Conversation with a Colleague: Robin Glosemeyer Petrone

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Conversation with a Colleague Editor:
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Meet Robin Glosemeyer Petrone

Robin Glosemeyer Petrone is the next acoustician in our "Sound Perspectives" essay series "Conversation with a Colleague." Robin received her bachelor's degree from the University of Kansas, Lawrence, and has worked at several acoustics and architecture firms since then. Robin is currently a partner at Threshold Acoustics, Chicago, Illinois. We asked Robin to give us her elevator pitch and then to elaborate on her inspirations, contributions, and hopes for the future.

Give your "elevator speech" about the thrust(s) of your scholarly work over your career.

As a partner in Threshold Acoustics (see thresholdacoustics.com), I am hired as an acoustic consultant to advocate for and shape the aural experience in the built environment. Our project types vary greatly, including any spaces where one gathers to learn, share wisdom, and pass along culture, with a specialization in the performing arts.

Most of my time is spent as a translator to decipher descriptions of the human experience of sound. A musician may describe a concert hall as being "clear" or "lush." I pair this description with my scientific knowledge of the behavior of sound, translating the descriptive terms into the application of scientific principles and explaining to an architect how the shape and finishes of the room result in that acoustic perception of clarity or lushness.

We acousticians begin our work in the design process by developing a program for the building. A program is a list of the rooms required to allow a building to function properly. If we are building a concert hall, we require a lobby to hold the guests, restrooms for bio-breaks, a place for the musicians to store their instrument cases and change into their concert attire, and mechanical rooms to provide the building's ventilation, to name a few. We also provide a description of the functions that occur within each room. In the concert hall lobby, the space hosts patrons preshow and during intermission. However, the lobby may also be used as a banquet space for weddings and fundraisers or to host preshow lectures and smaller performances. We describe the basic acoustic conditions required to support each of the functions identified for each space. In a building for music education, for example, we identify the area, or footprint, required for each musician in an orchestral rehearsal room along with the amount of height needed to create the appropriate "acoustic volume" to accommodate the sound energy that each musician produces.

In the design phase, we lay out the building on a site, paying attention to the way people move through the building and to the locational relationship of sound-sensitive spaces to the noise-producing spaces. It is desirable to have the stage and a scene shop next to one another so as to easily move scenery between the two, but the close proximity can also be problematic if the scene shop is being used while there is a production on stage and the sound of hammering can be heard during a performance.

As we move into the detailing of the design, we work with the architects and engineers to shape the way sound is generated in the building and control how it travels from

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a source to a receiver. For instance, we want to help the audience hear a performer on the stage. We educate the architects on how to shape and construct the walls of the theater to provide useful reflecting surfaces that support or add to the direct sound from the performer to the audience members' ears. We do not, however, want the audience to hear the mechanical unit that supplies the air conditioning. In this case, we work with mechanical engineers to design the duct path that delivers the cold air so that it does not deliver the noise of the fan that pushes that air. We also work with the architect to build walls to block the sound radiating out of an air handler.

In the construction phase, the contractors are building from a set of construction drawings and specifications that we developed during design. We meet with the contractors to explain the acoustic goals of the building, and this includes describing the science behind the details that they are asked to construct. We visit the site during construction to review the installation progress, answer questions as contractors implement the design, and watch for conflicts that may prevent the details from being built as intended.

What inspired you to work in this area of scholarship?

My curiosity is boundless. I am also a highly sensitive individual, interpreting all experiences in great detail. My ultimate satisfaction comes from understanding how all of the smallest details function and then come together to create complex systems.

In my youth, I enjoyed the sciences, with physics and mechanics piquing my curiosity. I similarly experienced an intense gravitational pull toward the performing arts. With dance as my primary focus, I also played musical instruments and participated in any theatrical production I could fit into my schedule. Through all my studies and extracurricular activities, I have always experienced a keen sensitivity to our senses and emotions.

In researching universities, I happened on an architectural engineering program at the University of Kansas. Students entered through the School of Architecture to complete architectural studies and design studios while simultaneously completing studies in structural, mechanical, electrical, and lighting systems as well as building contracting in the School of Engineering. In the final years of the program, I chose an emphasis in acoustics that offered a grand intersection, allowing an opportunity to apply scientific knowledge in all aspects of building systems and artistic endeavors through architecture, all in pursuit of the human sensory experience of sound. I supplemented my building acoustics base studies with courses in musical acoustics in the School of Education and in speech and hearing through the Department of Speech-Language-Hearing.

Of all your contributions during your career, which are you most proud of and why?

In 2020, we opened the Brockman Hall for Opera in the Rice University Shepherd School of Music, Houston, Texas (**Figure 1A**) (see bit.ly/3qixs7z). Working with Allan Greenberg, architect, and Fisher Dachs Associates, theater consultants, my business partner Scott Pfeiffer and I were part of the design team tasked with creating a hall ideally suited to the training of young, exceptionally gifted, aspiring professional opera singers and orchestral musicians and that provides an exquisite balance of the operatic voice with the accompanying orchestra ensemble from the pit.

We began our design process by reviewing more than a hundred opera houses constructed throughout history around the world. We then chose several representative opera houses to investigate in more depth with the client and design team, providing visual imagery of the houses as we described the key layout, shaping, and architectural features that come together to create each opera house's specific acoustics response.

