

360° Binaural Room Impulse Response (BRIR) Database for 6DOF spatial perception research

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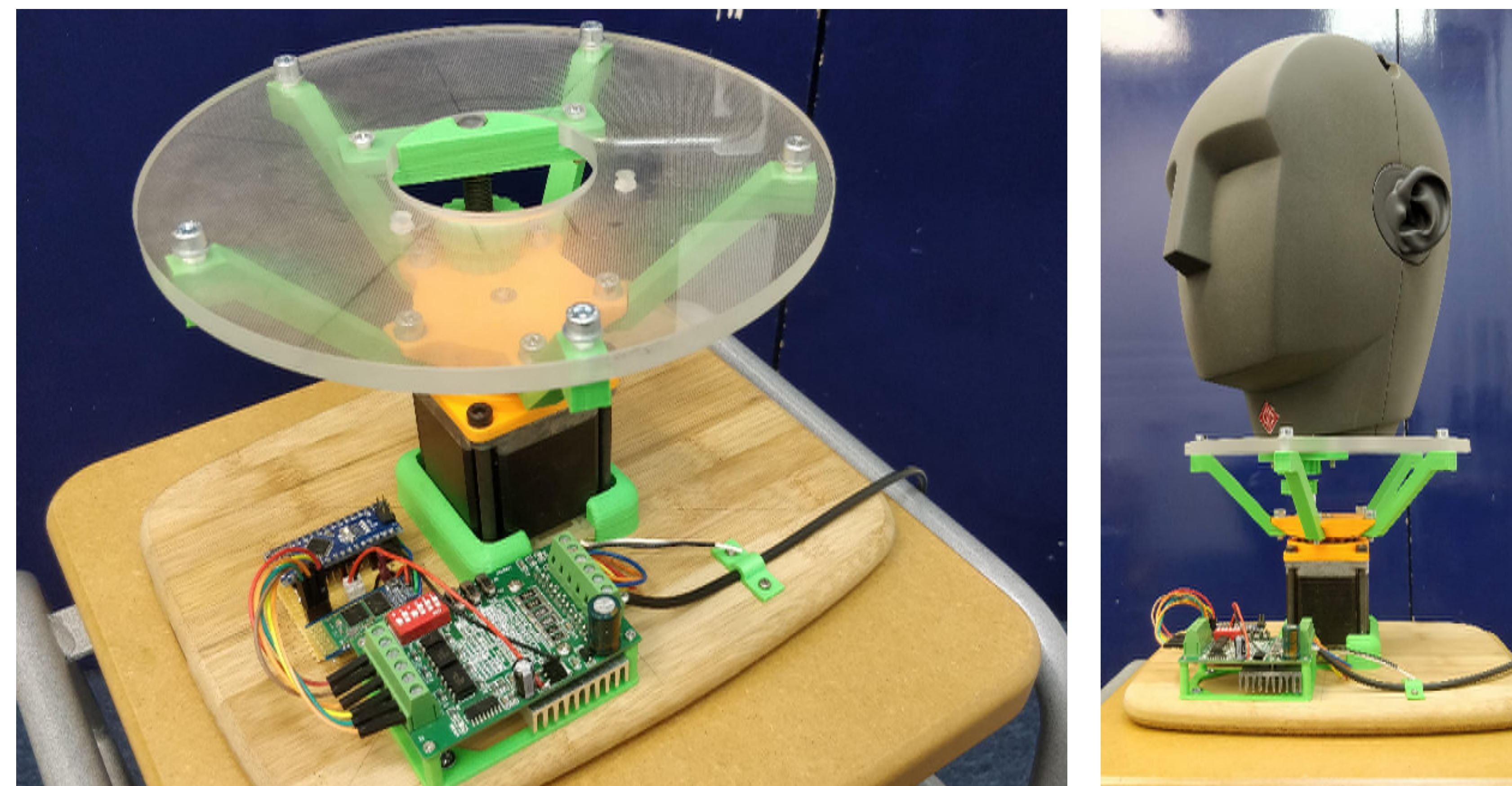
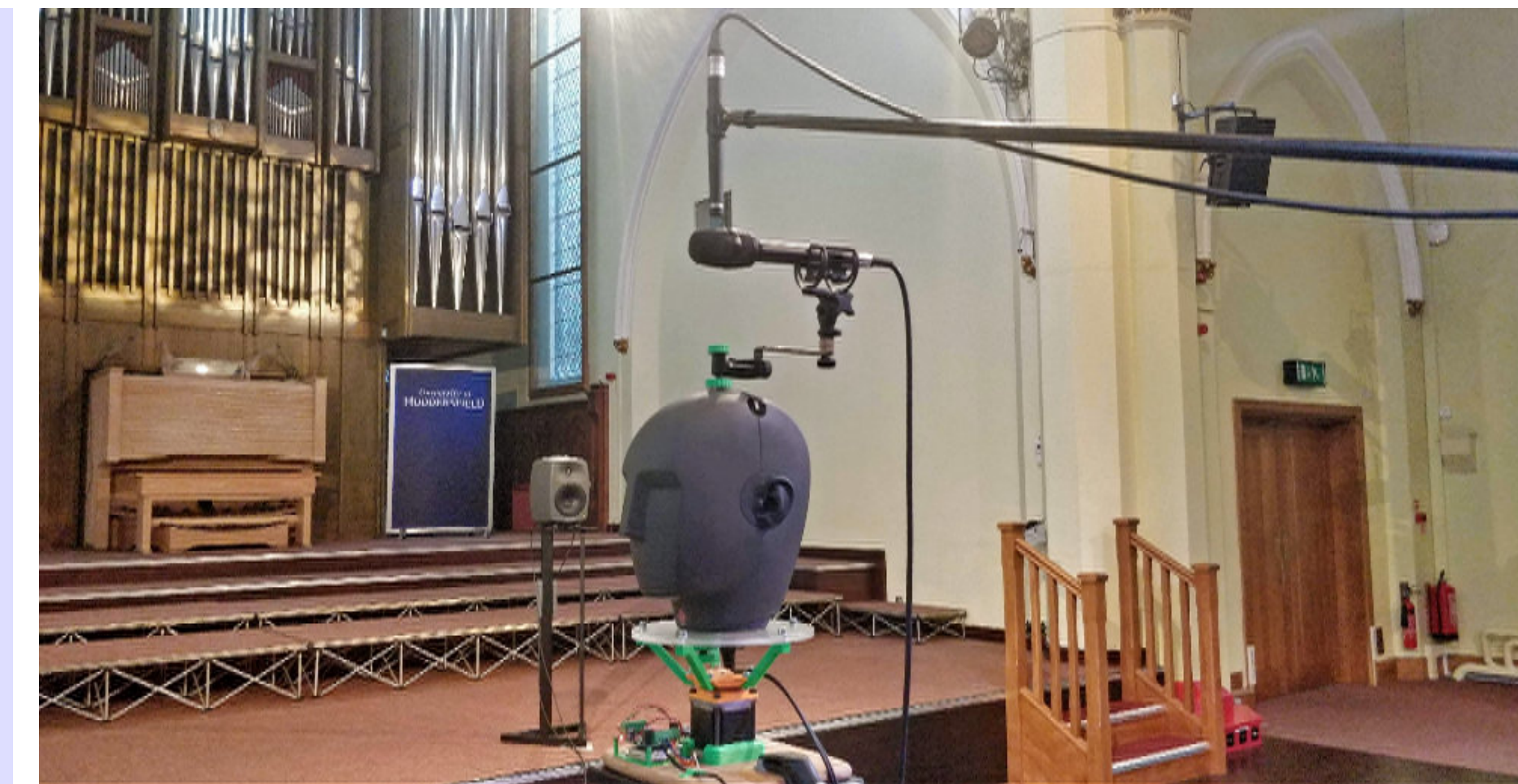
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Abstract

