

DO PERFORMANCE MUSICIANS NEED ACOUSTIC EDUCATION ?

Luis Gomez-Agustina

*School of Built Environment and Architecture, London South Bank University (LSBU),
London SE1 0AA, UK. email: gomezagl@lsbu.ac.uk*

Muriel Swijghuisen Reigersberg

Sydney Conservatorium of Music, University of Sydney, Sydney NSW 2006, Australia.

In music, acoustics is the physical underlying phenomenon and vehicle of music production, performance and composition. Performance musicians around the world (and specifically in the UK) complete their extensive musical training without basic understanding of the fundamental acoustics concepts behind their practice, making their instruction arguably incomplete. Through quantitative and qualitative methods this novel and extensive study explored and evaluated the perceived value, suitability and attitudes towards the initiative of introducing basic acoustic education in performance music training in the higher education in the UK. It was conclusively shown that the vast majority of the performance music education community, believe that such introduction would be highly beneficial and they would agree with an actual implementation. However less clear accord was found at this early stage on the proposed duration, methods, integration and implementation routes. Prospective benefits, drawbacks and barriers were identified by the large sample of participants if the introduction were to be implemented. The convincing findings of this study will serve to bring the identified knowledge gap to the attention of the relevant education field, influence curriculum change, and to serve as the foundation to the design and development of the next phases of this education initiative.

Keywords: music training, syllabus, musicians, acoustics education, curriculum change

1. Introduction

Acoustics can be defined as the behaviour and perception of sound in space and time. The field of acoustics studies the significant interactions of sound with listeners and the environment where sound is produced and propagated. In music, acoustics is the underlying physical phenomenon and vehicle of music production, performance, composition and reception. The acoustics of a space affect the perception of an instrument by performers and other listeners such as audiences and conductors. This essential link between acoustics and musical performance, however, has been ignored or taken largely for granted by performers and music educators in the UK. Musicians, composers and conductors around the world (and specifically in the UK) complete their extensive musical training without a basic understanding of the fundamental acoustic concepts supporting and influencing their practice. We argue here that this makes their education incomplete.

The novel research presented in this paper, identifies and evaluates the perceived value, suitability, and attitudes towards the potential introduction of basic acoustic tuition in UK music performance training curricula. Secondly, the authors aim to use the evidence presented here to lobby for

change in UK and international music curricula as they believe it will enhance holistic approaches to musical performativity and wellbeing whilst creating a better informed, multi-disciplinary workforce in the creative industries. For the purposes of this study ‘basic acoustic education’ is defined as topics considered essential for the holistic training of musicians, including: the nature of sound, the auditory system, hearing conservation, psycho-acoustics, acoustics of performance spaces and musical acoustics. These can be presented using practice-relevant, engaging examples focussing on performative outcomes.

2. Acoustics education in music training and literature

This paper offers a unique contribution to knowledge as no other relevant literature could be identified within the fields of acoustics and music performance education.

The only study in the literature which briefly and tangentially touches upon the subject of this paper is that of Zepidou and Dance [1]. This study describes the implementation of an extra-curricular education programme on hearing conservation of music students and staff of the Royal Academy of Music (London, UK). A similar education programme has also been successfully undertaken at the Royal College of Music (London, UK) since 2005 [2]. Since the start of the enforcement of the UK Control of Noise at Work Regulations [3] on professional musicians in 2008, more music education institutions are expected to introduce similar informative training. These short noise exposure awareness courses, however focus exclusively on the hearing conservation aspects of acoustics and less on acoustics more broadly. A significant number of publications addressing the essential role of acoustics in musical performance and production do exist however [4,5,6], [7], [8]. In these seminal publications eminent acousticians who are also musicians and were designers of the most prestigious music concert halls in the world, discuss the intimate relationship between musical performance and acoustics.

In the UK, only three Higher Education (HE) institutions (including universities, music colleges and conservatoires) offer some form of optional musical acoustic education to some routes in music performance degrees. However, this instruction largely focuses on aspects of instrument acoustics neglecting other subjects considered essential (proposed above), for a complete musical instruction.

