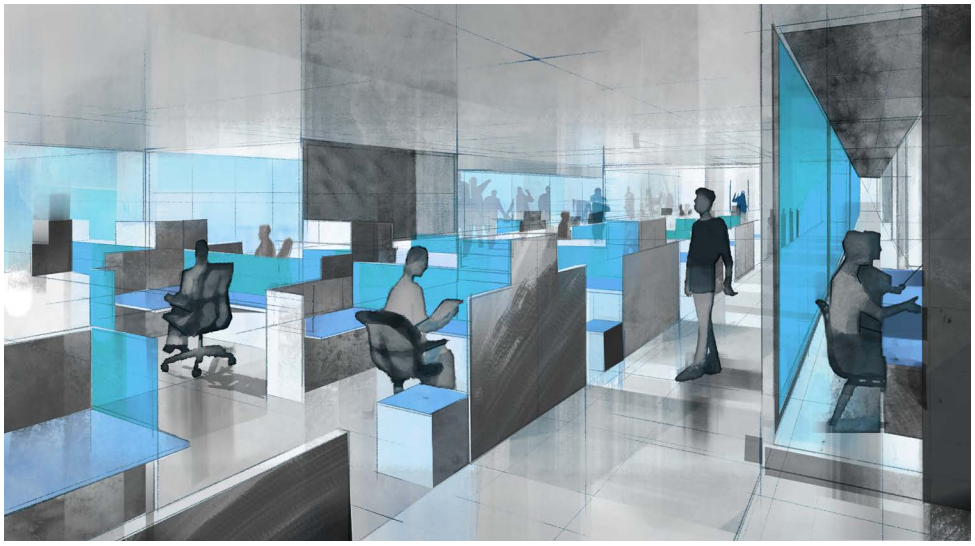

THE SOUND OF PRODUCTIVITY

EXPLORING ACOUSTIC PROPERTIES OF THE MODERN WORKPLACE

BY

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01: Introduction

Two crucial concepts shape the dynamics of office communication: **speech intelligibility** and **privacy**. These concepts can apply to any open-plan or closed offices, meeting and collaboration spaces and can be meaningfully altered through the use of specific acoustics strategies, including surface finishes, sound isolation and background noise levels. Below we'll explore these concepts in two different office scenarios with the help of spatial, three-dimensional sound simulations.

Akamai Headquarters, Cambridge, MA (designed by Sasaki Associates)

