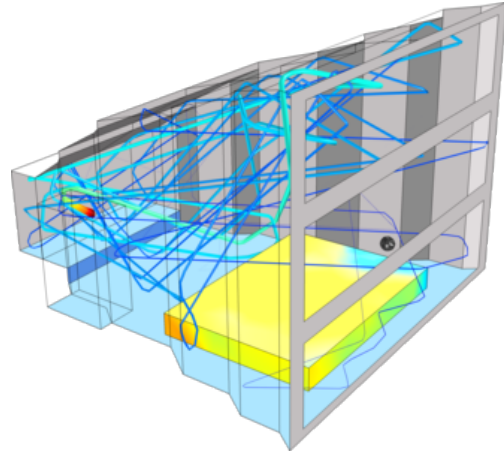
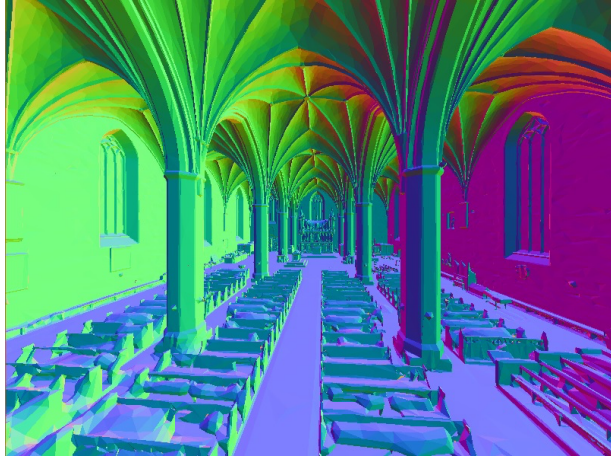




## Room acoustics modelling in a medieval church using COMSOL



### Objectives

The church of Vadstena is under investigation by researchers who try to virtually restore the monument. A “restoration” of the old sound field of the church during operation is developed at the same time by LTH-Acoustics. The geometry of the church will be used for a set of acoustic simulations which model the sound propagation in the space and calculate the impulse response on certain positions. Room acoustic parameters such as RT, EDT, Clarity, etc will be investigated as well.

- **Main challenge**

To develop a good acoustic model, based on simplicity of geometry, optimization of the ray tracing method and settings, as well as good comparison with measured data in certain key positions of the church.

- **Research questions**

Which parameters affect significantly the room acoustics model? And how do we interpret the calculated acoustic metrics? E.g. is the acquired RT60 and C80 appropriate for such a space? How do those values compare with similar spaces or music spaces for choirs?

- **Expected outcome**

The target is to create a working acoustic model, which will provide valuable information of the church’s acoustics and sound propagation.

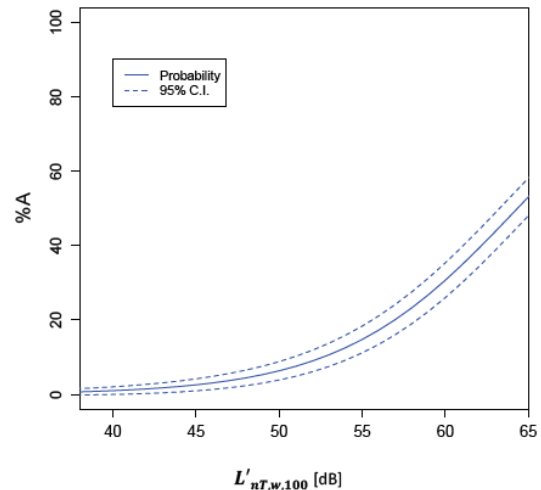
### Student profile (1-2 persons)

This is a project for students interested in acoustics, both theory and application. You like to explore further room acoustics but also gain hands-on experience with acoustic measurements and computer modelling.

<b>Contact:</b>	Nikolas Vardaxis	nikolas.vardaxis@construction.lth.se
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## Soundscapes data analysis: perception in Swedish apartments



### Objectives

Flat owners or renters still complain about various factors related to the sound environment at home. Better prediction of residents' perception in apartment buildings is demanded, especially after the entry of wooden buildings in the construction industry of Sweden. During this project, measured data from airborne and impact sound in flats is gathered. Then it is compared to subjective annoyance data of building's occupants (questionnaire survey).

- **Main challenge**

To develop an acoustic comfort model, derived from statistical associations between building acoustic data and noise annoyance data.

- **Research questions**

Which types of noise dominate the soundscape and mostly affect subjective annoyance in flats? What other factors play a big role in perception of sound environment at home? How do those factors relate to the building acoustic descriptors  $D_{nT,w,50}$  and  $L'_{nT,w,50}$ ? What about other acoustic metrics?

- **Expected outcome**

The target is to build statistical models which describe the relation between measured acoustic data and subjective perception of residents.

### Student profile (1-2 persons)

This is a project for students interested in acoustics and data analysis. You like to explore further building acoustics, gain hands-on experience with ISO measurements and data analysis.

<b>Contact:</b>	Nikolas Vardaxis	nikolas.vardaxis@construction.lth.se
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## Building acoustics investigation of wooden components



### Objectives

Concrete and wooden building components differ regarding their acoustic behavior. This project concerns investigation of modern CLT (or other wooden) floors, walls and junctions in order to study which configurations offer the best sound insulation conditions. Measured data from airborne and impact sound in CLT flats or in a lab setup will be gathered and analyzed accordingly.

- **Main challenge**

To explore how the parameters of different building component configurations affect their acoustic behavior and sound insulation efficiency.

- **Research questions**

Which parameters play a big role for sound insulation in wooden elements and what acoustic environment do they offer? Relation to building acoustic descriptors  $D_{nT,w,50}$  and  $L'_{nT,w,50}$ ? Which design principles and configurations work better?

