# abstracta

**We create better Soundscapes**

# Sound vs Noise

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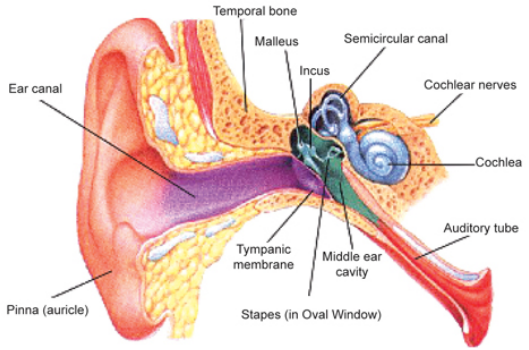
# The sound as an information carrier

- The sound we hear is **pressure variations** that spread in the air.
- The sound **conveys information** on communication and warning signals.
- Two receivers of sound mean that we can also perceive the **direction** from which the sound comes.

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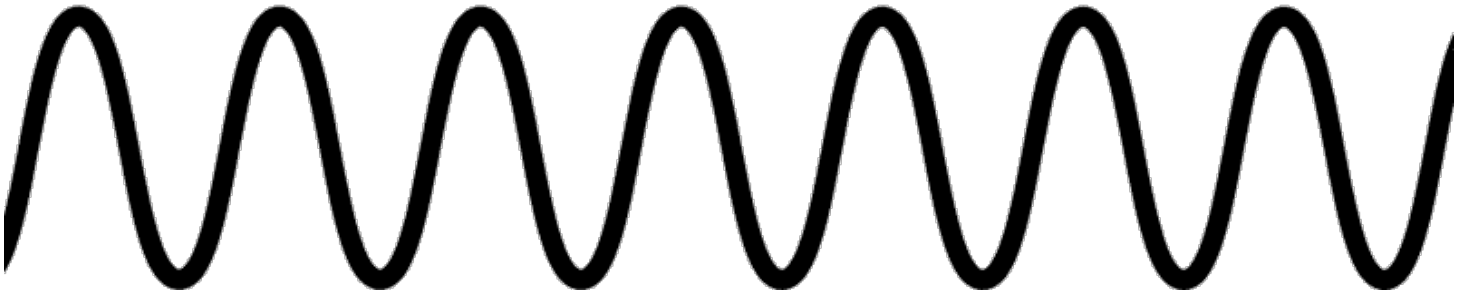
# Frequency

Long Sound Waves - Dark Tones



Short Sound Waves - Bright Tones

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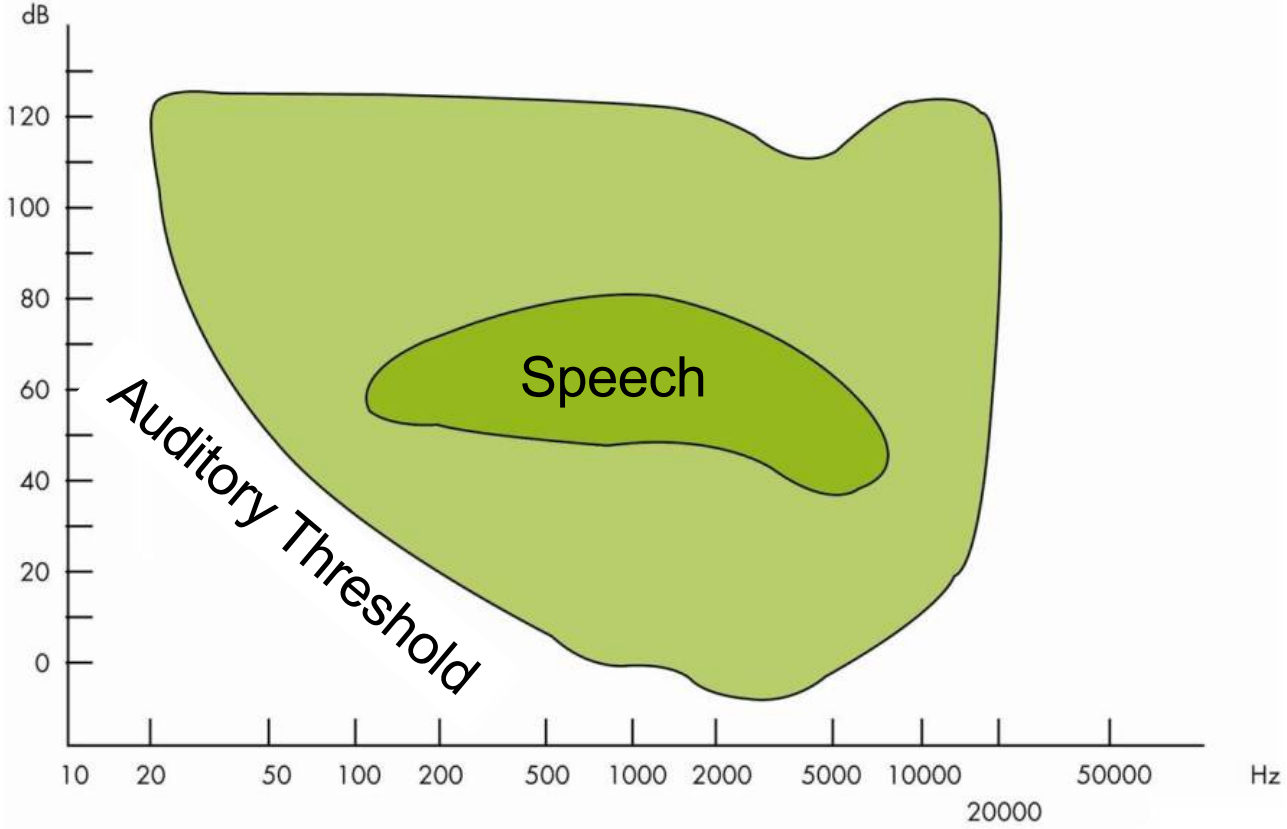
# Auditory range




Infrasound

Ultrasound

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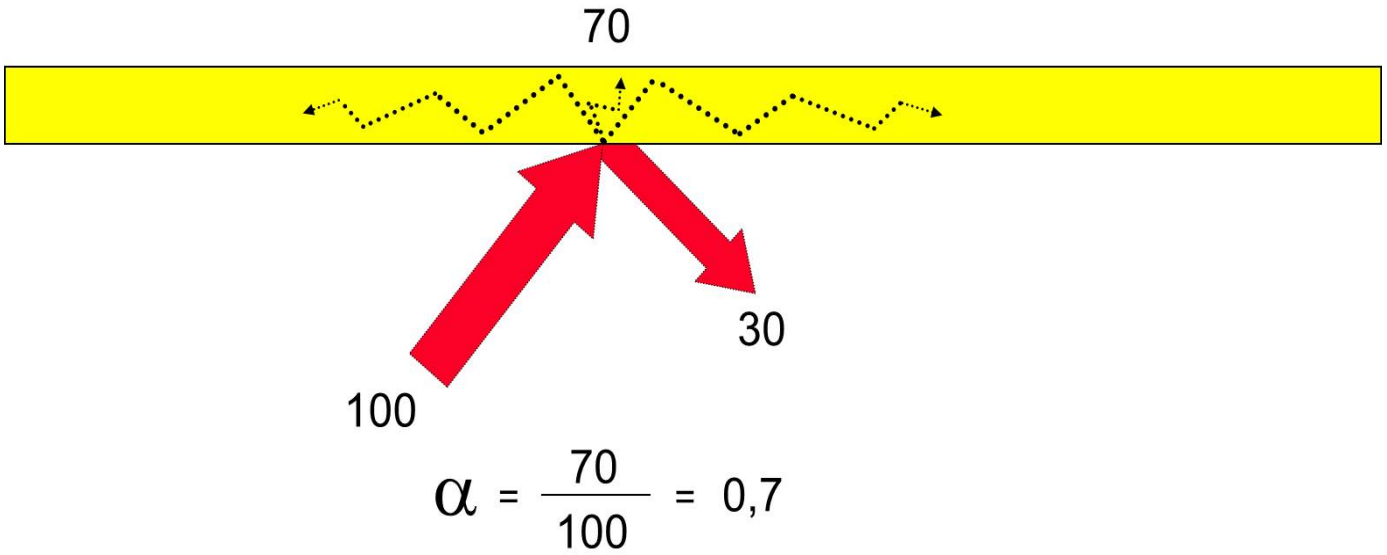
# Sound absorption

Sound is energy, energy cannot be destroyed, but it can be transformed into another type of energy.
A sound absorber often has the task of not reflecting sound. Sound absorption is reported with a "sound absorption factor" $\alpha$ (alpha) which can vary between 0 and 1.