It has become well accepted in the music education community that performance studies and musical training are intrinsically multidisciplinary [9]. Several examples demonstrate how traditional music performance institutions have progressively opened to change and exploration in their delivery of training in recognition of this fact [10], [11]. In the UK some leading institutions have introduced scientific and other non-musical topics into the syllabus [12],[13],[14]. However, no reports describe the design and implementation processes of such initiatives or provide an evaluation of those introductions.

3. Methodology

In order to obtain data on practice-based, experiential perspectives of musical performance in relation to acoustics training a phenomenological approach was chosen, informed by social science methodologies. A combination of quantitative and qualitative methods was used to obtain robust inferences and reliable findings. Three data collection techniques were employed: (1) an extensive UK-wide online survey questionnaire 2) a semi structured interview and (3) a documentary analysis. The semi-structured interview was incorporated to collect detailed descriptive and experiential information to supplement quantitative information extracted from one of the online questionnaires.

3.1 Basic acoustic education in music training study

The online questionnaire was designed to collect demographic and attitudinal data from the HE performance music education community in the UK. The qualifying respondents (target group) for the questionnaire and semi structured interview consisted of the following groups: trained musicians (amateur or professional performers), students, lecturers, teachers, academics, researchers, conduc-

tors, composers, HE institution management and acousticians having formal musical training or substantial performance musical background. For the purpose of this study performance music education covers the areas of: performance, composition, conducting, music theatre, education in music and musicology. Higher Education music education institutions were limited to conservatoires, academies, colleges and universities with music departments.

3.1.1 Online questionnaire

Google forms [15] was selected to host the online questionnaire. The first phase of the study reported here commenced in Nov 2014 and the data collection closed in June 2015. The questionnaire was first piloted and iterated. Data validation processes were undertaken on the raw collected responses. The questionnaire was comprised of 12 multi choice closed ended questions. Question 13 was open ended for free comment (Table 1).

Table 1: Basic acoustic education in music training online questionnaire

Q1 I AM ...						
Music student/graduate/performer		Music conductor/director/composer		Music researcher/consultant/academic		
Acoustician with music training		Acousician and amateur musician		Not a musician		
Q2 The instrument type I specialise in is....						
Woodwind	Brasswind; Percussion	Stringed: Voice	Keyboard	None		
Q3 What is your gender ?						
Female	Male					
Q4 What is your age ? (years old)						
18 - 24	25 - 34	35 -44	45 - 54	55 - 64	65 - 74	75 ≥
Q5 How many years of musical training and/or performing experience do you have?						
≥ 20	19 -10	9 - 5	4 -1	≤ 1	None	
Q6 What is your background in acoustics ?						
Prof acoustician	Academic/Researcher	Basic academic	Self learned	No knowledge		
Q7 How many years of education/practical experience in acoustics do you have?						
≥ 20	19 -10	9 - 5	4 -1	≤ 1	None	
Q8 What is your level of responsibility in your occupation ?						
Student	Academic	Managerial	Consultant	Self Employed		
Q9 Basic acoustic education can be beneficial in the training of performance musicians composer and conductors						
Strongly agree	Agree	Not agree-Not disagree	Disagree	Strongly disagree		
Q10 How do you consider the potential introduction of basic acoustics education into the performance music syllabus ?						
Necessary	Complementary	Not a priority	Unsuitable	Irrelevant		
Q11 If basic acoustic educationwere integrated into the syllabus, how should it be integrated ?						
Compulsory	Optional	Extra Curricular	Not sure	Should not be integrated		
Q12 If basic acoustic education were integrated , approx how many contact hours would you recommend in total ?						
>30	30	20	10	<10	0	
Q13 Please add any final comment you wish to make on this inititative						

3.1.2 Semi structured interviews

The semi structured interview was designed to complement the online questionnaire. To this end 21 open ended, clear and specific written questions were provided to avoid interviewer intervention. .