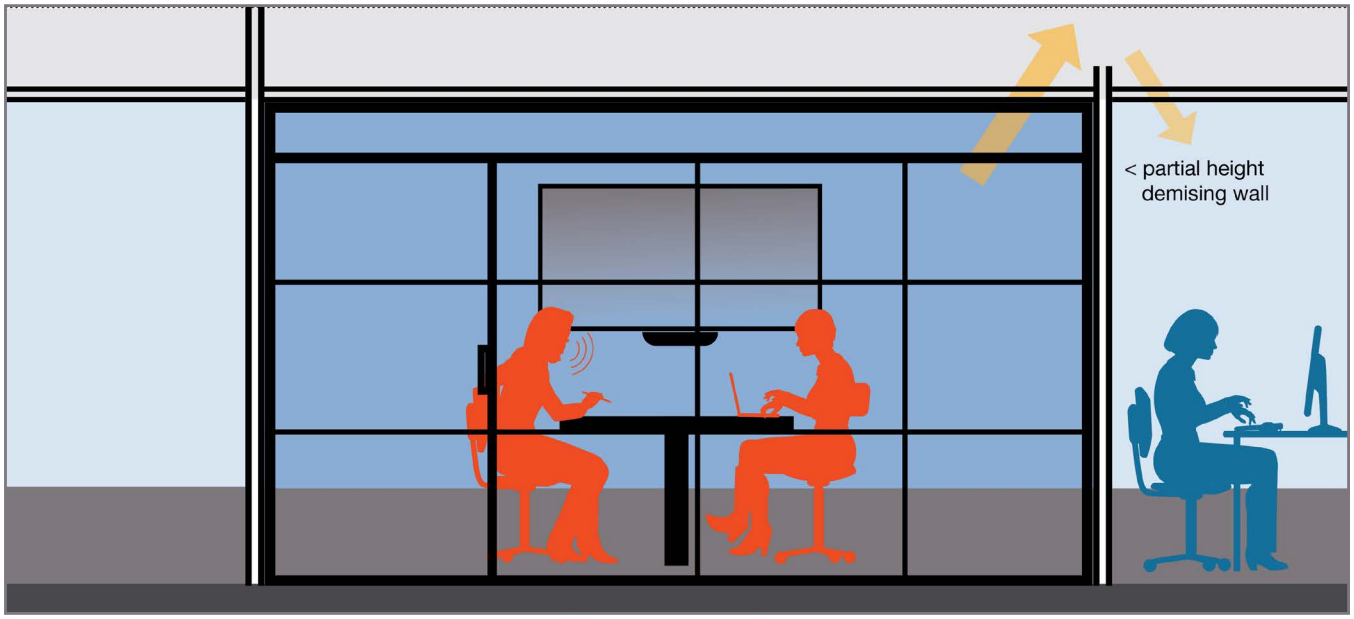
01: Acoustical Design

Before diving into our workplace scenarios, let's first outline the two central concepts we'll be covering. **Speech intelligibility** is our ability to communicate clearly and understand others well within a space, whether physical or virtual. **Speech privacy**, on the other hand, is when we want to obscure the ability to hear and understand well, preserving some degree of privacy in a conversation.

Depending on the space, speech privacy can vary from normal to confidential. Normal speech privacy is defined as "**freedom from distraction**" where conversations nearby are audible and intelligible, but they should not distract someone absorbed in their work. With confidential speech privacy, conversations may be occasionally audible but they are not intelligible.

These concepts are influenced by the three tenets of acoustical design: Absorption, Blocking (or Isolation) and Coverage.

Known as the "ABC's of acoustics," they guide the selection and implementation of our strategies to create environments that are conducive to communication, comfort, and well-being.



The ABC's of Acoustics

A

ABSORB

Sound absorption is achieved through the selection of room finishes. Absorption involves reducing the reflection of sound waves within a room. Excessive reverberation, caused by sound bouncing off hard surfaces like walls, floors, and ceilings, can degrade speech intelligibility, increase background noise levels, and create an uncomfortable listening experience. Sound absorptive surfaces such as acoustic panels, ceiling tiles, drapes, and carpets reduce reverberation and noise build up, enhancing acoustical comfort and normal speech privacy.

B

BLOCK

Blocking, also known as isolation, focuses on preventing the transmission of sound between different areas or rooms. Unwanted noise from adjacent spaces, outdoor sources, or mechanical systems can disrupt activities and compromise privacy. To mitigate this, the use of carefully designed constructions can effectively block the sound and provide the desired degree of speech privacy.

