

ARCHITECTURE, ACOUSTICS, AURALIZATION & EMOTIONS

An interview with Dr. Alaa Algargoosh, a research fellow at MIT Media Lab.

by Jeff Hawley

As regular readers of this publication may know, I am hard at work pursuing a PhD in philosophy centered around the topic of Philosophy of Sound. A summary of findings from my latest research project (featuring responses from more than 1,000 professional live sound engineers and music industry professionals) is in the final number crunching and philosophical analysis stage before publication in an upcoming issue. We may finally have an answer to whether the proverbial lonely tree falling in the forest makes a sound or not. Stay tuned for the survey results shortly.

Through the process of my research, I came across several interesting articles and projects related to how the architectural characteristics of a given performance venue can affect how the occupants not only *see* the space – but how they *hear* and react psychologically and physiologically. In other words, what is the relation between acoustic design, audio mixing, various playback systems, etc., and human emotion?

I noticed that many of the articles I referenced included Alaa Algargoosh as a key researcher, so I reached out to see if she would like to share some of her research and insights with the live sound community directly. Luckily for all of us, she agreed! Join me for an interesting dive into the ways our mixing, sound system and venue design choices impact listeners on multiple levels.

Jeff Hawley: Dr. Algargoosh, thanks for taking the time to share your research with the readers of *Live Sound International*. First off, how did you make your way into this particular topic of research?



Dr. Alaa Algargoosh.

Alaa Algargoosh: My path into this field began with my architectural background. I participated in a hospital renovation project, which highlighted the significance of the built environment in affecting health and well-being, underscoring the importance of sustainable design in fostering supportive spaces. This initial interest deepened during my master's in sustainable architecture, where I explored the relationship between geometry and acoustics.

My work led to the creation of the [Cymatic Sound Diffusers](#), which was recognized by the MIT Technology Review's *Innovator Under 35* award. Motivated to delve further, I shifted my focus from purely physical acoustics to also encompass perceptual and cultural dimensions, aiming to better understand how acoustic environments can enhance well-being.

JH: It seems to me that your research deals with a number of theoretical issues and the philosophy and psychology of sound,

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but you also propose tangible steps that can be taken to put these theories into practice. Can you share some of the more applied sorts of findings that you've presented?

AA: My "Aural Affect" project investigates the impact of acoustic environments on human emotions and well-being. This project involved capturing the acoustics and visuals of four socially and historically significant buildings for the community in Detroit using binaural recording and a 360 camera.

We found that the recorded sound "wet recording" enhances the emotional effect when compared to the "dry recording," which does not include the effect of sound reflection from the architectural surfaces. We measured the emotional effect by adopting a mixed-method approach that included objective and subjective data.

The first was obtained by measuring the heart rate and skin conductance, providing information about the intensity of the emotional impact, and the second was collected by asking the research participants about their experience after listening to each dry and wet recording and visualizing the space using a VR headset.

Certain architectural elements acted similarly to musical instruments, enhancing the dominant frequency range of the sound source and altering its musical characteristics. The find-

ings indicated that the acoustic environment can amplify the emotional impact of a sound source, influenced by the architectural features of the space.

JH: Your 'A method for analyzing room modal response using auralization' research was quite interesting to me. Can you provide a brief overview of the method you propose and how it would differ from the more common room analysis tools and practices for measuring and analyzing room acoustics and evaluating sound system intelligibility?

AA: [This method](#) was inspired by Lucier's sound art piece "I am sitting in a room," where he records his voice, plays it back, and re-records it multiple times until the resonances of the room become dominant. My approach applies a similar iterative process through simulation. By convolving a dry recording with an impulse of a room, then using the output as an input and convolving it with the impulse response multiple times, we can identify the frequencies where the room modes occur.

This method overcomes the limitations of the traditional room mode calculation method that does not take into account the room geometry, materials, sound source location, and the interaction between the sound source and the room. Thus, this method allows for analyzing resonance in rooms with

complex geometries and understanding how different rooms work as an audio equalizer EQ that changes the characteristics of the sound source.

JH: We've touched on psychological impacts, intelligibility, accuracy in sound reproduction, etc. It would seem that in some cases these areas may end up being in conflict – a 'wet' mix enhancing overall positive psychological impacts yet possibly reducing intelligibility, etc. Do you have a view on how audio engineers and system designers might want to balance these goals?

AA: Through my research and analysis of the link between the acoustic parameters and emotional response indicators, I realized that the ones with long reverberation time at frequencies lower than 1000 Hz, and shorter at 1000 to 4000 Hz allowed for maintained speech clarity within the crucial frequency range for speech, while simultaneously enhancing the aesthetic quality of sounds at lower frequencies.

The building with the described acoustic characteristics in my research was rated for the highest emotional intensity of positive emotional impact, and many historic buildings known as acoustic icons share the same pattern, such as Hagia Sophia.

JH: For aspiring live sound engineers and system designers or those simply wishing to expand their knowledge on these sorts of topics, where would you recommend they start their journey

AA: "The Sound Book: The Science of the Sonic Wonders of the World" by Trevor Cox has profoundly influenced me. It has transformed how I perceive everyday sounds. Additionally, I highly recommend "Spaces Speak, Are You Listening?: Experiencing Aural Architecture" by Barry Blesser and Linda-Ruth Salter. This book has shaped my interdisciplinary approach to architectural acoustics.

JH: What is next for you and your research?

AA: I currently lead two main projects: Sound(e)scape and Sonic Sculpting. Sound(e)scape is focused on understanding how acoustic environments can evoke emotions of awe and wonder, and examining the role these experiences play in psychological restoration. The ultimate aim of this project is not only to improve well-being but also to develop a supportive tool for neurodivergent individuals, enabling them to thrive in various environments.

On the other hand, Sonic Sculpting leverages machine learning and generative AI to create a 3D model of an environment using



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At work in the field, gathering data.

the acoustic data obtained from impulse responses. This project is designed to be a collaborative tool enabling designers and AI to co-design spaces tailored to specific acoustic needs. **LSI**

Alaa Algargoosh is a research fellow at the MIT Media Lab. She develops innovative solutions for acoustics that utilize computational models, immersive experiences that enhance well-being, and advanced computational technology that enables designing and analyzing complex acoustic environments. She received her Ph. D. in Architecture from the University of Michigan in addition to many awards, including the Innovators Under 35 Award by MIT Technology Review, Dow Sustainability Fellowship, Barbour Scholarship, ArtsEngine Grant, Humanities Institute Fellowship, the Mellon Foundation Grant, the MIT IBK Research Award and the ARCC King Medal for Excellence in Architectural and Environmental Research. Her projects were also featured at International Innovation Exhibitions.

Jeff Hawley heads up the marketing for Allen & Heath USA. In addition to his diverse background as a musician, engineer, and industry executive, he is pursuing a Ph.D. in philosophy at York St. John University and serves as the Communications Officer for the British Postgraduate Philosophy Association. He is a frequent contributor to philosophical, music industry and live sound publications.