

Tutorial: Interactive low-delay audio processing using the open source toolbox for acoustic scene creation and rendering (TASCAR)

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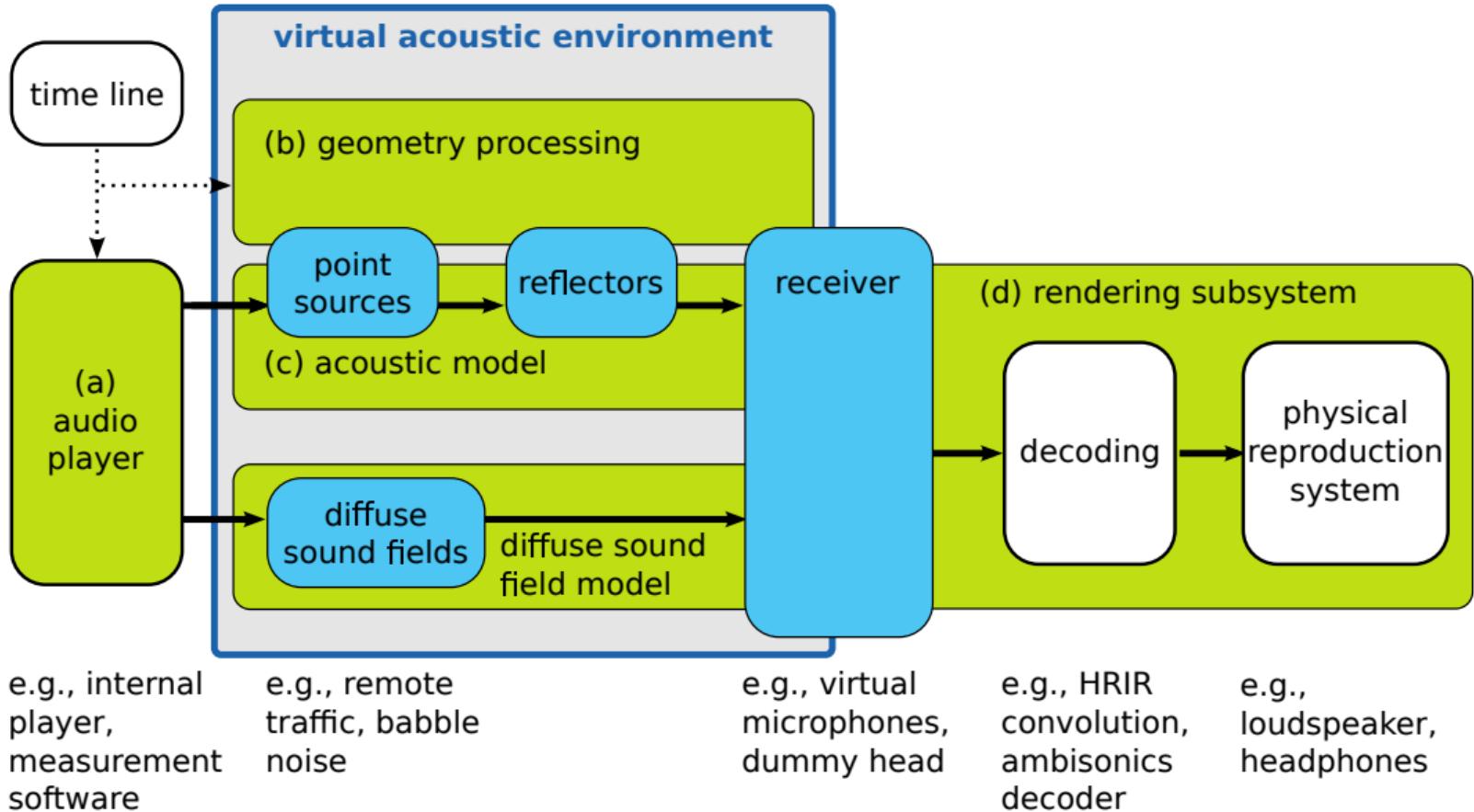
- 1 Introduction
- 2 TASCAR basics: a bit of live coding
- 3 Hearing aid benefit
- 4 Coupling to a game engine
- 5 TASCAR on stage: spatialization and in-ear monitoring

