Sound technology

TNGD10 - Moving media

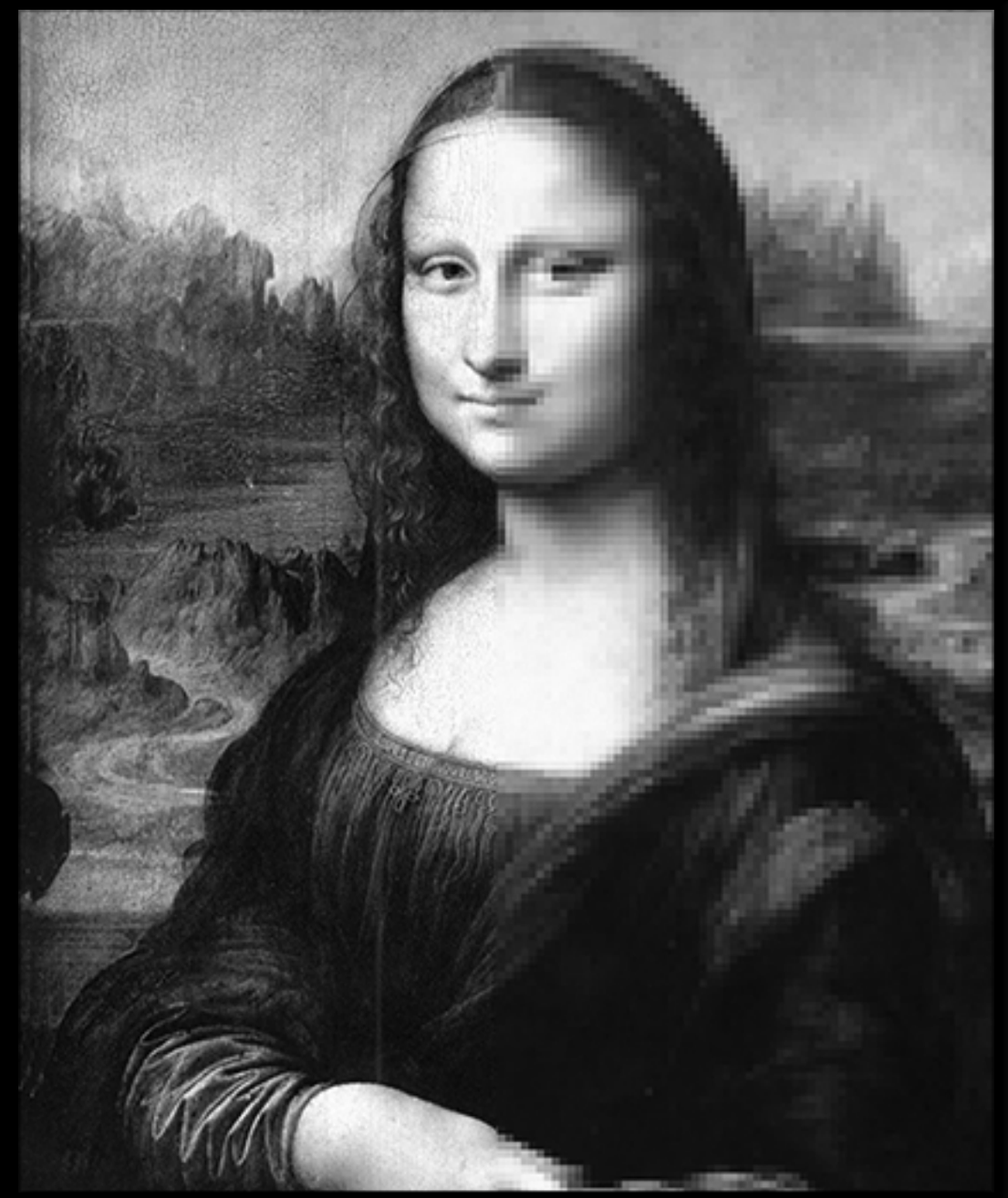
The hearing ability…

- 20-20000 Hz
  - 3000 & 4000 Hz
  - octave = doubling of the frequency
  - the frequency range of a CD?

- 0-120+ dB
  - the decibel scale is logarithmic
  - the dynamic range of a CD?

Digital sound

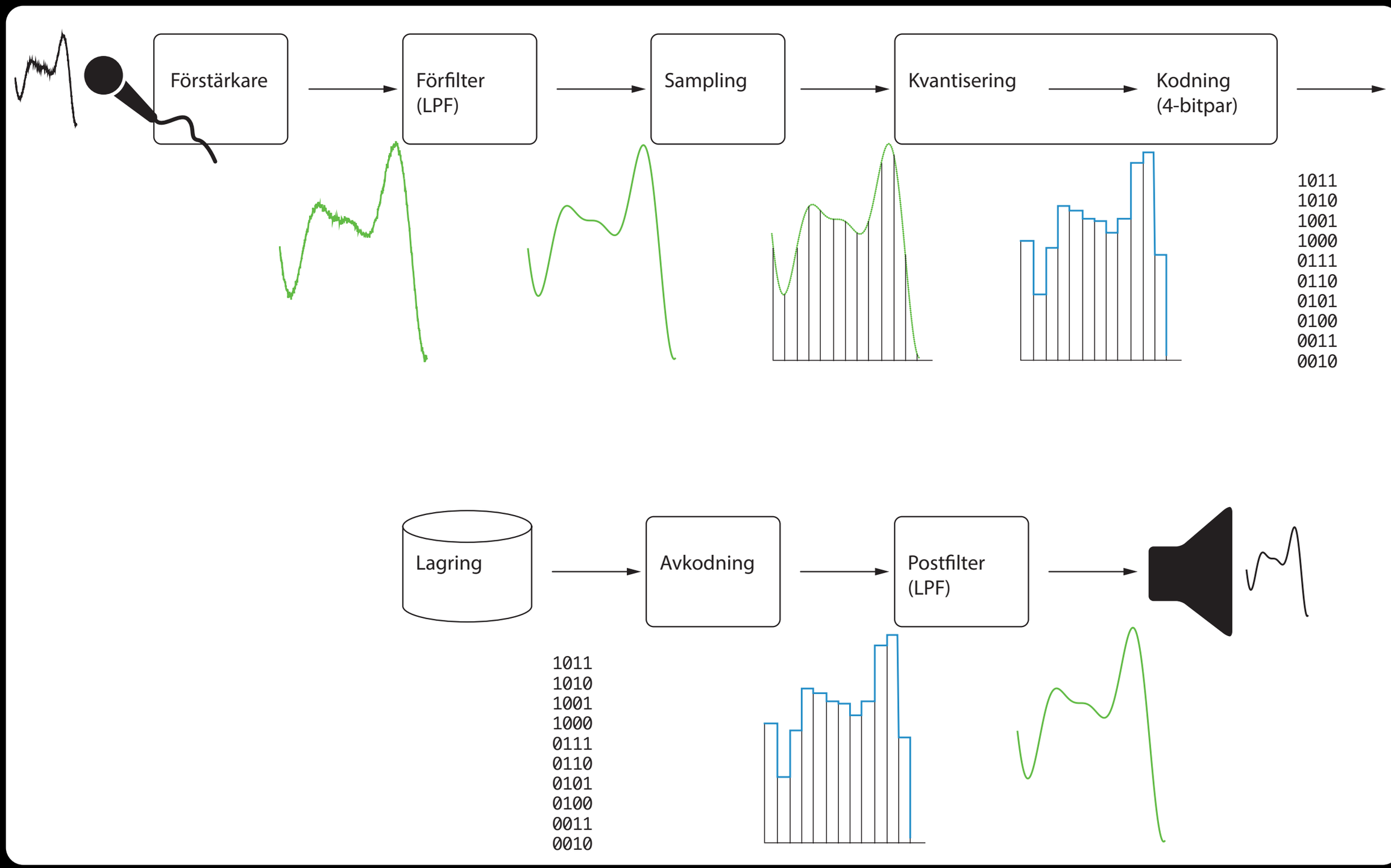
- Sound is pressure changes in the air.
- These are continuously changed over time.
- Thereby, sound is analogue.
- Analog <-> digital.



AD/DA-converter

- A band limited signal might be sampled and reconstructed without any loss.
- The numeric values associated with the sampled value can be stored digitally.
- The sample will be held at the same level during a clock cycle during reconstruction.
- A low pass filter interpolates to recreate the original sound wave.

AD/DA-converter



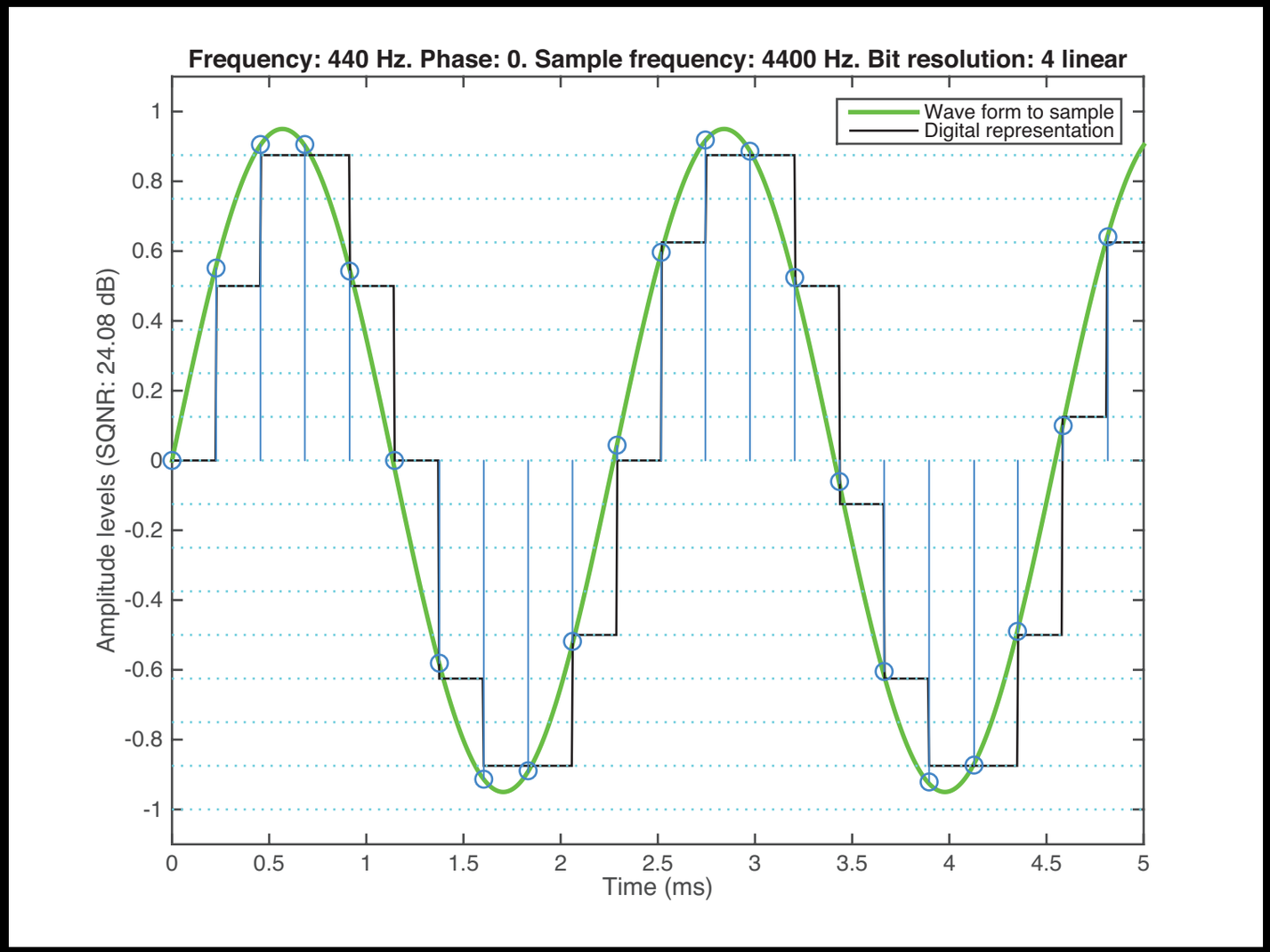
Sampling

- The Nyquist theorem
    - A sound (band limit time continous signal), with bandwidth of f_0 Hz, that are sampled with the sample frequency of f_s can be reproduced from the sampled signal if $f_s > 2f_0$.

