Production and Application of Room Impulse Responses for Multichannel Setups using FLOSS Tools

Martin Rumori & Florian Hollerweger

11 May 2013

Introduction

Binaural Room Impulse Responses (BRIRs)

Room IRs

convolution reverb

Binaural Room Impulse Responses (BRIRs)

Room IRs

convolution reverb

☞ voice $*$ room IR $=$ voice in room

Binaural Room Impulse Responses (BRIRs)

Room IRs

convolution reverb

☞ voice $*$ room IR $=$ voice in room

$+$

Binaural IRs

simulating binaural recordings

Binaural Room Impulse Responses (BRIRs)

Room IRs

convolution reverb

☞ voice $*$ room IR $=$ voice in room

$+$

Binaural IRs

simulating binaural recordings

$=$

Binaural Room IRs

production & documentation of multichannel pieces

☞ Binaural 2ch mix of 8ch (use headphones)

Contribution

- IRs for concert halls in AT, DE, UK, NZ

Contribution

- IRs for concert halls in AT, DE, UK, NZ
- Extensive documentation (DIY)

Contribution

- IRs for concert halls in AT, DE, UK, NZ
- Extensive documentation (DIY)
- Using exclusively FLOSS tools ...

Contribution

- IRs for concert halls in AT, DE, UK, NZ
- Extensive documentation (DIY)
- Using exclusively FLOSS tools ...
- ... and extending some of them

Contribution

- IRs for concert halls in AT, DE, UK, NZ
- Extensive documentation (DIY)
- Using exclusively FLOSS tools ...
- ... and extending some of them
- All freely available at `http://irdb.kug.ac.at` ...

Contribution

- IRs for concert halls in AT, DE, UK, NZ
- Extensive documentation (DIY)
- Using exclusively FLOSS tools . . .
- . . . and extending some of them
- All freely available at `http://irdb.kug.ac.at` . . .
- . . . except they're not (quite yet) ☺

