



Presentation of acoustics of vanished concert halls in an exhibition on music history of Helsinki

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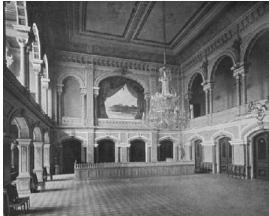
³Helsinki City Museum

Introduction

- Exhibition at Helsinki City Museum 3/2015-
- History of music lovers, listeners and enthusiasts
- One aim of the exhibition: an audible experience of concert halls from 19th century Helsinki

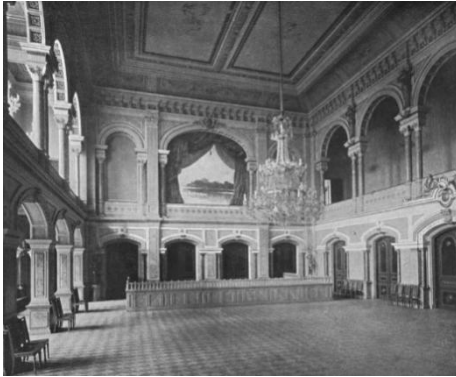


Vanished concert halls of Helsinki

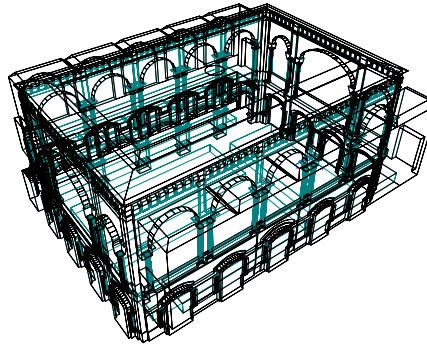
| Hall | Time in use | Reason for vanishing | Picture |
|--|-------------|---|---|
| Main Auditorium of the University of Helsinki | 1832–1944 | Air raid of the Continuation War in 1944, rebuilt and enlarged in 1944–1948. |  |
| The 1st Banquet Hall of the Hotel Societetshuset | 1833–1862 | Changed into hotel rooms in 1862. |  |
| The 2nd Banquet Hall of the Hotel Societetshuset | 1863–1887 | Enlarged in 1887. The original roof is still existing in the assembly hall of Helsinki City Hall. |  |
| The Banquet Hall of the Voluntary Fire Brigade House | 1889–1907 | Altered to assembly hall of Finnish Parliament in 1907. The building was demolished in 1967. |  |



