UCL STUDENT AND REGISTRY SERVICES
Research Degrees

Examiners' Joint Report for a PhD Candidate			
Student's Full Name:	Andrew James Mitchell		
Student Number:	18161071	**Examination for:**	PhD
Thesis Title: *(Please enter complete thesis title)*	Predictive Modelling of Complex Urban Soundscapes Enabling an engineering approach to soundscape design		
Date of Viva Examination:		08/09/2022	
Supervisor present? (If yes, please enter the supervisor's name in box below)			
Yes ☐		**No** ☒	

Please complete all sections of this report.

If you have not already submitted your preliminary report(s), please submit them with this signed joint report to Research Degrees.

These reports will be forwarded by Research Degrees to the candidate, their supervisor and the Faculty Graduate Tutor.

SECTION A		
The examiners confirm that they have examined the thesis submitted by the candidate and have also examined the candidate orally on the subject of the thesis and on subjects relevant to the thesis		
☒ Yes	☐ No	
The examiners confirm that they have satisfied themselves that the candidate, as evidenced by the thesis and the viva, can communicate with the scholarly community about their areas of expertise		
☒ Yes	☐ No	
The examiners confirm that the thesis:		
is genuinely the work of the candidate:	☒Yes	☐ No
forms a distinct and significant contribution to knowledge of the subject:	☒ Yes	☐ No
affords evidence of originality: a) by the discovery of new facts and/or b) by the exercise of independent critical power	☒ Yes	☐ No
is an integrated whole and presents a coherent argument:	☒ Yes	☐ No
gives a critical assessment of the relevant literature:	☒ Yes	☐ No
gives the method of research and its findings:	☒ Yes	☐ No
gives discussion of those findings and how they advance the study of the subject:	☒ Yes	☐ No
demonstrates deep and synoptic understanding of the field of study, including objectivity, autonomy and the capacity for judgement in a complex situation:	☒ Yes	☐ No
is satisfactory as regards literary presentation:	☒ Yes	☐ No
includes a satisfactory bibliography and references:	☒ Yes	☐ No
demonstrates research skills relevant to the thesis:	☒ Yes	☐ No
is of a standard to merit publication in whole, in part or in revised form:	☒ Yes	☐ No

SECTION B
The examiners confirm one of the following outcomes (please tick) **Outcomes if the candidate will meet the required standard for a PhD award:**
1.) The candidate has met the criteria for a **PhD** without the need for corrections and **can be awarded the PhD** ☐
2.) The candidate **is required** to make **specified amendments to the examiners' satisfaction within three months** ☒
i) The examiners confirm that the candidate has been provided with **a list of minor amendments or an annotated thesis** either immediately after the oral or within two weeks of the oral examination and has been asked to **send the amended thesis for confirmation to the person nominated to check the corrections:** ☒ **OR**
ii) The candidate has **already** made the minor amendments required to the satisfaction of **designated checker:** ☐
If outcome **(i)** has been selected, please nominate an individual to check the amendments. The person nominated should confirm these have been made satisfactorily by email to Research Degrees
Name of corrections checker: Pierre Aumond, Arianna Astolfi
Email address: pierre.aumond@univ-eiffel.fr, arianna.astolfi@polito.it
3.) The candidate must **re-enter** for the examination and **resubmit the thesis in a revised form within a period not exceeding eighteen months.** (The examiners may require a further viva examination) ☐ NB If examining a resubmitted thesis, this result is not applicable Further viva examination required: **Yes** ☐ **No** ☐ **To be confirmed** ☐

Outcomes if candidate does not meet required standard for a PhD award:

4.) The candidate has met the criteria as outlined in the regulations and guidelines for examiners and be **awarded the degree of MPhil** ☐

5.) The candidate is required to make **specified minor amendments** to the examiners' satisfaction **within three months** for the award of the degree of **MPhil** ☐

i) The examiners confirm that the candidate has been provided with **a list of minor amendments or an annotated thesis** either immediately after the oral or within two weeks of the oral examination and has been asked to **send the amended thesis for confirmation to the person nominated to check the corrections:** ☐

OR

ii) The candidate has **already** made the minor amendments required to the satisfaction of **designated checker:** ☐

If outcome **(i)** has been selected, please nominate an individual to check the amendments. The person nominated should confirm these have been made satisfactorily by email to Research Degrees

Name of corrections checker:

Email address:

6.) The candidate is required to **enter for the degree of MPhil and to re-present the thesis** in a revised form **within twelve months.** (The examiners may require a further viva examination) ☐

NB If examining a resubmitted thesis, this result is not applicable

Further viva examination required:
Yes ☐ **No** ☐ **To be confirmed** ☐

7.) The candidate has **not fulfilled the requirements for a PhD or MPhil.** The candidate may not re-enter this thesis for examination. ☐

SECTION C

Examiners' Joint Report of the Viva

This section should be used to provide your opinion of the thesis and the candidate's performance in the viva.

