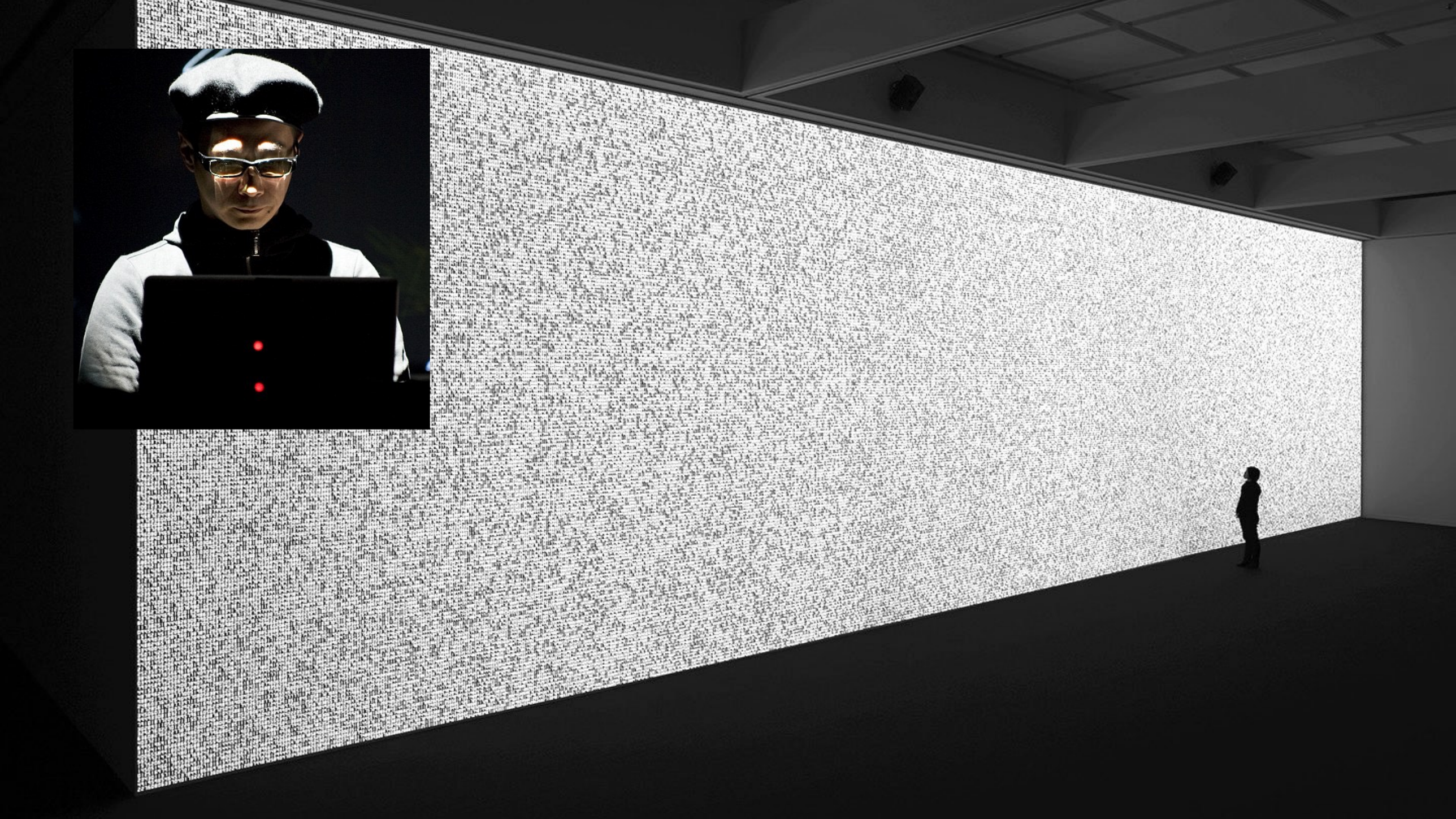
TECH 101

AU CENTRE POMPIDOU



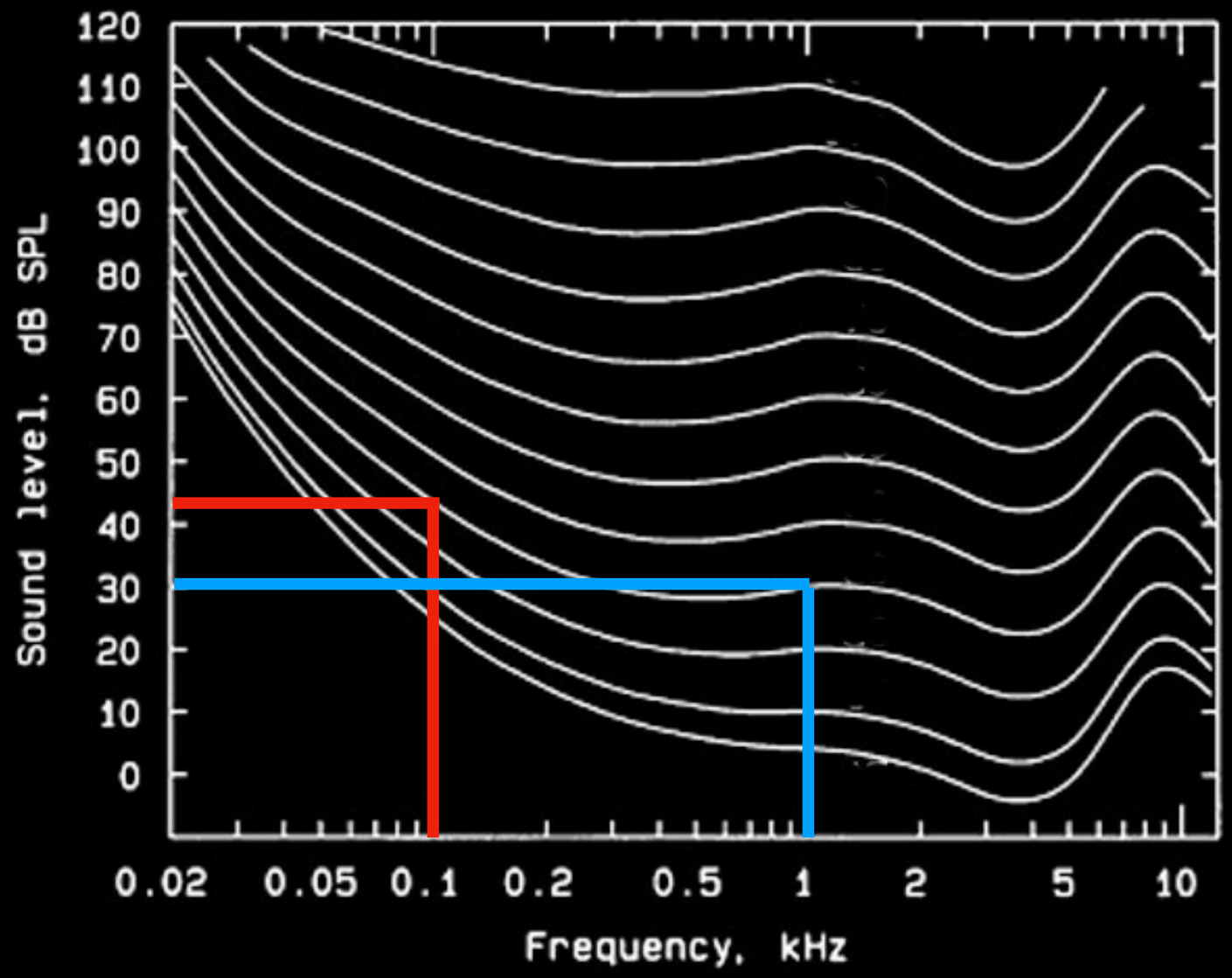

ELECTRONIC
SACKBUT

Review of Last Class

- Acoustics vs. Psychoacoustics (Objective vs. Subjective)
- Waves
  - Longitudinal vs. Transverse
  - Compression vs. Rarefaction
  - Periodic vs. Aperiodic
  - Sine waves = unnatural, single frequency
- Amplitude vs. Loudness, Decibels (dB)
  - Inverse Square Law (double distance -> quarter intensity)
    - intensity = 1 / distance^2
- Frequency vs. Pitch, Hertz (Hz)
  - frequency = 1 / period
  - 20 Hz to 20 kHz - human hearing range
- Phase (more to come!)