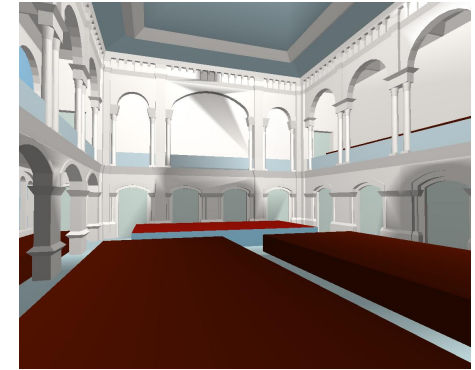
Multidisciplinary procedure



1. Architectural history



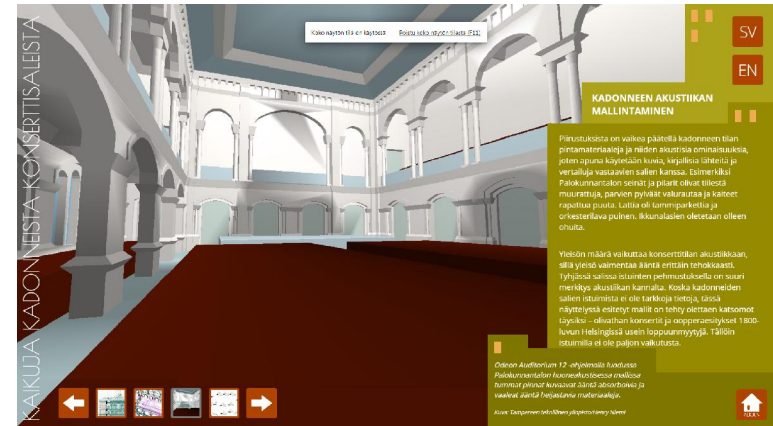
2. Geometrical modelling



3. Room acoustical modelling



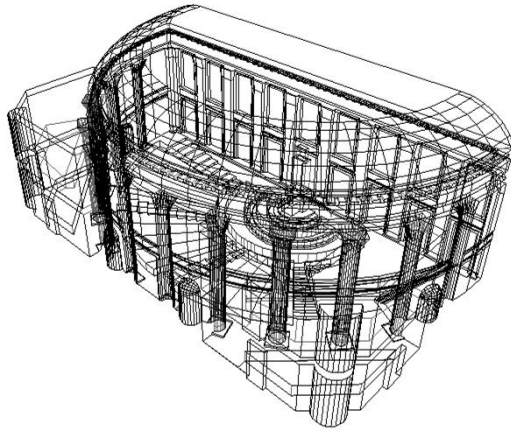
4. Composition, size and seating arrangements of the orchestras



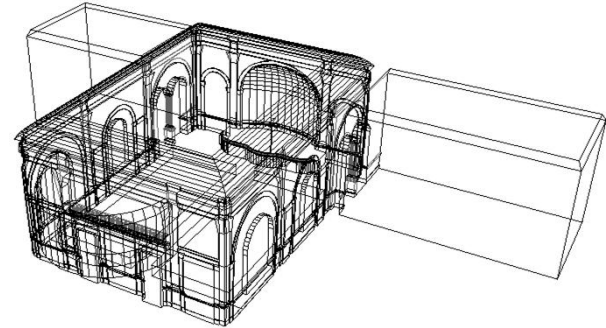
5. Presentation in the exhibition



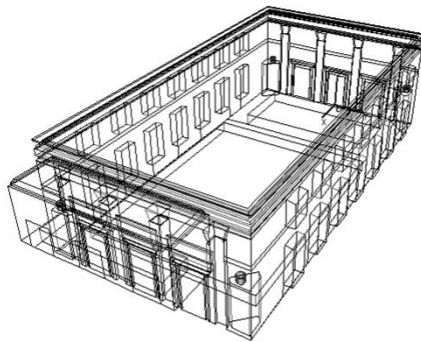
Geometrical modelling



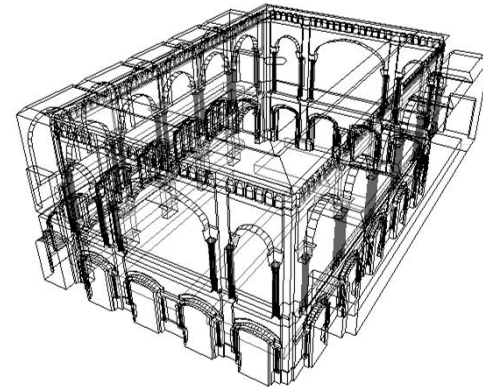
Main Auditorium of University of Helsinki



2nd Banquet Hall of Hotel Societetshuset



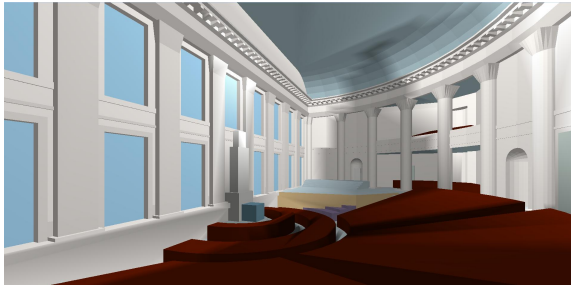
1st Banquet Hall of Hotel Societetshuset



