technique for Working in Stereo." *Journal of the Audio Engineering Society* 30(10): pp. 707-718.

2. Horning, S. S. 2002. "From Polka to Punk: Growth of an Independent Recording Studio, 1934-1977." In H. Braun, ed. *Music and Technology in the Twentieth Century*. Baltimore: The Johns Hopkins University Press, pp. 136-147.

3. Katz, B. 2007. "Equalization Techniques." *Mastering Audio: The Art and the Science*. 2nd ed. Burlington: Focal Press, pp. 103-112.

4. Katz, B. 2007. "How to Manipulate Dynamic Range for Fun and Profit." *Mastering Audio: The Art and the Science*. 2nd ed. Burlington: Focal Press, pp. 113-138.

5. Katz, M. 2004. "Aesthetics Out of Exigency: Violin Vibrato and the Phonograph." *Capturing Sound: How Technology Has Changed Music*. Berkeley: University of California Press, pp. 94-108.

6. Lazzarini, V. 2011. "Introduction to Digital Audio Signals." In R. Boulanger and V. Lazzarini, eds. *The Audio Programming Book*. Cambridge, Massachusetts: MIT Press, pp. 431-462.

7. Millard, A. 2002. "Tape Recording and Music Making." In H. Braun, ed. *Music and Technology in the Twentieth Century*. Baltimore: The Johns Hopkins University Press, pp. 158-167.

8. Nielsen, S. H. and T. Lund. 2003. "Overload in Signal Conversion." *AES 23rd International Conference*.
9. Streicher, R. and W. Dooley. 2003. "The Bidirectional Microphone: A Forgotten Patriarch." *Journal of the Audio Engineering Society* 51(3): pp. 211-225.
10. Streicher, R. D. and W. L. Dooley. 1985. "Basic Stereo Microphone Perspectives -- A Review." *Journal of the Audio Engineering Society* 33(7-8): pp. 548-556.

1.21. 21M.380: Assignments

- Mix Graphs (3)
- Processing Reports (2)
- Mix Reports (2)
- Track Sheet Log
- Participation

1.22. 21M.380: Assignments: Submission

- All assignments are submitted digitally via email attachment (or as Forum posts)
- All assignments are due at 11:59:59 PM on due date
- No late assignments will be accepted

1.23. 21M.380: Attendance

- Mandatory and essential
- Always communicate with me about needs for excused absences
- More than one unexcused absence incurs a 3% grade reduction

1.24. 21M.380: Exams and Quizzes

- Quizzes will be announced
- All short written answers
- Quizzes will be based on reading, listening, and course content

- No final exam

1.25. 21M.380: Grading

- See distribution in syllabus
- Emphasis on projects; quizzes and participation are important

1.26. 21M.380: Additional Policies

- Read entire syllabus
- Common courtesies
- Computers in class
- Academic integrity

1.27. 21M.380: Contact

1.28. For Next Class

- Download and read entire syllabus, begin reading in Eargle, begin Mix Graph 1

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<http://ocw.mit.edu>

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