Recording Venues

Aula

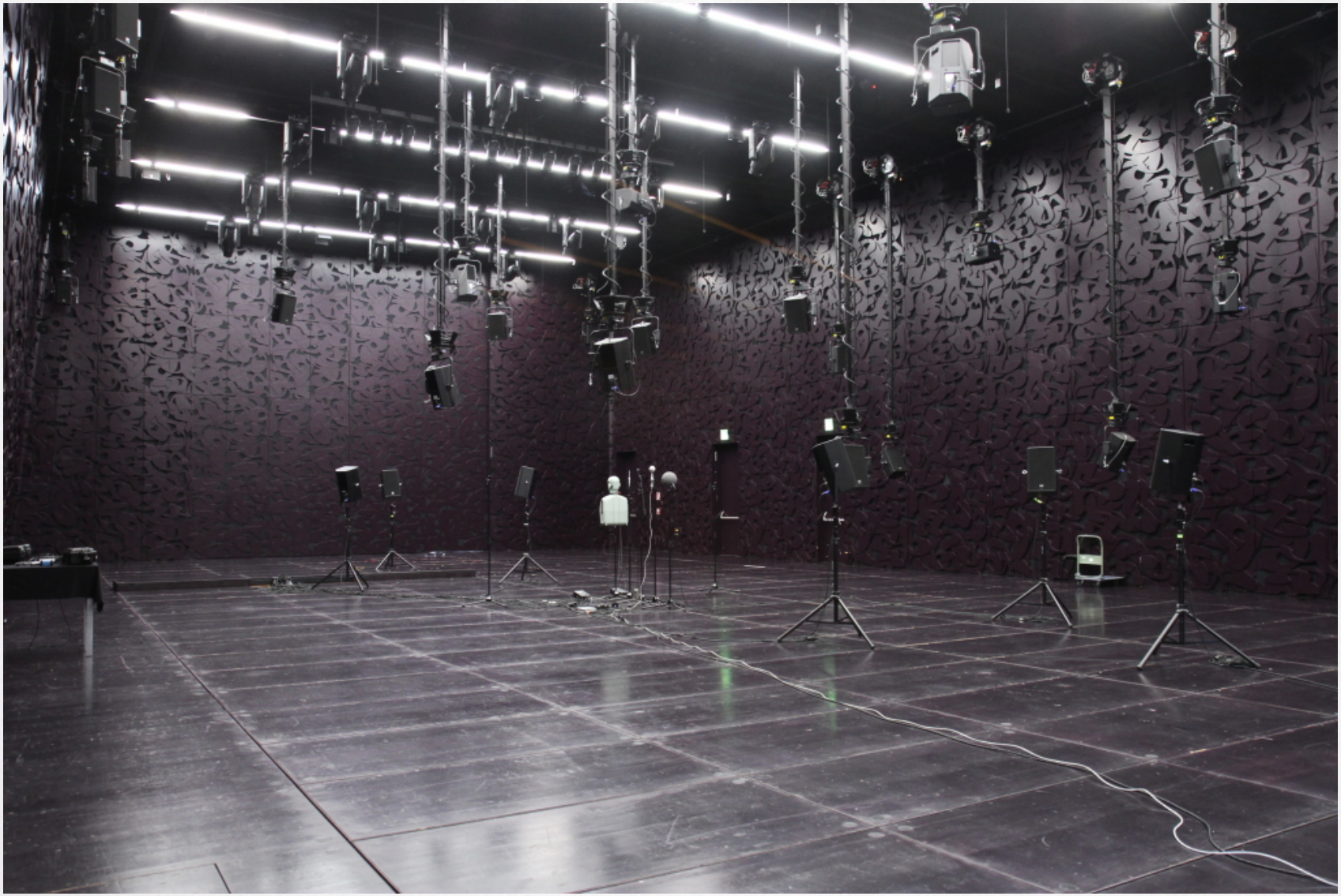
Academy of Media Arts, Cologne, Germany

CUBE

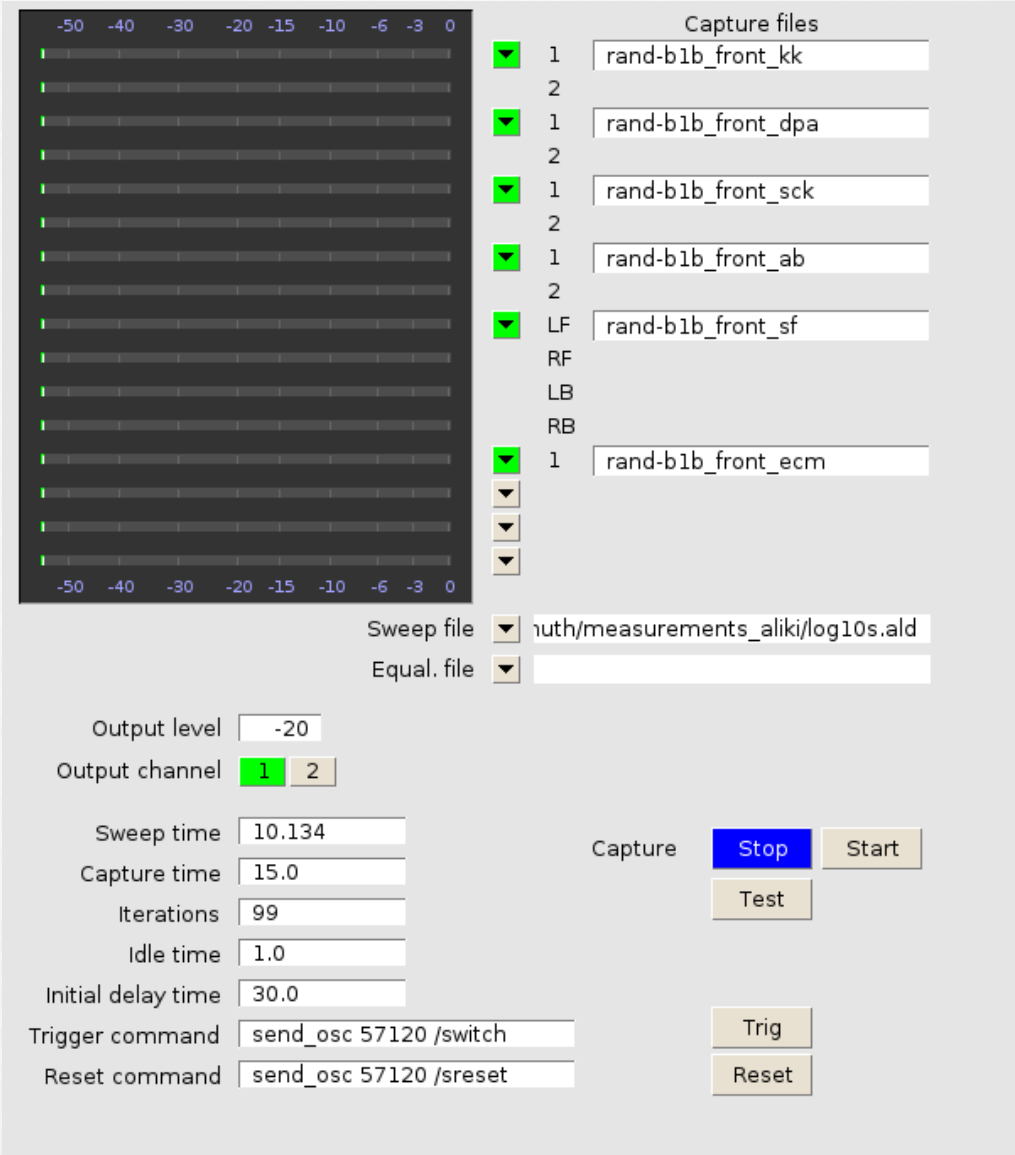
Institute of Electronic Music and Acoustics, Graz, Austria