Participation aimed to obtain a varied and representative group of interviewees, although priority was given to performers, teachers, PhD students, academics, composers, conductors and course managers. The final version of interview (Table 2) was informed by previous pilot versions. Relevant data and information was extracted from the interviews employing content analysis techniques. An answer matrix of valid data was employed to analyse and infer meaning from patterns observed from the qualitative data extracted from the interview responses. This tool included coding data categories based on key questions and main themes occurring from question responses.

Four interviews were undertaken and audio recorded. Questions and responses were transcribed to the matrix. For practical reasons the interview data collection method, was turned into a self-administered open ended questionnaire made in the same format and formed of the same questions

as the interview. The rest of participants who volunteered for interviews, responded to the open-ended questionnaire and returned their answers via email

Table 2: Basic acoustic education in music training interview questions

Number	Question
1	What is your current job title ?
2	What is your highest academic musical qualification?
3	How would you describe yourself Lecturer / performer / conductor/composer/ researcher/ manager
4	How many years of music instruction have you received ?
5	Have you ever been an active professional musician/performer? How many years ?
6	Have you ever been an active amateur musician/performer ? How many years ?
7	What is/are the main instrument /s you are proficient at ?
8	How would you describe your level of understanding of acoustics ?
9	Do you believe that the introduction of basic acoustic education would be or would not be beneficial in the training of performance musicians, composers and conductors ? Please explain the main reasons.
10	How important do you think is this introduction ?
11	What benefits could be the expected ? What drawbacks could be the expected ?
12	What could be the potential barriers to implementation?
13	How would you recommend implementing that basic acoustic education introduction ?
14	Should it be integrated into the syllabus as compulsory, optional or be offered as extra-curricular ?
15	If this introduction is to be implemented, what topics do you think should be covered ?
16	If this introduction is to be implemented, how many contact hours would you recommend ?
17	If this introduction is to be implemented, should it be assessed ?
18	What format(s) or teaching style(s) would you recommend ?
19	How do you predict that this initiative will be received in your institution and in other relevant institutions (schools/conservatoires/universities) ?
20	Do you know other music education institutions where basic acoustics education is part of the syllabus ? Would you know the duration and the contents ?
21	Is there any final comment you wish to add ?

4. Results and analysis

4.1 Documentary data analysis

Data provided by the Higher Education Statistics Agency (HESA) in April 2015, showed that in the UK there were 71 HE institutions which offered courses in music and music performance. 40 music performance related institutions were invited to participate in this study. Of those, 31 participated (including the most prominent ones in the UK) by distributing the online survey questionnaire among their students and staff as well as facilitating interviews. This participating group was comprised of universities music departments (32%), academies and conservatoires of music (23%), music education associations (16%), music research associations (10%) and musicians professional associations (19%). Here we present some indicative responses received from the participants at institutions identified above where musical acoustics is an optional part in syllabi.

Prof Murray Campbell, musician and world leader academic in musical acoustics who previously was responsible for the acoustic education in music courses at Edinburgh University, stated that the acoustic content in performance related music studies "*...has been running successfully for many years at my institution*". At the other university, acoustics topics have been offered in the music department for many years with great success. Prof Frank Fahy, world authority in acoustics and former lecturer to the performance music studies at Southampton University, noted on the content of acoustics tuition in those courses that "*It is very well received*".

Only one UK conservatoire incorporates musical acoustics as an elective research focus in their BMus (Hons) syllabus. The Head of Undergraduate Studies at Royal Northern College of Music (Dr Michelle Phillips) responsible for the syllabus commented: "*the musical acoustics elective part has been well-received at my institution*".

4.2 Online questionnaire

A total of 475 questionnaires were completed online of which 462 were deemed valid (97%). This sample exceeded the minimum size to make statistically significant inferences from the results with a 95% confidence level and at 4.5 confidence interval.

4.2.1 Sample composition

Statistical results for questions one to eight provide information on the sample composition.

Results from question one showed that 43% of the sample feel within the category of music students, 30% music researchers, 18% acoustician-musician, 8% conductor-composer and only 1% declared to be not a musician. Responses from questions two, three and four provide evidence of the sample being evenly distributed in the respective group categories.