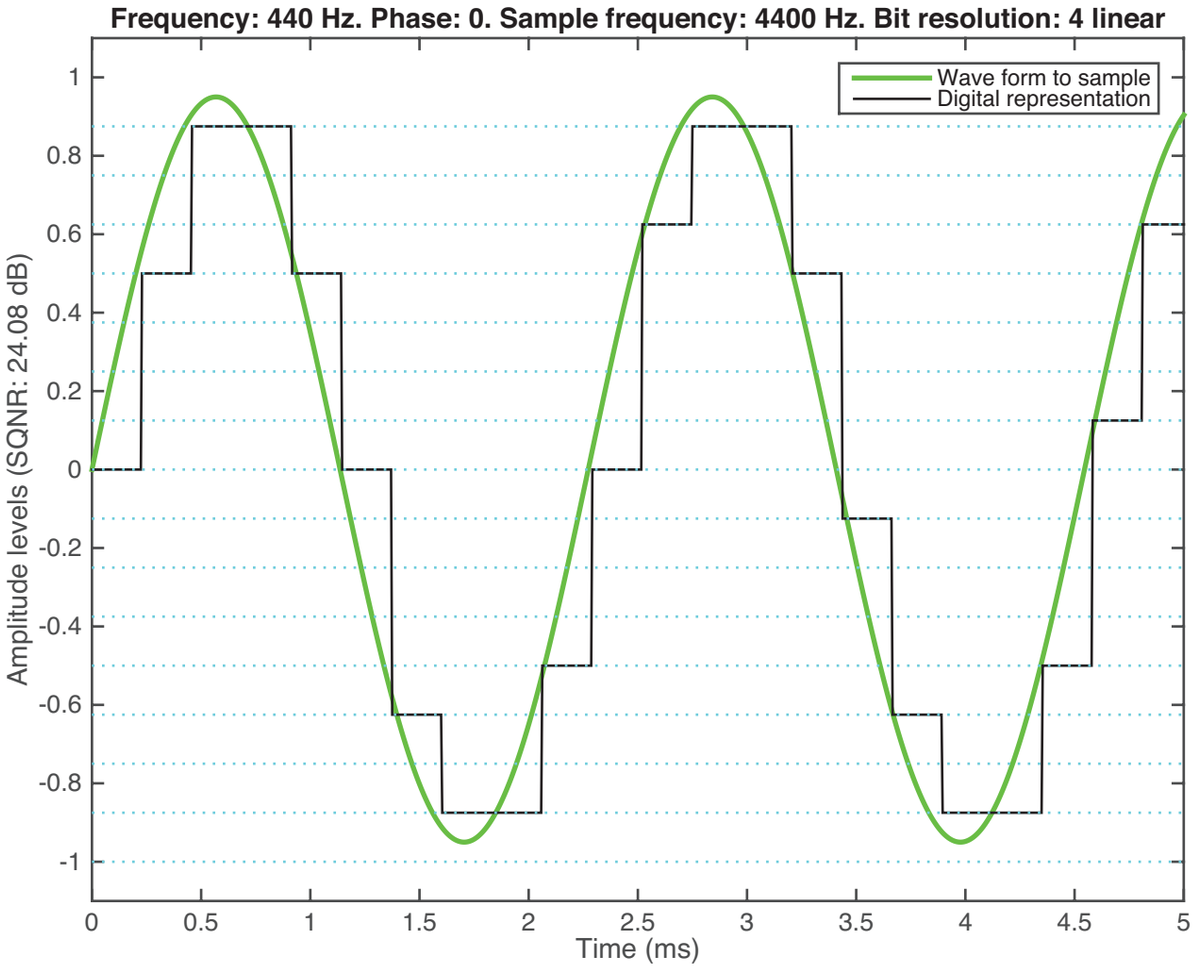
CD = 44.1kHz
DAT/DV = 48kHz
DVDA & SACD

96kHz
192kHz

Sample frequency



Sample frequency



Quantising

- The sampled analogue value is converted in an AD converter to a digital value.
- The value is represented digitally with a restricted number of levels, these levels are restricted due to the number of bits used.

- The number of intervals is 2^n, where n is the number of bits.

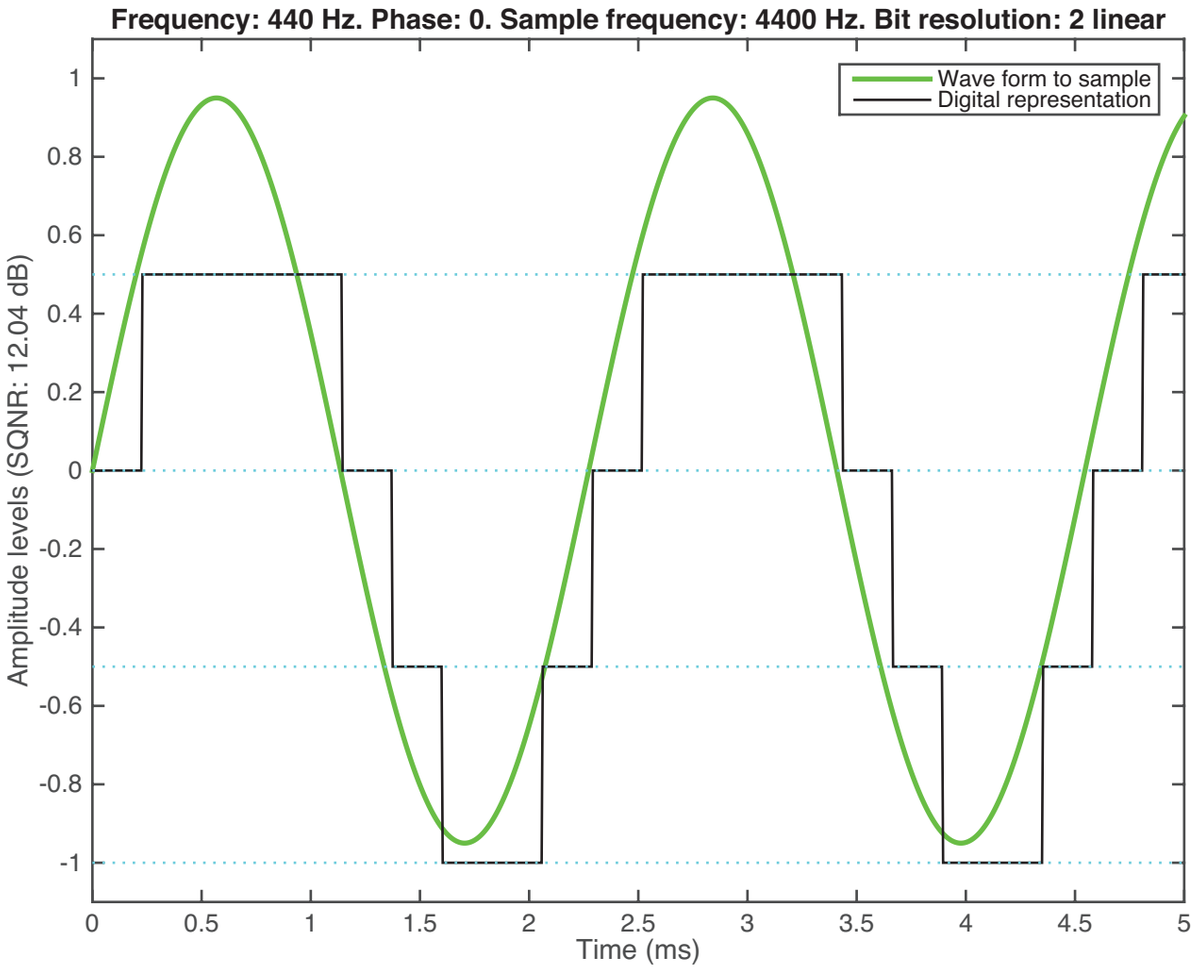
$2^4 = 16$

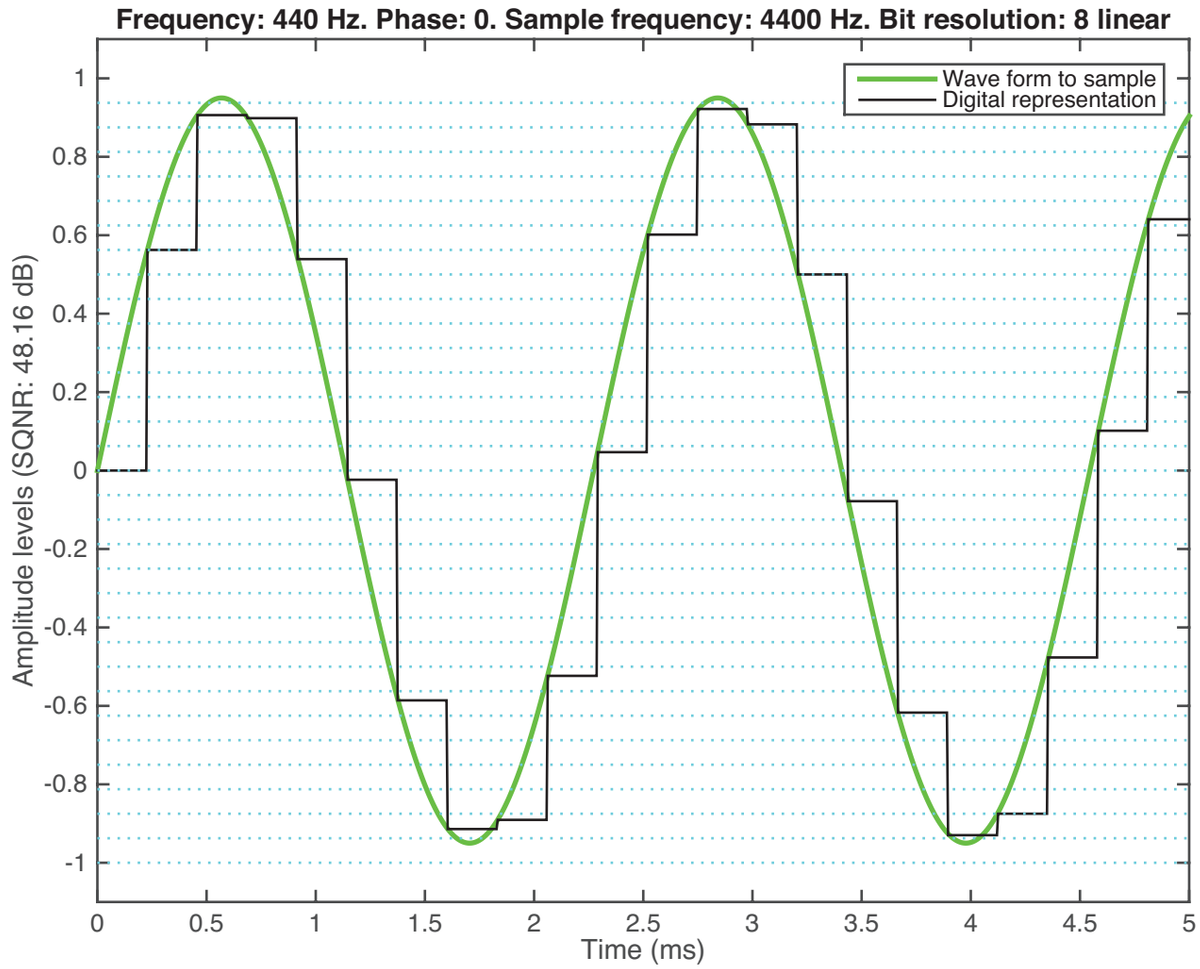
$2^{12} = 4096$

$2^{16} = 65536$

$2^{24} = 16777216$

Quantising (cont.)