- If $\alpha$ is 0, all sound will be reflected.
- If the $\alpha$ is 1, no sound will be reflected because all the sound energy has been absorbed.
- If 30% of the sound energy is reflected, 70% has been absorbed, $\alpha$ becomes 0,7.

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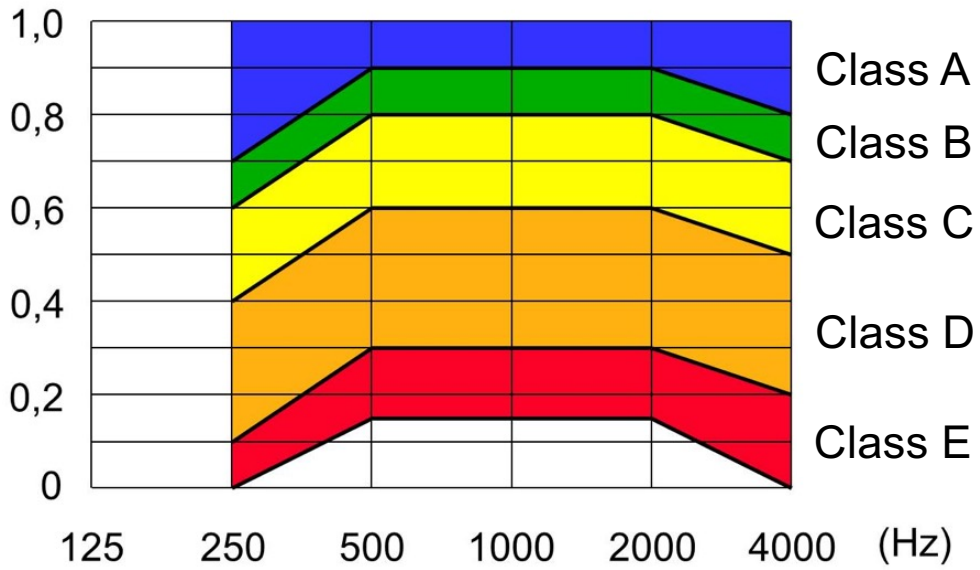
# Classification of sound absorbers




If low noise level is required in a room, use class A absorbers.
Should it be aimed for playing acoustic instruments and one would like to have a certain sound in the room, then a class D or E-absorbent is preferred.

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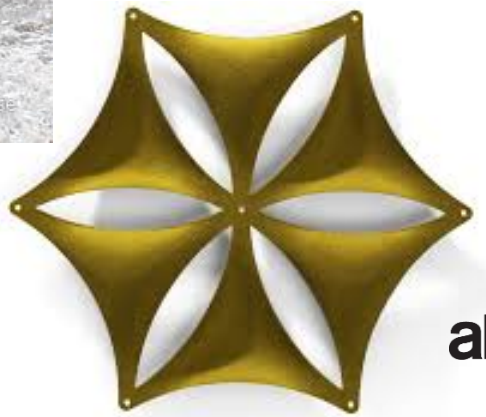
# Diffusion

Think of a sound wave as a water wave, when it hits a pier.

On a flat surface pier the wave doesn't disappears (absorbs), it bumps out back to the sea.

The wave strikes the irregular surface it breaks and shatters, (diffusion).

Typical product?



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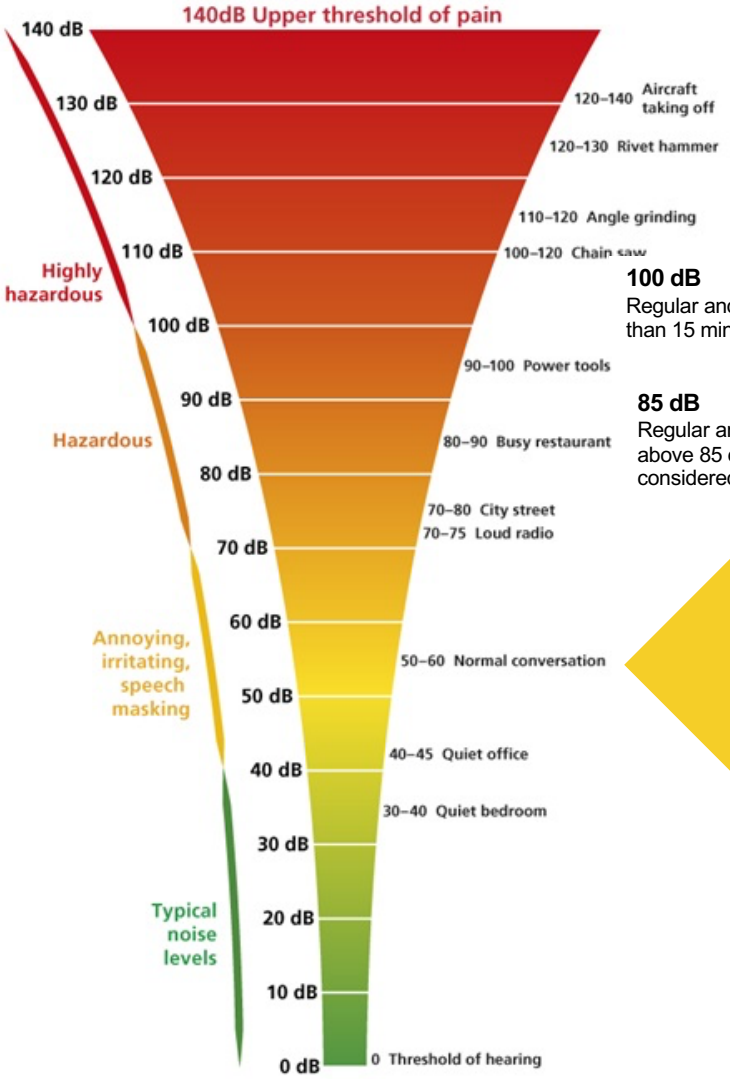
# Sound level