C

COVERAGE

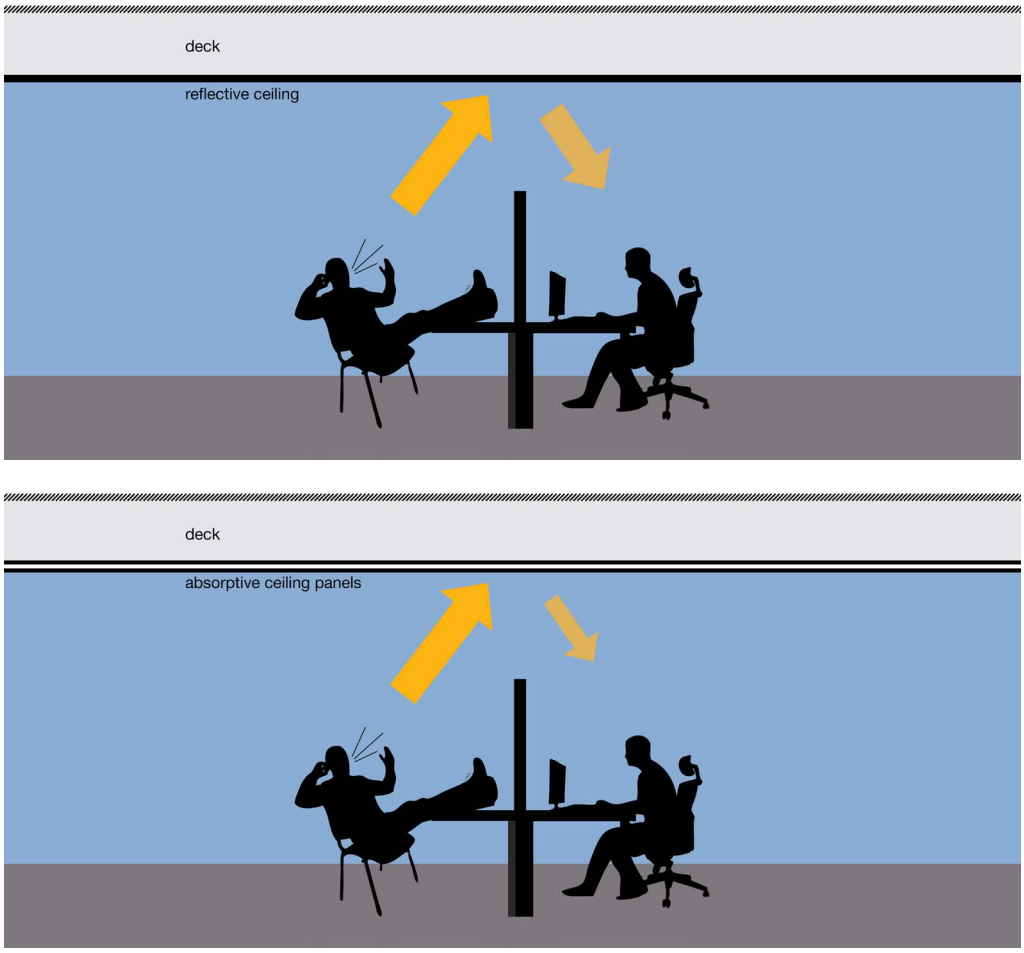
Sound coverage or masking refers to the use of elevated background noise levels, where the noise spectrum is shaped to specifically mask speech frequencies and provide more privacy. Suitable masking noise should be provided by a well-tuned electronic sound masking system as opposed to relying on environmental noises like mechanical systems serving a building. Acoustical design considers factors such as room geometry, and strategic placement of sound masking systems to optimize sound distribution and minimize variations in volume and clarity across different listening areas.

02: Auralization Scenarios

ENVIRONMENT 1: OPEN OFFICE

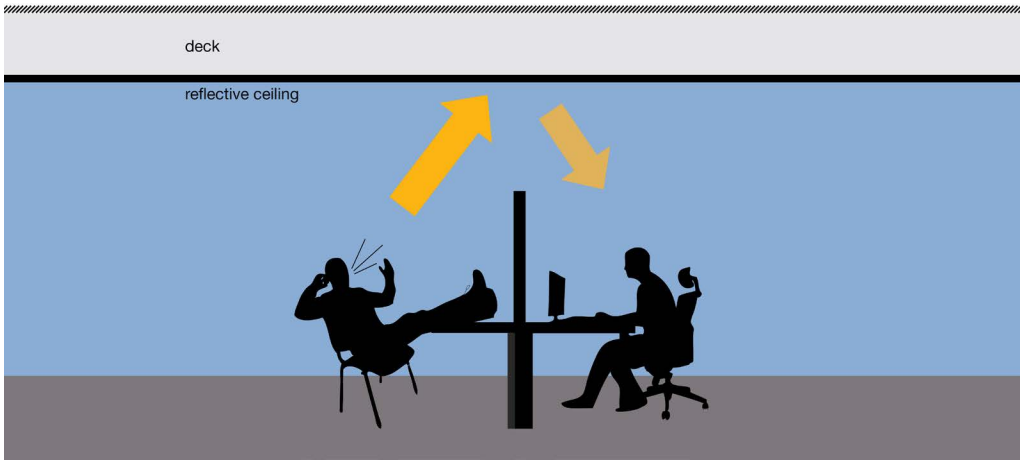
In this first scenario, let's imagine we want to achieve some level of speech privacy and reduced reverberation from environmental sounds within an open office. Through a combination of acoustically absorptive finishes we can create comfort and freedom from distraction for occupants—allowing them to find focus and achieve increased productivity.

