

Application Form for Physical Sciences Ethics Committee Approval***Advice for applicants on completing the form***

Please ensure that the information provided is:

- *Accurate and concise*
- *Clear and simple and easily understood by a lay person*
- *Free of jargon, technical terms and abbreviations*

Further advice and information can be obtained from your departmental representative on the PSEC and at: <http://www.york.ac.uk/admin/aso/ethics/cttee.htm>

Please return completed (typed) form to your departmental representative via email to:

elec-ethics@york.ac.uk

Title of project: Listening test for evaluating the similarity between artificial reverberation algorithms and real reverberation

SECTION 1 DETAILS OF APPLICANTS**Details of principal investigator (name, appointment and qualifications)**

Huan Mi, BEng, PhD student in Audio and Music Technology

Names, appointments and qualifications of additional investigators *(student applicants should include their project supervisor(s) here)*

Gavin Kearney, PhD, Associate Professor in Audio and Music Technology.
Helena Daffern, PhD, Senior Lecturer in Audio and Music Technology.

Location(s) of project

Project located at: University of York Audio Lab, Genesis 6, Science Park

Experiments will be undertaken in people's homes.

SECTION 2 FUNDERS**What is the funding source(s) for the project?**

This is a project from a self-funding PhD student, no external funding involved.

Please answer the following:

- (i) Does the express and direct aim of the research or other activity raise ethical issues?

YES ☐

NO ☒

- (ii) Is there any obvious or inevitable adaptation of research findings to ethically questionable aims?

YES ☐

NO ☒

- (iii) Is the work being funded by organisations tainted by ethically questionable activities?

YES ☐

NO ☒

- (iv) Are there any restrictions on academic freedoms – notably, to adapt and withdraw from ongoing research, and to publish findings?

YES ☐

NO ☒

If you answered **Yes** to any of the above, please give details below:

SECTION 3 DETAILS OF PROJECT OR OTHER ACTIVITY**Aims (100 words max)**

The project aims to find one or several reverberation algorithms from seven reverberation algorithms, which can simulate real reverberation as plausible as possible. It is devised for headphone listening. The project aims to test these reverberation algorithms with 20 subjects with Web-MUSHRA that will be deployed online.

Background (250 words max)

Artificial reverberation algorithms can generate plausible reverberation effects and the closer the artificial reverberation is to the reverberation of real rooms, the better the algorithm is suited for applications like Augmented Reality (AR).

The proposers have developed a listening test that attempts to evaluate the similarity between reverberation generated by different artificial reverberation algorithms and real reverberation to find the most plausible reverberation algorithm from seven proposed reverberation algorithms.

There are seven reverberation algorithms are used in this test:

- a) Schroeder reverberation algorithm
- b) Gardner reverberation algorithm
- c) Moor reverberation algorithm
- d) Feedback delay networks
- e) Directional feedback delay networks
- f) Dattorro reverberation algorithm
- g) New reverberation algorithm designed by the proposers

These seven reverberation algorithms will be evaluated with four different audio samples (male speech, female singing, solo cello piece and drumbeat) separately in different reverberation times (0.266s, 0.95s, 2.34s). Male speech, female singing as music sound sources are familiar sources for the public and are utilised in this test. A solo cello piece is used as a low frequency source, and a drumbeat is used as an example of a more transient sound.

Brief outline of project/activity (250 words max)

Due to Covid-19 restrictions, this experiment will be conducted remotely in participant's homes.

Consent will be gained using the Web-MUSHRA's online survey platform. Participants will also be given the information sheet using the Web-MUSHRA's online survey platform.

Once participants review the information sheet and agree the consent form, they can access the whole listening test via a URL provided by the proposers. The test is based on Web-MUSHRA paradigm, and the whole test can be done through the webpage.

There will be a training session before the test where participants can set a safe and comfortable headphone listening level, read the description carefully and get familiar to the user interface.

During the test, participants will be asked to evaluate the similarity between perceptual reverberation generated by different artificial reverberation algorithms and real reverberation for:

- (1) Male speech
- (2) Female singing
- (3) Solo cello piece
- (4) Drumbeat

At different reverberation time:

- (1) 0.266s
- (2) 0.95s
- (3) 2.34s

There are 9 stimuli (7 stimuli are convolved with different BRIRs generated by different reverberation algorithms, 1 is a Hidden Reference and 1 is a Hidden Anchor) required to be evaluated, therefore totally 108 trials.

Once participants finish all trials, they are required to submit a small number of demographic questions: unique identifier, email, headphone used, age and gender.

The test will be approximately 40 minutes dependent on participant reaction times.

Participants will then submit the results, upon which they will receive £10.00 remuneration for the test.

Study design *(if relevant – e.g. randomised control trial; laboratory-based)*

The test will be online and based on the Multiple Stimuli with Hidden Reference and Anchor (MUSHRA) paradigm. There are 12 sections under the test (as explained above), and 9 stimuli for each section of the test: Audio files convolved with 7 different BRIRs generated by seven different reverberation algorithms, 1 Hidden Reference and 1 Hidden Anchor (dual-mono 3.5kHz low pass filtered audio).

If the study involves participants, how many will be recruited?

Approximately 20-30 people. Participants will mostly be AudioLab team members. Other participants will be recruited via the department mailing lists for postgraduate and undergraduate groups.

If applicable, what is the statistical power of the study, i.e. what is the justification for the number of participants needed?