**110 dB**
Regular and prolonged unprotected exposures of more than 1,5 minutes per day risks permanent hearing loss

**100 dB**
Regular and prolonged unprotected exposures of more than 15 minutes per day risks permanent hearing loss

**85 dB**
Regular and prolonged exposures to noise at or above 85 dB, (average of 8 hours per day) are considered hazardous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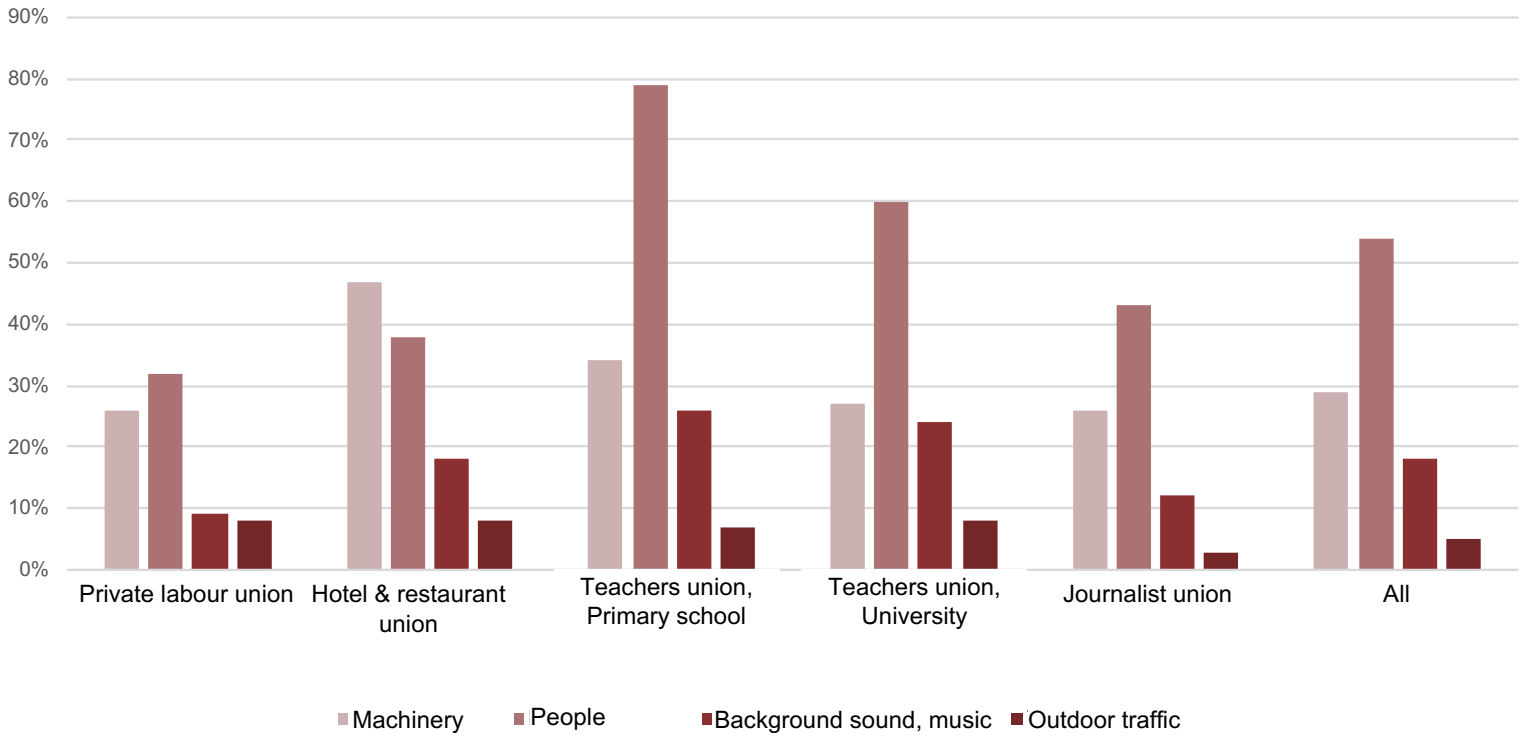
# How noise affects us

## What noise at work affect us the most negative?

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# Speech Perception

Affected by reflections,
background noise and absorption
in the room

**Good**
Direct sound
Early reflexes

**Poor**
Late reflexes / reverberations

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# Nature / forest acoustics as a target

- Voice comprehension in nature is fantastic
- No reverberation from any ceilings, walls or floors
- Our hearing works very well outdoors
- We strive to create nature's acoustic properties indoors

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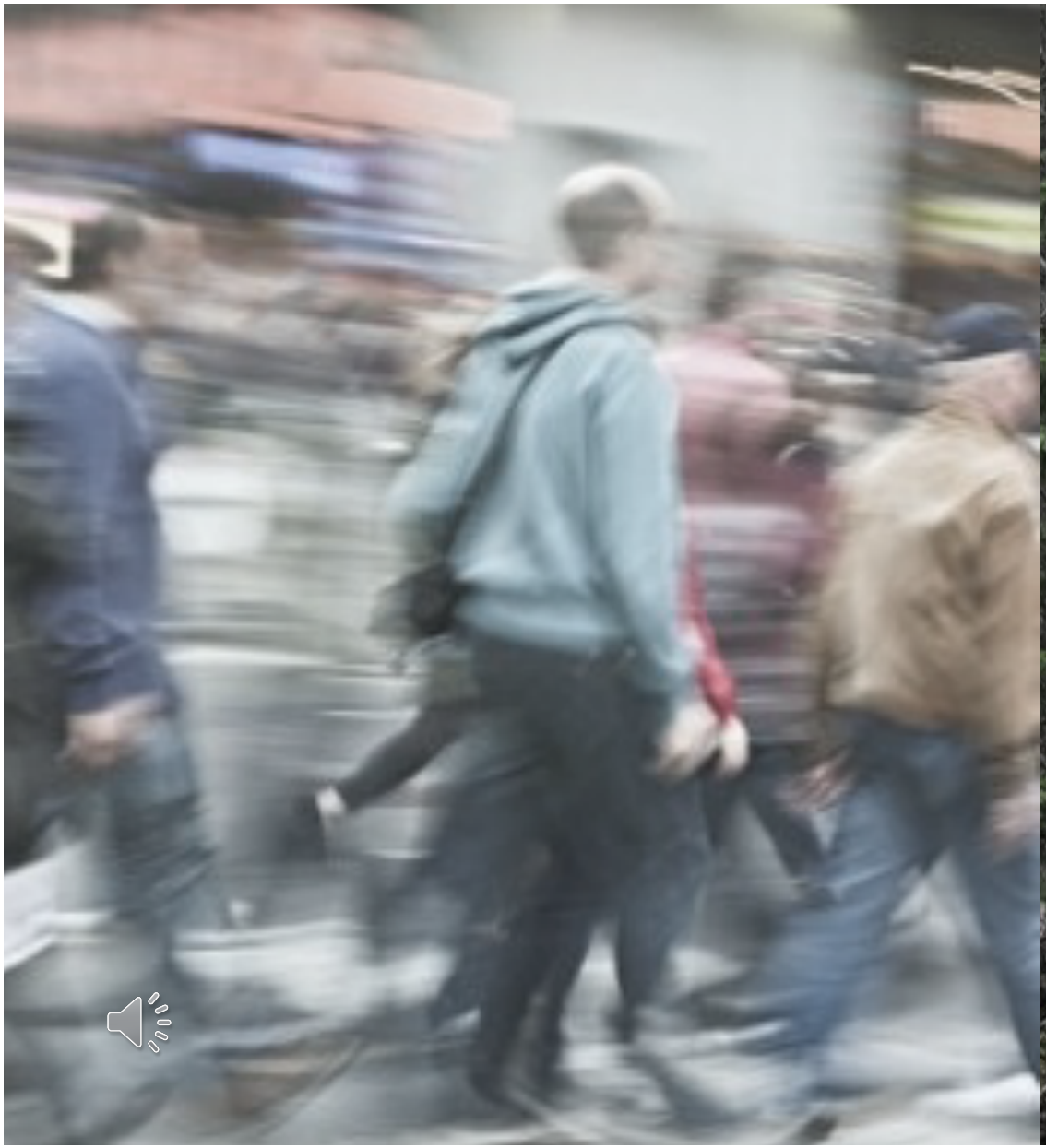