Reflective Ceiling vs Absorptive Ceiling



Having a sound absorptive ceiling reduces reverberation and noise build up, enhancing acoustical comfort. It also contributes to normal speech privacy, by minimizing the sound reflections that would otherwise help reinforce any direct sounds.

Workstation Barriers vs No Workstation Barriers

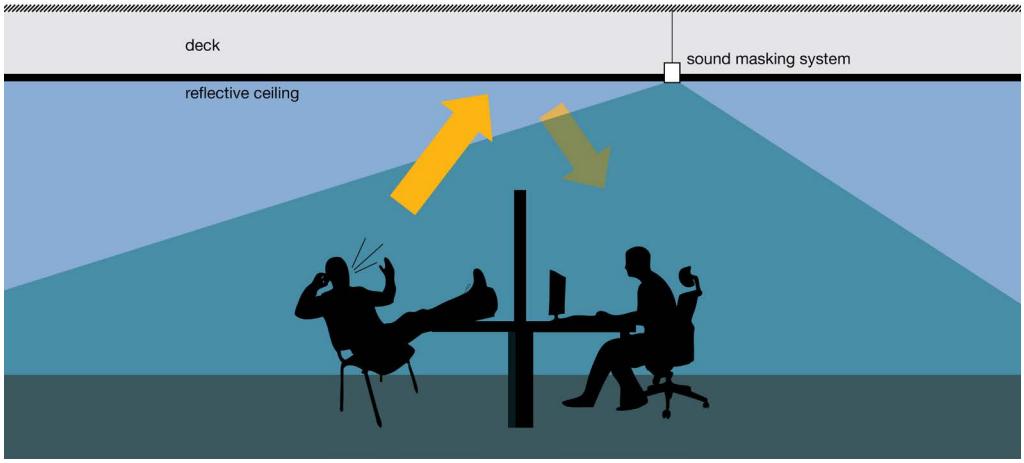


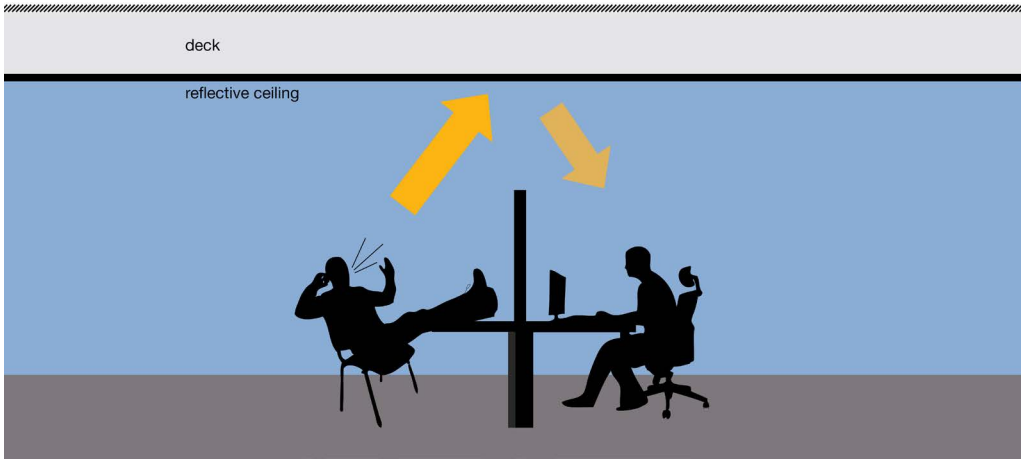
Sound blocking is achieved mostly by partial height dividers, such as cubicle partitions. The addition of work-station barriers has a noticeable effect on speech privacy.