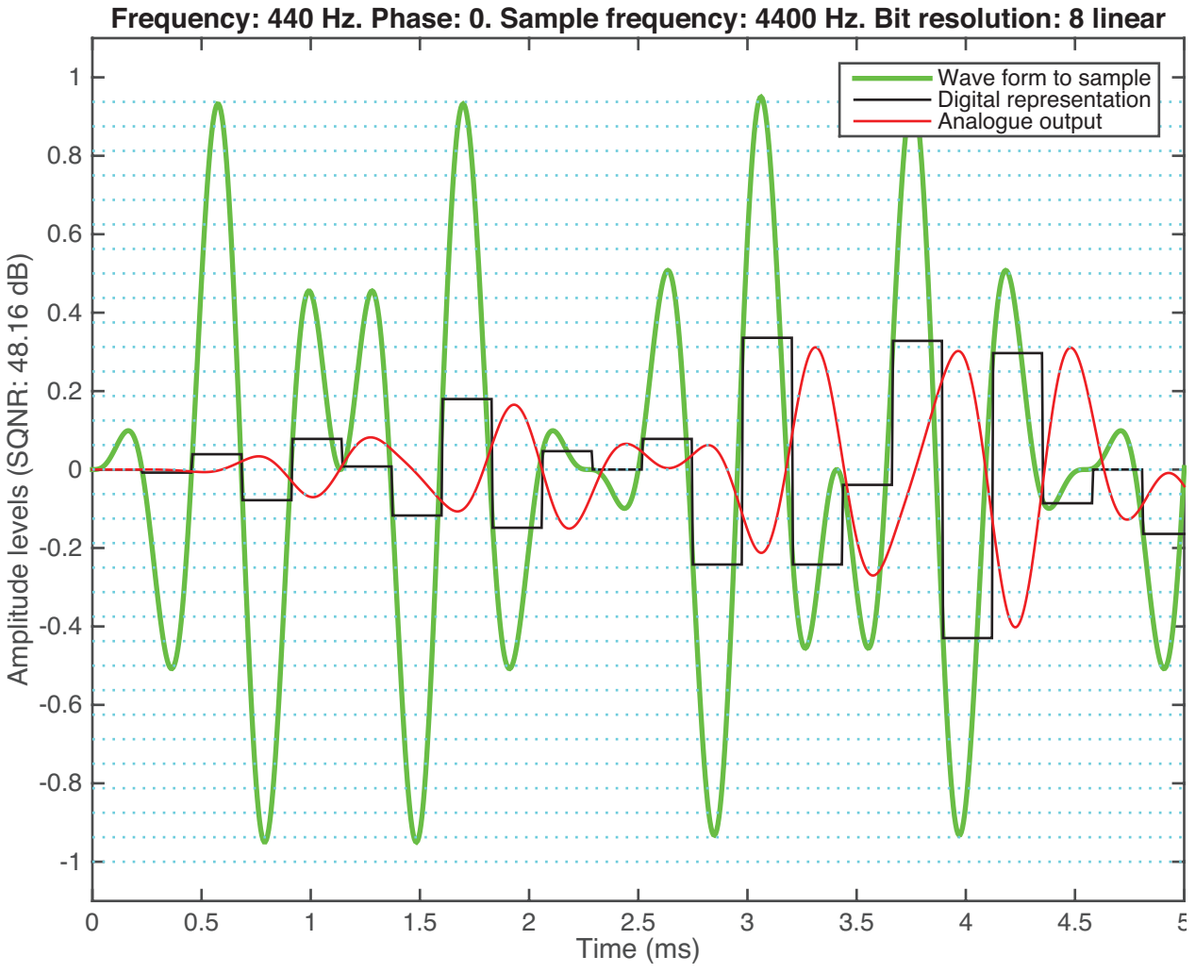


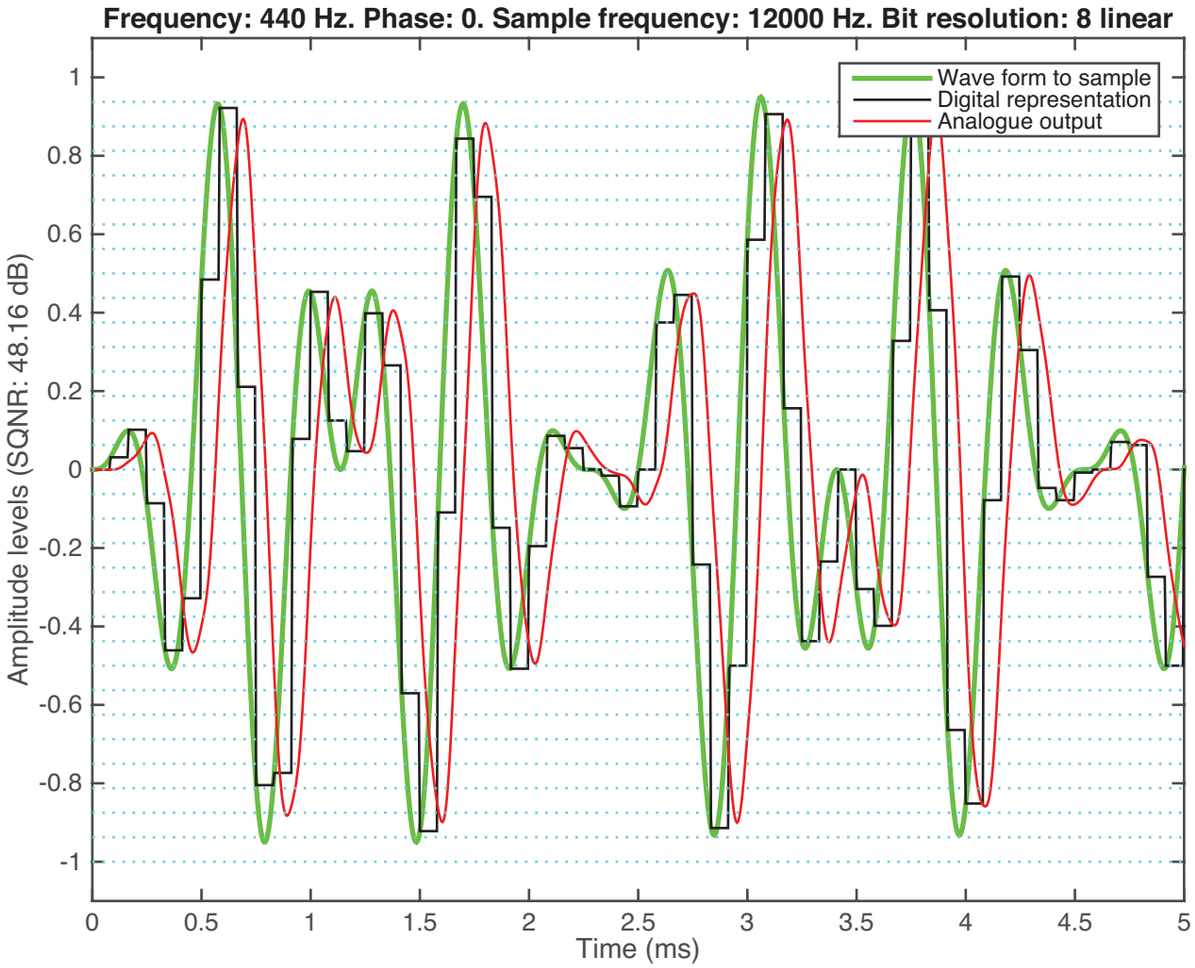


Dynamic range

- When recording a higher number of bits is best with regards to dynamic range and head-room.
- Dynamic range is the difference in amplitude between the loudest sample and quiet, or
- Signal-to-error ratio
- 8-bit = 49.8dB
- 16-bit = 97.8dB
- 24-bit = 145.8dB

Digital sound representation





The microphone

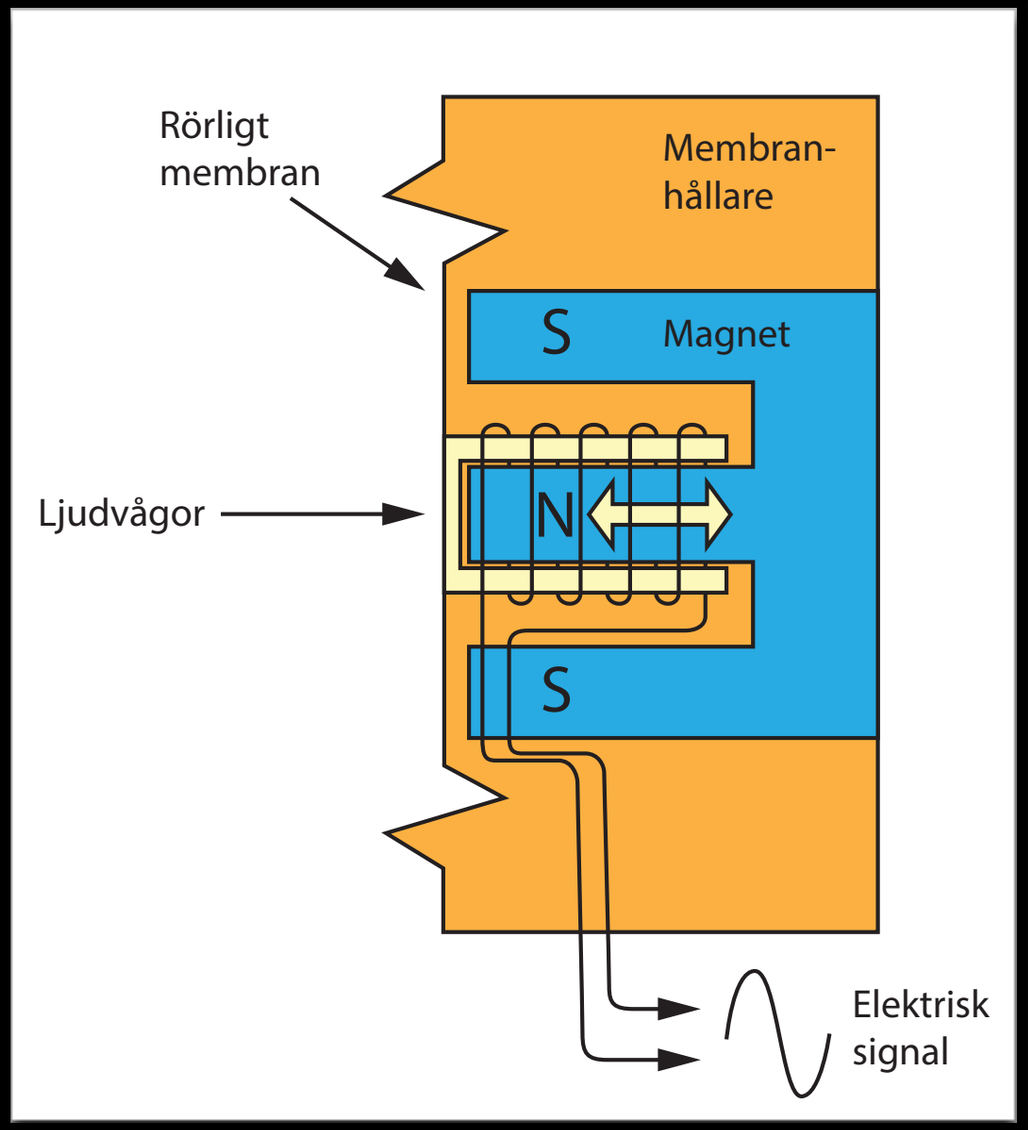
TNGD10 - Moving media

The microphone

- The funnel…
- The microphone was invented 1925
- Chrystal microphone
- Band microphone
- Dynamic microphone
- Condenser microphone (electret microphone)

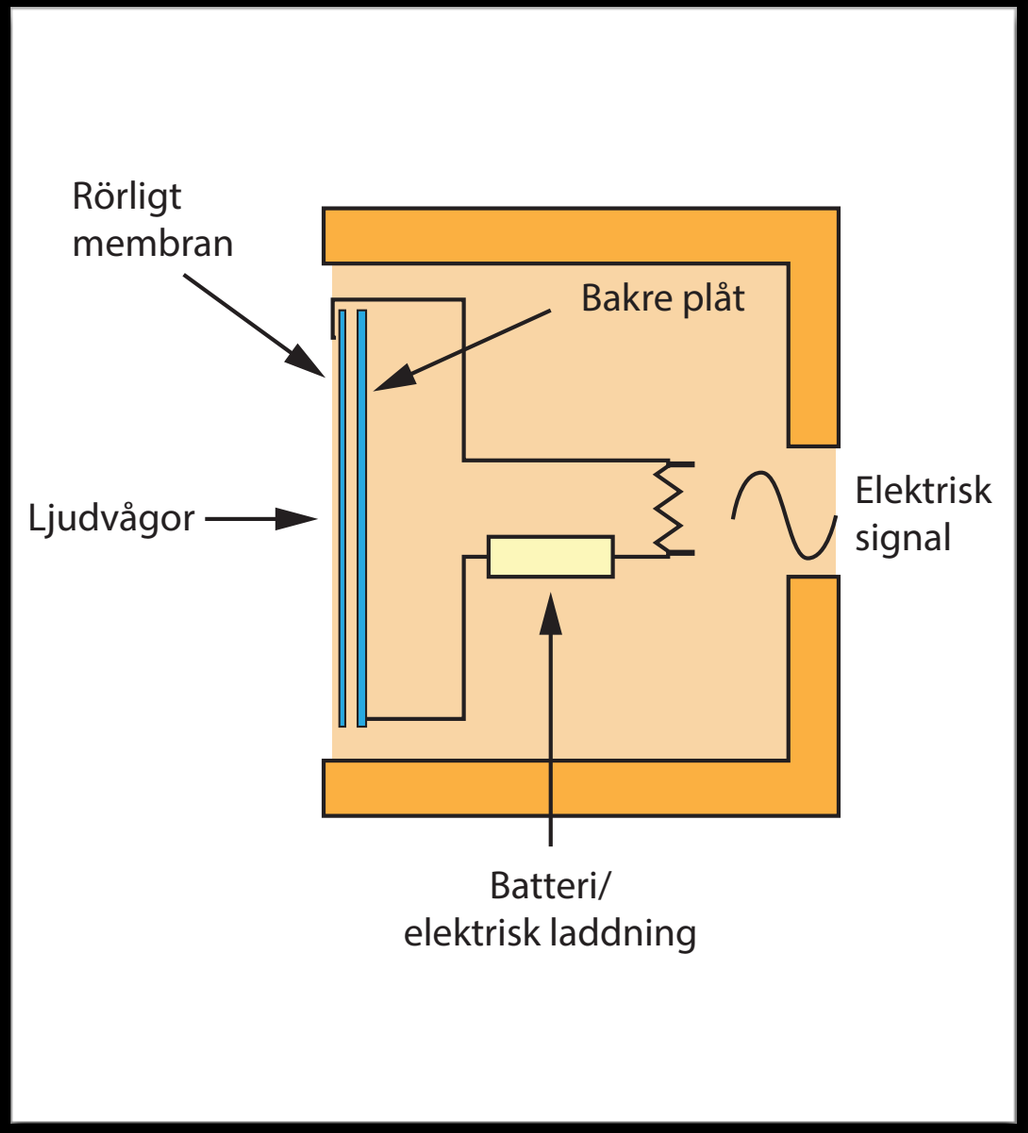
Dynamic microphone

- Withstand high sound pressures
- “Inherit” slowness
- Drums, amplifier, vocals
- Membrane
- Coil
- Magnet