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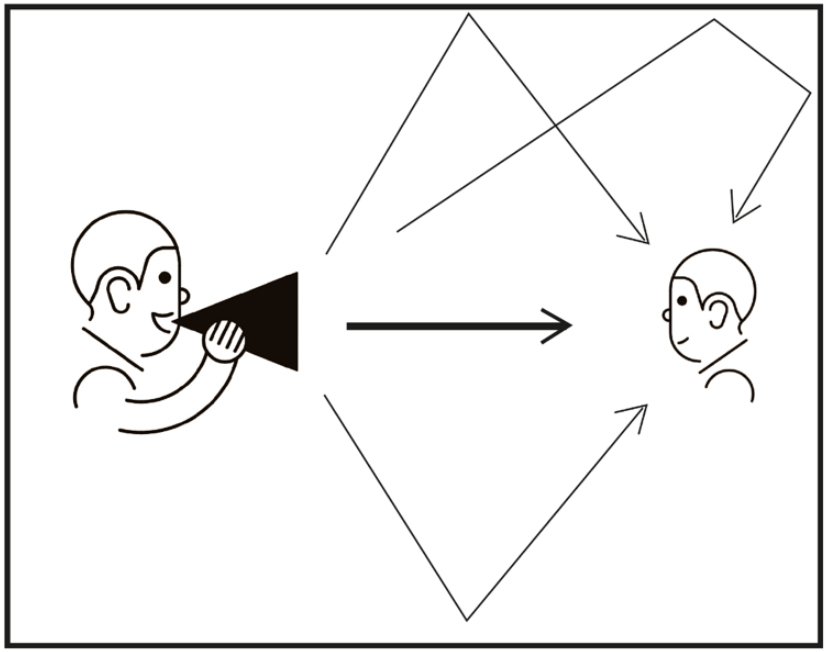
# Room acoustics - The characteristics of the sound in the room

**Direct Field**
Near the sound source the sound dominates directly from the sound source

**Reverb Field**
Further away from the sound source dominates the reflected sound



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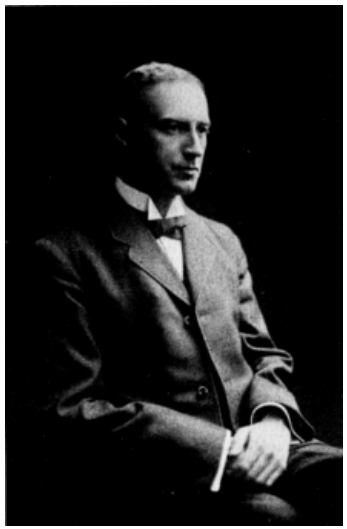
# Reverberation time



Wallace Clement Sabine
(1868–1919)

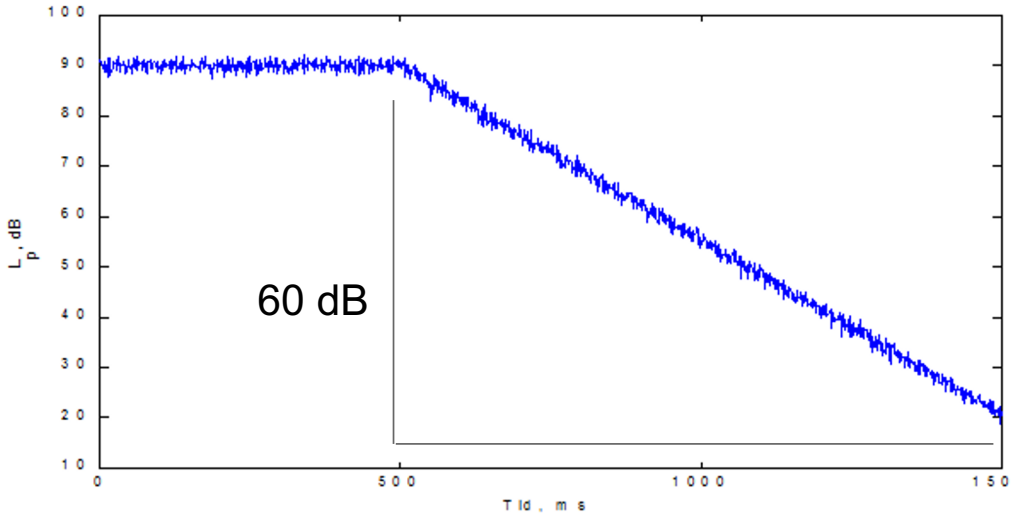
The reverberation time is the time it takes for the sound to decrease by 60 dB.

It is determined by how much sound is absorbed in the room's surfaces and interior.

Sabine's formula: T = 0.163 * V / A
Applies to diffused sound field in the reverb field

- V: room volume
- A: equivalent absorption area

Typical reverberation times
Classic room: 0.5 s Concert Hall: 0.8 - 1.5 s
Church: 1 - 3 s

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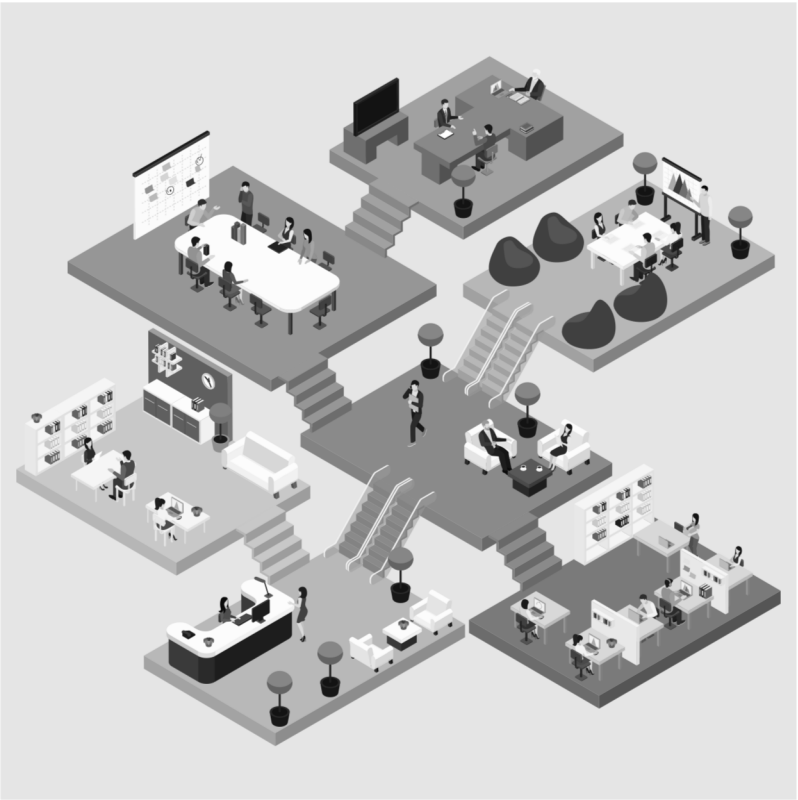
# Guidelines for different room types

| Swedish National Board of Housing, Building and Planning's building regulations<br>Swedish standard 25268 | Minimum Requirements |
|---|---|
| Teaching, for example, classrooms, teaching rooms, lecture rooms | 0,6 |
| Teaching or conversations in smaller groups such as group rooms, conference rooms | 0,6 |
| Education in open spaces such as educational landscape | 0,4 |
| Space for teaching music such as music hall, drama room | 0,8 |
| Large spaces for sports such as gymnasium, sports hall, indoor swimming pools | 1,5 |
| Operations with strong sound generation, for example, craftroom, technical room, kitchen areas | 0,5 |
| Space larger than 100m2 such as living room, dining room, restaurant, cafeteria | 0,6 |
| Other rooms such as rest rooms, teachers' room, staff room, office, expedition, study room, libraries | 0,6 |
| Other rooms where you stay temporarily, for example, corridors, entrances, copy space | 0,8 |