02: Auralization Scenarios

ENVIRONMENT 1: OPEN OFFICE (continued)

Sound Masking On / Sound Masking Off



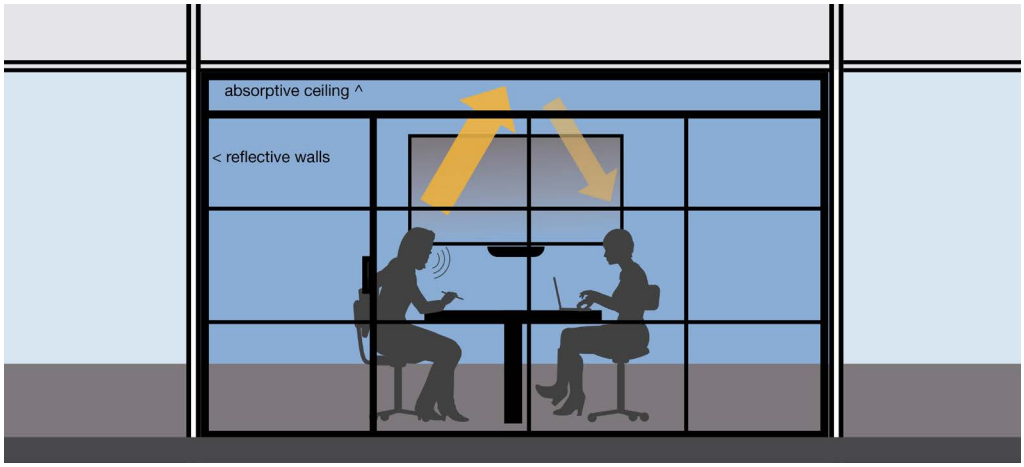


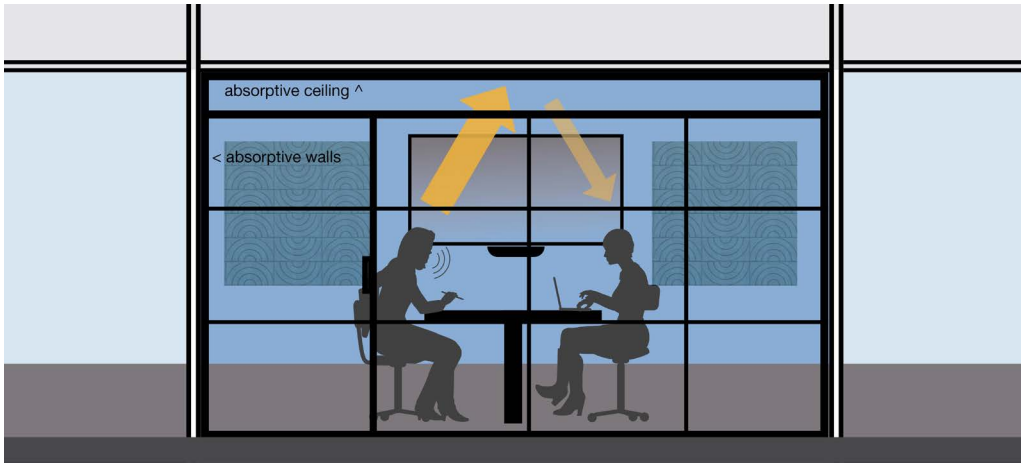
While noise from mechanical systems serving a building can provide some masking, it may not provide sufficient noise in the frequencies of interest for speech privacy (mid and high frequencies). Moreover, these types of noises are not evenly distributed throughout a space, meaning privacy is unreliable. In this scenario, a well-tuned electronic sound masking system is used to provide cover up.

ENVIRONMENT 2: MEETING ROOM

In a meeting room scenario the priorities are high speech intelligibility inside the room while also maintaining confidential speech privacy in neighbouring spaces. We may also need to attune our acoustical design to benefit both in-person and remote "occupants".. In this scenario, speech intelligibility requires a low background noise level from building mechanical systems, and reverberation control inside the room, to allow for a high signal to noise ratio.