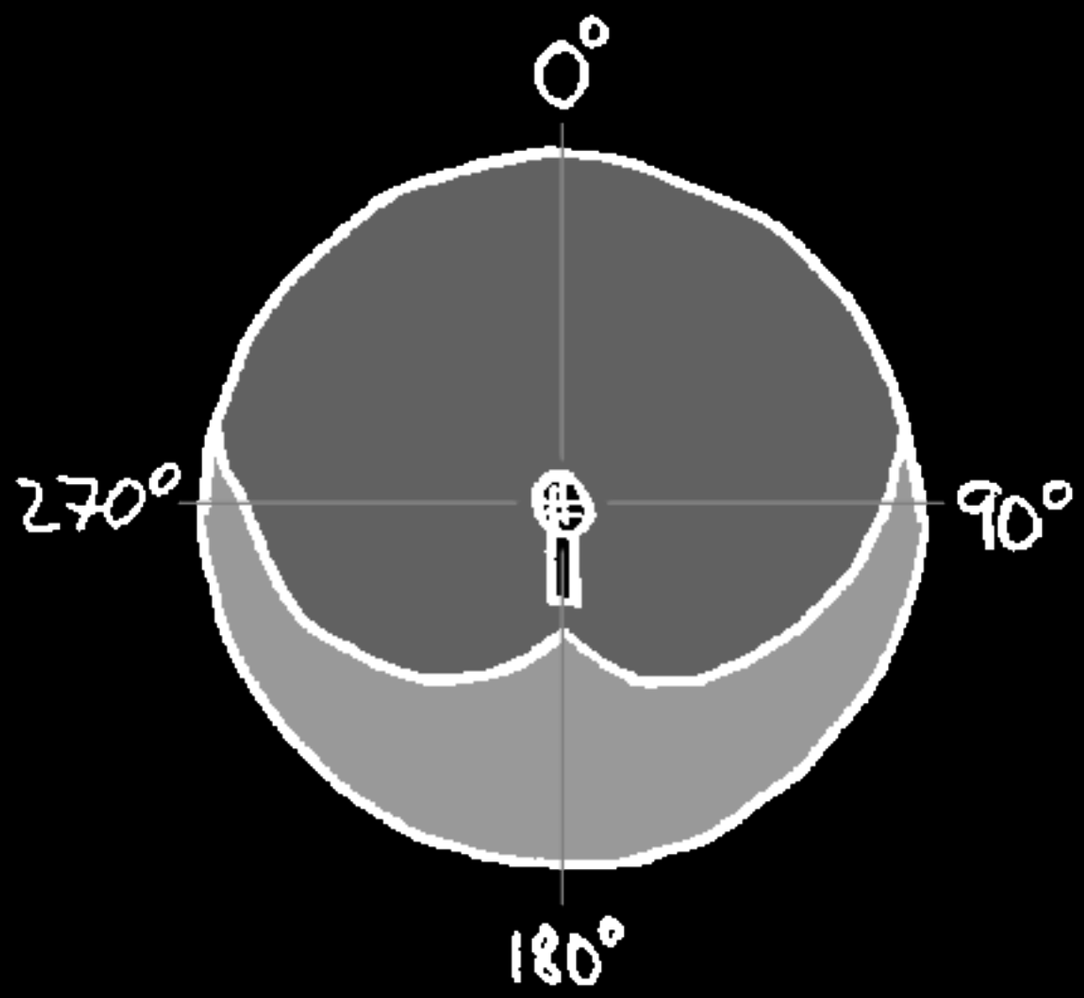
Condenser microphone

- Higher sensitivity
- Requires phantom power
- Vocals, acoustical instruments
- Membrane
- Fixed electrode



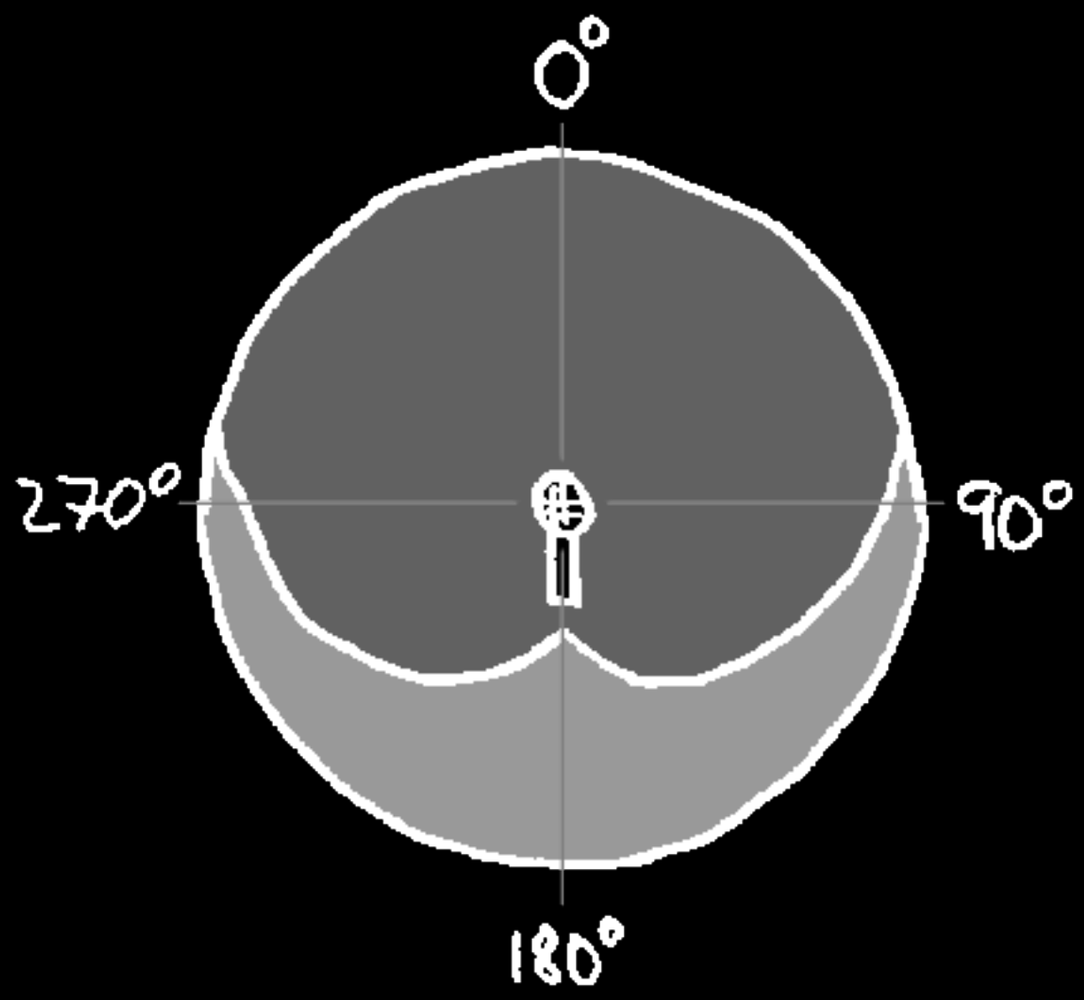
Directional microphone

- Velocity microphone/ pressure gradient microphone
- Proximity effect
- Cardioid
- Super cardioid
- Hyper cardioid



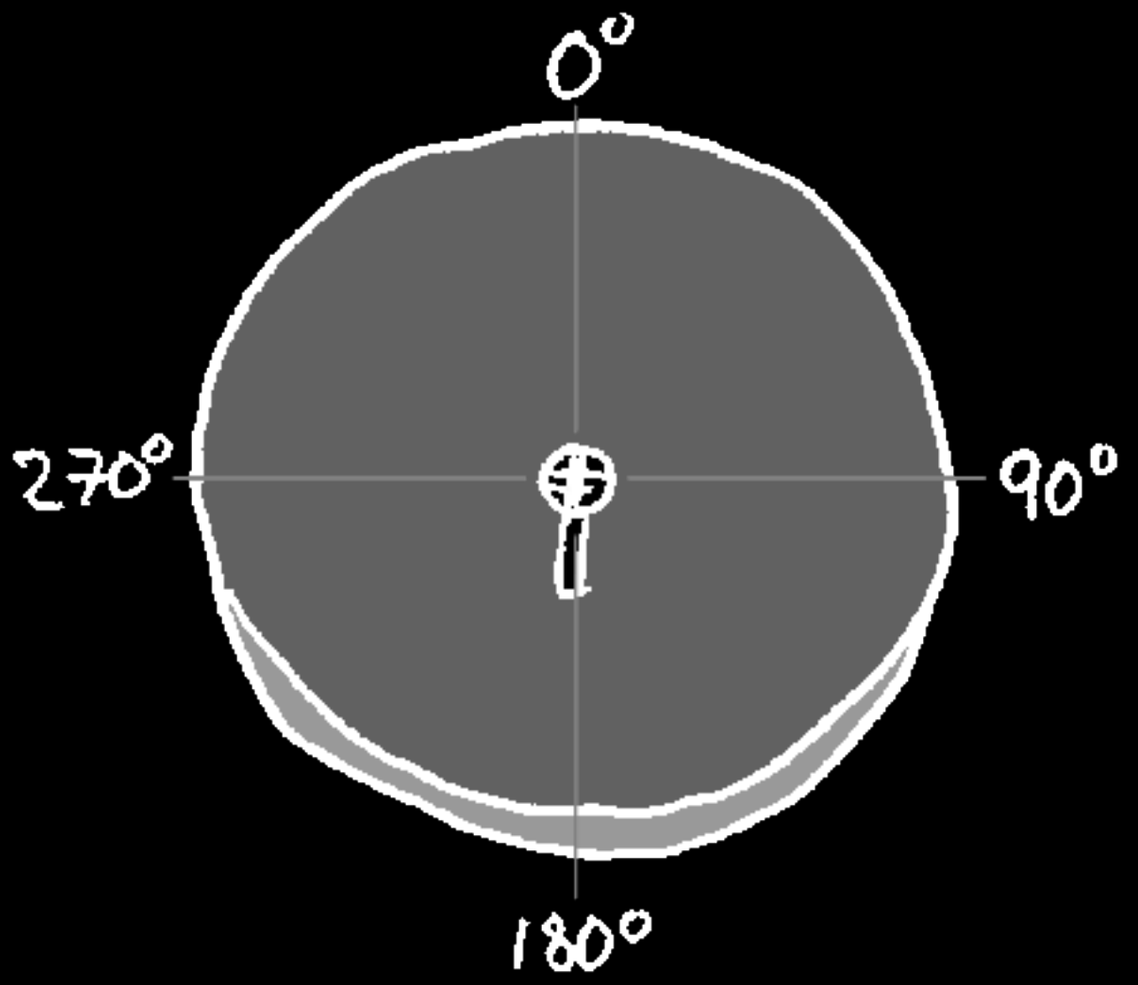
Directional microphone (cont.)

- Vocal and instrument microphone
- AB-stereo, ORTF
- XY-stereo
- (MS-stereo)



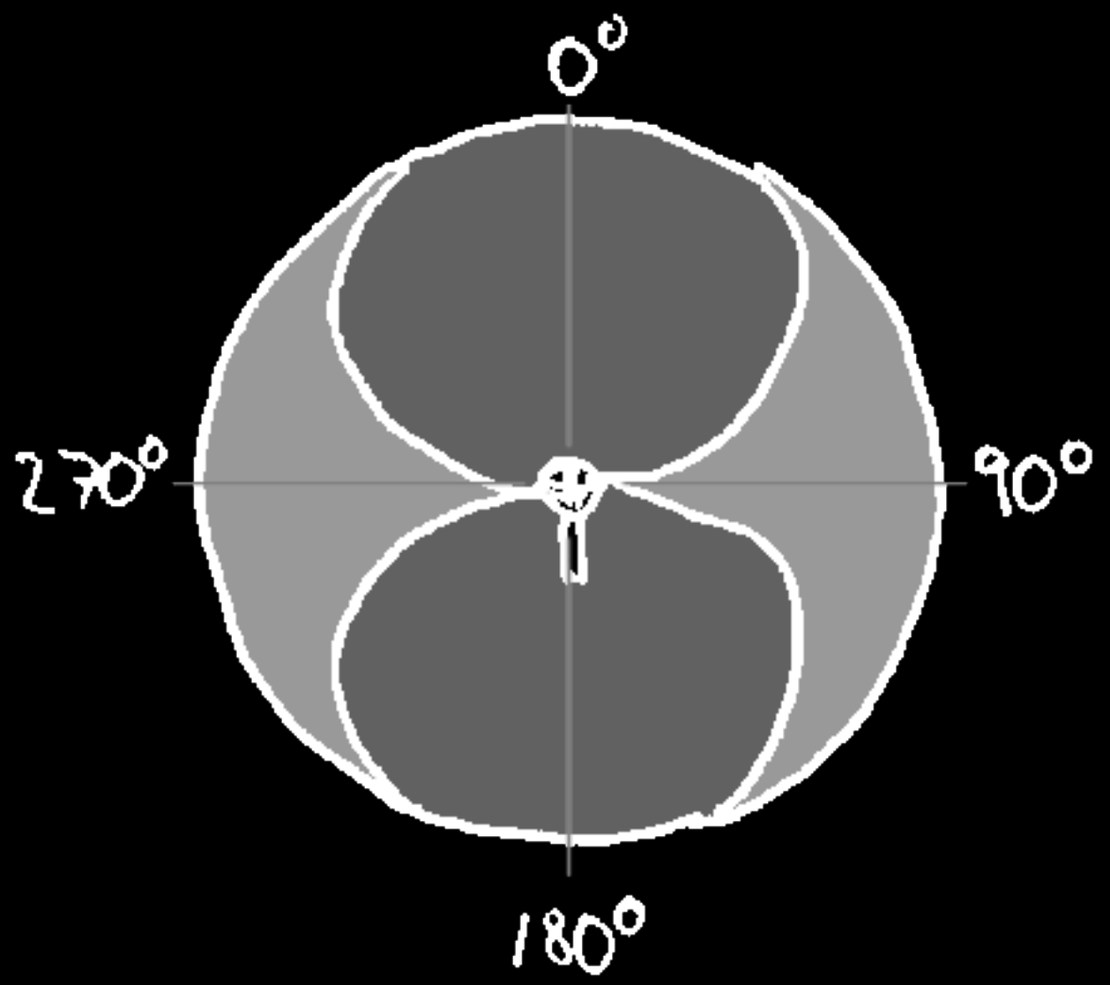
Omnidirectional microphone

- Pressure microphone
- No proximity effect
- Linear low frequency
- Ambience microphone
- MS-stereo



Bidirectional microphone

- Velocity microphone
- Proximity effect
- Reversed polarity
- Blumleinstereo
- MS-stereo



Microphones (cont.)