Equal Loudness Contours

(Fletcher-Munson Curves)



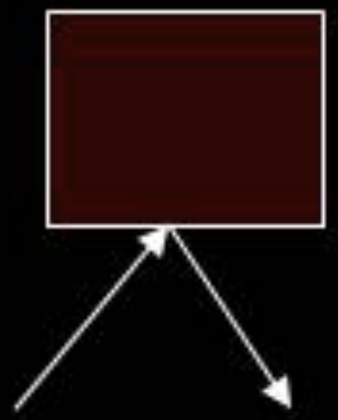
sound & space

Room Acoustics

DIFFRACTION - Long waves will bend around (or move through) objects.

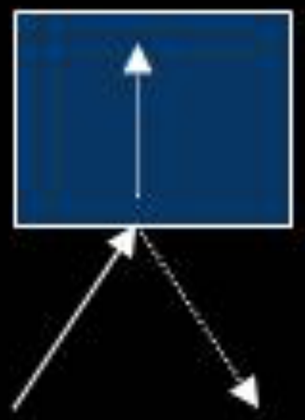
ABSORPTION <---> REFLECTION
Hard surfaces reflect, soft surfaces absorb.
Short wavelengths become trapped in soft material - carpets, drapes, etc.

Reflected sound is REVERBERATION, a series of echoes, and reverb time depends on the size and material of the space



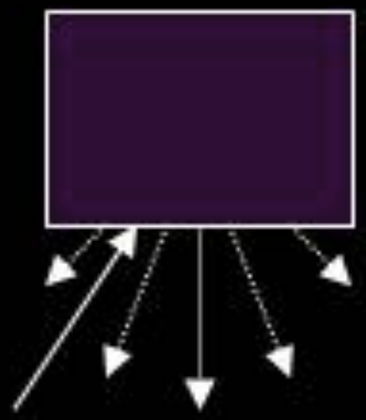
Reflection:

Most of sound is reflected which is almost as loud as incoming sound



Absorption:

Absorbing power is determined by material used

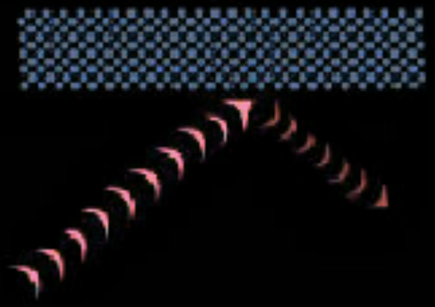


Diffusion:

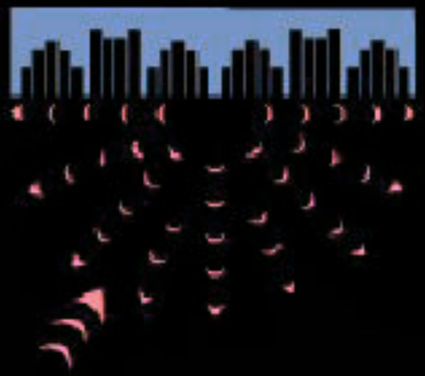
Scatters sound depending on desired effect