MUMUTH

University of Music and Performing Arts, Graz, Austria



Customised Aliki version

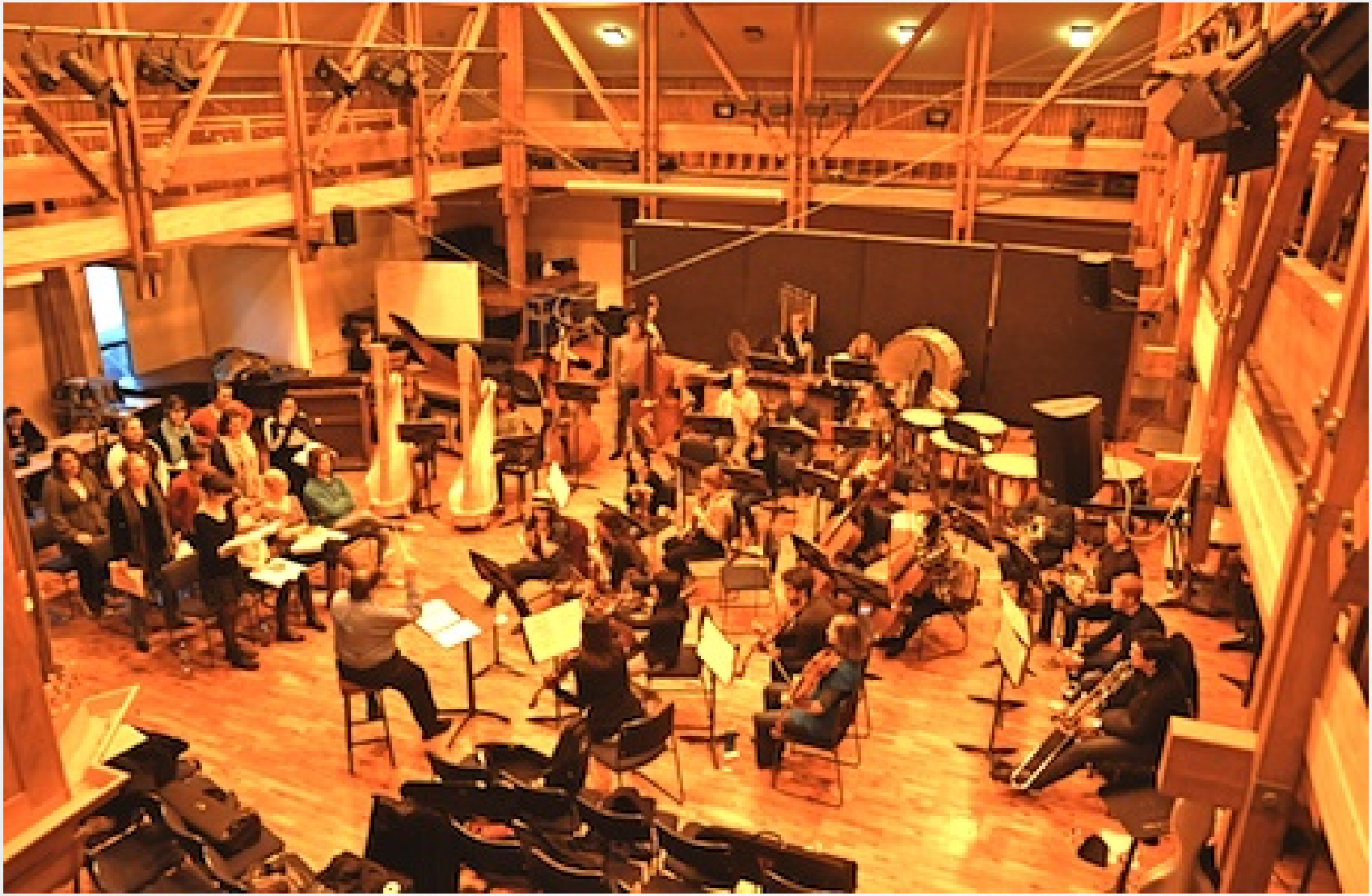