Variations on Reflective & Absorptive Ceilings & Walls



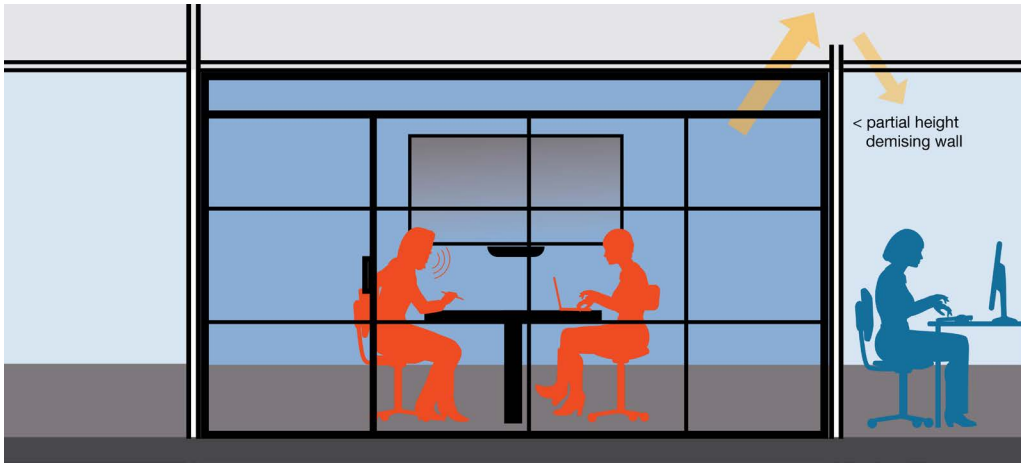


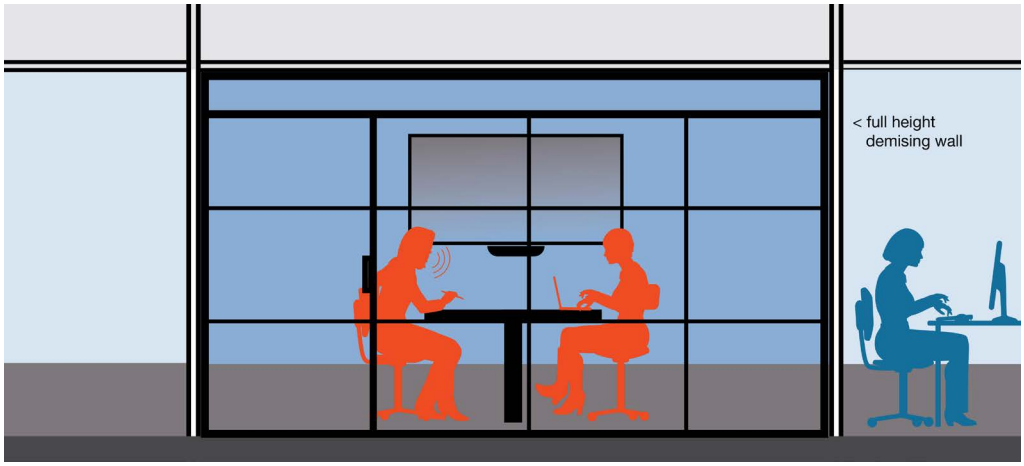
In this setting we may use a combination of absorptive and reflective surfaces to reduce reverberation and noise build up. Notice how different combinations of wall and ceiling treatments have a distinct effect on speech intelligibility.

02: Auralization Scenarios

ENVIRONMENT 2: MEETING ROOM (continued)