ITU recommendation ITU-R BS.1116-3 [1] suggests 20 subjects for the MUSHRA paradigm. The participants are all experienced listeners. They have more professional knowledge and testing experience, so the error of perceptual difference between these participants could be small. As such 20 participants or more will be required to show statistical significance.

[1] ITU Radiocommunication Assembly. "ITU-R BS. 1116-3: Methods for the subjective assessment of small impairments in audio systems. February 2015, https://www.itu.int/dms_pubrec/itu-r/rec/bs/R-REC-BS.1116-3-201502-I!!PDF-E.pdf

SECTION 4 RECRUITMENT OF PARTICIPANTS**How will the participants be recruited?**

Primarily people from the Audio Lab, students/lecturers recruited through emails sent throughout the department, and personal contacts.

What are the inclusion/exclusion criteria?

Exclusion:

People who:

1. have hearing, vision or movement disabilities.
2. are not comfortable with audio noise.

Will participants be paid reimbursement of expenses?

YES ☐

NO ☒

Will participants be paid?

YES ☒

NO ☐

If yes, please obtain signed agreement

Will any of the participants be students?

YES ☒

NO ☐

SECTION 5 DATA STORAGE AND TRANSMISSION

If the research will involve storing personal data, including sensitive data, on any of the following please indicate so and provide further details (answers only required if *personal* data is to be stored).

Manual files	<input checked="" type="checkbox"/>
University computers	<input checked="" type="checkbox"/>
Home or other personal computers	<input checked="" type="checkbox"/>
Laptop computers, tablets	<input checked="" type="checkbox"/>
Website	<input checked="" type="checkbox"/>

Please explain the measures in place to ensure data confidentiality, including whether encryption or other methods of anonymisation will be used.

Computers will be password protected. Stored participant data will be anonymised. No paper documentation will exist for this study. Data will be stored in encrypted files/folders.

Please detail who will have access to the data generated by the study.

Investigators only

Please detail who will have control of and act as custodian for, data generated by the study.

Investigators only

Please explain where, and by whom, data will be analysed.

By the investigators at the University of York Audio Lab and at the investigator's homes.

Please give details of data storage arrangements, including where data will be stored, how long for, and in what form.

Data will be stored on investigators' personal computers and at the University of York Audio lab storage in encrypted files. Data will only be stored on the investigators' PCs until the end of the PhD study.

SECTION 6 CONSENT**Is written consent to be obtained?**YES ☒NO ☐*If yes, please attach a copy of the information for participants**If no, please justify***Will any of the participants be from one of the following vulnerable groups?**

Children under 18

YES ☐ NO ☒

People with learning difficulties

YES ☐ NO ☒

People who are unconscious or severely ill

YES ☐ NO ☒

People with mental illness

YES ☐ NO ☒

NHS patients

YES ☐ NO ☒

Other vulnerable groups (if 'yes', please give details)

YES ☐ NO ☒**If so, what special arrangements have been made for getting consent?**

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SECTION 7 DETAILS OF INTERVENTIONS**Indicate whether the study involves procedures which:**

Involve taking bodily samples

YES ☐ NO ☒

Are physically invasive

YES ☐ NO ☒

Are designed to be challenging/disturbing (physically or psychologically)

YES ☐ NO ☒**If so, please list those procedures to which participants will be exposed:**

List any potential hazards:

The audio stimuli last for 10 seconds. During this time, the participant will not hear external sounds. However, the test instructions stipulate that the subject should be seated in a quiet, non-distracting environment. The risk of any external factor causing injury due to the participant not being able to hear it during the test is extremely low. The participant will also be guided through the process of setting a comfortable and safe listening level for the experiment.

List any discomfort or distress:

None.

What steps will be taken to safeguard

- (i) the confidentiality of information

Data will be saved in password protected devices. Files will be encrypted. Only a small amount of personal data is obtained, which will be stored in accordance with GDPR requirements using the University of York's computers or personal laptop. All data will be stored anonymously, but retrieved and deleted for a particular individual if requested.

- (ii) the specimens themselves?

Participants are instructed to stop the test immediately if they show any signs of significant discomfort or distress. Participants can also withdraw from the test at any time.

What particular ethical problems or considerations are raised by the proposed study?

None

What do you anticipate will be the output from the study? *Tick those that apply:*

Peer-reviewed publications	<input checked="" type="checkbox"/>
Non-peer-reviewed publications	<input checked="" type="checkbox"/>
Reports for sponsor	<input checked="" type="checkbox"/>
Confidential reports	<input checked="" type="checkbox"/>
Presentation at meetings	<input checked="" type="checkbox"/>
Press releases	<input type="checkbox"/>
Student project	<input type="checkbox"/>

Is there a secrecy clause to the research?

If yes, please give details below

YES ☐

NO ☒

SECTION 8 SIGNATURES

The information in this form is accurate to best of my knowledge and belief and I take full responsibility for it.

I agree to advise of any adverse or unexpected events that may occur during this project, to seek approval for any significant protocol amendments and to provide interim and final reports. I also agree to advise the Ethics Committee if the study is withdrawn or not completed.

Signature of Investigator(s):



Date:

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7th August 2021

Responsibilities of the Principal Researcher following approval

- If changes to procedures are proposed, please notify the Ethics Committee
- Report promptly any adverse events involving risk to participants