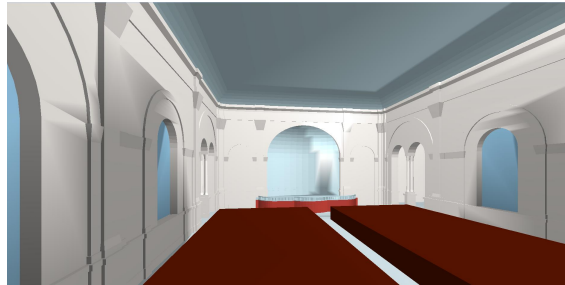
Banquet Hall of Voluntary Fire Brigade House



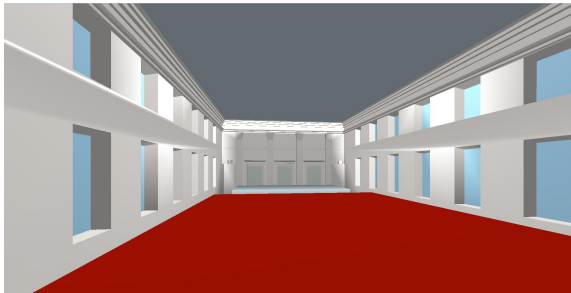
Room acoustical modelling



Main Auditorium of University of Helsinki



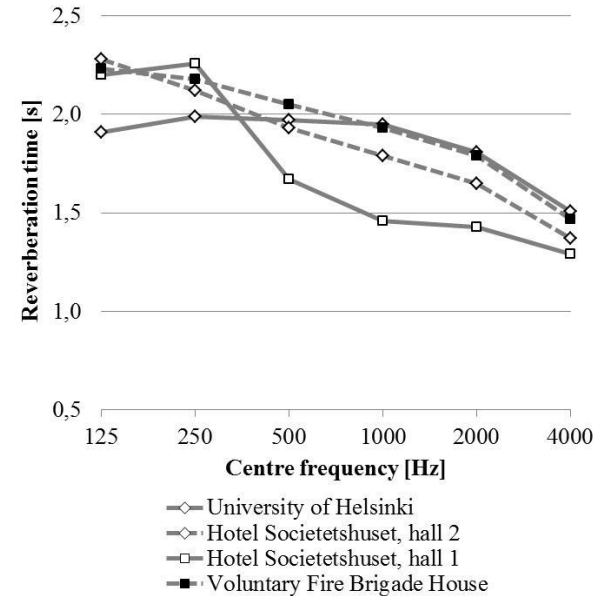
2nd Banquet Hall of Hotel Societetshuset