Reflection

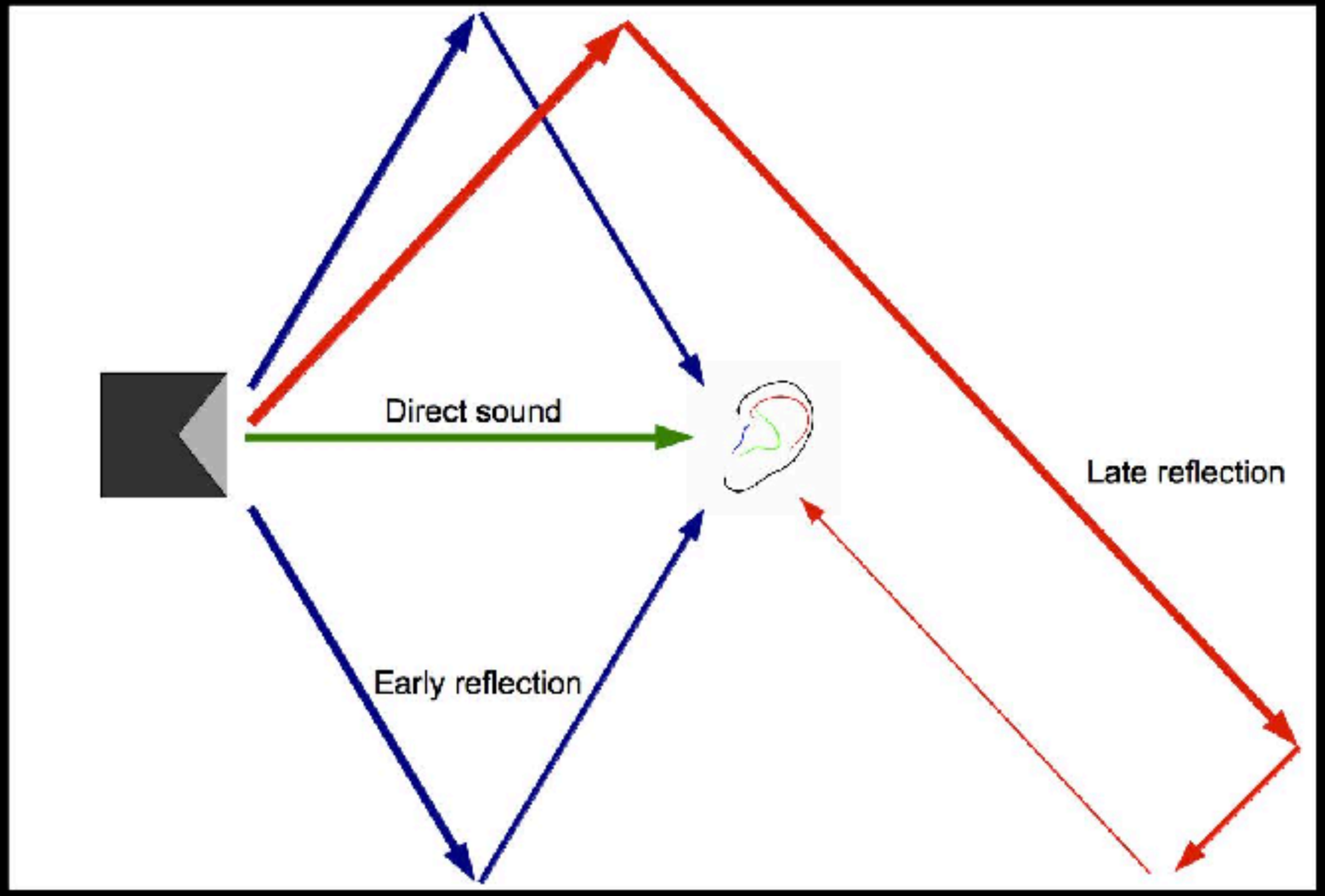
Absorption



Diffusion



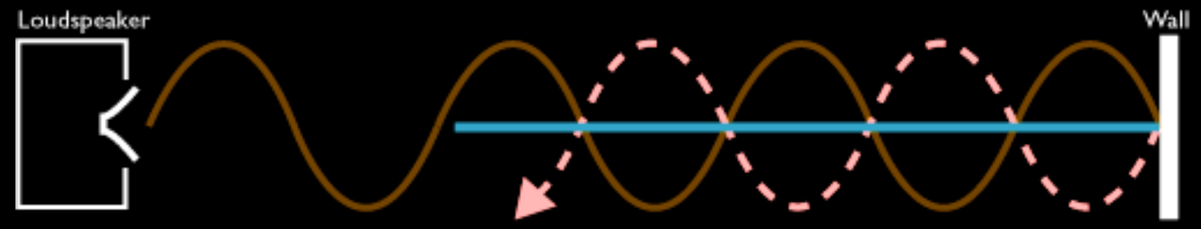
Reflections and Reverberation



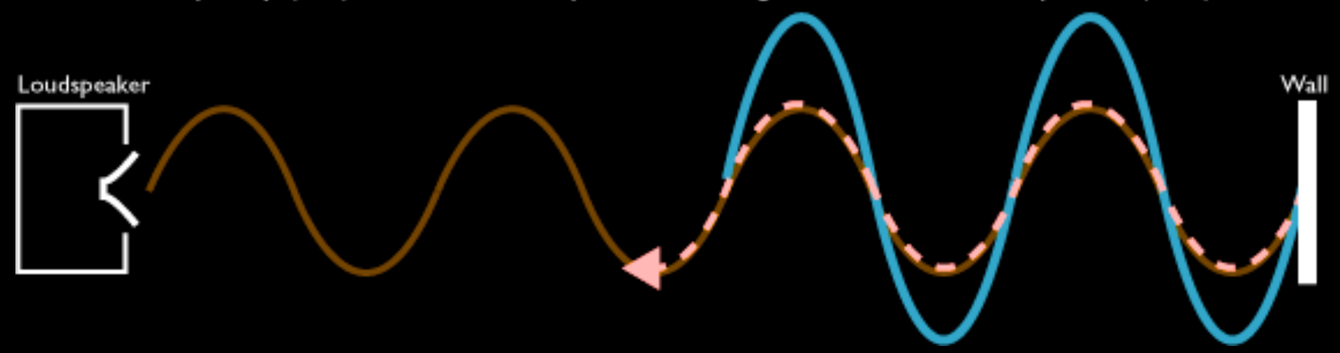
Room Resonance

Destructive vs Constructive Interference

Room modes. Standing waves out-of-phase cancellation.
Reflected frequency (red) refects back out-of phase, resulting in cancellation (blue).



Room modes. Standing waves combine in-phase.
Reflected frequency (red) reflects back in-phase, resulting in an increase in amplitude (blue).



I AM SITTING IN A ROOM (1970)

ALVIN LUCIER

I am sitting in a room different from the one you are in now. I am recording the sound of my speaking voice and I am going to play it back into the room again and again until the resonant frequencies of the room reinforce themselves so that any semblance of my speech, with perhaps the exception of rhythm, is destroyed. What you will hear, then, are the natural resonant frequencies of the room articulated by speech. I regard this activity not so much as a demonstration of a physical fact, but more as a way to smooth out any irregularities my speech might have.

Hanna Hartman

~$90

~$150

~$600

~$1300

~$9000

Describing Microphones

Polar Pattern:

Sensitivity to sound of a microphone relative to the angle from which sound arrives

Microphone Polar Patterns

Characteristic	Omni-Directional	Sub-Cardioid	Cardioid	Super-Cardioid	Hyper-Cardioid	Bidirectional
Polar Response Pattern						
Coverage Angle	360°	150°	131°	115°	105°	90°
Angle of Maximum Rejection (null angle)	—	180°	180°	126°	110°	90°

MORE REJECTION

Describing Microphones

Polar Pattern:

Sensitivity to sound of a microphone **relative to the angle** from which sound arrives

Transduction Principle:

How the microphone transduces (translates) an **acoustic signal** to an **electrical signal** (electromagnetic transduction)