- **Expected outcome**

The target is to build a comparable dataset of various acoustic measurements from wooden elements and analyze their characteristics.

### Student profile (1-2 persons)

This is a project for students interested in acoustics and data analysis. You like to explore further building acoustics, gain hands-on experience with ISO measurements and data analysis.

<b>Contact:</b>	Nikolas Vardaxis	nikolas.vardaxis@construction.lth.se
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## Master Thesis Project in Acoustics

### *Binaural recordings and listening tests of different room acoustic environments*

### Company Description

Ecophon offer acoustic solutions that meet the increasing demands of a good sound environment, where people work and communicate – it can be offices, education premises, healthcare institutions, industries or other commercial environments. Our daily work is always based on a conviction, that is summarized in our mission.

*Our mission is to contribute to a good working environment for the eye, the ear and the mind.*

### Research Objectives

- What is the **main challenge**?

To investigate the correlation between subjective and objective evaluation of different room acoustic environments. Subjectively by listening tests and objectively by measuring relevant room acoustic parameters.

- What are the **key objectives/questions** that need to be answered?

This challenge is important for us to solve because we need to know how people experience different kinds of acoustical design. This is of importance in the development of new acoustic products. We would like you to perform listening tests in rooms with different acoustic design and compared these with acoustic measurements. The Master Thesis work is part of a larger research project. The resources needed for the projects are available at Ecophon in Hyllinge where the measurements are supposed to take place.

- What would be the **ideal/expected** outcome?

Our expected outcome of the project is an evaluation of the listening tests and the measurements, showing the effect of different room acoustic treatments.

### Student Profile

This is a master thesis work for you who have an interest in acoustics and how people experience different environments. You also like to use your engineering knowledge in practice.

The work can be done individual or in a group of two students.

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## Master thesis project in acoustics

### Investigation of acoustic comfort in indoor multi-room spaces

#### Company description

Brekke & Strand Akustik AB is an independent and focused specialist company with acoustics, noise and vibrations as its field of expertise. Our continued focus on technical expertise, independence, cost-effectiveness and good customer service ensures that we can contribute among the largest and most prestigious acoustic tasks.

#### Research objectives

Indoor spaces may feature interconnected rooms each with different sound sources. Think about a foyer of a hotel, the entrance of V-huset at LTH or a private house on two floors: various spaces are connected via openings in walls or via corridors, with or without doors. Those who use these spaces may, from an acoustical perspective, have conflicting needs: relax, study, listen to music, etc.

- What is the main challenge?

To investigate the ability of different numerical solutions in predicting the acoustic comfort of a space. To investigate some real-case scenario and propose improved solutions (acoustic comfort is tentatively defined as the amount of unwanted sound pressure level one person is subject to; the higher unwanted sound pressure level, the lower acoustic comfort is).

- What are the key objectives/questions that need to be answered?

The challenge in this project is to compare acoustic diffusion equation, ray tracing and statistical energy analysis for acoustical simulation of large open spaces. Commercial (COMSOL) and free software is available for the student.

- What would be the ideal/expected outcome?

The expected outcome of this project is a step forward in the comprehension of practical differences of using different numerical methods to evaluate acoustic comfort in complex spaces, showing their strengths and weaknesses.

#### Student profile

This is a master thesis work for you who have an interest in acoustics and both in its theory and application. You like to learn new things by reading documents and by communicating with colleagues. You enjoy communicating what you have learnt to other experts in the field. This work is for a single student.

Contact: Mathias Barbagallo ([mba@brekkestrand.se](mailto:mba@brekkestrand.se) / [mathias.barbagallo@construction.lth.se](mailto:mathias.barbagallo@construction.lth.se)) and Marcin Brycki ([mbr@brekkkestrand.se](mailto:mbr@brekkkestrand.se))

## Master thesis project in acoustics

### **Determination of sound power and sound pressure in different conditions and with different methods.**

#### **Company description**

Brekke & Strand Akustik AB is an independent and focused specialist company with acoustics, noise and vibrations as its field of expertise. Our continued focus on technical expertise, independence, cost-effectiveness and good customer service ensures that we can contribute among the largest and most prestigious acoustic tasks.

#### **Research objectives**

Sound power level (SWL) is a key quantity in acoustics as it allows to describe objectively a sound source i.e. regardless of the acoustic environment where it is located. Knowing SWL, sound pressure level (SPL) at various positions may be calculated. SWL is determined either via sound intensity or via sound pressure measurements, accordingly following different standards.

- **What is the main challenge?**

To investigate the differences in determining SWL via different standards, different instruments (microphone, intensity probe and acoustic camera) and in different scenarios both in lab and in the field. Moreover, to investigate the difference between calculations and measurements of SPL.

- **What are the key objectives/questions that need to be answered?**

The determination of SWL and the estimation of SPL from a given sound source is a key task that acoustic consultants meet in their daily job. Different measurement conditions, different measured objects, different instruments may give different estimates for SWL and accordingly different calculated SPL, thus putting at risk the reliability outdoor noise studies.

- **What would be the ideal/expected outcome?**

The expected outcome of this project is a step forward in the comprehension of practical differences of using different approaches to determine SWL and compute SPL at distance.

#### **Student profile**

This is a master thesis work for you who have an interest in acoustics and both in its theory and application. You like to learn new things by reading documents and by communicating with colleagues. You enjoy communicating what you have learnt to other experts in the field. This work is for a single student.

Contact: Mathias Barbagallo ([mba@brekkestrand.se](mailto:mba@brekkestrand.se) / [mathias.barbagallo@construction.lth.se](mailto:mathias.barbagallo@construction.lth.se)) and Marcin Brycki ([mbr@brekkestrand.se](mailto:mbr@brekkestrand.se))