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

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Introduction
Binaural Room Impulse Responses (BRIRs)

Room IRs
convolution reverb
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Room IRs
convolution reverb

voice * room IR = voice in room
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\[ \text{voice} \ast \text{room IR} = \text{voice in room} \]

Binaural IRs
simulating binaural recordings
Binaural Room Impulse Responses (BRIRs)

Room IRs
convolution reverb
행 voice * room IR = voice in room
+

Binaural IRs
simulating binaural recordings

= Binaural Room IRs
production & documentation of multichannel pieces

행 Binaural 2ch mix of 8ch (use headphones)
Contribution

- IRs for concert halls in AT, DE, UK, NZ
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- Extensive documentation (DIY)
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- . . . and extending some of them
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- . . . except they’re not (quite yet) 😊
Recording Venues
Aula
Academy of Media Arts, Cologne, Germany
MUMUTH
University of Music and Performing Arts, Graz, Austria
Customised Aliki version

Capture files
- 1: rand-blb_front_kk
- 2: rand-blb_front_dpa
- 1: rand-blb_front_sck
- 2: rand-blb_front_ab
- LF: rand-blb_front_sf
- RF: rand-blb_front_rf
- LB: rand-blb_front_lb
- RB: rand-blb_front_rb
- 1: rand-blb_front_ecm

Sweep file: /path/to/sweep_file.aid
Equal file: /path/to/equal_file.aid

- Output level: -20
- Output channel: 1 Z
- Sweep time: 10.134
- Capture time: 15.0
- Iterations: 99
- Idle time: 1.0
- Initial delay time: 30.0

Capture:
- Stop
- Start
- Test

Trigger command: send_osc 57120 /switch
Reset command: send_osc 57120 /reset
Adam Concert Room
New Zealand School of Music, Victoria University of Wellington
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 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 responses (as opposed to anechoic chambers), the sweep method is superior to other approaches. Firing starter pistols or playing binary MLS sequences, a sweep represents a source signal which can easily and exactly be reproduced by means of a loudspeaker. Moreover, the sweep method eliminates non-linear distortions typical for loudspeakers. Fons Adriaensen’s Ailki package, which was used in such sweep-based impulse response measurements.

Concert Hall Preparation

It was decided to conduct the recordings during the evening, in order to minimise unwanted reason, we confirmed that no Gamelan rehearsal was scheduled on the day of the recording. It was 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 permanent
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

- **impltrim.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:

  ```bash
  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) – *Abandoned*
  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
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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