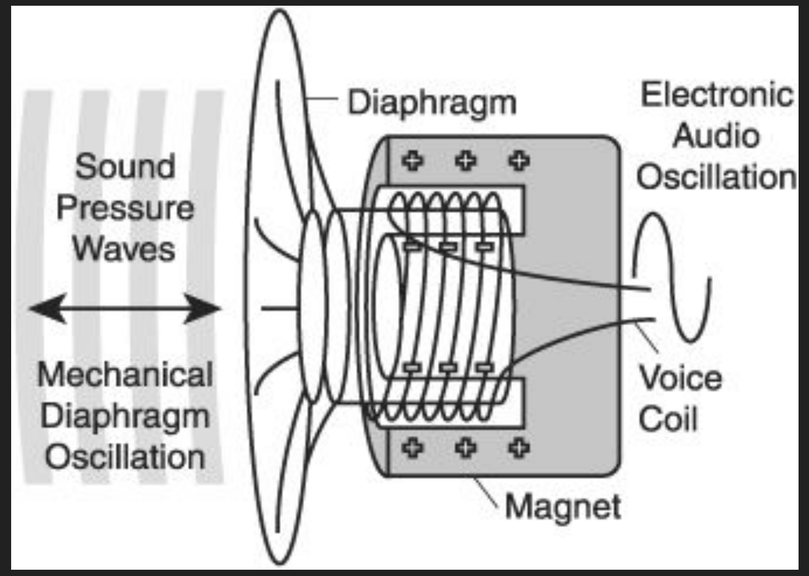
Microphone Transduction Principles

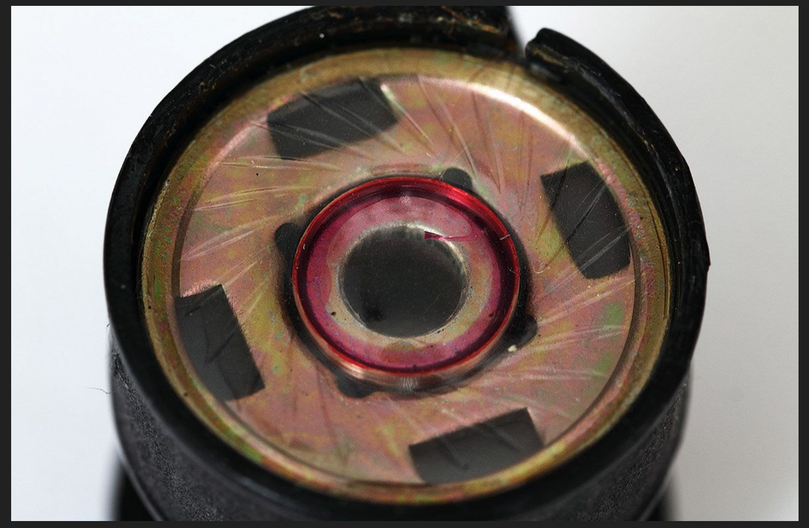
dynamic mics

magnetic transducer - essentially the design of a speaker, in reverse

generally heaviest & most robust, making them ideal live mics

polar pattern is frequently cardioid





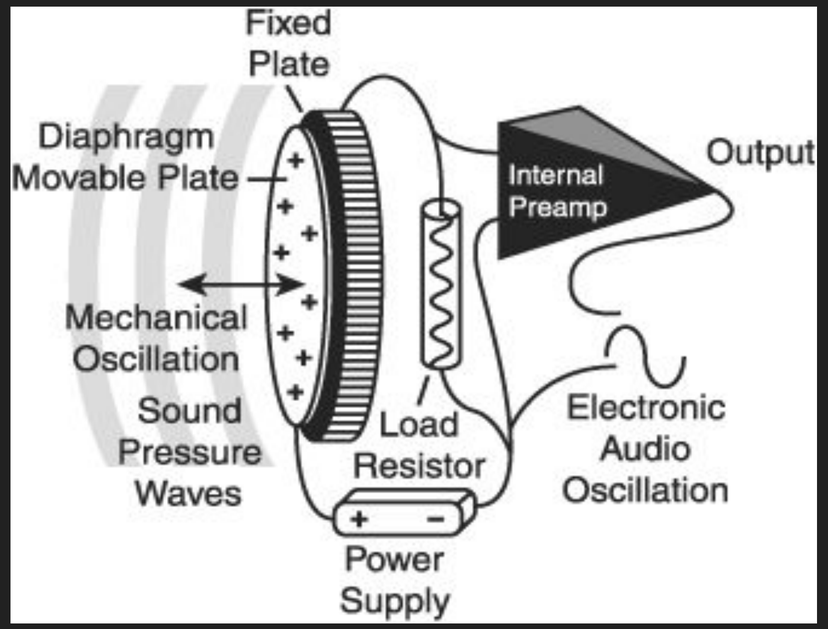
condenser mics

electric transducer - thin membrane over a solid metal backplate (capacitor)