- - High pass filter
  - Attenuation, pad
  - Selectable patterns
- Balanced XLR
- Puff protection
  - Socks…
  - Windshield
  - Pens
- Phantom power, +48V

Sensitive signal

- Use balanced XLR.
- Be aware of parallel 230V cables.
- Avoid old computer & TV screens, fluorescent lamps, mobile phones…
- Ground hum (50Hz), use different outlets.

The preamplifier

- Amplifies the signal to line level.
- High pass filter
- Phantom power
- Change polarity

Microphone placement

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Stereo

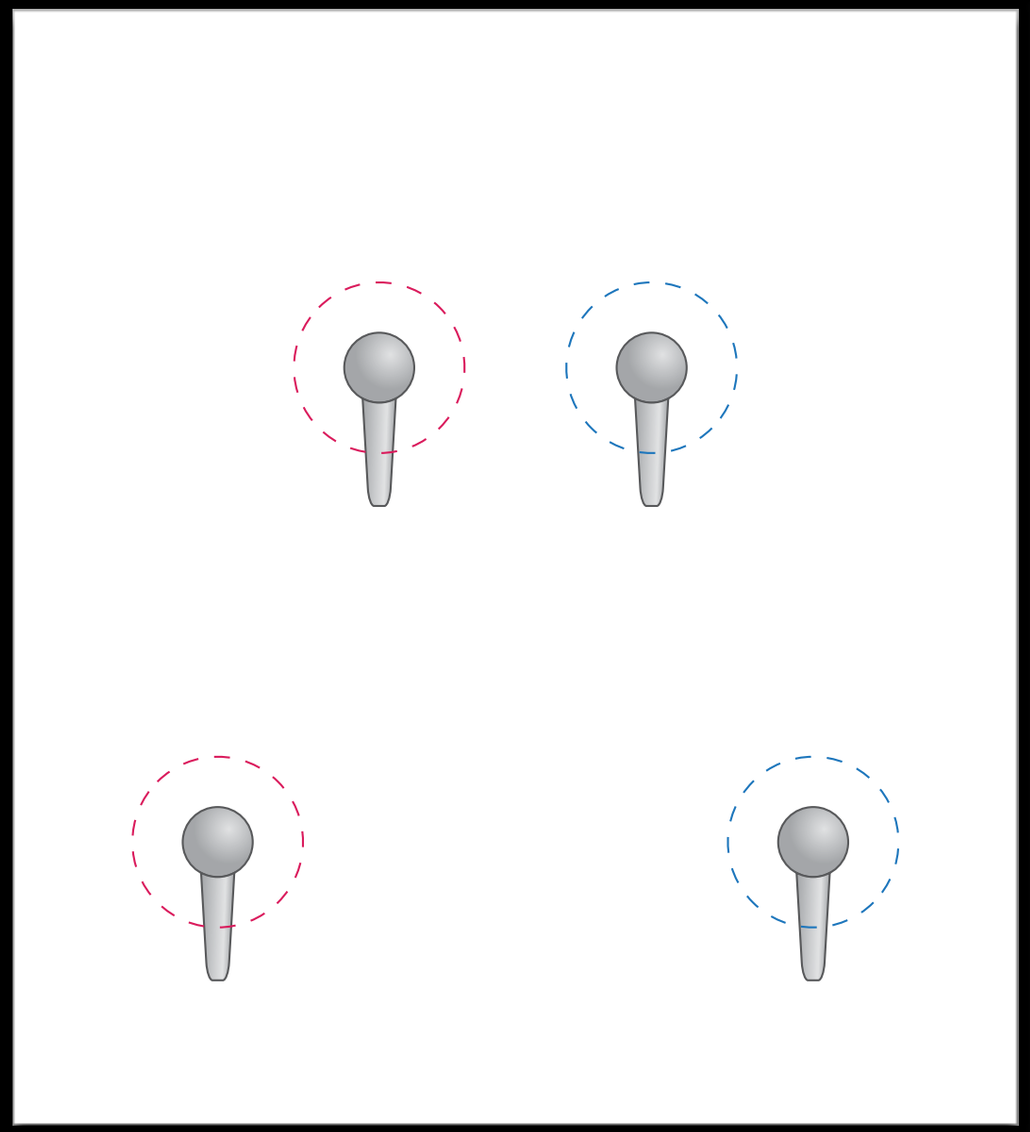
- Intensity stereo/coincident stereo
- The intensity/sound level varies with the direction of the sound.
- The sound is in phase, no cam filter effect when summed to mono.
- X/Y, Blumlein, MS

Stereo (cont.)

- Near coincident stereo/ spaced pair/ear spaced stereo
- Phase difference
- A slightly more spacey stereo
- Not as mono compatible
- ORTF, AB

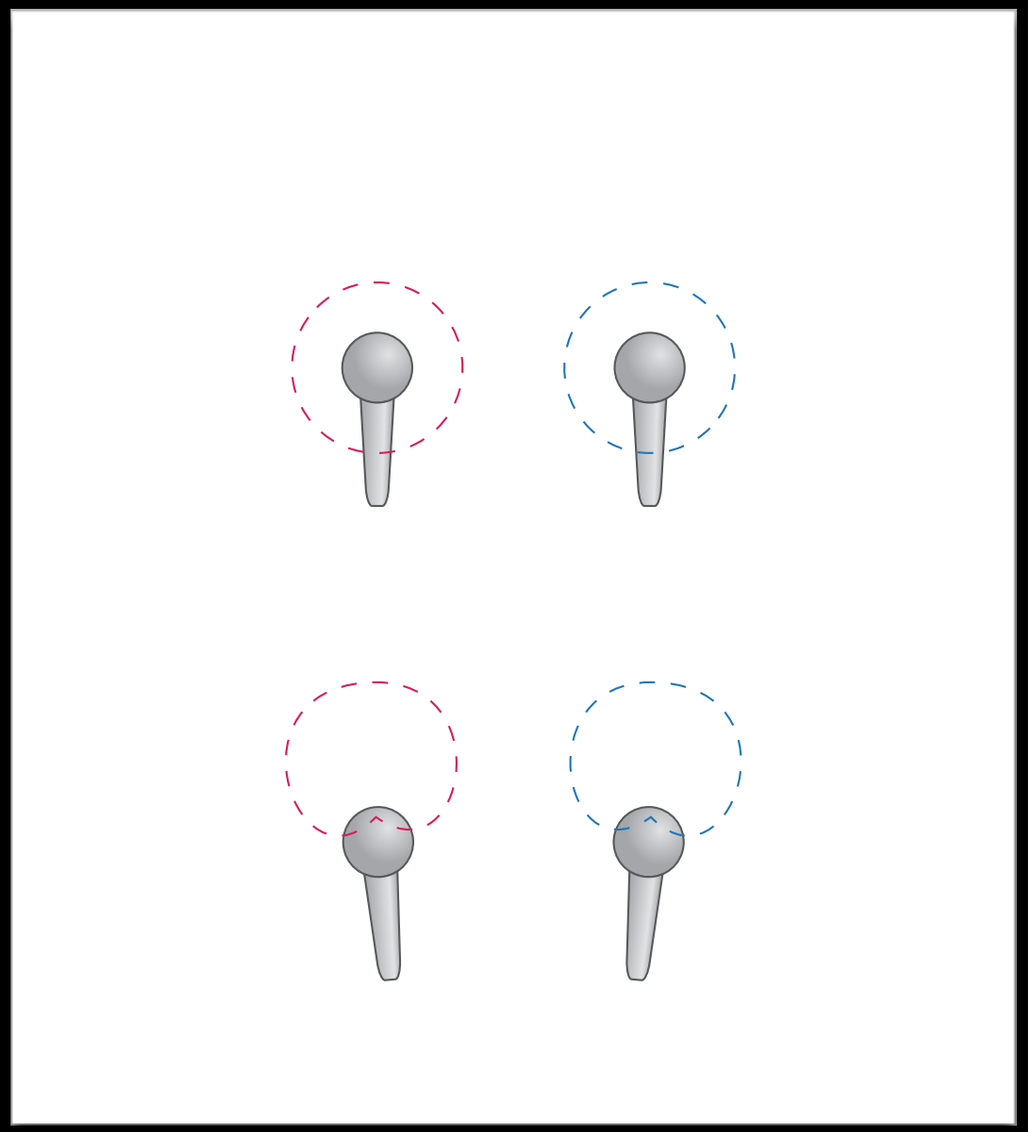
Stereo (cont.)

- The quality on the stereo recording is due to three factors:
- The distance



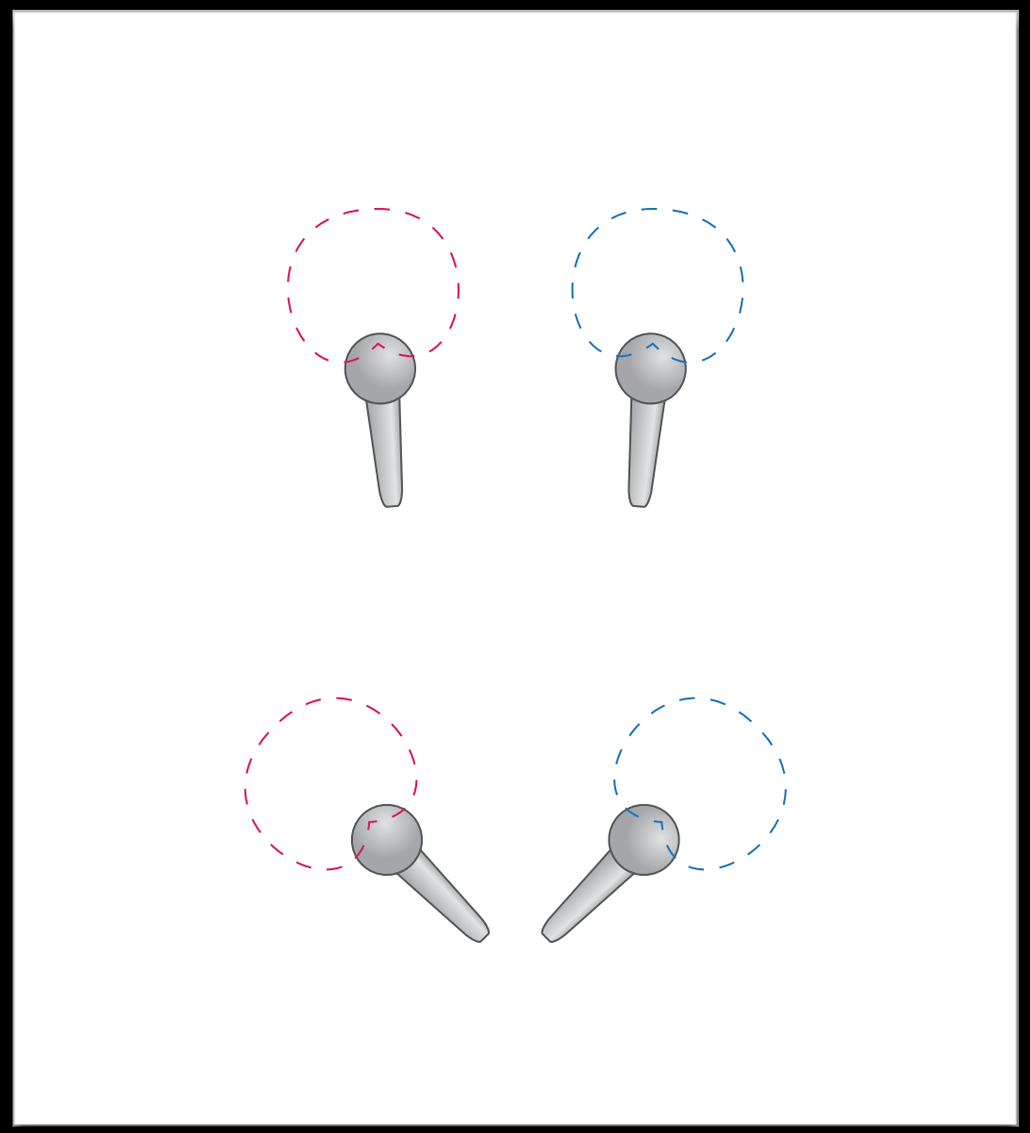
Stereo (cont.)