In question five 94% of the respondents declared that they have more than 4 years of formal music training. This result provides confidence in the validity and relevance of the sample for the purposes of the study. 56% of the sample declared in question six, that they possess at least basic academic knowledge of acoustics while 29% stated they possess self-learned basic knowledge. In question seven 51% of the sample declared that they have more than 1 year of acoustic education or practical experience in acoustics. This result is consistent with results from question six.

Interpretation of results from questions 5,6 and 7 conclusively indicate that the vast majority of participants were able to correctly interpret what is meant by acoustics and therefore infer the correct meaning and context of the subsequent questions.

In question eight 28% of the respondents define themselves as music students, while 12% consider themselves consultants in music or in acoustics. 20% are self-employed, 30% are academics and 9% in managerial positions. This constitution of the sample provides evidence of the relevance, validity and required diversity of respondents.

4.2.2 Key questions results

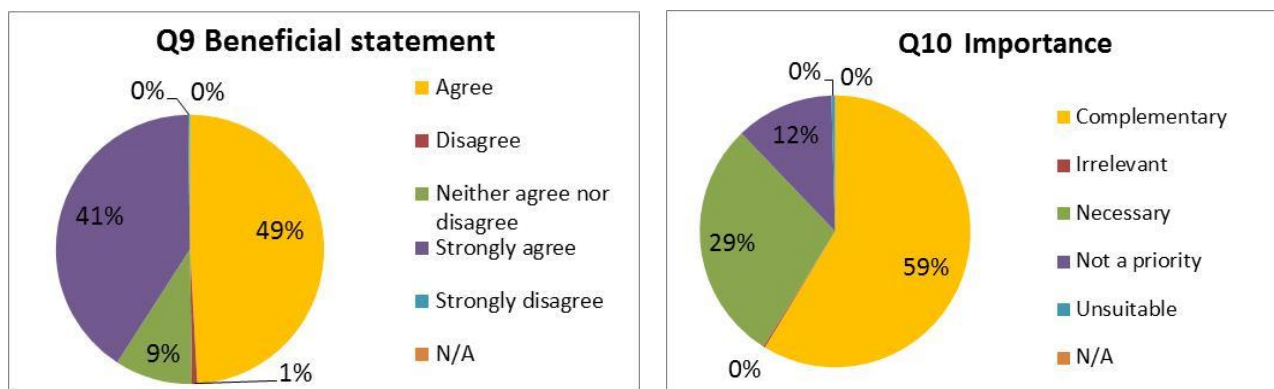


Figure 1: Statistical results for questions 9 to 10 on agreement level and importance of the introduction

Results for question nine shown in figure 1, reveal that 90% of the respondents agreed with the statement that basic acoustics education can be beneficial in the training of performance musicians, composers and conductors. Only 0.9% disagreed and 9% did not agree or disagree.

29% of the sample believed that the introduction of basic acoustic education in performance and music syllabi is necessary, 59% think it should be complementary, while 12% consider that it is not a priority. Only 0.4% believe that an introduction to acoustics is not suitable and 0.2% that is irrelevant. Results from question eleven indicate that 33% of the respondents consider that the provision of a potential introduction of basic acoustic education should be compulsory, 49% optional and 5% extra-curricular while only 0.4% believes that the acoustic education should not be introduced. The combined result indicates that 87% of the respondents agree with providing the introduction in some way. These results agree closely to the responses to questions nine and ten.

Results from question twelve showed more diversity of opinion with regards to the recommended duration of the introduction. 56% of the respondents recommended 10 or 20 contact hours. Only

0.6% recommended 0 hours which can be interpreted as lack of support for the introduction. This result is consistent with similar answers to questions nine, ten and eleven.

In all questions the N/A answer was chosen by less than 0.9% of the sample, except in question twelve where this answer was chosen by 2.8%. These results suggest that virtually all respondents found all questions and their answers clear, relevant and accurate. This in turn provides further assurance of the validity of the responses, confirming the reliability and relevance of the sample.