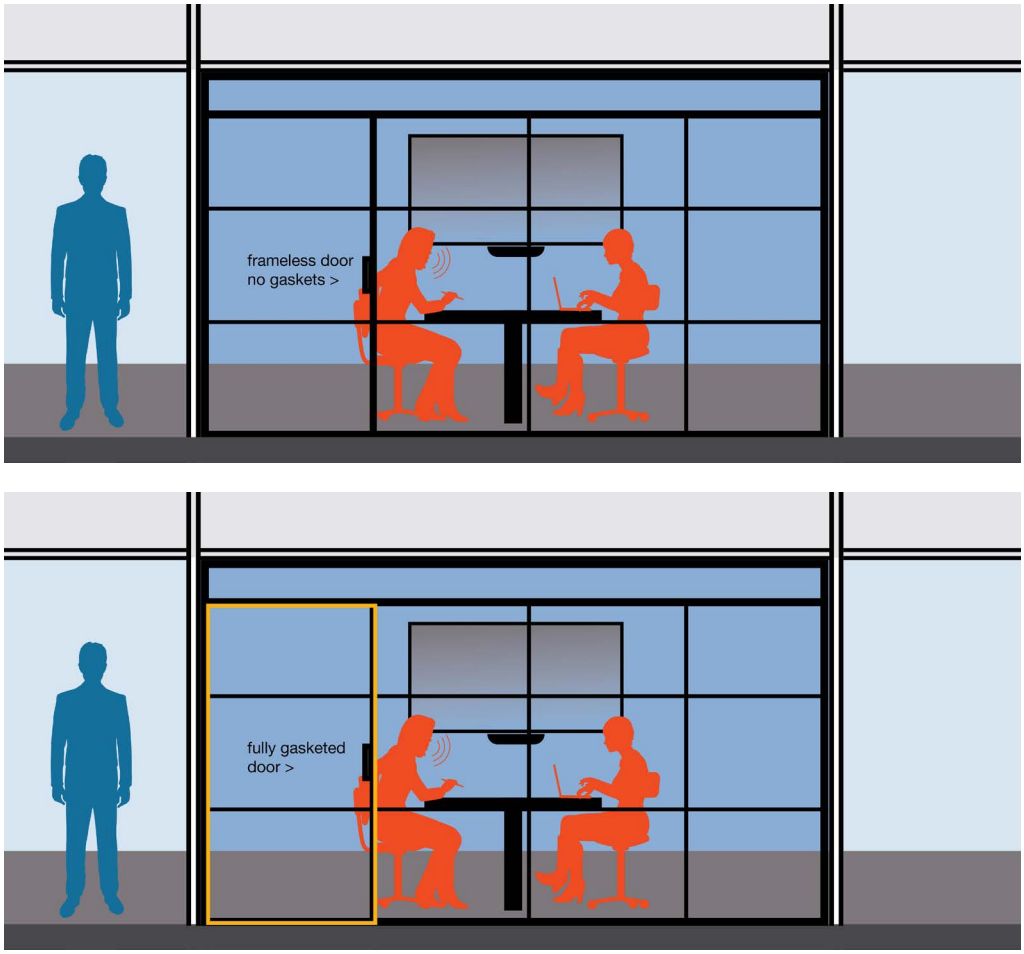
Partial Height Demising Wall vs Full Height Demising Wall





For sound isolation, varying the height of demising walls has a significant impact on speech privacy. Listen to the difference in sound isolation between two adjacent closed rooms, where the demising construction varies from a partition extending only 6" above ACT and a partition extending to the deck.

