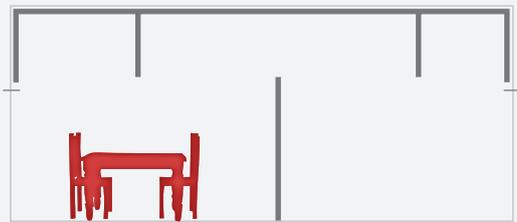
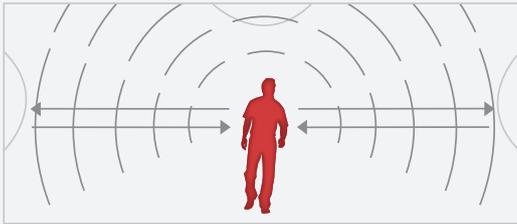


## HOW TO DESIGN ACOUSTICS IN DIFFERENT ROOM SHAPES?

The shape of the room defines the movement of the sound waves within the room. Placement of acoustic materials should be determined by the way the sound moves in that particular room in order to ensure optimal efficiency of the materials.



### LARGE ROOMS WITH HIGH CEILING

The acoustic environment in large rooms is sometimes experienced as the one at a railway station. This is partially connected to the fact that it is difficult to concentrate due to the relatively high noise level. Another reason for this is the fact that the conversation over short distances is impeded due to the sound being masked or drowned by the surrounding noise. The sound level should be reduced in such a way that some of the sound masking effect from the relevant noise is still present. Furthermore, the spreading of sound should be limited.

It is therefore important that all the available surfaces are equipped with effective sound absorbers and sound diffusers.

The furniture along with the sound barriers play a highly active role by diffusing the sound and thereby making the existing sound absorbers and diffusers even more efficient.

### LARGE ROOMS WITH LOW CEILING

In large rooms the sound spreading is experienced as the greatest challenge, since the speech sounds can be heard over long distances.

Sound absorbing and sound diffusing materials should be used, and sound barriers should be applied to the ceiling. The sound regulation from the floor is secured by furniture and the use of sound barriers.

NOTE: If the sound absorbers in the ceiling absorb too much sound, the reflections from the walls will be even more audible. Should this be the case, the walls must be equipped with sound absorbing or sound diffusing materials.





## NARROW ROOMS

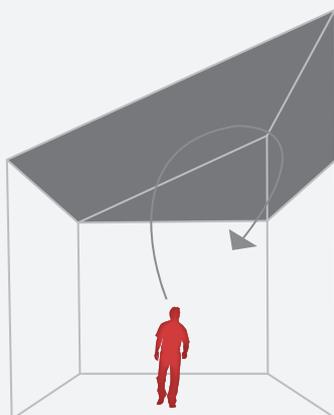
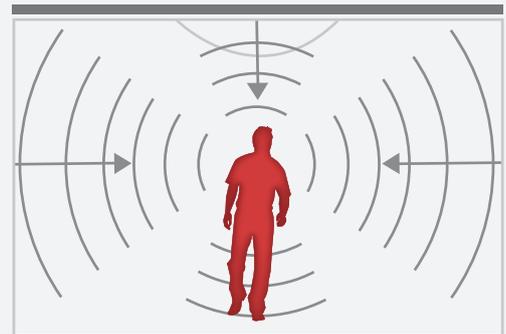
Placing the sound absorbing materials on the ceiling in a narrow room will not create the wanted acoustic effect.

Sound absorbers must be placed as close to the sound source as possible. Therefore, the absorbing materials must primarily be placed on the walls.

## SMALL ROOMS WITH PARALLEL WALLS

In small rooms, the low frequencies often seem to be predominant. Therefore, the speech appears to consist primarily of humming sounds.

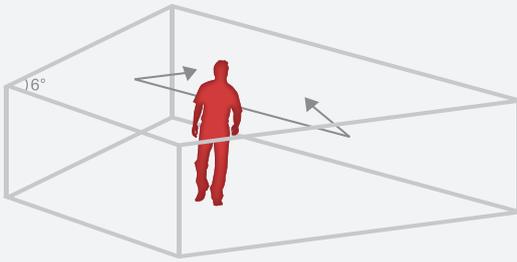
Sound absorbers with a low-frequency profile should be used and placed on the ceiling surface.



## INCLINED CEILINGS

Inclined ceilings have both a sound spreading and a sound concentrating effect. In most cases, the sound is concentrated because the sound regulation of the area around the inclined ceiling has not been considered carefully.

The wall area opposite the inclined ceiling should also be equipped with sound absorbing materials. As a principal rule, all surfaces above the normal ceiling height (2.60 m) including the end walls should be equipped with sound absorbers.