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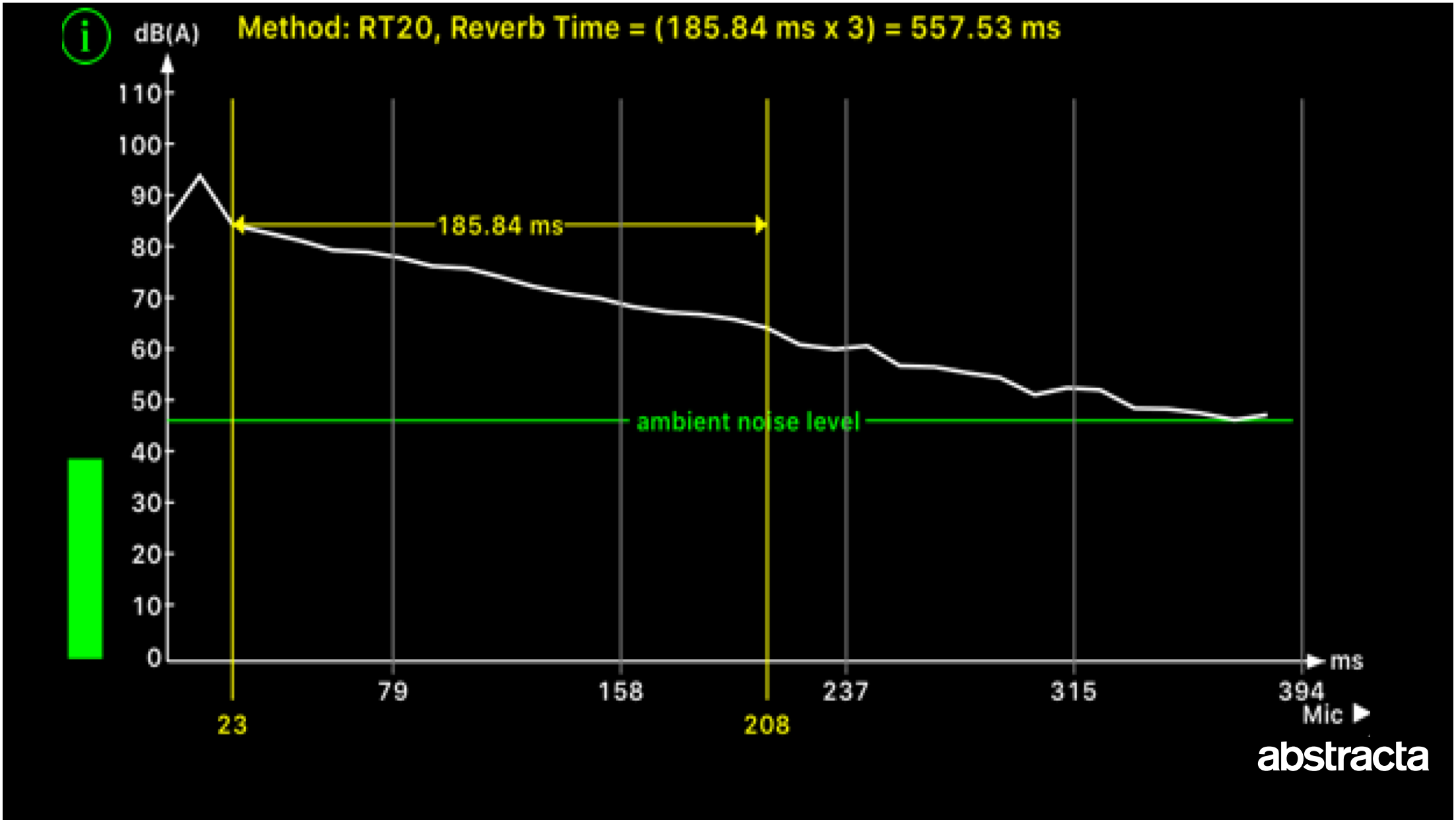
Method: RT20, Reverb Time = (185.84 ms x 3) = 557.53 ms
dB(A)
110
100
90
80
70
60
50
40
30
20
10
0
185.84 ms
ambient noise level
ms
23
79
158
208
237
315
394
Mic
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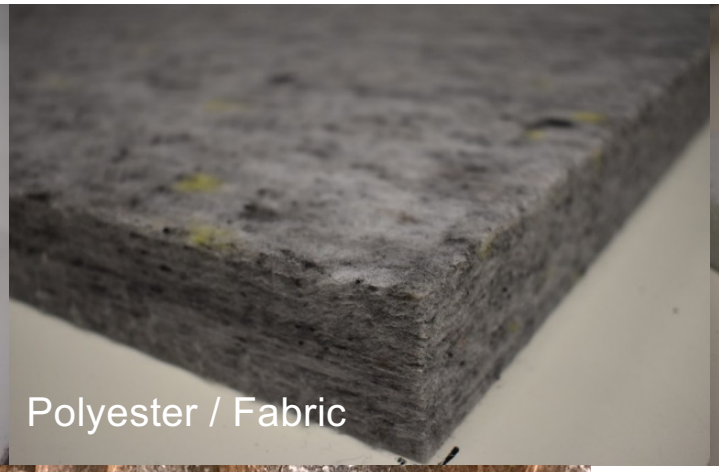
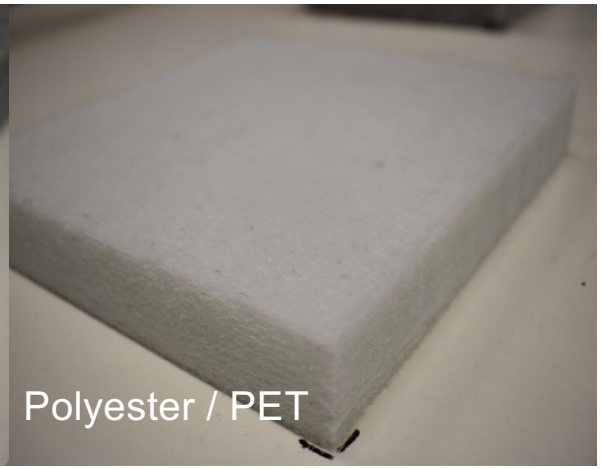
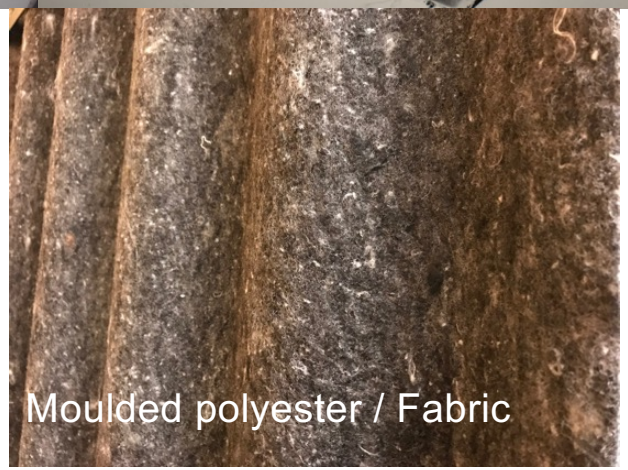
# Our absorption fillings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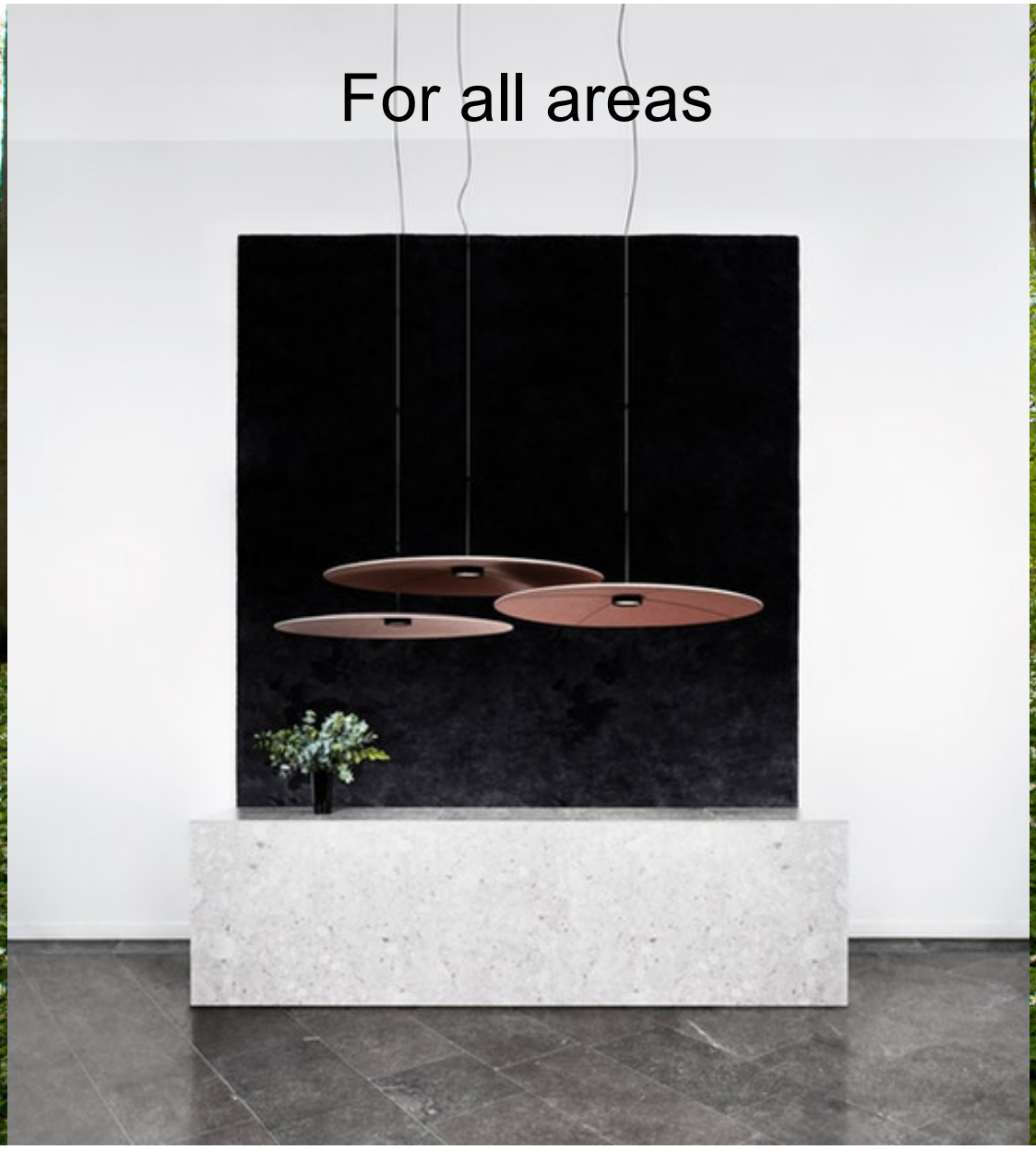
# For all areas