TASCAR

Toolbox for Acoustic Scene Creation And Rendering

- Installation (Ubuntu 14.04, 16.04, 18.04):
<http://install.tascar.org/>
- Workshop material:
<http://github.com/gisogrimm/iia2019/>
- Virtual Acoustic Environments
- Interactive, Real-time Rendering
- Moving sources, Acoustic modelling
- Text based Scene design





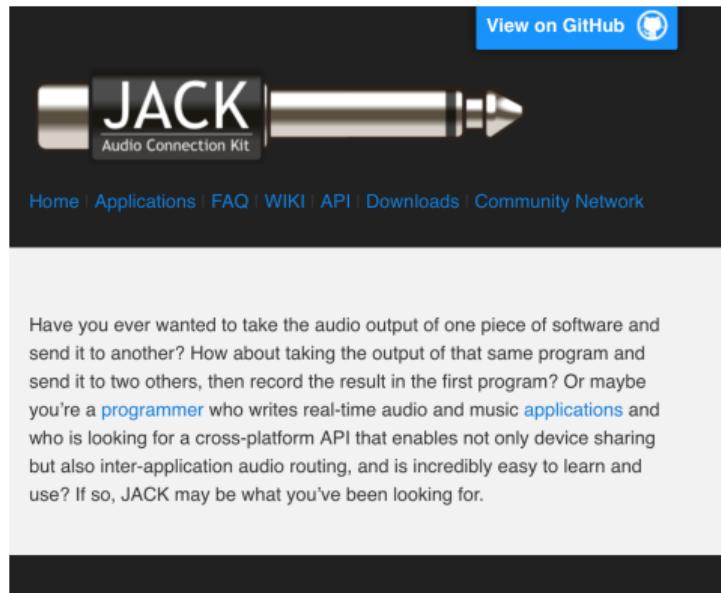
TASCAR is built on Jack. But who is Jack?

Jack is used for:

- Link between audio player and acoustic simulation
- Routing from TASCAR to hardware
- Streaming from/to Matlab
- Embedding of diffuse reverberation
- Time line of audio and data logging

<http://jackaudio.org/>

Front ends: qjackctl and patchage



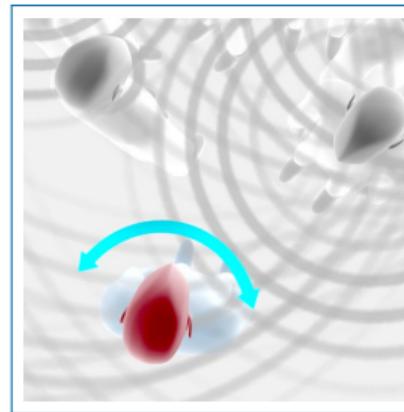
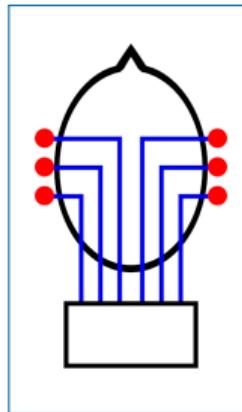
The screenshot shows the official website for JACK (Audio Connection Kit). At the top right is a blue button labeled "View on GitHub" with a GitHub icon. Below the header is a large graphic featuring a central "JACK" logo with "Audio Connection Kit" underneath, flanked by two stylized audio jacks. The main navigation menu below the header includes links for Home, Applications, FAQ, WIKI, API, Downloads, and Community Network. The main content area contains a paragraph of text about JACK's capabilities, followed by a large black horizontal bar at the bottom.