Frameless Door with No Gaskets vs Fully Gasketed Door

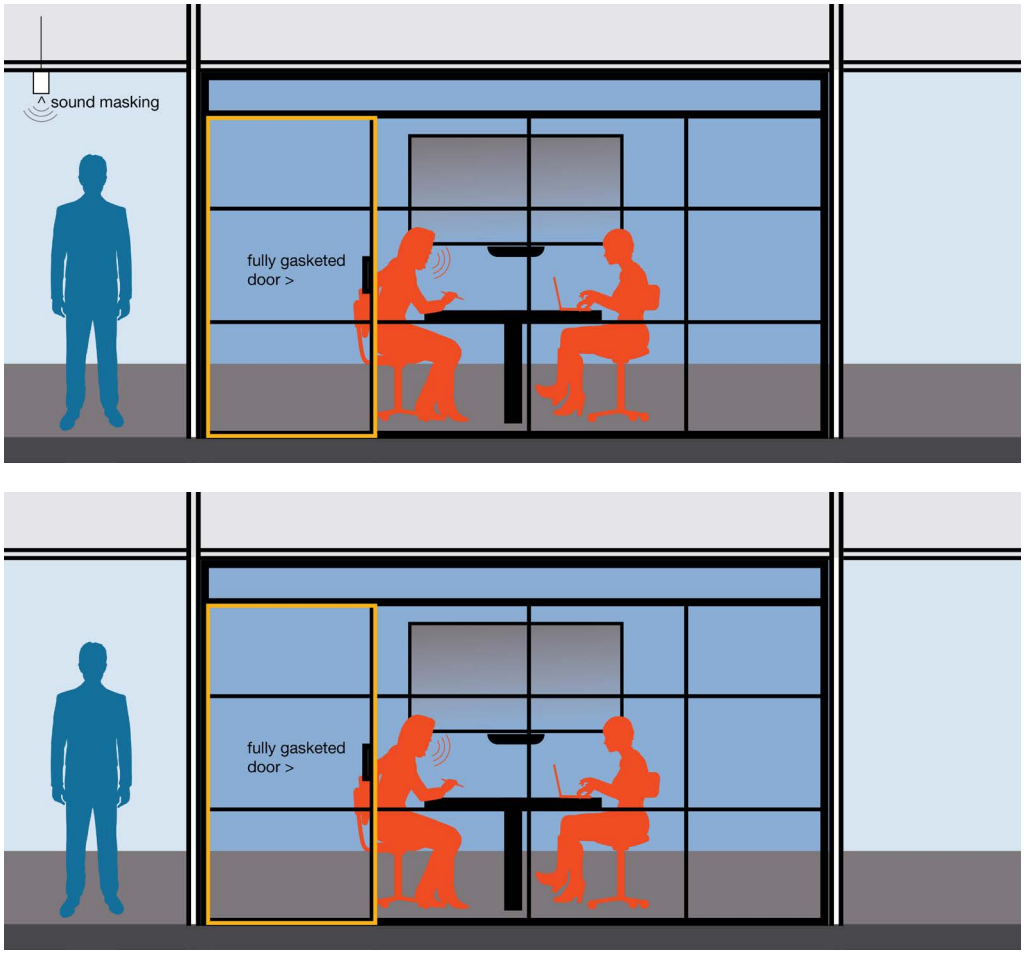


In this setting we may use a combination of absorptive and reflective surfaces to reduce reverberation and noise build up. Notice how different combinations of wall and ceiling treatments have a distinct effect on speech intelligibility.

02: Auralization Scenarios

ENVIRONMENT 2: MEETING ROOM (continued)

Sound Masking On vs Sound Masking Off



Like our open office, sound cover up might also be employed to further improve privacy. Using an electronic sound masking system tuned to interfere with speech frequencies, we can further improve speech privacy between our closed room and the adjacent corridor.

03: Hearing is Believing

All spaces have unique architectural characteristics, and all occupants have unique expectations of acoustics in their environment. Therefore a universal recipe for great office acoustics is not possible. Nevertheless, these concepts and listening exercises are useful by raising awareness of the importance of an intentional acoustic design.

GMO Headquarters, Boston, MA (designed by Nelson Worldwide)

About the author

Ioana Pieleanu is Director of Architectural Acoustics at Acentech, a world-class acoustics, technology, and vibration consulting firm. She is a versatile acoustician and accomplished musician with a background in piano and music studies. She is adept at combining classical acoustics concepts and methods with 3DListening® — Acentech's trademark acoustical modeling technology. Ioana serves as the Market Leader of Acentech's Studio A/Performing Arts practice and Co-Leader of our 3DListening® Services, providing marketing strategy, client development, and industry thought leadership.

"I believe that any challenge, big or small, can have a simple and elegant solution. I also believe in information parity and that there is a better chance to come up with a best solution when all those involved in the process are adequately educated on the subject. With this in mind, I've spent good part of my career sharing without restraint my knowledge in acoustics, and distilling it such as to be comprehensible to those I am sharing it with, regardless of their background. I am thrilled to be able to continue doing this through the Lab @ Acentech portal. "

About the Lab @ Acentech

Innovation is in the Acentech DNA, stretching back to our earliest origins at Bolt Beranek and Newman (BBN). In the early days, BBN was likened to a university faculty where research and development was encouraged, nurtured and supported. A culture of curious and rigorous inquiry lies at the core of what we do, stemming from a desire to advance our knowledge, and share our findings with the world. We are more than a workplace – Acentech is also a research lab, playground, support system, jam space, and vehicle for positive social change.

The Lab @ Acentech is a space where we can share some of the exciting things we have been working on. The projects you will read about are but a small sample of the innovation culture at Acentech. The Lab is where our passion intersects with our clients, colleagues, and future coworkers. The work described herein builds on ideas inherited from our founders, and is nurtured by generations of consultants and scientists along the way. We are delighted to share it with you.

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