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# Abstracta's symbols describing acoustic terms

Absorption Diffusion Attenuation

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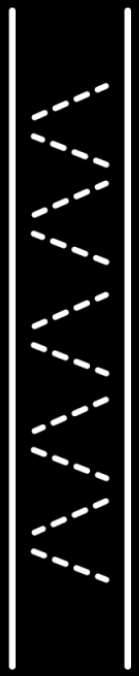
# Absorption



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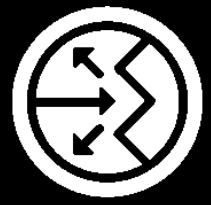

# Diffusion

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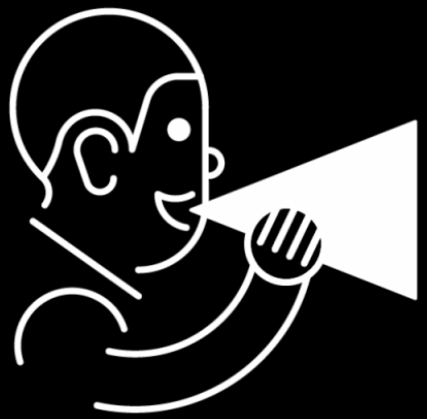
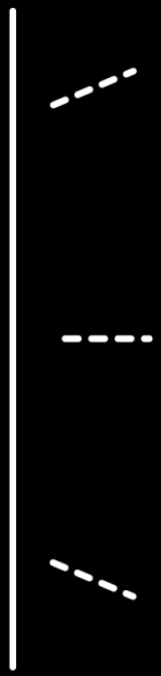
# Attenuation





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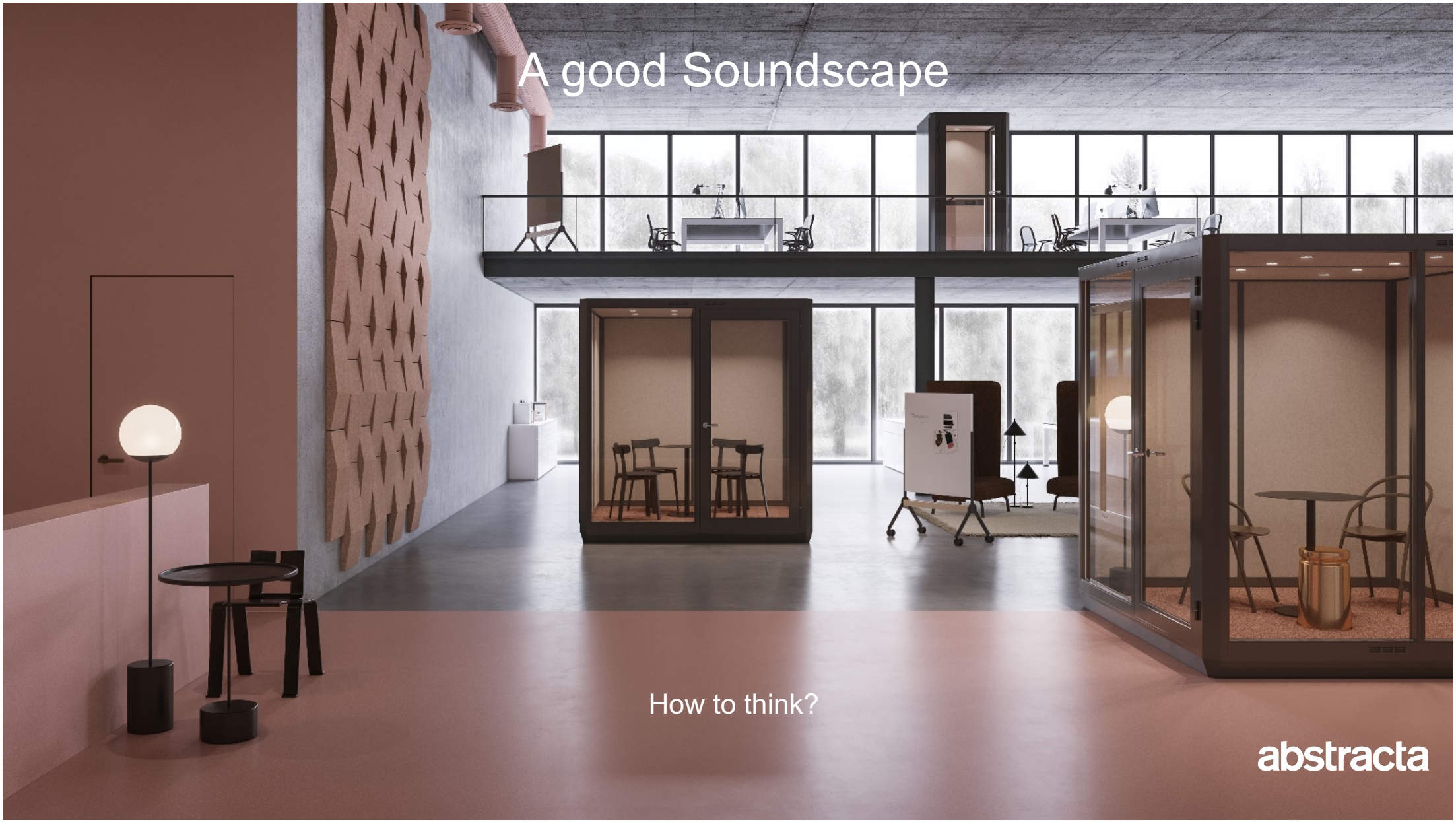
A good Soundscape
How to think?
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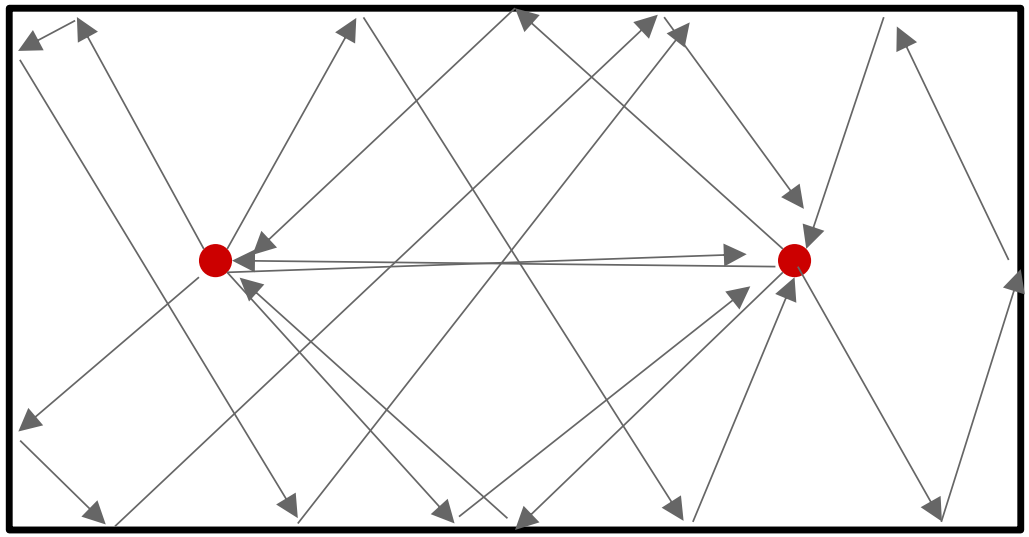
# A good Soundscape