Sonic Lab

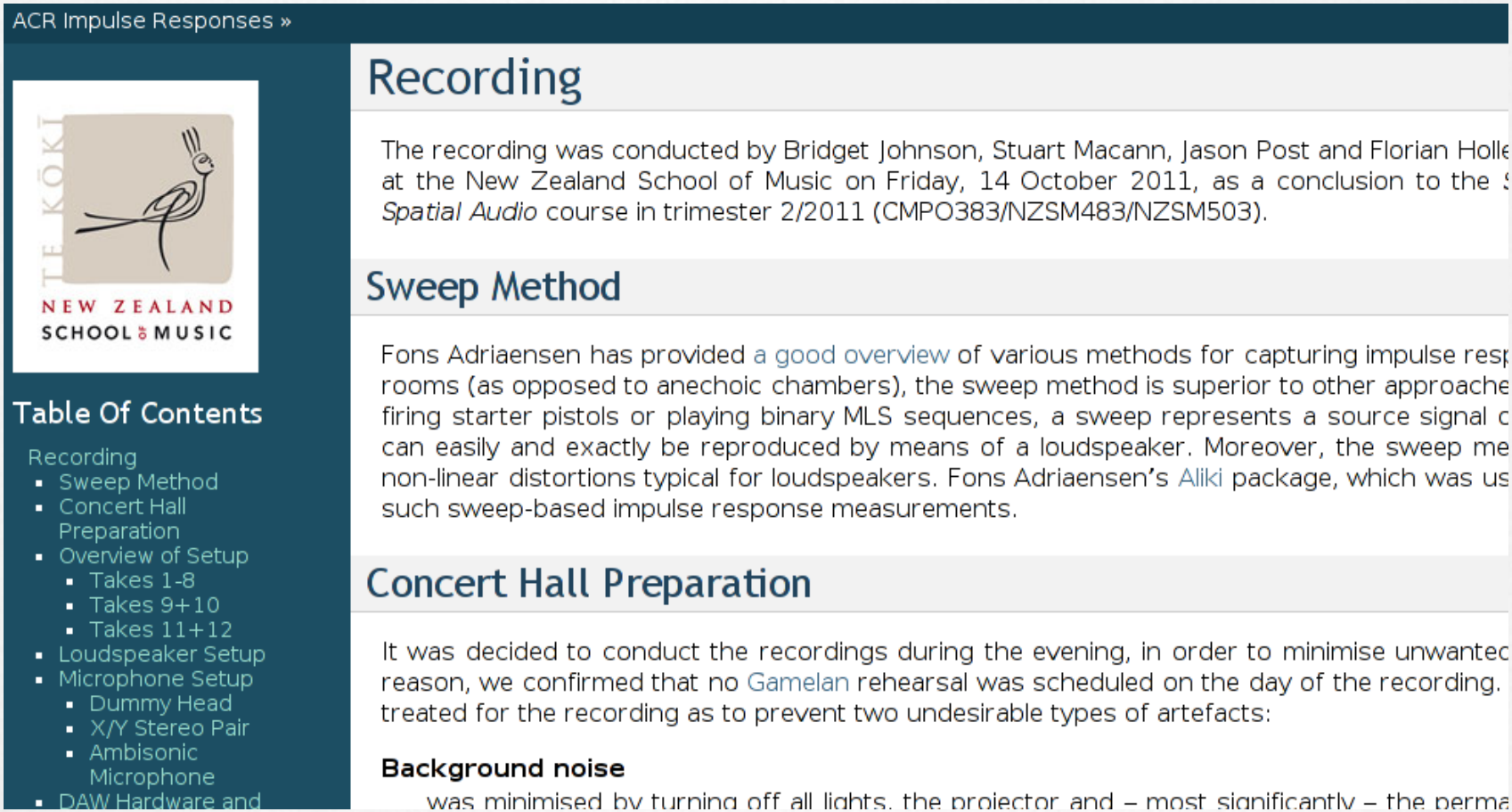
Sonic Arts Research Centre, Queen's University Belfast, Northern Ireland

