



Aalto University
School of Electrical
Engineering

Acoustics seminar ELEC-E5631

Introduction

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These slides

- Learning targets for the seminar
- Scientific and review articles
- Writing seminar article, requirements, tools, tips
- Deliveries, Peer review, Grading

Learning targets

- Learn to read scientific articles in the field of acoustics
- Learn to digest the information, compare different articles, see the topic in larger view
- Learn to write a technical document on the topic
- Learn to make a scientific talk

All this is needed: first in MSc project, then in engineering work

Scientific article

The vehicle of dissemination of academic knowledge to everybody interested. In academic world articles are public by default, firms and some other bodies may have secret articles also.

- Title: What is this paper about, important when people are searching for relevant articles
- Abstract: what was done and what was found
 - One paragraph, summarising everything in the article
- Introduction: What is the problem, why don't we know the answer yet, how do we approach it?
- Background: earlier relevant work by us and others
- Methods, "name of the new technique", etc
 - Novel part: describe what did you do in a way that somebody can repeat it
- Evaluation, Results: What did we measure, how does the new technique perform, curves, graphs, error measures, graphics whatever
- Discussion: how does this compare to others, why did we get different results from the others?
- Conclusions: what is the novelty, what did we find expressed in concise sentences.

Review article

Summary of several articles, commenting the state of knowledge, what is known and what is not known.

- Title: Defines what is being reviewed
- Abstract
 - One paragraph, summarising everything reviewed
- Introduction: What is the problem area
- Review sections
- Discussion of many scientific articles
- Comparison and combination of knowledge from different sources
 - No novel part
- Summary: what did we learn with this review

Seminar articles in this course

- Review articles on topics within Spatial sound
- 10 pages for MSc students, 15 pages for PhD students
- LaTeX template

Topics 1: Spatial sound perception

- Psychoacoustics
 - Perception of direction
 - Perception of distance
 - Perception of moving sources
 - Spatial unmasking
 - Immersion (\approx "this is true, not reproduced")
 - Incoherent ear canal signals (fluctuation of cues) (reserved)
- Computational modeling of perception
 - ITD-ILD models
 - Modeling of neural mechanisms
 - Spectral cue modeling

Topics 2: Reproduction

- Ambisonics for loudspeakers (FOA and HOA)
- Ambisonics for headphones, with enhancements
- Parametric reproduction of room impulse responses
- Impulse-response-based 6DOF reproduction of spatial sound
- Continuous signals: 6DOF reproduction of spatial sound
- Parametric and adaptive reproduction (DirAC, HARPEX, COMPASS etc)
- Multichannel loudspeaker setups (MSc)
- Sound field control (e.g. hot spots / cold spots)
- User interfaces for spatial audio production (MSc)
- Stereo - multichannel upmixing
- Multichannel microphone techniques and spatial audio quality

Topics 3: Spatial audio

- Synthesis methods
 - Binaural techniques: HRTFs, head tracking, quality evaluation
 - Wave field synthesis
 - Amplitude panning, time-delay panning
 - Spatial audio effects
- Visualisation of recorded spatial sound (MSc)
- Room response modeling in virtual reality
- Source directivity modeling in virtual reality (MSc)

You can also suggest a topic of your interest. You should then have knowledge of 1-3 big articles in that field.

Timeline

- March 4. Topics dealt after lecture
- March 18 Outline and some references
- April 13 First draft (some text and references)
- April 25 Second draft (more text and figures)
- May 9 Full paper (all text and figures)
- May 14 peer reviews
- May 17 Final revised paper, Presentation slides,

Introductory lectures

- 4.3 Spatial sound perception: auditory cues, and modeling of hearing. Quality evaluation of spatial sound. **Pedro Llado**
- 11.3 Spatial audio: capture, modification and synthesis. **Ville Pulkki**
- 18.3 Research towards efficient VR audio engines: Heuristic and AI-based approaches **Georg Götz**
- 25.3 Parametric time-frequency-domain spatial audio applications in compression of Ambisonic signals (Chris) and in hearing aids (Janani) **Chris Hold & Janani Fernandez**

Assistive tools

- Search articles
 - scholar.google.com: search by title, search articles that refer to an article
 - AES online library
- You should also use some advanced tools for text writing
 - ChatGPT
 - grammarly
- Caution: the use of AI is ok. But..
 - Facts have to be checked: AI quite often is hallucinating
 - References have to be flawless in seminar papers. AI does not generate them.

Grading

Deliverables:

- seminar article
- introductory talks are mandatory / 1 no-show ok / if more then extra work
- 2 peer reviews on papers assigned to you
- making good a comment/question on the presentation of the papers you peer reviewed
- I will grade the articles
- I will grade the peer reviews

Questions?