



DIPARTIMENTO DI INGEGNERIA INDUSTRIALE

Effect of room acoustics on speech

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This seminar offers a thorough exploration of the intricate relationship between room acoustics and speech communication, spanning three blocks of 4 hours each. It serves as a dynamic platform for the exchange of ideas and ongoing research, fostering discussions among faculty, visiting researchers, and students that extend into the realms of professional and academic careers. By immersing ourselves in these critical components of signal processing and statistical analysis throughout the three blocks of hours, our collective aim is to advance our understanding of the intricate dynamics between room acoustics and speech communication. This exploration contributes significantly to the creation of optimal acoustical conditions, ultimately enhancing the efficiency of both speaking and listening experiences.

Introduction to Speech Acoustics (First Block)

lecture 1

December 11th (Monday) 15.00-17.00 room 7.4 (Viale Risorgimento, 2)

lecture 2

December 11th (Monday) 17.00-19.00 room 7.4 (Viale Risorgimento, 2)

Connessione remota Teams (lectures 1-2) <http://bit.ly/3NiECoi>

This initial block serves as a foundational introduction to the fundamentals of speech acoustics. Participants will delve into the basic principles underpinning the interaction between room acoustics and speech communication, laying the groundwork for a comprehensive exploration of the subsequent blocks. Topics covered include:

- Overview of Speech Acoustics
- Fundamental Principles of Speech Production
- Laryngeal System and Its Functions
- Physical Model of Vocal Fold Vibration
- Glottal Signal
- Calculation of Vocal Tract Resonances (Formants)
- Source-Filter Model
- Articulation and Its Relationship with Formants for Vowels and Consonants



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Vocology and Speech Production (Second Block)

lecture 3

December 14th (Thursday) 11.00-13.00 room 5.2 (Viale Risorgimento, 2)

lecture 4

December 14th (Thursday) 14.00-16.00 room 5.2 (Viale Risorgimento, 2)

Connessione remota Teams (lectures 3-4) <https://bit.ly/3GCmnWQ>

This block focuses on vocology and the intricacies of speech production. Through in-depth lectures and discussions, participants gain insights into how speakers adapt their speech production in response to various auditory feedback, exploring factors such as noise levels, spectral characteristics, reverberation time, acoustic clarity, and artificial augmentation of auditory feedback. Topics covered include:

- Understanding the Lombard Effect
- Evaluation of the Starting Point of the Lombard Effect
- Effects of Voice Style on Speech Production
- Influence of Noise Level on Objective and Subjective Voice Evaluations
- Impact of Acoustic Feedback on Speech Production
- Effect of Room Acoustics on Speech Production
- Vocal Doses and Parameters in Classroom Environments
- Changes in Voice Production in Artificial Acoustic Environments
- Singing Voice Production and Room Acoustics
- Accuracy of Quantities Measured by Vocal Dosimeters
- Reproducibility of Voice Parameters: Room Acoustics and Microphones
- Measurement of Speech: The Effect of Room Acoustics
- Reproducibility of Voice Parameters in Various Room Acoustic Conditions

Speech Intelligibility (Third Block)

lecture 5

December 20th (Wednesday) 9.30-11.30 room 7.6 (Viale Risorgimento, 2)

lecture 6

December 20th (Wednesday) 11.30-13.30 room 7.6 (Viale Risorgimento, 2)

Connessione remota Teams (lectures 5-6) <https://bit.ly/46MCqfp>

The final block concentrates on unraveling the impact of room acoustics on speech intelligibility. Engaging lectures and discussions explore research studies investigating the intelligibility of different speech types—ranging from normal voice quality to dysphonic, diverse foreign accents, and various articulations—across a spectrum of room acoustic conditions. Topics covered include:

- Speech Intelligibility and Room Acoustics in Children
- Investigating Speech Intelligibility in Primary School Classrooms
- Enhancing Students' Understanding in Classrooms with Dysphonic Voice
- Speech Intelligibility and Room Acoustics in Adults
- The Lombard Effect, Intelligibility, Ambient Noise, and Preferences in Restaurants
- Intelligibility of Dysphonic Speech in Auralized Classrooms