Please use this section to list any minor corrections or major revisions required.

Mr. Andrew Mitchell is presenting a thesis entitled: "Predictive Modelling of Complex Urban Soundscapes - Enabling an engineering approach to soundscape design". The document synthesizes work on the design of predictive soundscape models. Mr. Andrew Mitchell explored each of the factors that influence the perception of sound environment (acoustic, psychoacoustic, personal, sound source related…), but also developed a critical view of the tools and methods proposed in the ISO 12943 standard published in similar years to his thesis work.

On the substance, the thesis testifies to the quality of the scientific work of Mr. Andrew Mitchell and the distance he was able to take on his subject, which opens up particularly interesting perspectives for the entire soundscape community. The jury also appreciated Andrew Mitchell's commitment to producing a comprehensive and quality paper, without over-reliance on his numerous published articles and thus providing additional insights, even if sometimes the document lacks clarity in summarizing the main points.

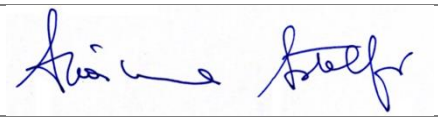
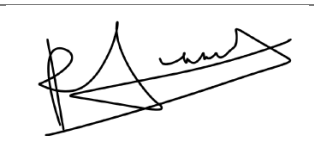
More generally, the work of Mr. Andrew Mitchell demonstrates his expertise of an ambitious subject, and also testifies to his ability to work in collaboration with many researchers (numerous co-authored publications valued in the manuscript) and the jury appreciates his concern to have methods and results that are replicable and transparent, particularly through the fact of offering the openness of his databases and tools.

During the viva, the jury noted Mr. Andrew Mitchell's ability to transcribe in a synthetic and particularly clear manner all of the work done in the framework of his thesis and thus counterbalanced the weakness of the manuscript. He also provided clear and well-reasoned answers to the numerous questions of the jury members, demonstrating great insight into the topics discussed.

Subject to minor revisions to the thesis document to be reviewed by the Jury members, the degree of Doctor is granted to Mr. Andrew Mitchell.

Some minor corrections are indicated here, and a commented pdf will be sent to the candidate:

- Separate the layers of information according to their importance and better highlight the main results of your work.
- Better highlight the data that was used for modeling.
- Mention your hypothesis for why the online survey did not work well.
- Better highlight the near-term future prospects for validating and improving the proposed model.
- Mention how your proposed protocol could be soberer, using the minimum number of items needed for a similar/useful soundscapes collection.

SECTION D	
Examiners' Signature Confirming Result of the Examination	
Declaration: We confirm this is the joint examiners' report for the candidate named above.	
Signed:	
Please print name:	Ariana Astolfi
Date:	08/09/2022
Signed:	
Please print name:	Pierre Aumond
Date:	08/09/2022
Signed*:	NA
Please print name:	NA
Date:	NA
(* Only for use in the exceptional cases when UCL has approved the appointment of a third examiner)	

If electronic signatures are to be used, these must be the image of a hand written signature. **We cannot accept a typed name in place of a signature.**

UCL STUDENT AND REGISTRY SERVICES
researchdegrees@ucl.ac.uk

Research Degree Examination: Examiner's Preliminary Report

You must complete an independent preliminary report after reading the thesis but before conferring with your co-examiner. Please exchange your report with your co-examiner before the candidate's viva and sent a copy by email to Research Degrees.

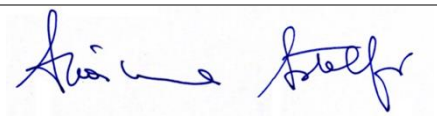
If you have not submitted the preliminary report before the viva, please include a copy with the joint report.