requires external power

typically the most sensitive, best frequency response, less noisy

frequently come with switchable polar patterns



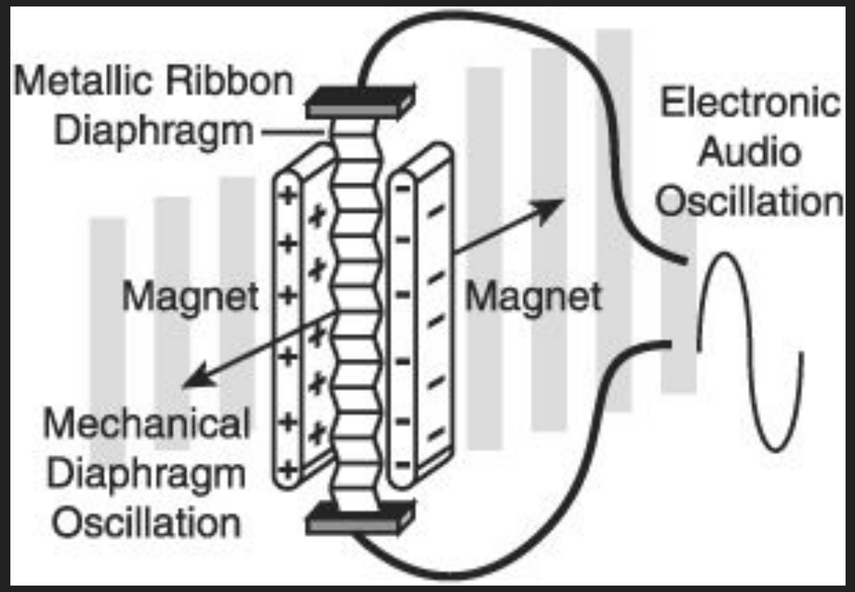
ribbon mics

electromagnetic transducer (a very thin, corrugated strip of metal)

polar pattern is always bidirectional

universally lower output compared to other mics

high velocity sound pressure waves can cause the ribbon to stretch, break, or snap



Considerations for Microphone Placement

inverse-square law: distance vs. intensity

High frequencies are more **directional** than low frequencies.

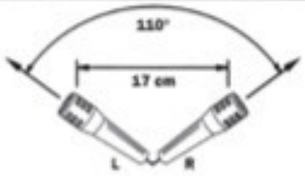
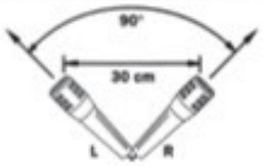
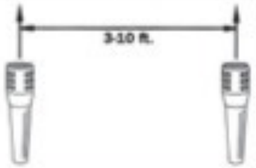
Room sound: close mic for less hall sound (reverberation)

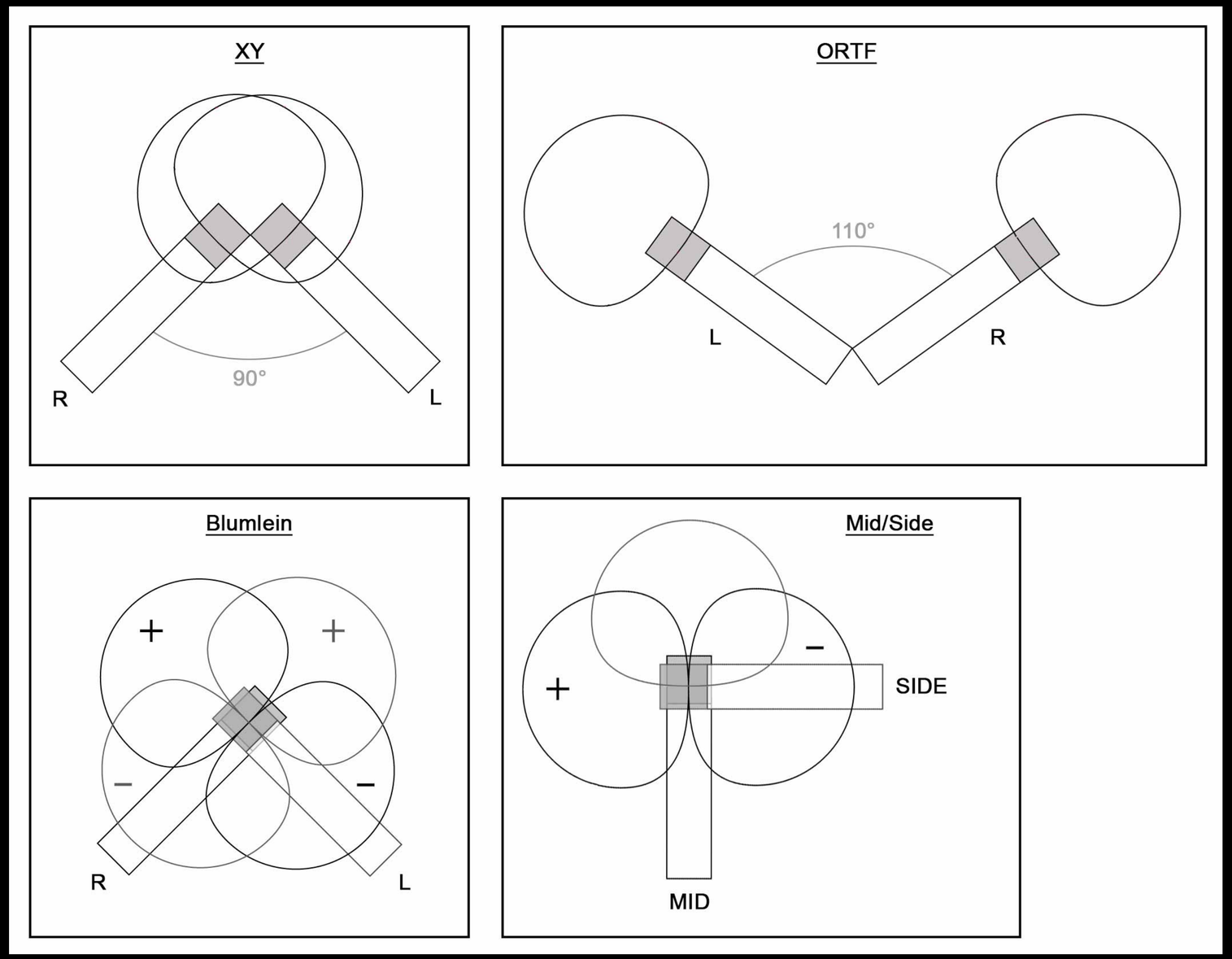
Proximity Effect: (Bass boost) on directional mics.