- The quality on the stereo recording is due to three factors:
  - The distance
  - The pattern



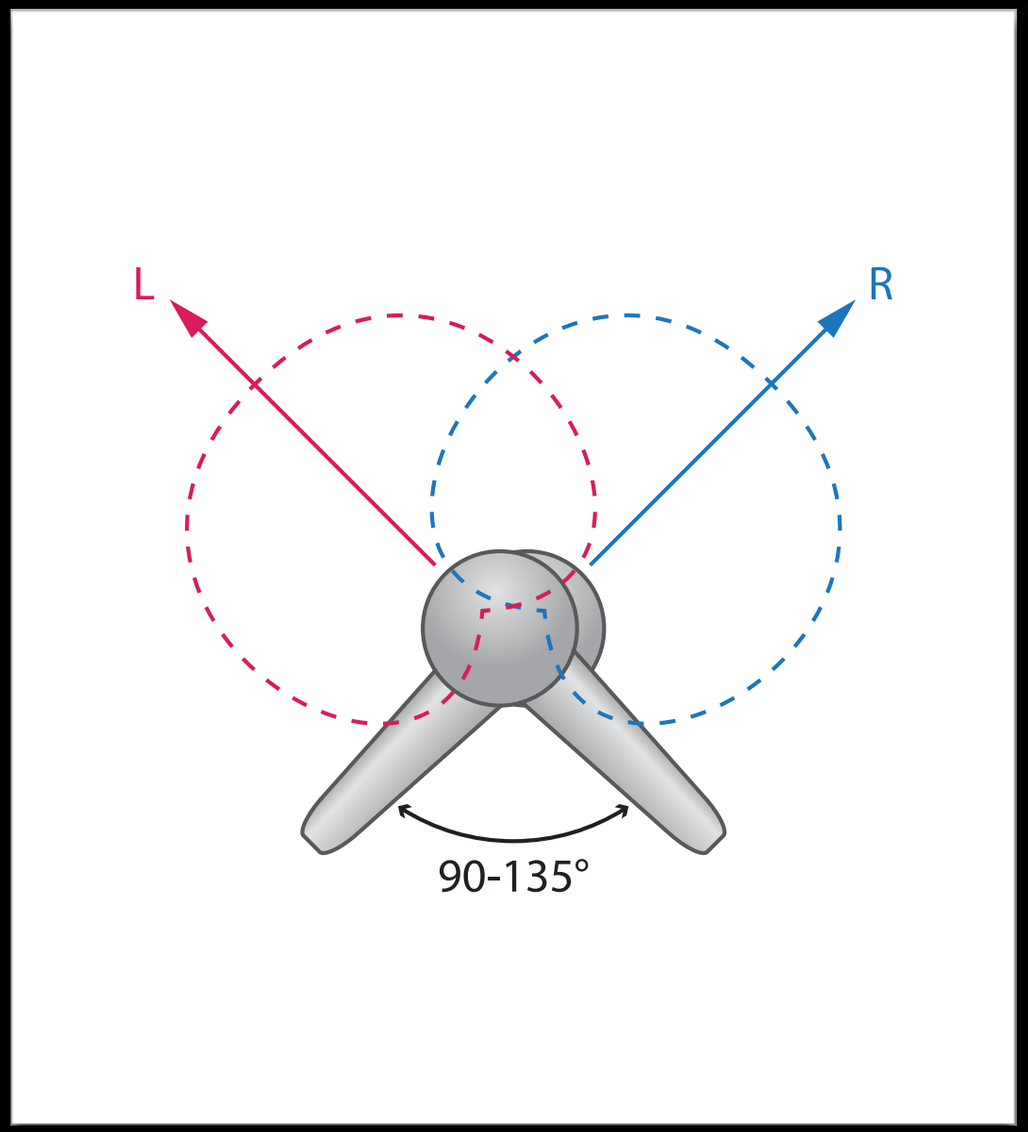
Stereo (cont.)

- The quality on the stereo recording is due to three factors:
  - The distance
  - The pattern
  - The spacing angle



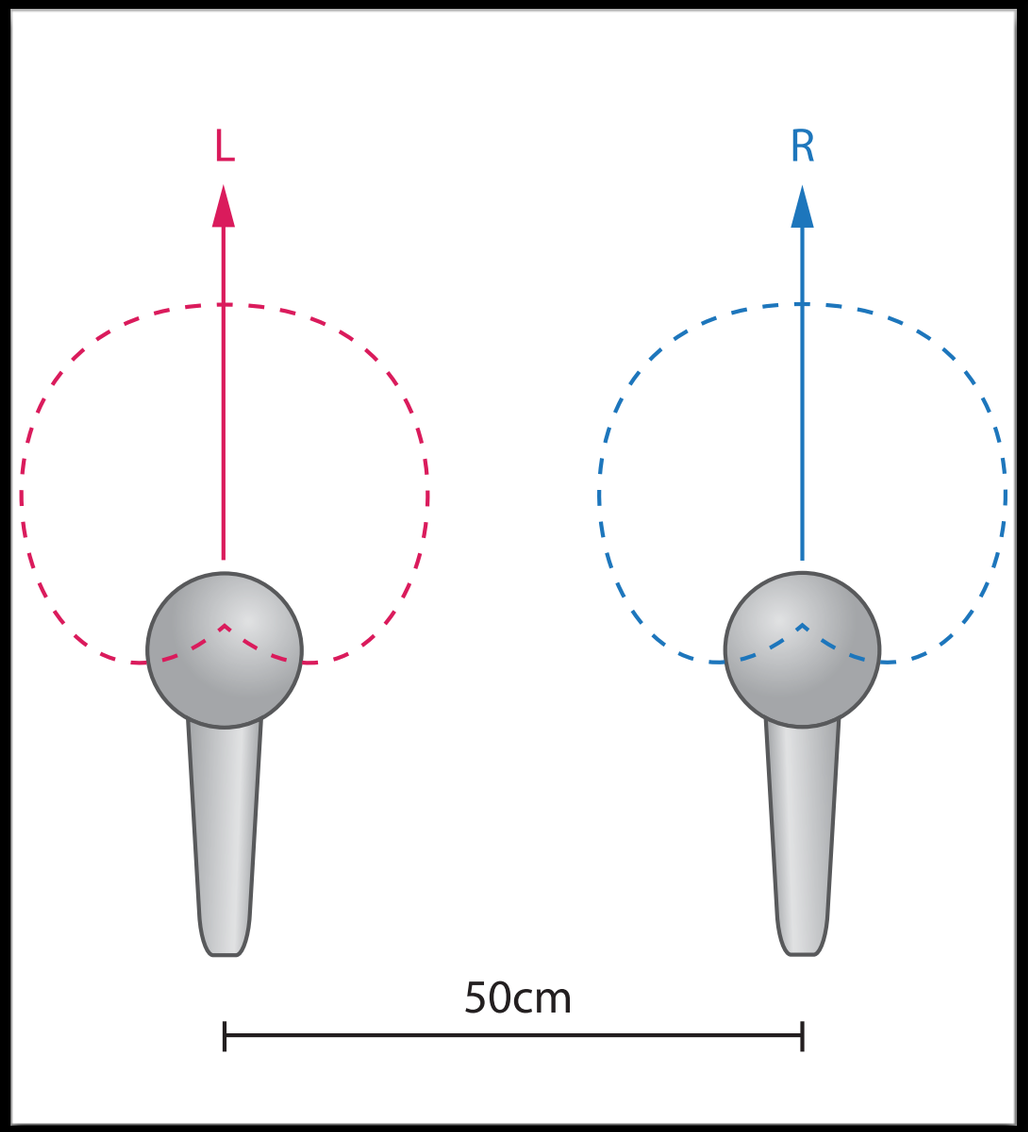
XY-stereo

- Two directional microphones (carioid, super, or hyper)
- 90°-135°
- A too tight angle creates a rather poor stereo image.
- Good mono compatibility.



AB-stereo

- Two omni or directional microphones.
- Omni directional records more of the room acoustics.
- The distance between the microphone 40-100cm.
- A too wide separation creates a "whole" in the middle.
- Less good mono compatibility.



Recording for video

TNGD10 - Moving media

Recording

- Always keep as short distance between the sound source and the microphone
- Make sure that the stage/ room is quiet.
- Use stands or boom
- Use a windshield

Recording (cont.)

- Take care of the cable
- Use gaffa
- Avoid microphonics
- Use a clapper board
- Write down recording list

Zoom H5

- Hand held audio recording device
- Two channels microphone input
- Built in XY stereo
- XLR + phantom power for external microphones
- USB connection

Recording sound

- 48kHz 16-bit
- Remove the “built in” microphones
- Choose the right input
- Check the input sound level
- Write down audio file name/time

Before using H5

- Buy batteries
- Make sure to have the XLR cable and microphones
- Microphone stands
- USB-cable and headphones
- And the memory card!

Using H5

- Remove built in microphones

Using H5

- Remove built in microphones
- Connect headphones

Using H5

- Remove built in microphones
- Connect headphones
- Connect XLR cable (use left channel if mono)

Using H5

- Remove built in microphones
- Connect headphones
- Connect XLR cable (use left channel if mono)
- Start the H5

Using H5

- Remove built in microphones
- Connect headphones
- Connect XLR cable (use left channel if mono)
- Start the H5
- Set Stereo recording mode with Selector and Menu

Using H5

- Select the input channels

Using H5

- Select the input channels
- Set the input level

Using H5

- Select the input channels
- Set the input level
- Check the input level

Using H5

- Select the input channels
- Set the input level
- Check the input level
- Start recording

Using H5

- Select the input channels
- Set the input level
- Check the input level
- Start recording
- Pause/resume recording

Using H5

- Select the input channels
- Set the input level
- Check the input level
- Start recording
- Pause/resume recording
- Stop recording

Using H5

- Select the input channels
- Set the input level
- Check the input level
- Start recording
- Pause/resume recording
- Stop recording
- Headphone sound level

Using H5

- Select REC in the menu
- Select REC FORMAT
- Set format, 48kHz/16bit
- In IN/OUT
  - Set LOW CUT 80 Hz
  - Set COMP/LIMITER to LIMITER(GENERAL)
  - Set In1/2PHANTOM to +48V
- Set for INPUT 1/2

Using H5

- Play back

Using H5

- Play back
- Selecting recordings

Using H5

- Play back
- Selecting recordings
- Connect to computer via USB

Using H5

https://www.zoom-na.com/sites/default/files/products/downloads/pdfs/E_H5_0.pdf

Sound in Adobe

TNGD10 - Moving media

Sound in Adobe

- Audition - sound editing
- Dynamic processing, filters & EQ, room effects
- Dynamic link workflow between Premiere and Audition
  In Premiere
  Edit -> Edit in Adobe Audition -> Sequence
  In Audition
  Export to Adobe Premiere Pro