Adam Concert Room

New Zealand School of Music, Victoria University of Wellington



Documentation



ACR Impulse Responses »

TE KŌKI
NEW ZEALAND
SCHOOL of MUSIC

Table Of Contents

Recording
- Sweep Method
- Concert Hall Preparation
- Overview of Setup
  - Takes 1-8
  - Takes 9+10
  - Takes 11+12
- Loudspeaker Setup
- Microphone Setup
  - Dummy Head
  - X/Y Stereo Pair
  - Ambisonic Microphone
- DAW Hardware and

Recording

The recording was conducted by Bridget Johnson, Stuart Macann, Jason Post and Florian Holle at the New Zealand School of Music on Friday, 14 October 2011, as a conclusion to the S *Spatial Audio* course in trimester 2/2011 (CMPO383/NZSM483/NZSM503).

Sweep Method

Fons Adriaensen has provided a good overview of various methods for capturing impulse resp rooms (as opposed to anechoic chambers), the sweep method is superior to other approache firing starter pistols or playing binary MLS sequences, a sweep represents a source signal c can easily and exactly be reproduced by means of a loudspeaker. Moreover, the sweep me non-linear distortions typical for loudspeakers. Fons Adriaensen's Aliki package, which was us such sweep-based impulse response measurements.

Concert Hall Preparation

It was decided to conduct the recordings during the evening, in order to minimise unwantec reason, we confirmed that no Gamelan rehearsal was scheduled on the day of the recording. treated for the recording as to prevent two undesirable types of artefacts:

Background noise

was minimised by turning off all lights, the projector and – most significantly – the perma

Post Production

Tools and Tool Extensions
for Automating the Post Production Process

- `aliki-convol`:
  Command line program for Aliki deconvolution
- `aliki-export`:
  Export from `.ald` to `.wav`
- `imptrim.sh` & `post_export.sh`:
  Shell scripts (`sox` etc.) for renaming, A-to-B conversion, roundtrip latency compensation, trimming, fade in, fade out, normalising, resampling
- `genjconv.sh`:
  for generating `jconvolver` configs:

```
ls ir_*.wav | sort -n | genjconv.sh \
    > irjconv.conf
```

Usage

Demo Scripts

Some `[f|j]convolver` config files and equivalent Octave scripts:

- `octo2binaural.[conf|m]`:
  Binaural headphone mixdowns of octophonic pieces
- `mono2stereo.[conf|m]`:
  à la standard convolution reverb
- `octo2stereo.[conf|m]`:
  Loudspeaker stereo mixdowns of octophonic pieces
  (experimental)