## INCLINED WALLS

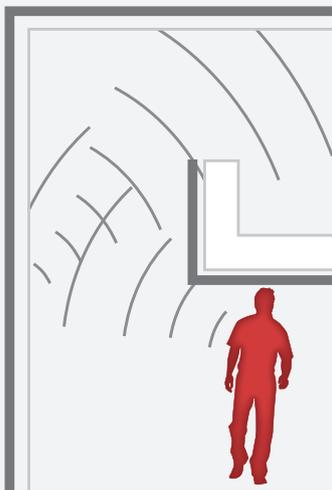
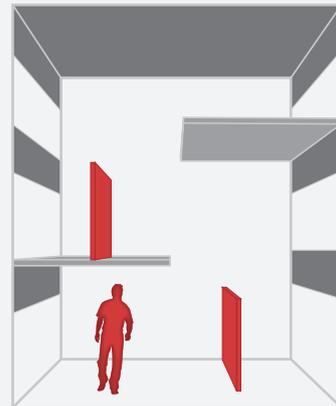
Inclined walls have both a sound spreading and sound concentrating effect.

The sound spreading effect is achieved by inclining the wall in proportion to other walls and the ceiling. In general, the walls inclined by more than 6 degrees ensure an excellent sound diffusion. The most effective diffusion is obtained by applying several angles.

## MULTI STOREY ROOMS

In multi-storey rooms, the large room volume makes it difficult to ensure a sufficient amount of absorbing materials and thus a sufficient level of sound absorption.

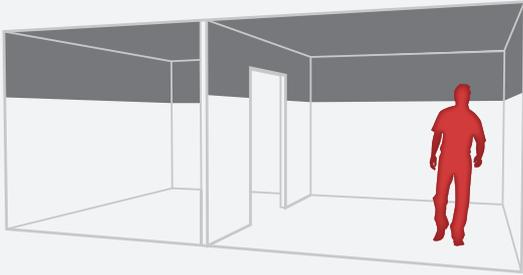
Sound absorbers and sound diffusers must be placed on all available surfaces. The absorption should be reinforced by the use of free-standing absorbing elements.



## ROOMS WITH MEZZANINE

In rooms with mezzanine, it is possible to create different sound environments in the same room. In the large, open room, an environment with long reverberation time is created. The space above and below the mezzanine has a shorter reverberation time. The challenge posed in this type of rooms is the sound reflection and the harmonization of the different reverberation times.

The wall opposite the mezzanine should be equipped with sound absorbers or diffusers. In addition, sound absorbers should be placed on the underside and the banister of the mezzanine. In order to prevent large differences in the reverberation times between the large room and the space around the mezzanine, sound barriers can be applied.



## CONNECTED ROOMS

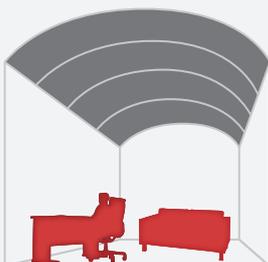
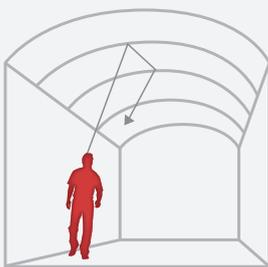
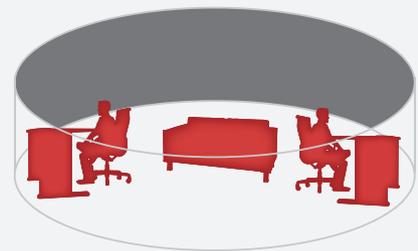
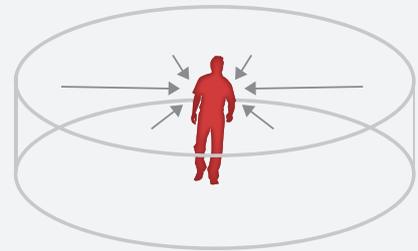
Rooms that are linked by a large opening in between, influence each others sound environment. A room without acoustic regulation can act as an echo chamber reinforcing the sound, when connected to an acoustically regulated room.

Both rooms must be equipped with sound absorbers. If the distance between the opening and the opposite walls is short (5-6 m), the walls must be covered with sound absorbers or diffusers.

## ROUND ROOMS

The sound moves towards the constructive centre thereby creating echoes.

The sound diffusing elements should be placed on the curved surfaces in order for the sound to be dispersed in many directions. The working stations should not be placed in the centre of the construction. In stead, furniture with sound diffusing properties should be placed in the centre.



## VAULTED CEILINGS

In rooms with vaulted ceilings, the sound is concentrated in the constructive centre making the sound appear with a stronger intensity. The sound movements also appear stronger along the curve.

The sound diffusing elements should be placed on the curved surfaces in order for the sound to be dispersed in many directions. The working stations should not be placed in the centre of the construction. In stead, furniture with sound diffusing properties should be placed in the centre.

Barriers should be placed along the curved surface in order to prevent the spread of sound.