Speech Privacy & Sound Masking in modern architecture

Presented By

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Course Description

about this course

This course will increase the student’s understanding of the principles behind speech privacy. Students will learn the fundamentals of how speech privacy is achieved and what metrics are used to measure speech privacy. Participants will also learn what role sound masking systems play within the context of speech privacy.
Learning Objectives
what you will learn

ACOUSTIC PRIVACY
Understand the importance of acoustic privacy in the workplace

SOUND MASKING
Understand what sound masking is and what role it plays in speech privacy

THE ABCs OF ACOUSTICS
Describe the principles involved in the ABCs of good acoustical design

DESIGN ISSUES
Identify some of the major design issues related to speech privacy in open offices, private offices and health facilities

SPEECH PRIVACY
Understand what speech privacy is and how it is measured
Acoustic Privacy

Improved acoustic privacy enhances worker productivity, comfort and fulfills legal requirements.
The Case for **Acoustic Privacy**

worker concerns

<table>
<thead>
<tr>
<th>Acoustic Privacy</th>
<th>Extremely Dissatisfied</th>
<th>Extremely Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office Layout</td>
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<td>Office Furnishings</td>
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<td>Thermal Comfort</td>
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<td>Air Quality</td>
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<tr>
<td>Lighting</td>
<td></td>
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<td>General Satisfaction / Maintenance</td>
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“I currently work in a cubicle – my neighbors are a man in the midst of a divorce, a woman with a problem child, another woman with an elderly parent who should be in a care facility. The only cure for my personal hell would be a quiet room with a door. Perhaps my employer would then get his money’s worth from my workday... did I mention that I am across from the copier?”

-GSA, Sound Matters (2012)

Survey of 25,000 Workers / 2000 different Buildings –
By: Center for the Built Environment
The Case for: Acoustic Privacy

Worker Concerns

• "Very loud. Sound travels too much"
• "Some conference rooms (noise/conversation) carries between them"
• "Some areas are noisy and loud, people can be distracting"
• "Can be noisy sometimes/hard to concentrate"
• “Noise level too high"
“Nearly 80 Hours per year lost productivity due to the distractions of others.”
The ABCs of Acoustics

The elements of effective acoustic design
The ABCs of Architectural Acoustics
the elements of effective acoustic design

**A**
Absorb
i.e., acoustic ceiling tiles, acoustic wall panels

**B**
Block
i.e., cubicle partitions, walls

**C**
Cover
i.e., background noise, sound masking
Furniture & Construction Trends

OPEN PLAN AREA
- Lower partition height
- Denser, smaller cubicles
- More reflective surfaces

ENCLOSED AREA
- Demountable walls
- Fewer walls to the deck
- Increased use of glass
Speech Privacy

What is speech privacy?
How is it measured?
What is **Speech Privacy**?

highlights from decades of scientific research

**Speech Privacy**

speech pri·va·cy (noun)

Speech Privacy is the inability of an unintentional listener to understand another person’s conversation.

- Speech privacy complaints are due to distractions caused by overheard conversations.
- The perceived level of distraction relates directly to the intelligibility of the overheard conversation.
- Intelligibility depends on the loudness of overheard speech compared to the loudness of the background noise.
Signal to Noise **Ratio**
the higher the ratio, the clearer the signal

- **Sound from talker (dBA):** 65, 59, 53, 47
- **Background noise (dBA):** 47, 41, 30

- **Signal to Noise Ratio:** 
  - 47 dBA: Excellent
  - 41 dBA: Good
  - 30 dBA: Fair

*Note: a 15 dB represents excellent speech intelligibility*
What is the **Privacy Index**? how private is my conversation?

- **0%** No Privacy
- **60 - 80%** Minimal Privacy
- **>95%** Confidential Privacy
- **>0 - 60%** Unacceptable Privacy
- **80 - 95%** Normal Privacy

*Goal for private offices*
*Goal for open offices*
Speech Privacy Potential (SPP)

<table>
<thead>
<tr>
<th>Privacy Rating</th>
<th>SPP</th>
<th>Description of Privacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>90</td>
<td>Shouting is barely audible</td>
</tr>
<tr>
<td>Highly Confidential</td>
<td>85</td>
<td>Normal Voices - not audible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Raised Voices - barely audible</td>
</tr>
<tr>
<td>Excellent</td>
<td>80</td>
<td>Normal Voices - barely audible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Raised Voices - audible, mostly unintelligible</td>
</tr>
<tr>
<td>Good</td>
<td>75</td>
<td>Normal Voices - audible, mostly unintelligible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Raised Voices - somewhat intelligible</td>
</tr>
<tr>
<td>Fair</td>
<td>70</td>
<td>Normal Voices - Audible, somewhat intelligible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Raised Voices - Intelligible</td>
</tr>
<tr>
<td>Poor</td>
<td>65</td>
<td>Normal Voices - Mostly intelligible</td>
</tr>
<tr>
<td>None</td>
<td>&lt; 60</td>
<td>No Speech Privacy</td>
</tr>
</tbody>
</table>

Speech Privacy Potential
A measurement used primarily by the GSA to determine speech privacy. The measurement is the sum of the space’s sound isolation (Noise Isolation Class) & background noise (Noise Criteria).
Sound Masking

What is sound masking? What does it sound like?
Sound Masking

**what is it?**

Sound Masking is the process of adding low level background sound to an environment to promote speech privacy and freedom from distractions.