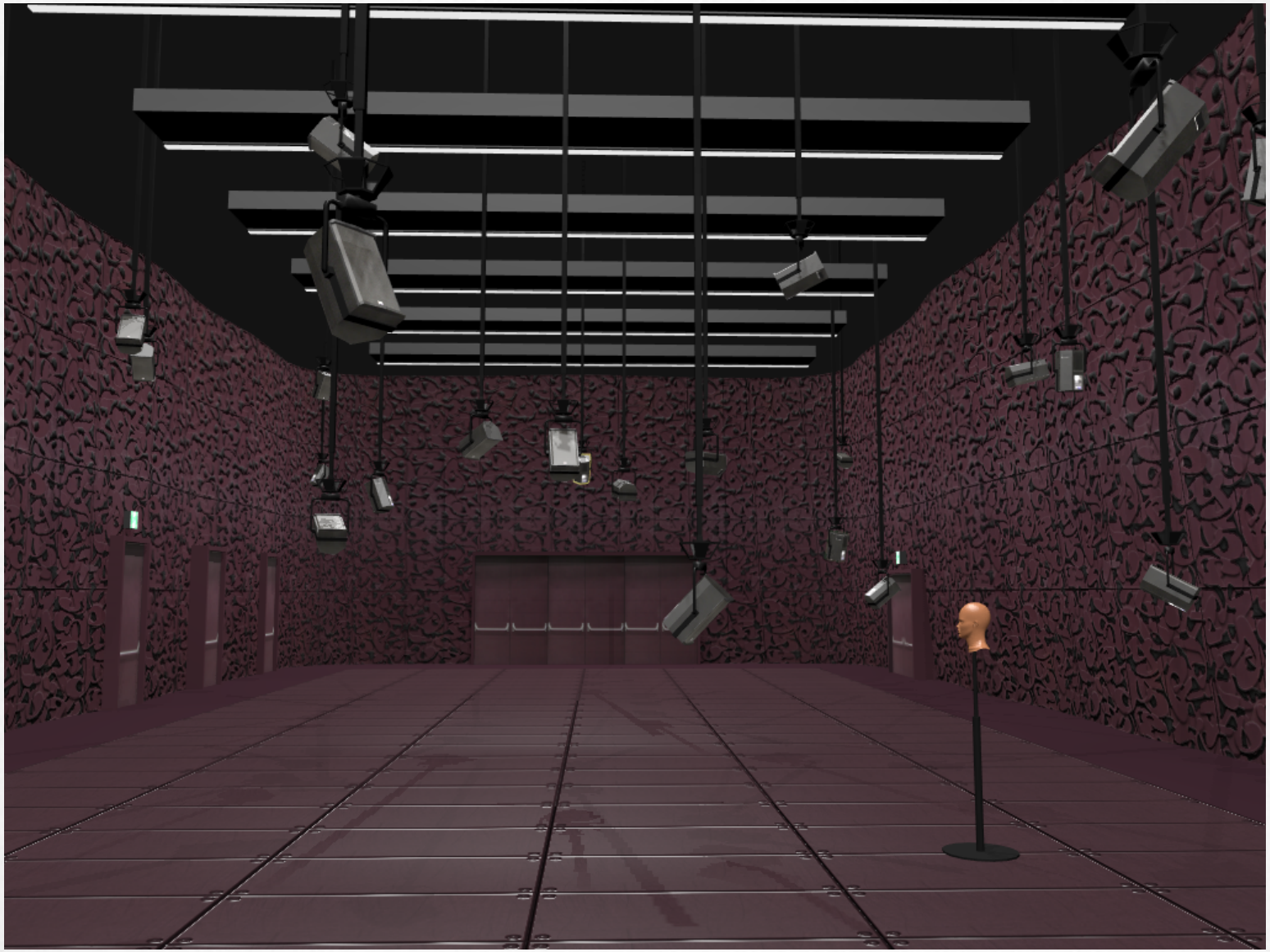
Applications

Applications

- NooK (Dirk Specht & Gerriet K. Sharma) – *Abandonee*
  Gerriet K. Sharma – *I_LAND*
  (binaural CD releases)
- Martin Rumori – *Parisflâneur*, *ruhrprotokolle*
  (audio augmented environments)
- Nic McBride, Elyssa Vulpes – *L'addio Scontato*
  (pop production)
- Martin Rumori et al. – *VirtualMUMUTH*
  (tool for *The Choreography of Sound* research project)