**What defines a good soundscape?**

Different environments require different types of acoustic products to create good soundscapes.



Reflections in a room with two people talking.

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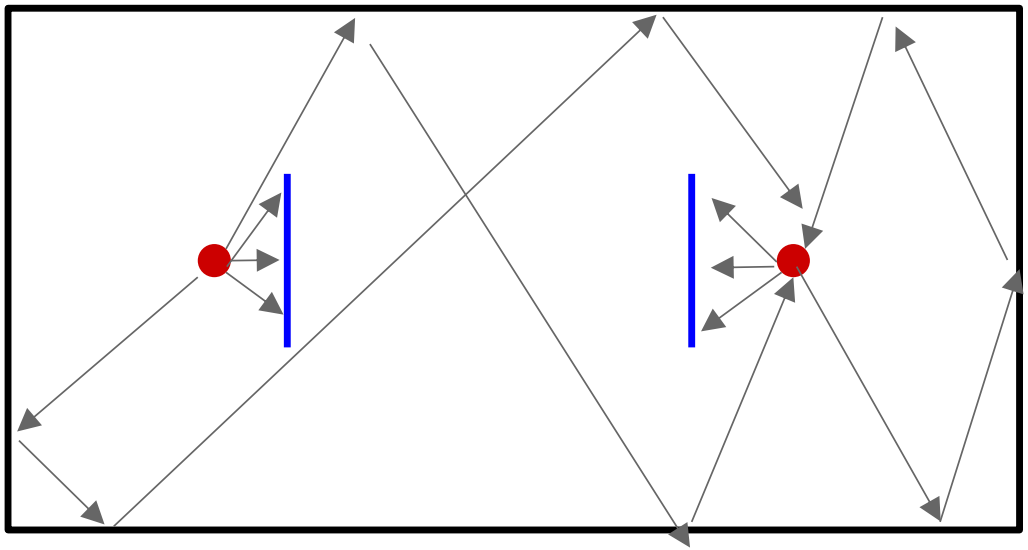
# A good Soundscape

**Reflections in office space**

Table- and/or Floor-screens



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A good Soundscape
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# A good Soundscape

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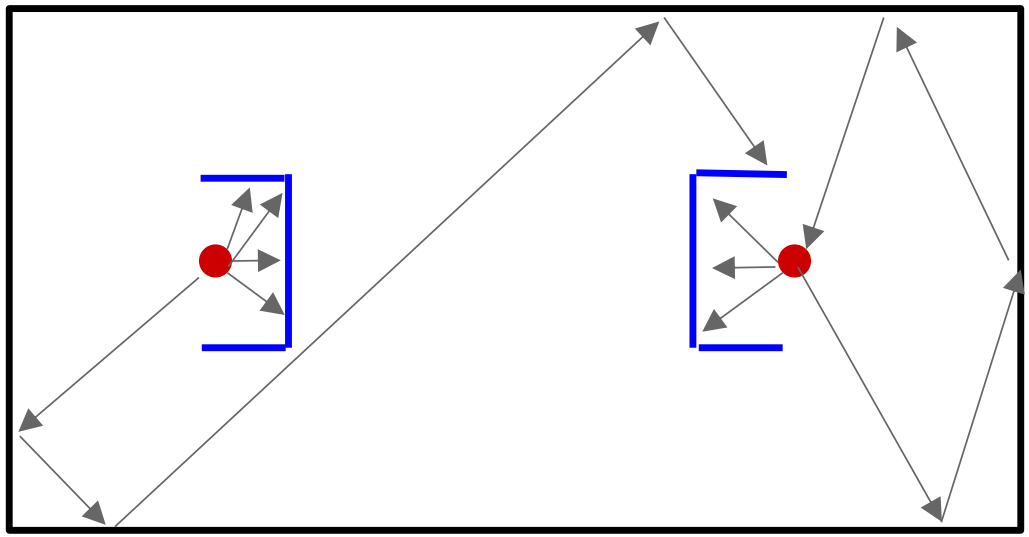
# A good Soundscape

**Reflections in office space**

Table and / or floor screen booth



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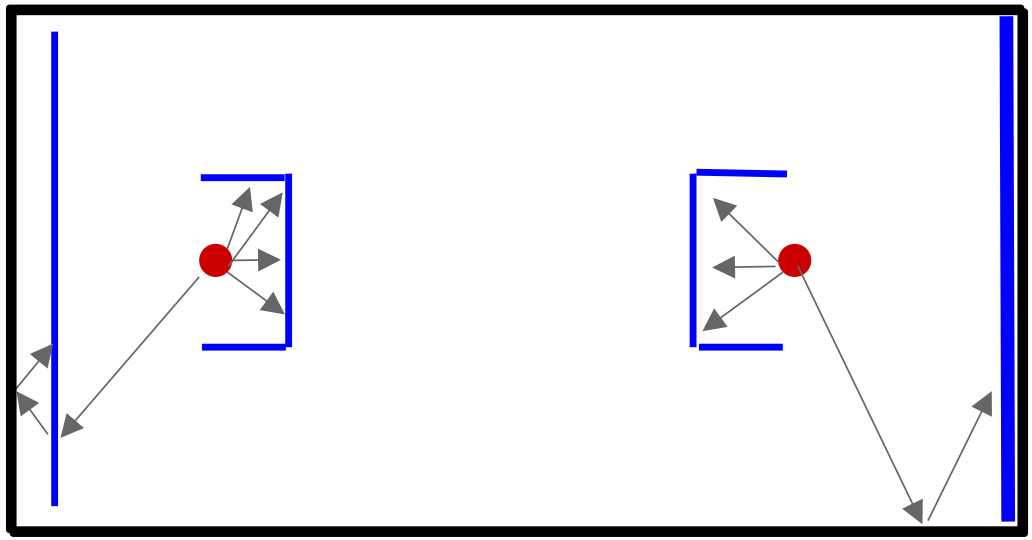
# A good Soundscape