1st Banquet Hall of Hotel Societetshuset



Banquet Hall of Voluntary Fire Brigade House



Curves and parameters are interesting. **But how do the halls sound?**



Auralization

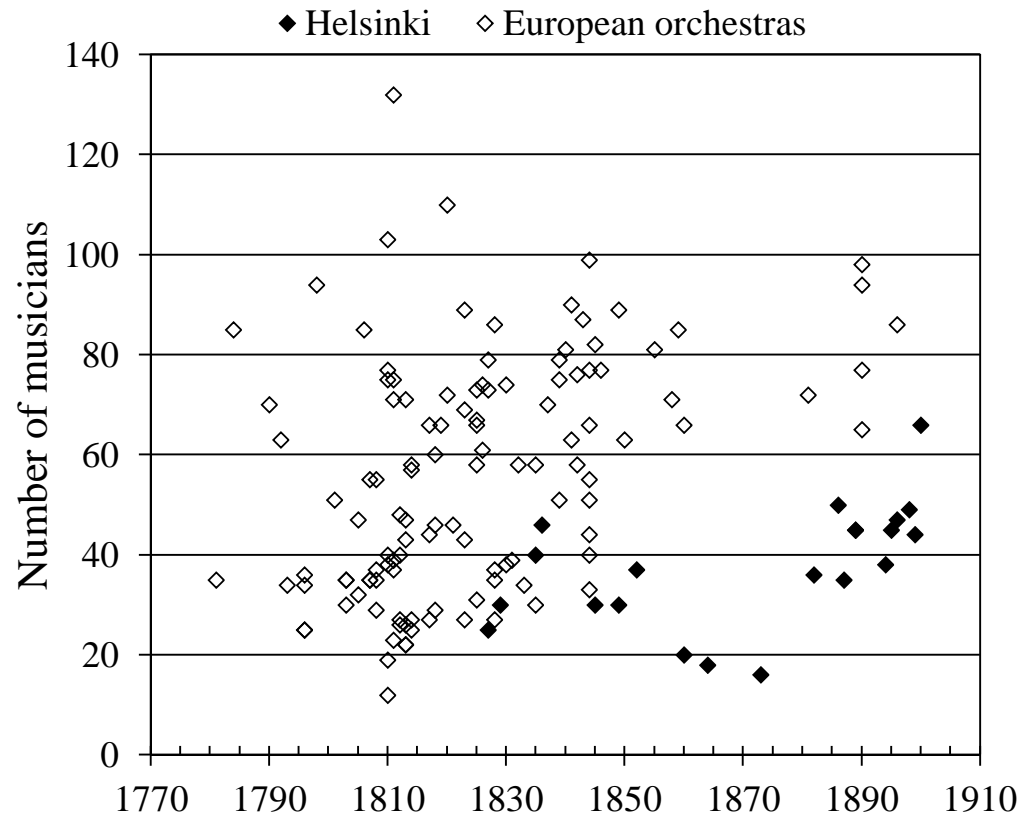
- Vorländer 2009: “Auralization is the technique of creating audible sound files from numerical (simulated, measured, or synthesized) data”
- Room acoustical modelling produces an impulse response of a room
 - Impulse \approx clapping of hands in a room
 - Response \approx decaying sound in a room
- If impulse was replaced by an anechoic recording of some sound, response corresponded to decay of that sound in a room
- Anechoic recordings of orchestras:
 - J. Pätynen, V. Pulkki, T. Lokki: Anechoic recording system for symphony orchestra. Acta Acustica united with Acustica 94, 856–865 (2008).
 - J. Pätynen, T. Lokki: Directivities of symphony orchestra instruments. Acta Acustica united with Acustica 96, 138–176 (2010).
 - Work: Beethoven’s 7th Symphony, 1st movement



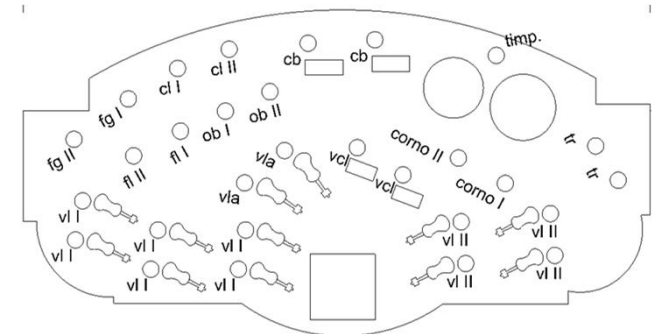
Test person screaming in an anechoic chamber



Seating arrangements and sizes of auralized orchestras



| Hall | Size of the orchestra |
|------------------------------|-----------------------|
| University Main Auditorium | 50 |
| Hotel Societetshuset I | 31 |
| Hotel Societetshuset II | 29 |
| Voluntary Fire Brigade House | 34 |



Seating arrangement in the 2nd Banquet Hall of Hotel Societetshuset



Presentation in the exhibition



Let's listen to the first movement of [Beethoven's 7th Symphony](#)

Whenever the picture changes, also the place or hall and the acoustics change



Auralization as augmented reality?

- Most applications of augmented reality are connected with visual reality
- Audio augmented reality has been defined as introduction of artificial sound material into the real world
 - Sound reinforcement?
 - Assisted reverberation systems?
- Our auralizations augmented the visualization of vanished buildings by adding an aural sensation to them



Thank You for Your
attention!

Questions?

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