- Premiere
  - keyframes and automation
  - sound level
  - effects

Dynamics

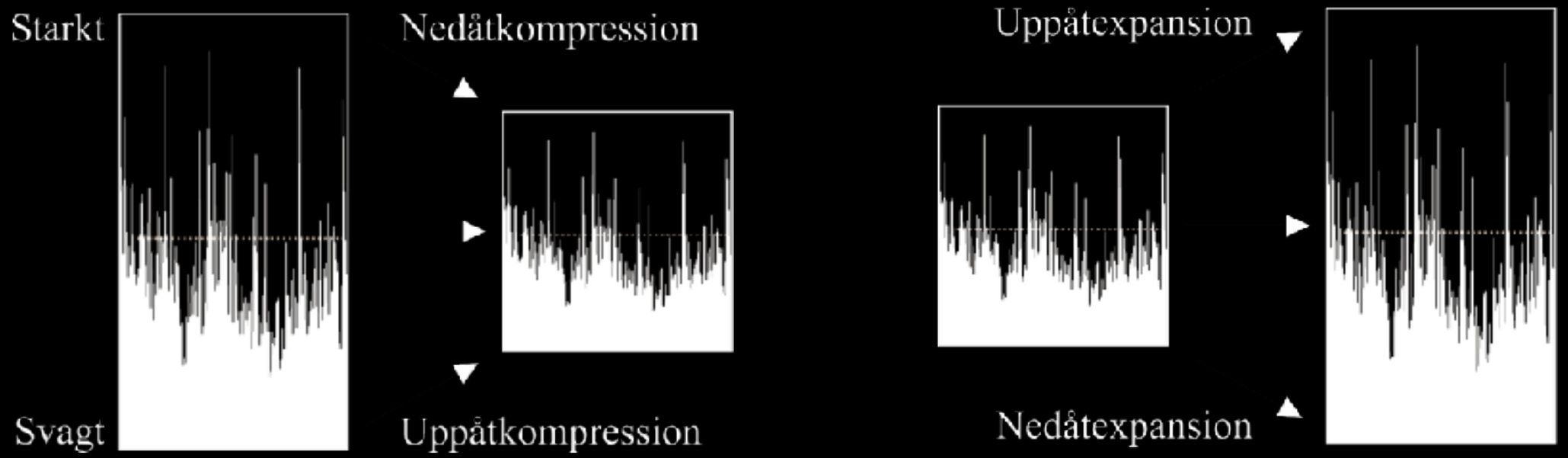
TNGD10 - Moving media

Dynamics

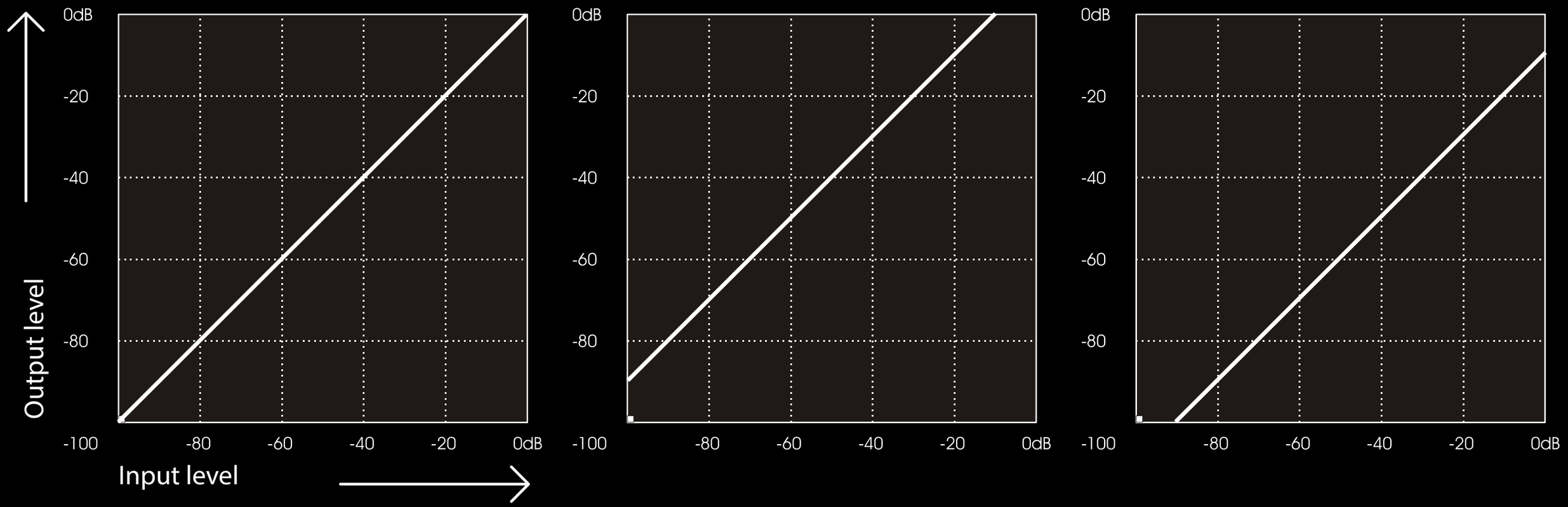
- Dynamics/dynamic range is equal to difference.
- Modern pop music has a dynamic range of about 9dB.
- The CD format, 44.1kHz and 16 bits can theoretically give 96dB in dynamic range.
- Macro and micro dynaics

Upwards or downwards…

- Downward compression - the normal
- Upward compression - for noise reduction
- Downward expansion - the normal
- Upward expansion - for noise reduction

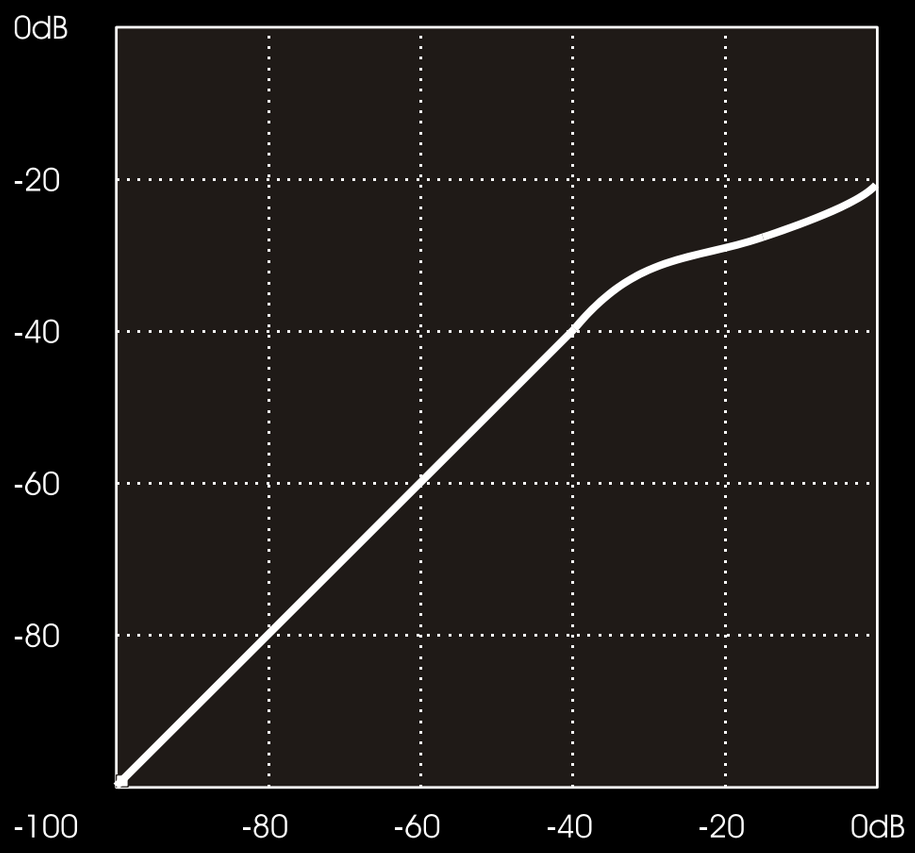


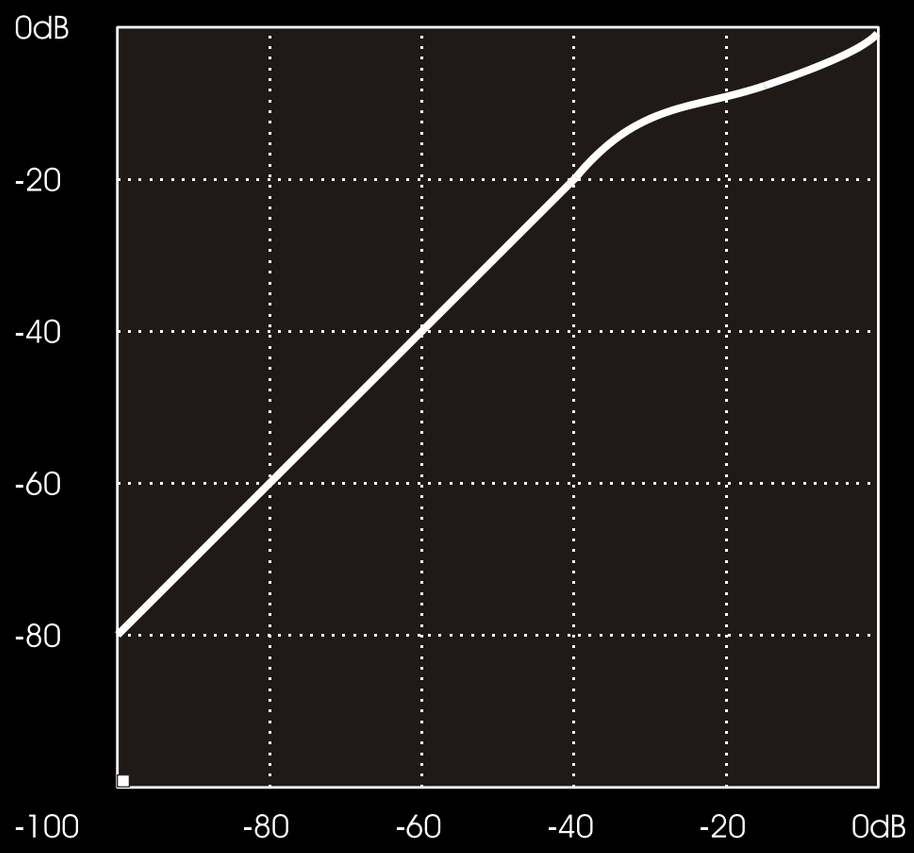
Transfer curves



Compression

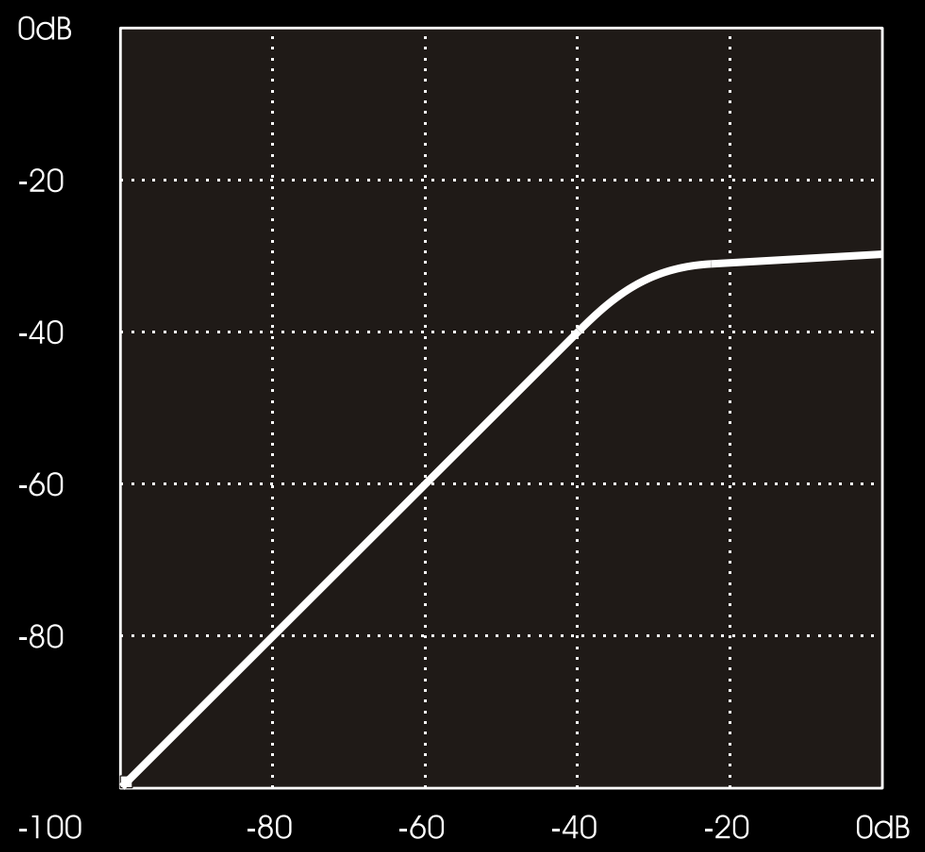
- Threshold - when the compression starts
- Compression ratio - the amount of compression