# A good Soundscape

**Reflections in office space**

Wall absorbants and diffusors



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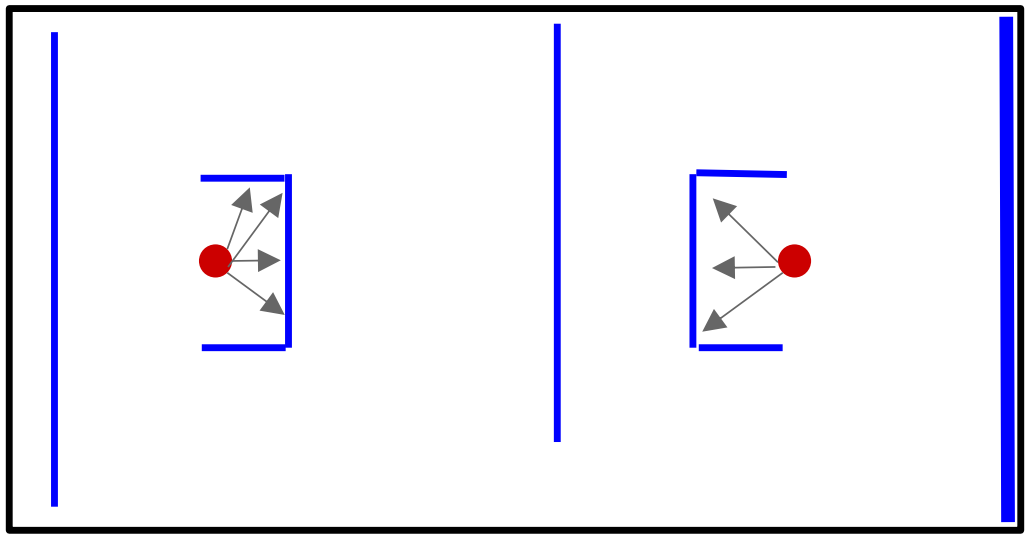
# A good Soundscape

# A good Soundscape

**Reflections in office space**

Diffusors in e.g the Air series



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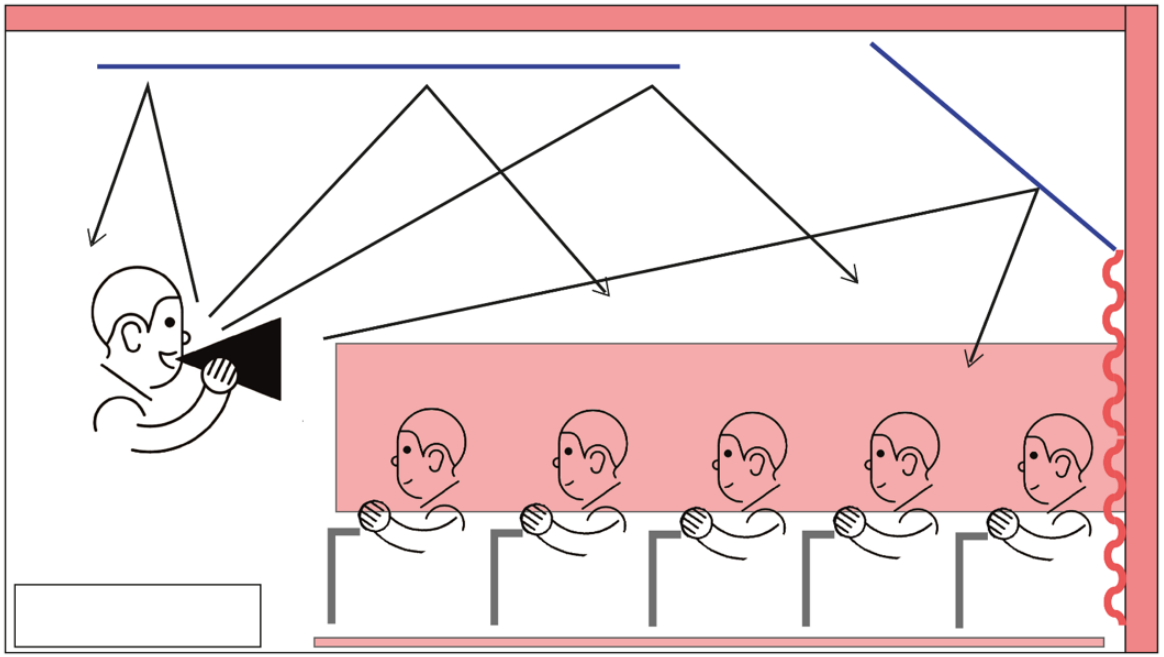
# A good Soundscape

**Reflections in educational halls**

Diffusors and absorbers in combination



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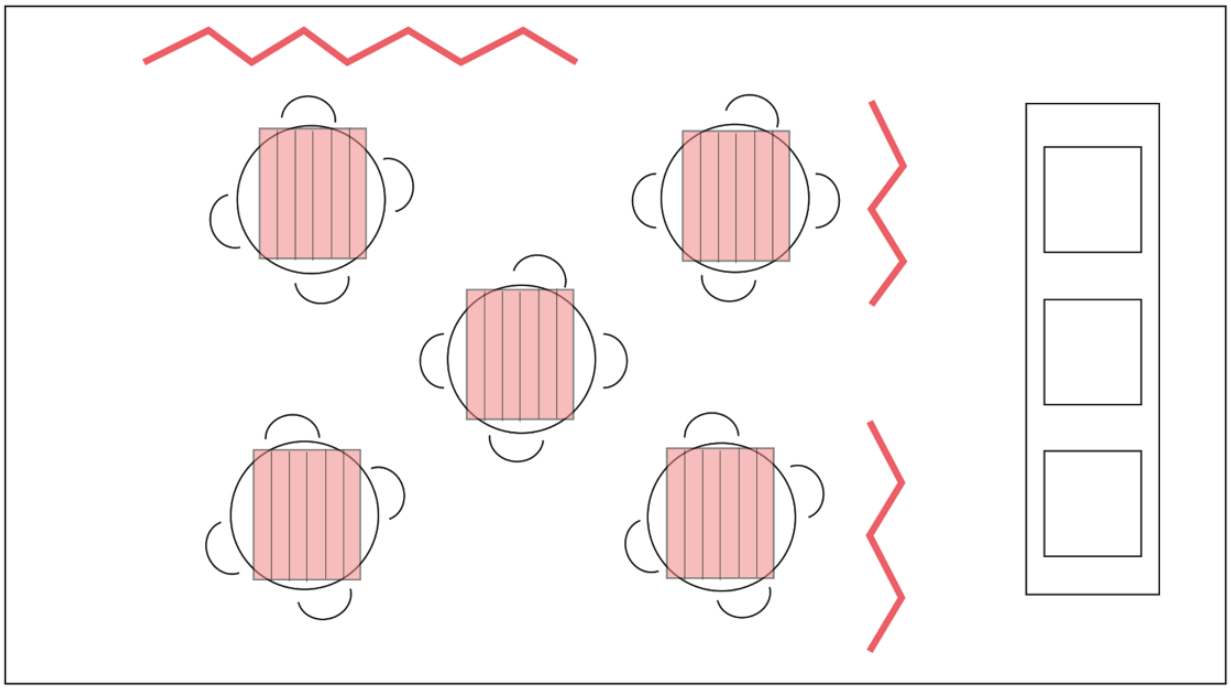
# A good Soundscape

**Reflections in canteens, cafes**

Diffusors and absorbers in combination together with ceiling absorbers/diffusors



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**We create better soundscapes**