Candidate and Thesis Details	
Candidate's Full Name:	Andrew James Mitchell
Student Number:	18161071
Degree Award (PhD, etc.)	PhD
Thesis Title:	Predictive Modelling of Complex Urban Soundscapes Enabling an engineering approach to soundscape design

Report
The PhD Thesis by Andrew Mitchell represents a step forward in the soundscape research and in its modelling. Many important insights have been reported, such as the provision of a protocol for soundscape assessment which allows for open data sharing, the importance of having the sound source identified and the inclusion of demographic features, the inclusion of personal factors, the new method for representing soundscape that considers its uncertain nature. The thesis also stresses the weaknesses that are intrinsic in the soundscape research and that concerns the lack of generalisation since it is not possible to consider all the aspects of influence, among which the long-term validity of the estimations. The manuscript is well written and organised but lacks in synthesis. Often, information is repeated along the chapters and makes heavy the reading of the text. Particularly, I would suggest shortening the conclusions and to open each chapter with a summary of the main results. Some data has not been used for the modelling or other results and should be skipped as, e.g., the SPL in the soundscape survey, as these data make confuse the reading of

the text since they are redundant or not used. In some chapter the comparison with literature is missing.
During the viva I would deepen the following parts:

- Starting from the literature survey, which are the already acquired insights of soundscape? Can you list them in a table?
- Related to Chapter 3, on the protocol and questionnaire survey, I wonder if it could be useful to add questions about the perceived importance of the different aspects of the environmental quality or the noise sensitivity.
- Why do you call the Protocol the "Soundscape Indexes Protocol"?
- As far as Chapter 5 is concerned, to the reader is unclear if predictions for modelling of soundscape have been based on data acquired on site in 2019, and instead in 2020 the model validation is based on data acquired from surveys carried out with headphones. Please comment on that and clarify the applied method in the text.
- The reader did not understand if **correlations** between objective and subjective data are considered in the predictive model in Chapter 5.
- It is unclear in Chapter 5 if **visual impact** has been or not considered in the soundscape modelling.
- I think that in the soundscape modelling a **longitudinal study** is needed or a test-retest to evaluate reproducibility of data. Mainly because of data was acquired during lockdown period where people were affected by anxiety and other psychological problems. Furthermore, day/night differences, season difference and differences along time must be investigated. Anyway, it is hard to extend the model to new locations if only **two locations** have been considered in training the original one.
- In Chapter 7 it is unclear why sharpness represents the main parameter associated with soundscape in the case of noise source identification. Please comment on that. And however, it is unclear how it will be possible to detect sources in future survey (automated sound source recognition algorithm?)
- In Chapter 8 the influence of **personal information** is unclear. Do you think that is worth to consider them as they account for a very low percentage of the variance? Or is it useless and it could be instead important to have the soundscape predicted for an "average" occupant?
- I found the probabilistic representation of Soundscape in Chapter 9 very effective. The only thing that I would deepen is the use of **50^{th} percentile**.
- Application to **indoor soundscape** described in Chapter 10 is unclear and deserves further explanation.

Examiner Details	
Name:	Arianna Astolfi
Signature:	
Date:	07/09/22

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Candidate and Thesis Details	
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Degree Award (PhD, etc.)	PhD
Thesis Title:	Predictive Modelling of Complex Urban Soundscapes Enabling an engineering approach to soundscape design

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results that are replicable and transparent, particularly through the fact of offering the openness of his databases and tools.

Some minor revisions to the thesis document will be required and will be discussed with the candidate during the viva as well as some of the following:

- You have applied the ISO standard, reviewed and critiqued it and you are probably one of the people who have done it to the greatest extent. If you had to improve it, what would be your priorities?
- You used psychoacoustic indices during your thesis. I would like to have your own opinion on their usefulness in the soundscape.
- I don't really understand your position and your use of binaural measurements. Can you tell me a little more about it?
- You have a very critical review of parts 1 and 3 of the ISO standard but less of part 2. I would especially like to hear your opinion on the taxonomy of sources. (you talk a bit about the traffic/other sound sources distinction).
- Can you explain me more how the lockdown impacted your research questions? Flaws/lacks vs opportunities.
- Some of your parameters/indices like LA10-LA90 or Age are non-linear with respect to pleasantness (at least that is what I observe), but you are using linear statistical tools. Have you observed the same thing? did you explore this problem?
- You propose a prediction of the dispersion on the values of each attribute. I really like the idea and the approach, but I regret that you do not present an analysis of the dispersion according to the axes. Is it really different between attributes? Have you started looking? The risk is for example that the mean value is not very dependent on your sample, but that the dispersion is very dependent on it. The practical impacts can then be important.

Examiner Details	
Name:	Pierre Aumond
Signature:	
Date:	07/09/22