Have you ever wanted to take the audio output of one piece of software and send it to another? How about taking the output of that same program and send it to two others, then record the result in the first program? Or maybe you're a [programmer](#) who writes real-time audio and music [applications](#) and who is looking for a cross-platform API that enables not only device sharing but also inter-application audio routing, and is incredibly easy to learn and use? If so, JACK may be what you've been looking for.

TASCAR basics:

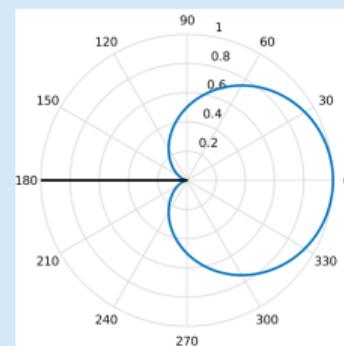
a bit of live coding

Hearing aid benefit



Largest benefit of hearing aids is achieved by directional microphones

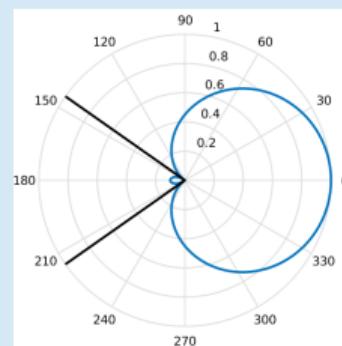
- Adaptive Differential Microphone
(Elko & Pong, 1995)
- Directivity adapted to minimise energy of back-facing signal
- Typical SNR benefit: 3 to 6 dB, robust!
- openMHA implementation (<http://openmha.org/>)



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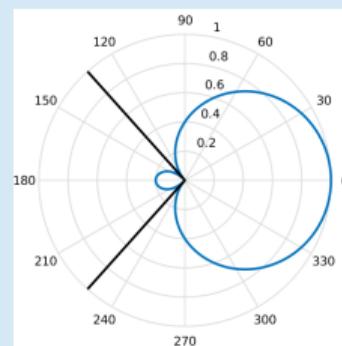
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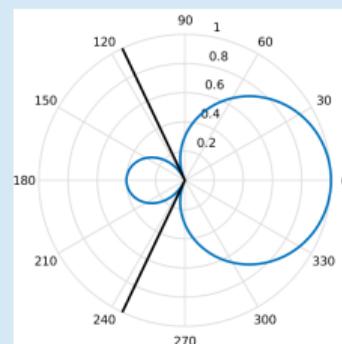
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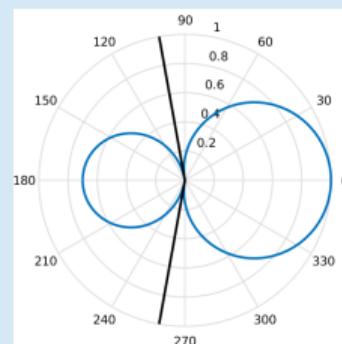
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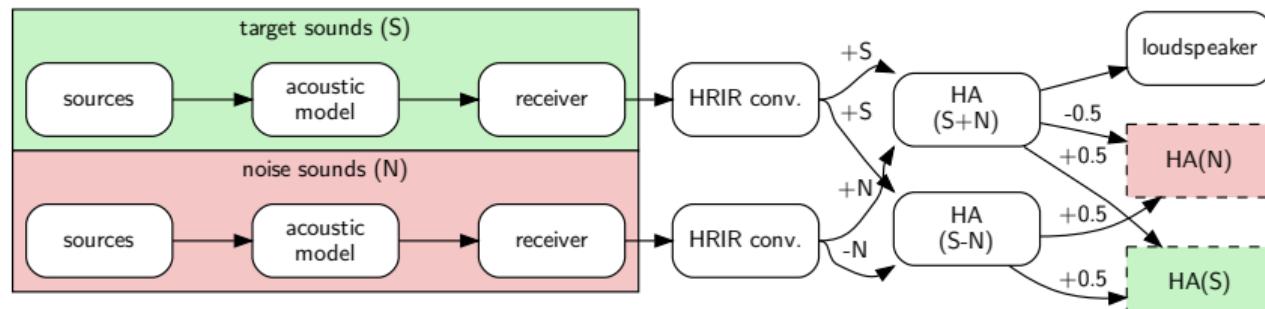
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Quantification of benefit