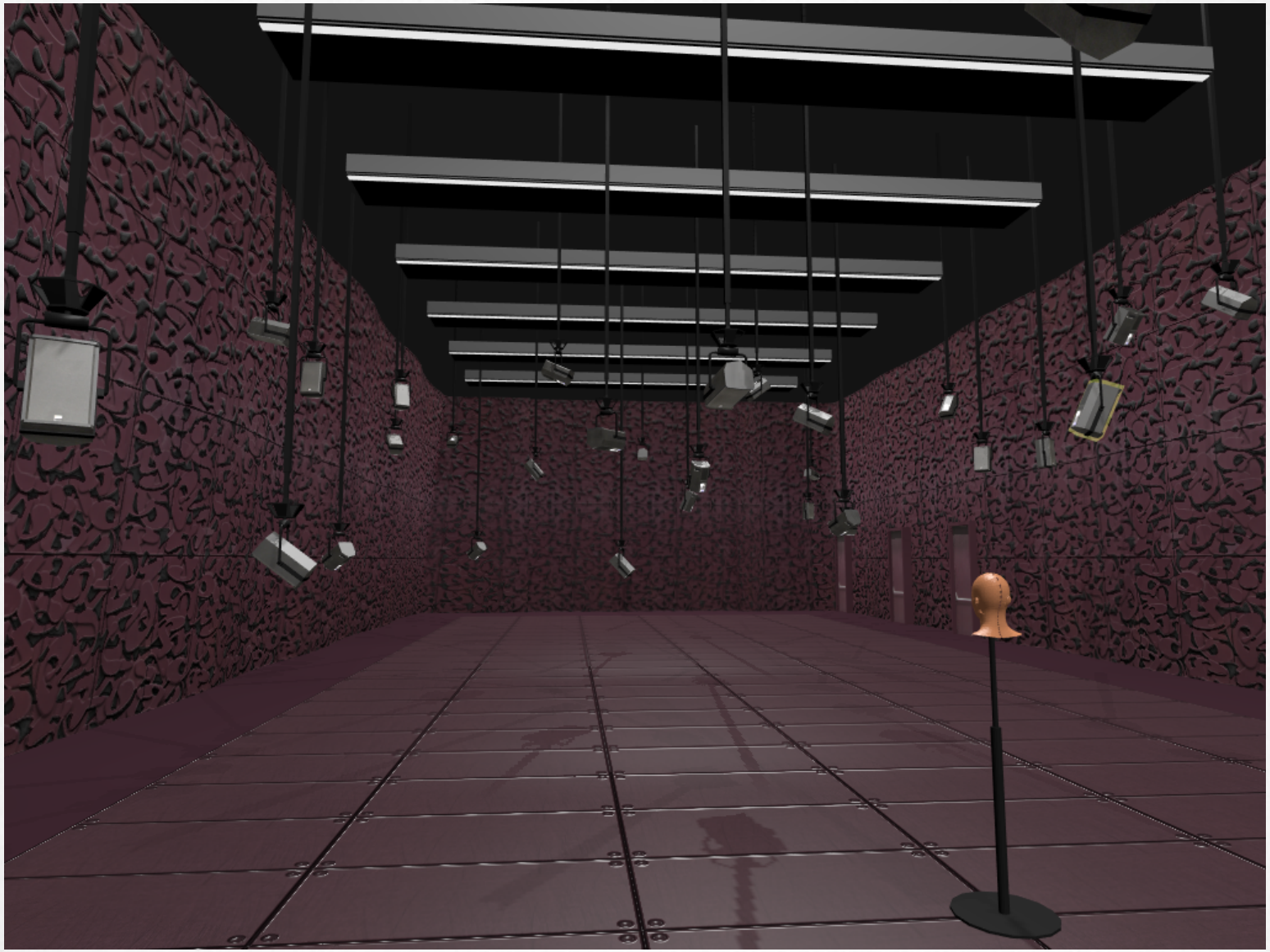
VirtualMUMUTH

3D model and auralisation tool



VirtualMUMUTH

3D model and auralisation tool



Thanks to . . .

Gerhard Eckel, Ramón González-Arroyo, Fons Adriaensen, Bridget Johnson, Jason Post, Stuart Macann, Roy Carr, Dugal McKinnon, Mark McGann, Mark Poletti, Andrés Cabrera, Gary Kendall, John Moeller, Justin Yang, Chris Corrigan, Anthony Moore, Dirk Specht, Thomas Musil, David Pirrò

SONICARTSRESEARCHCENTRE