- Open-access library of 360 degree binaural and First-Order-Ambisonics (FOA) room impulse responses (RIRs), captured in St.Paul's concert hall in Huddersfield.
- A custom-made, automated head-rotation system was created for the precise acquisition of the IRs
- 13 positions were recorded, each being comprised of 100 impulse responses, equally spaced at 3.6°.
- BRIRs provided in SOFA and MATLAB format and FOA Impulse Responses provided in A and B format

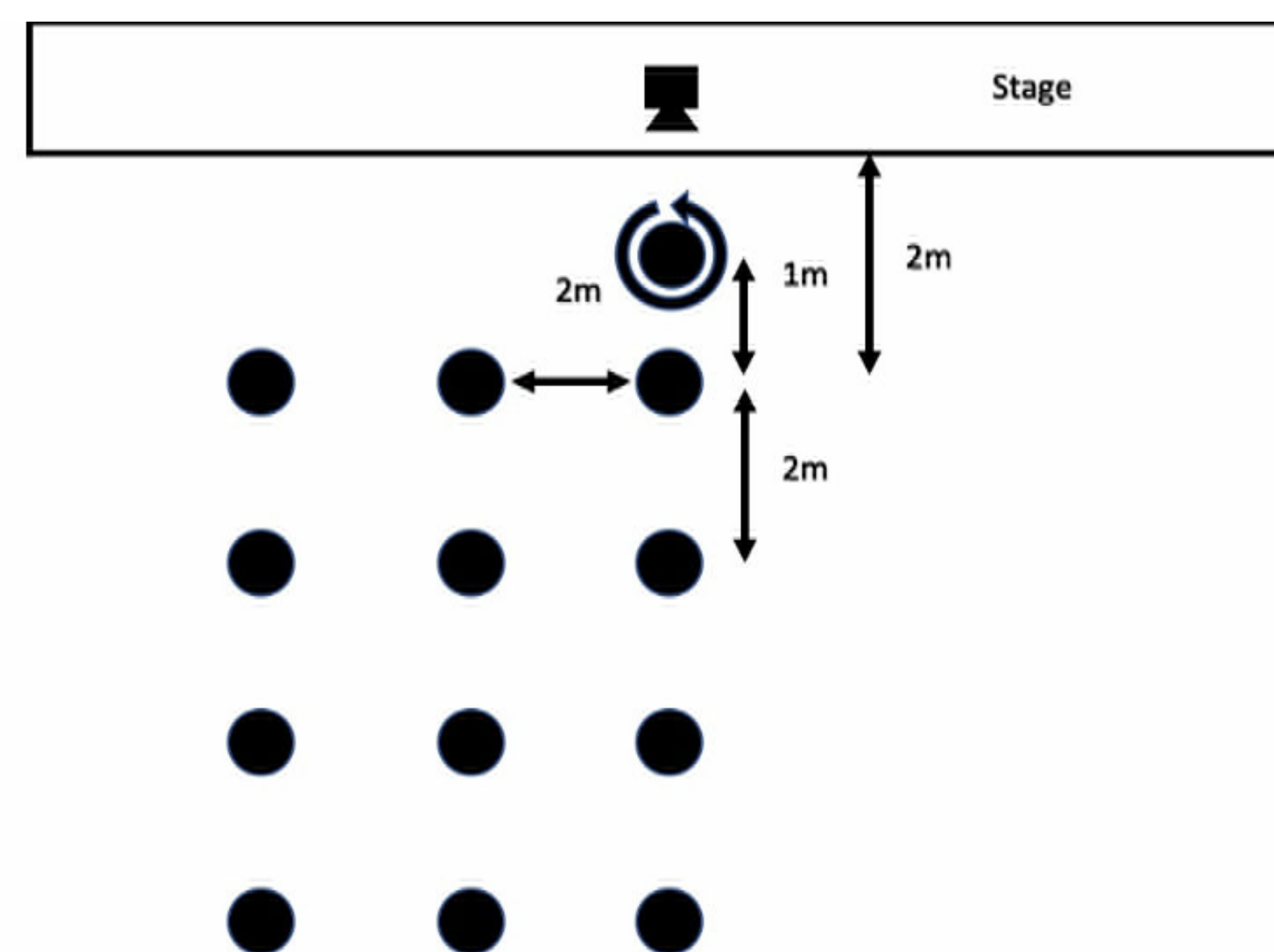
Precision Turntable

- Developed and used for rotating the binaural head with a 3.6° angular resolution.
- The turntable is based on a NEMA 23 stepper motor, driven by a TB 6560 stepper driver and controlled by an Arduino Nano.
- Controlled via Bluetooth and integrated with the HAART software for a fully automated measurement.



Impulse Response Acquisition

- A total number of 2613 RIRs were recorded at 13 positions, with 3 microphones:
 - Neumann KU100 binaural head
 - Sennheiser Ambeo first-order Ambisonics microphone
 - DPA 4006 omnidirectional microphone
- A Genelec 8040A loudspeaker placed in the centre of the stage was used as an excitation device.
- The RIRs were captured with the HAART [1] software, which was integrated with a custom-built turntable for a precise rotation of the microphones.



Impulse response processing

- MATLAB was used for normalisation, and further processing.
- The IRs were encoded into MATLAB (.mat) 3-dimensional arrays, allowing for any further processing if necessary.
- Binaural files encoded into SOFA format [2].

Summary and future work

- It is expected that the database would be useful for studying the perception of spatial attributes in a six degrees-of-freedom context.
- Further work will involve recording more positions in the same room as well as more rooms with different acoustic characteristics.

References:

- [1] D. Johnson, A. Harker, and H. Lee, 'HAART: A New Impulse Response Toolbox for Spatial Audio Research', presented at the Audio Engineering Society Convention 138, 2015.
- [2] R. Cabot, 'AES standard for file exchange - Spatial acoustic data file format', p. 33.