4.2.3 Questionnaire results cross analysis

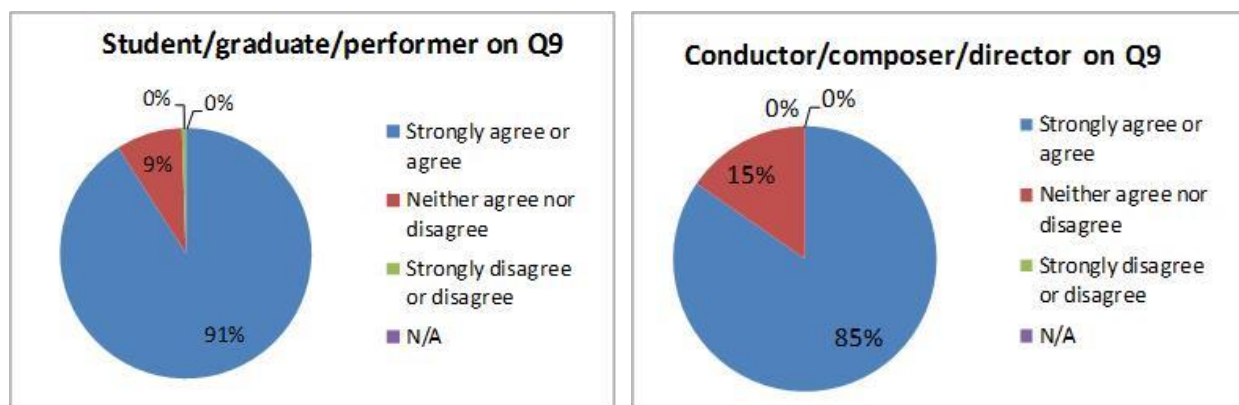


Figure 2: Statistical results from selected respondent groups on question 9 statement

Answers to question nine by selected groups of the sample showed (Figure 2) that 91% of the music student-graduate-performer and 85% of composer-director-conductor group strongly agreed or agreed with question nine statement. 0.5 % of the former group disagreed or strongly disagreed.

88% of the music researchers-consultant-academics group strongly agreed or agreed with question nine statement while only 0.7% disagreed or strongly disagreed.

The vast majority (97%) of the key group (acoustic consultants with musical training) expressed agreement with question nine's statement, while only 3% neither agreed or disagreed.

62% student-graduate-performer group (the largest group and possibly the most relevant to this study, 43% of the sample) think that the introduction should be complementary, 25% that is necessary, 13% is not a priority, 0.0% is irrelevant and 0.5% is unsuitable.

4.3 Semi-structured interviews

A total of 22 valid interviews were completed. All interviewees were experienced performers with extensive musical education except two acoustic academics which have amateur self-instruction and experience. Here we discuss the findings of questions 9-12,14,18-20, offering some indicative quotes from respondents to complement the statistical evidence. For brevity we will not discuss answers received to questions 1-9, 13, 15-17, and 21 considered auxiliary to the focus of the study. All interviewees unanimously believed that the introduction of basic acoustic education would be beneficial in the training of performance musicians, composers and conductors (question 9). The ample majority of respondents considered the introduction very important while five of them believe this to be of moderate importance (question 10).

"Extremely important. I wish this subject had been available to me during my studies. Musicians create sound for a living. It's shocking that we are not better educated in the science of sound" (Georgia Browne, Senior flutist performer and flute teacher, MMus,)

"..I think It is a great idea, I really do. It should been thought earlier !" (Stuart Morley, musical director, pianist and vocal coach at London Royal Academy of Music, MusDip)

" Yes, very useful, very important " (Dr Michelle Phillips, Lecturer at Royal North College of Music , Head of Music Undergraduate Programmes, saxo and flute performer, PhD)

"Yes I strongly believe it is very important, for composers especially" (Dr John Cole, Area Leader in Postgraduate Composition, Royal College of Music, senior composer, conductor, PhD)

Some comments on the moderate importance (Question 10) are provided below:

"Moderately important. Not essential, but could be a useful option particularly for composers" (Dr Valerie Langfield, Senior professional piano performer and teacher, PhD)

"Moderately important. Musicians have gotten by without it for a long time" (Dr Matthew Wright, Lecturer in music acoustics at Southampton University, amateur musician, PhD).