It is believed that one of the earliest examples of sound masking is the Roman’s use of water fountains to mask the sound of chariots on cobblestone streets.

In the late 1950’s and early 1960’s, an acoustical consulting firm in Boston known as Bolt, Beranek, Newman (BBN) pioneered the first electronic sound masking systems.
Sound Masking **Key Elements**

how to establish an effective sound masking system

- **Uniformity**
- **Proper Zoning**
- **Sound Spectrum**
- **Sound Level**
Sound is emitted from an array of loudspeakers, distributing a consistent and uniform sound masking signal. (which sounds much like air movement)

Key Elements: **Uniformity**

uniformity = undetectable
Key Elements: **Proper Zoning**

zones help to meet the requirements of diverse spaces
Key Elements: **Sound Spectrum**

the color of noise: *sound masking is not white noise*

Those in the sound masking industry generally agree on a spectrum for effective sound masking.

When sound masking operates within this spectrum, it is simultaneously effective and unobtrusive.

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**Key Elements:**

- **Sound Spectrum**
- **White Noise**
- **Pink Noise**
- **Masking Noise**
- **Recommended Spectrum**
Key Elements: **Level of Sound**
comparing common noises to masking sound

The graph below gives the decibel level (dB SPL) of common sounds:

- **Quiet Library**: 30 dBA
- **Quiet Television**: 60 dBA
- **Vacuum Cleaner**: 70 dBA
- **Garbage Disposal**: 80 dBA
- **Power Drill**: 98 dBA
- **Sound Masking**: 47 dBA
Sound Masking Myths

setting the record straight

• HVAC noise is a substitute for a sound masking system
• Sound masking can reduce noise that is already too loud (i.e. restaurants/bars)
• Sound masking cancels sound
• Sound masking absorbs other sounds
• Sound masking can block sound
• Sound masking will prevent face-to-face communication
• Sound masking causes headaches, or is otherwise detrimental to health
• Sound masking will interfere with hearing aids or cochlear implants
Design Issues

How can I achieve acoustic privacy in open office environments? What are the best practices for improving acoustic privacy?
Open Office Design: **Privacy**

Privacy Goal: PI = 80 - 95%

Key Parameters for privacy:
- Distance between Talker and Listener
- Ceiling / Room Absorption
- Barrier Effectiveness
- Background Sound Level
Open Office Design: Goals
reducing the radius of distraction
Open Office Design: **Trade Offs**

improve acoustics while preserving aesthetics

<table>
<thead>
<tr>
<th>Acoustic Environment</th>
<th>Sound Masking</th>
<th>Partition Height</th>
<th>Ceiling Tiles (NRC Rating)</th>
<th>Average PI</th>
<th>Average Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Office</td>
<td>No</td>
<td>48”</td>
<td>0.5</td>
<td>58.83%</td>
<td>-</td>
</tr>
<tr>
<td>Increased Absorption</td>
<td>No</td>
<td>48”</td>
<td>0.95</td>
<td>73.79%</td>
<td>$$</td>
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<tr>
<td>Increased Blocking</td>
<td>No</td>
<td>80”</td>
<td>0.5</td>
<td>81.5%</td>
<td>$$$</td>
</tr>
<tr>
<td>Increased Coverage</td>
<td>Yes</td>
<td>48”</td>
<td>0.5</td>
<td>87.25%</td>
<td>$</td>
</tr>
</tbody>
</table>
Other Applications

- Healthcare
  - Patient Rooms
  - Pharmacies

- Finance
  - Retail Banks
  - Call Centers

- Hospitality
  - Guest Rooms
  - Spas

- Venues & Events
  - Houses of Worship
  - Conference Centers

- Legal
  - Law Enforcement Agencies
  - Courtrooms

- Government
  - Secured Facilities
  - Service Centers

- Education
  - Counseling Offices
  - Health Centers

- Retail
  - Showrooms
  - Public Spaces

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Summary
what we have learned today

• Employees and employers both can benefit from increased acoustic privacy.

• Absorption, Block, and Covering define the speech privacy potential of a space.

• Controlling the background sound of an environment with sound masking has the greatest impact on speech privacy and distractions.
Questions & Answers

Go ahead. Ask away.
THANK YOU

See you soon!