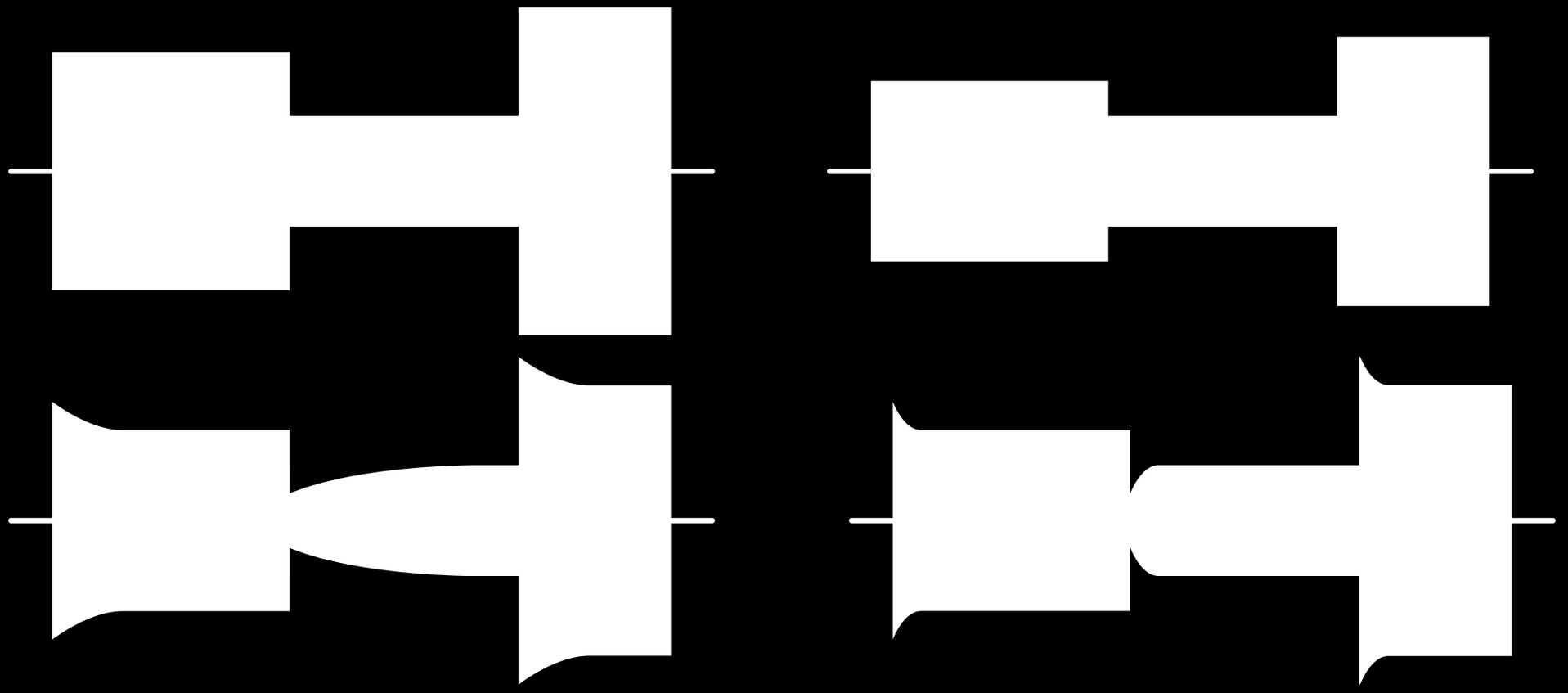
Compression (cont.)

- Limiting around ratios of10:1 or more (∞:1)



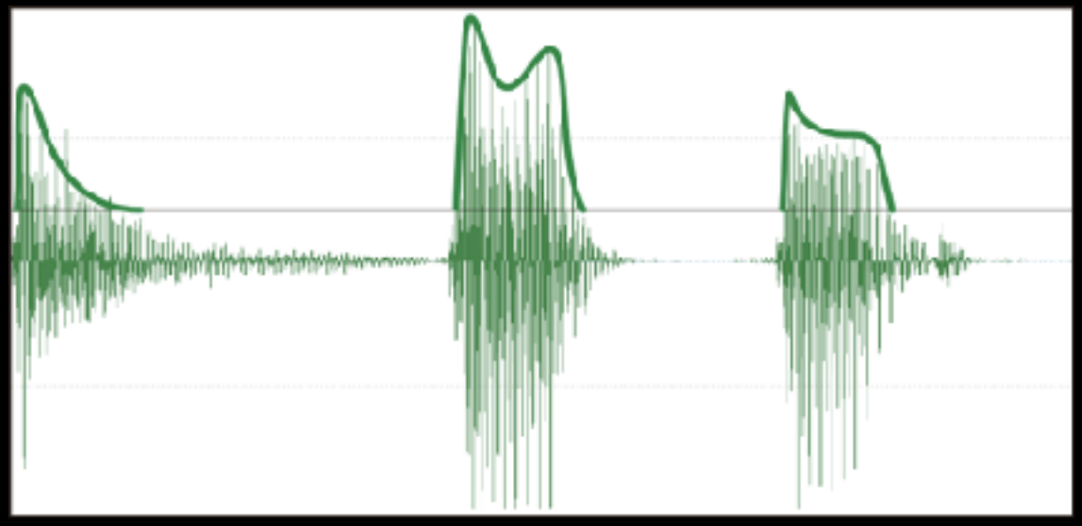
Time settings

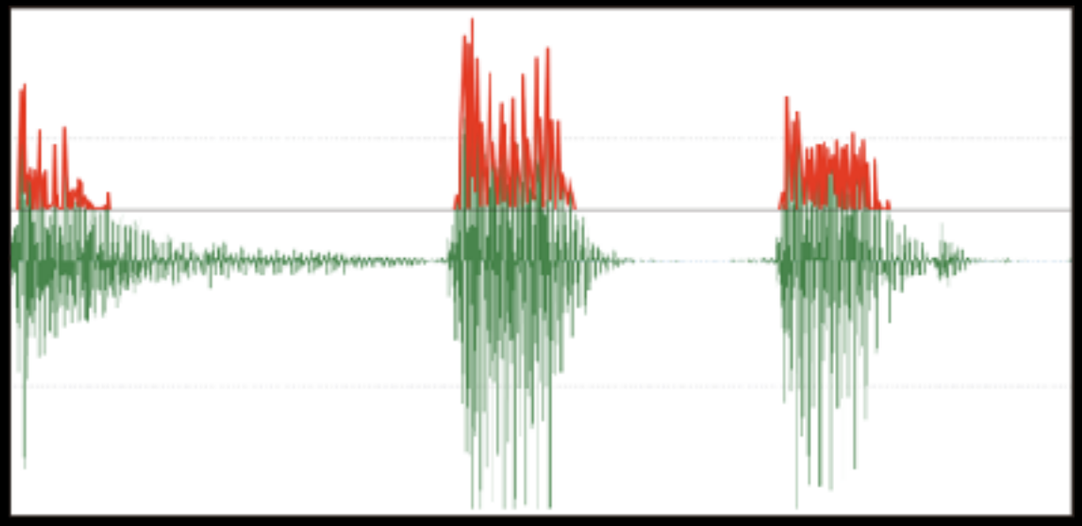
- Attack - how fast attenuation will start
- Release - how fast attenuation will stop



Time and compression

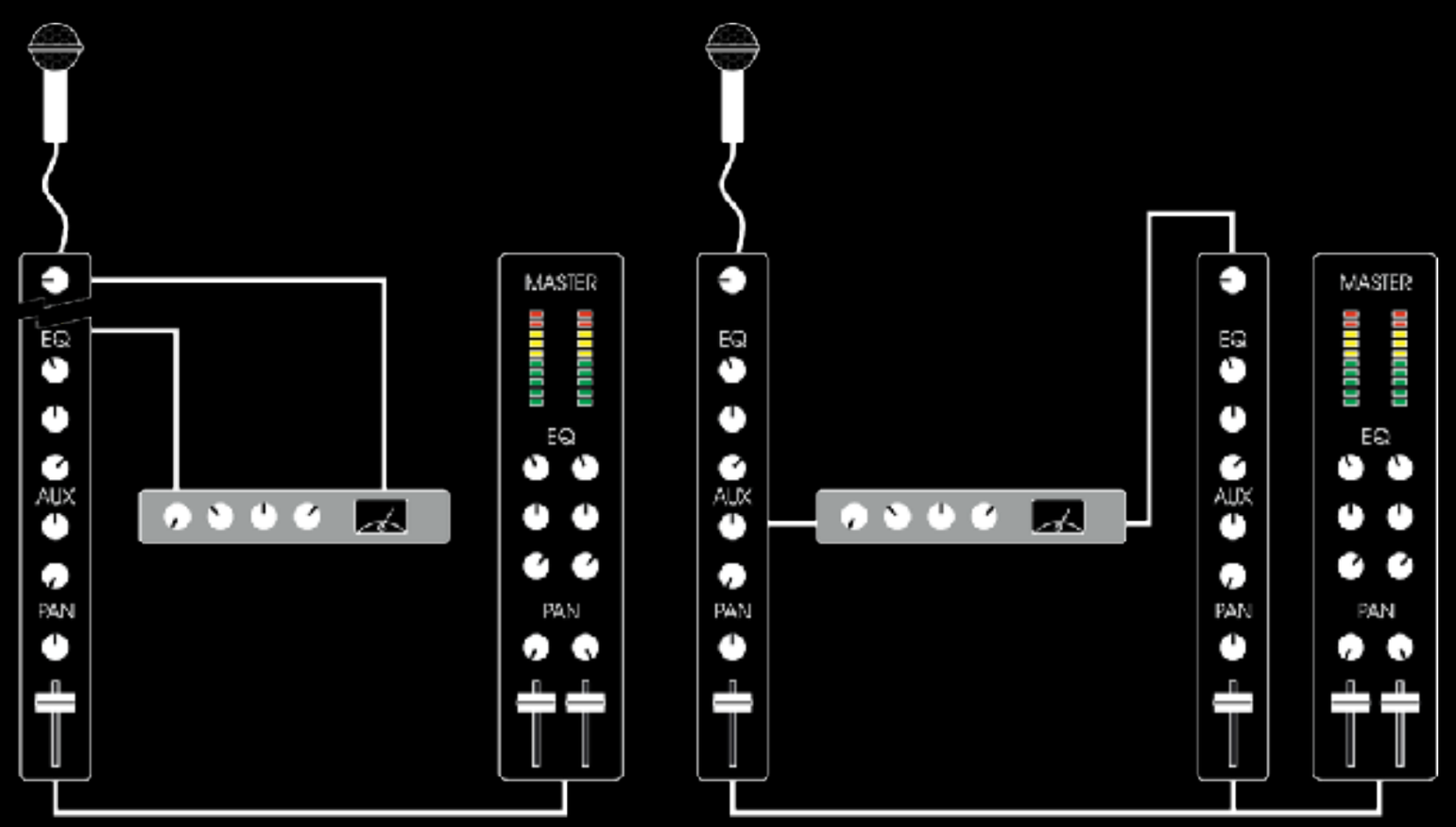
- Too short release time setting might lead to distorsion





What is compressed?

- Everything. Dialogue, sound Fx, movie score…
- Side-chaining to open up the dynamics to let through the dialogue.
- Serial and/or parallel compression

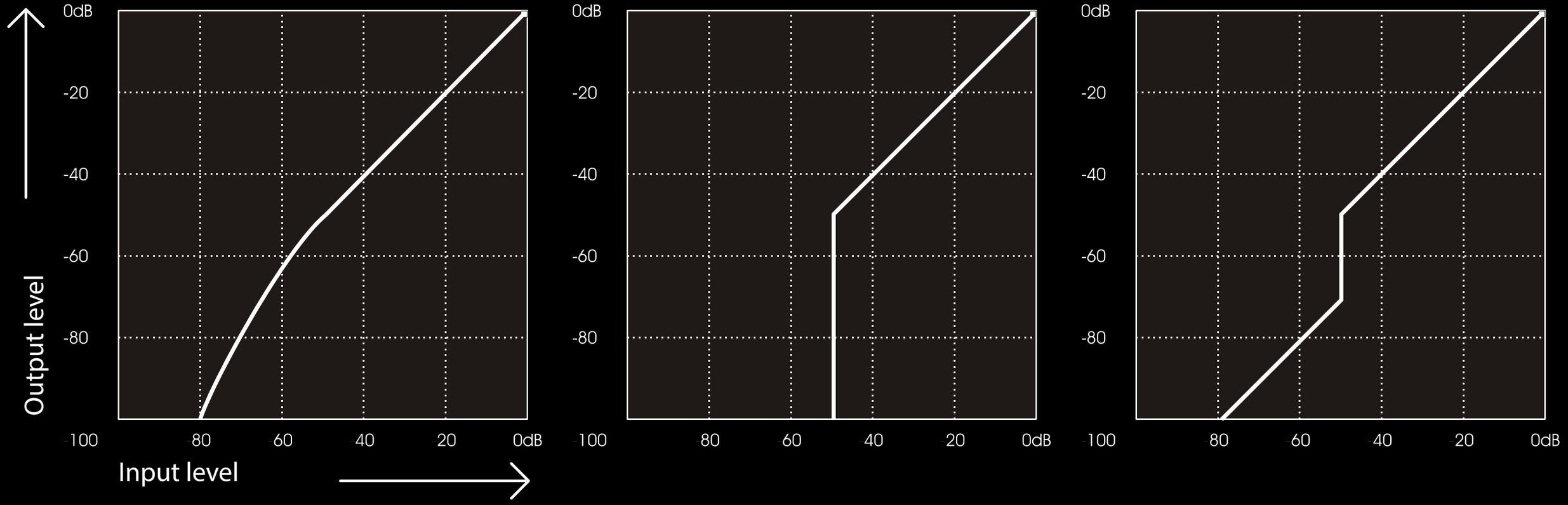


Effects on the sound

- Listen for changes on the transients (the attack) in the sound.
- Listen after frequency changes in the sound…
- Keep an eye on the master level on the output…

Expansion

- Expander, gate, noise-gate
- Expansion ratio - the amount of expansion



Expansion / gating

- Frequency settings in a gate
- Attack, release and hold

What is expanded/gated?

- Noisy recordings
- Reverb (for 80ies snare drums)
- Side-chaining to create effects and give room for other sounds in the dynamics.
- Listen for changes in the transient in the sound.