- Signal-to-noise ratio at output versus input (SNR benefit)
- Knowledge of S and N at input and output of hearing aid required (Hagerman & Olofsson, 2004)



Hagerman, B., & Olofsson, Å. (2004). A method to measure the effect of noise reduction algorithms using simultaneous speech and noise. *Acta Acustica United with Acustica*, 90(2), 356-361.

Coupling to a game engine

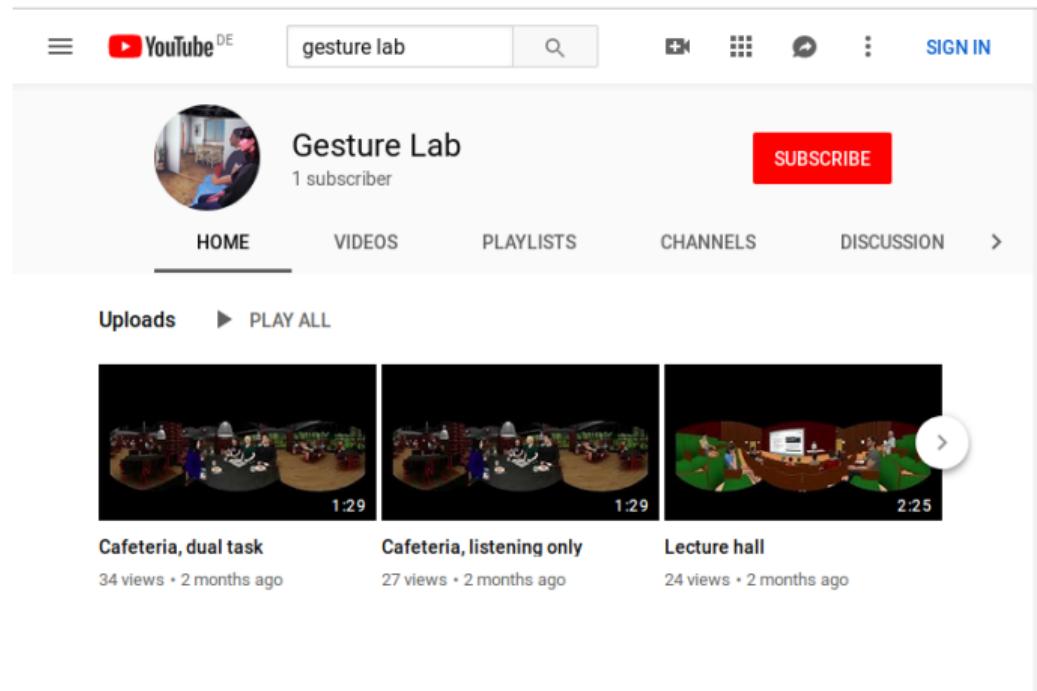
- Add visual components to acoustic environment
- Control acoustic environments based on motion in game engine

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 - Positions from TASCAR to game engine
- Control acoustic environments based on motion in game engine
 - Positions from game engine to TASCAR

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- Control acoustic environments based on motion in game engine
 - Positions from game engine to TASCAR
- Open Sound Control (OSC) interface

Coupling to a game engine

Interactive audio-visual environments



The screenshot shows a YouTube channel page for 'Gesture Lab'. The channel has 1 subscriber and a red 'SUBSCRIBE' button. The navigation bar includes 'HOME', 'VIDEOS', 'PLAYLISTS', 'CHANNELS', and 'DISCUSSION'. Below the navigation, there's a 'Uploads' section with three video thumbnails:

- Cafeteria, dual task** (1:29) - 34 views • 2 months ago
- Cafeteria, listening only** (1:29) - 27 views • 2 months ago
- Lecture hall** (2:25) - 24 views • 2 months ago



TASCAR on stage: spatialization and in-ear monitoring

TASCAR on stage: Motivation

- Concert project “Harmony of the Spheres”



TASCAR on stage: Motivation

- Concert project “Harmony of the Spheres”
- Spatialization of acoustic instruments



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- “Isotropic” concert setup:
 - Musicians and loudspeaker array around the audience



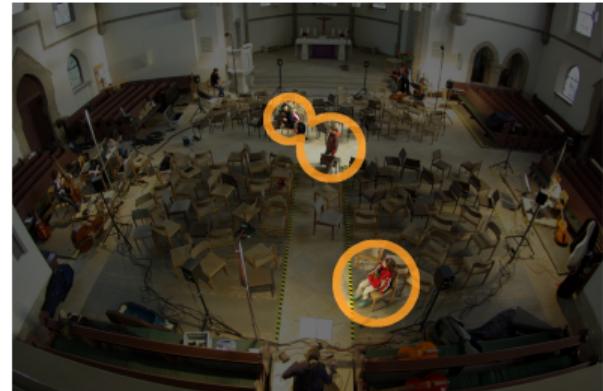
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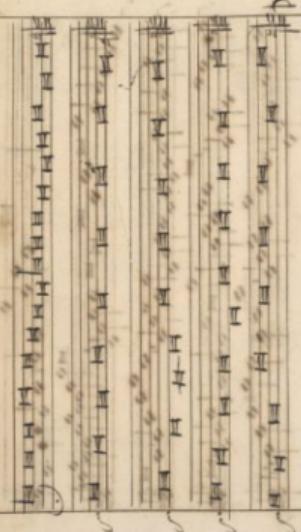
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 - Processed sound should arrive earlier (or only marginally after) direct sound



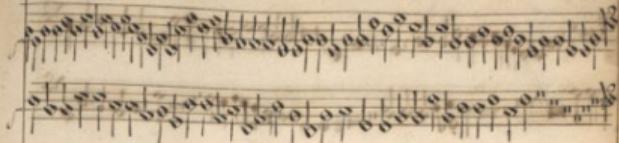
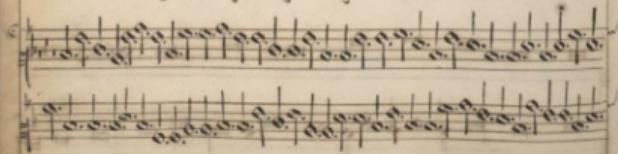
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- Precedence effect: **low-delay spatialization**
 - Processed sound should arrive earlier (or only marginally after) direct sound
- Huge distance between musicians: **in ear monitoring**
 - Provide dynamic spatial cues for musicians
 - Improved identification of acoustically similar instruments

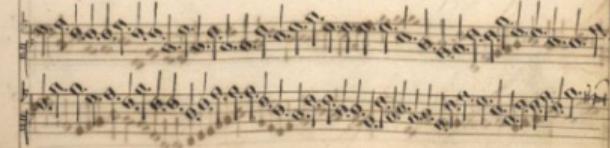




Succinctus



Si perficit



A page from a handwritten musical manuscript, likely for a harpsichord or organ. The left side features two staves of music for a single melodic line. The top staff uses a soprano C-clef, and the bottom staff uses a bass F-clef. Both staves are in common time (indicated by a 'C'). The right side contains three staves of music, each consisting of two parallel horizontal lines. These staves represent the harmonic basso continuo, with the upper line being the basso continuo itself and the lower line providing harmonic support. The music is written in a cursive hand, with some notes and rests indicated by small dots or dashes. The page is numbered '98' at the bottom left and '99' at the top right.