In question 11 there is clear agreement among respondents that there are many benefits and only few or no drawbacks to introducing acoustics in to music syllabi. Reoccurring themes included: (a) the importance of gaining an understanding of how different spaces influence performance outcomes and performer-audience interactions and perceptions; (b) the significance of acoustics to historical musicological understandings of musical practices; (c) the prevention of hearing loss; (d) the need for an increased sensitivity and awareness of the nature and characteristics of instruments; (e) improved communicative potential between related professional groups (e.g. music producers).

"Better understanding of live sound production and how this reaches the listener will help adjust performance techniques, influence the choice of performance/training etc. spaces, selected repertoire, etc. I see no drawbacks". (Georgia Zepediou, Senior Acoustician and qualified pianist, MSc)

"Understanding the ingredients of music is bound to be beneficial to the people serving it up. Lots of benefits – e.g. Composers would understand more about orchestration, performing musicians would understand concepts like loudness and tuning. No drawbacks" (Prof John Powell, Music composer and scientist, seminal book author, MMus, PhD).

There was also a strong agreement among interviewees to question 12. Answers showed the lack of perceived value (awareness), potential cost/revenue implications, crowded syllabus, lack of expertise to teach the subject as the potential barriers.

"Perceived need to focus on the development of other skills; lack of appropriate knowledge among staff used to teaching performance" (Kate E Walker, Performer, composer researcher, MA)

"Cost, space and time in an academic institution" (Dr Anastasia Belina-Johnson, Assistant head of Undergraduates programmes at Royal College of Music, Lecturer, Researcher, PhD).

Answers for question 14 were generally spread between compulsory and optional with two senior performers answering *"Compulsory for conductors/composers, optional for all rest "*. This has been also observed in responses to other questions.

A clearly reoccurring theme on question 18 was the concern by respondents that the content although science based should be made relevant, accessible and tailored to music students.

Regarding the prediction asked in question 19, most of opinions reflected confidence in acceptability while few others indicated that institutions would be reluctant is they not see a significant relevance and value.

" A lot of interest. Performance driven conservatoire might not be the case As long as the material is presented in a vibrant manner which draws links to real life situations I can't imagine why it wouldn't be taken up by institutions" (Georgia Browne, Senior performer and flute teacher, MMus)

"I have experience of trying to introduce novelties into my academy's curriculum and that has not always been easy. The sometimes overwhelming tradition of teaching harmony, history etc. has been hard to confront" (Petur Jonnanson, Head of guitar studies, senior performer, MMus).

None of the interviewees knew any performance music institution where basic acoustics education is part of the syllabus (question 20).

5. Discussion

Findings obtained from the online questionnaire agreed closely with those obtained from the interview thematic analysis.

Benefits to be expected from the introduction consistently identified by respondents included: Gain an understanding of how the acoustics of different spaces can affect the performance on stage and on the audience or enrich composition, understand the historical significance of acoustics, prevention of hearing loss and understanding of hearing system, increase sensitivity and awareness of the

nature and characteristics of instruments, improve communication/ appreciation of other related professionals, enrichment of musical learning experience, awareness of acoustics as a related industry for potential career change, alignment with current trend to produce more rounded musicians in a multidisciplinary industry. No significant drawbacks derived from a prospective introduction were found. However the following barriers to implementation were identified: initial lack of appreciation of the potential value and benefits, lack of qualified staff, crowded syllabus, cost/revenue considerations

6. Conclusions

This novel and comprehensive scoping study has been undertaken to explore and evaluate the perceived value, suitability and attitudes towards introducing basic acoustic education in performance music training in UK higher education (HE) institutions.

Findings from this study clearly and conclusively show that the vast majority of the HE performance music community in the UK believe that such introduction would be highly beneficial and relevant. Results indicate that the large majority of that community support the implementation of acoustics training although views on suitable modes of implementation and duration differed.

The results strongly support the argument that there is a perceived knowledge gap in performance music education in the relevant field of acoustics.

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