Bass Rolloff: reduces low frequency sensitivity

Phase Cancellation: frequencies 180 degrees out of phase will cancel - **Constructive-Destructive Interference**

Stereo Microphone Techniques

STEREO PICKUP SYSTEMS	MICROPHONE TYPES	MICROPHONE POSITIONS	
X-Y	2 - CARDIOID	AXES OF MAXIMUM RESPONSE AT 135° SPACING: COINCIDENT	
ORTF (FRENCH BROADCASTING ORGANIZATION)	2 - CARDIOID	AXES OF MAXIMUM RESPONSE AT 110° SPACING: NEAR-COINCIDENT (7 IN.)	
NOS (DUTCH BROADCASTING FOUNDATION)	2 - CARDIOID	AXES OF MAXIMUM RESPONSE AT 90° SPACING: NEAR-COINCIDENT (12 IN.)	
MS (MID-SIDE)	1 - CARDIOID 1 - BIDIRECTIONAL	CARDIOID FORWARD-POINTED; BIDIRECTIONAL SIDE-POINTED; SPACING: COINCIDENT	
SPACED	2 - CARDIOID OR 2 - OMNIDIRECTIONAL	ANGLE AS DESIRED SPACING: 3-10 FT.	



Jecklin disc

Blumlein pair

Binaural

Multi-channel

Hydrophone (underwater microphone)

Contact microphone


L
R
TASCAM
PEAK
REC
DR-05X
HOME
RECORD
LINEAR PCM RECORDER


OMNI MIC L
TASCAM
OMNI MIC R
DR-100MKII LINEAR PCM RECORDER
HOME
MENU
PB CONTROL
INPUT
I/O LOOP
QUICK
ENTER/
MARK
STOP
PLAY/PAUSE
RECORD — AUTO

9/12

Microphones, Recording

Lab: Demo'ing recording using a portable recorder and saving sound to a computer

HW: Right after class, check out a portable recorder (TIMARA Depot hours on Thursdays: 2:30PM - 5:30PM).

Using that recorder, in groups of 2 to 3, please record the following sounds over the weekend.

RECORDER SCAVENGER HUNT SOUND LIST

2 periodic sounds (pitched sounds)

2 aperiodic sounds (noisy sounds)

2 close sounds (near to the mics)

2 faraway sounds (far from the mics)*

2 moving sounds (source/mics changing location during recording)

2 'what the…' AKA 'guess the source' sounds

*although what you're recording is faraway (and perhaps quiet), it should not be overpowered by close sounds

Transfer the recorded files (should be 12 (at least)) to one or more group member's computer!

Read "Some Sound Observations" by Pauline Oliveros, from *Audio Culture: Readings in Modern Music*