On this project, we were able take our precedent investigations a step further by taking a European tour that allowed the team to see and hear seven opera houses in person. At the conclusion of the tour, the team settled on two favored opera house precedents, one Italianate and one French. We built the two precedent opera houses in a three-dimensional acoustical modeling program. We then introduced sound sources recorded in an anechoic chamber (a room that is devoid of any reflecting surfaces) into the computer models that applied the modeled rooms' acoustic response to create auralizations. Auralizations (Kleiner et al., 1993) are simulated virtual binaural listening experiences rendered at a given position in the computer-modeled space. We brought the team into

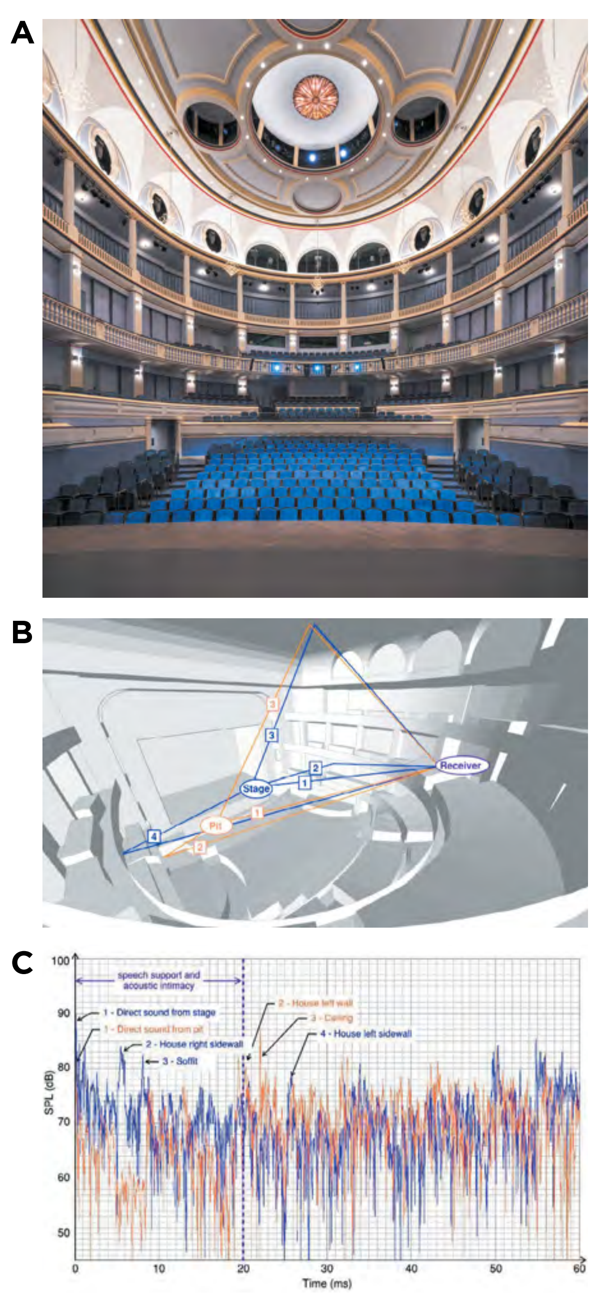

Figure 1. ***A:*** *view from the stage into the audience chamber of the Lucian and Nancy Morrison Theater in the Brockman Hall for Opera, Rice University, Houston, Texas.* ***B:*** *three-dimensional model illustrating the reflection paths from an opera singer on stage (**blue**) and a musician in the pit (**orange**) to an audience member seated in the Grand Tier of the Lucian and Nancy Morrison Theater.* ***C:*** *receiver impulse responses comparing the balance of the sound from a stage and from a pit source as heard by an audience member seated in the Grand Tier of the Lucian and Nancy Morrison Theater. SPL, sound pressure level.*

a space with a 22-channel spatial audio system and a 4-meter diagonal video screen to immerse them visually and aurally in the virtual experience of the opera houses, allowing them to listen to side-by-side comparisons of the precedent houses with the concepts for the new theater at Rice University.

The acoustic design of the 600-seat opera house that emerged from this process envelopes the listener aurally in a room with clear ties to both the French and Italian operatic traditions. It engenders a sense of intimacy and immediacy, providing a strong connection between performer and audience.

The SketchUp model (**Figure 1B**) and the measured impulse responses (**Figure 1C**) illustrate the direct and early-order reflection paths and the balance of sound energy from both a vocal source on the stage (**Figure 1B,** *blue*) and the concert master source in the pit (**Figure 1B,** *orange*) to a receiver seated in the Grand Tier. Direct sound from the stage and pit arrives at the listener's ear within fractions of a millisecond of each other, with a 10 dB preference toward the voice on stage. First-order reflections from the side wall and soffit continue to favor the voice in both energy level and time of arrival, arriving within the critical first 20-millisecond time window that supports speech intelligibility and creates the perception of acoustic intimacy.

What are some of the other areas in which you feel you made substantive contributions over your career?

The main thrust of my work is to share research and project-specific knowledge of sound behavior with clients, design teams, and contractors, showing everyone how their work impacts the spaces we build together. I am driven by the belief in designs where acoustics and audio/video (AV) become a natural extension of a unified design rather than an additive element.

I also take opportunities to share my knowledge through teaching engagements, invited presentations, and publications. I am currently an adjunct lecturer in the School of Communication Master of Sound Arts and Industries Program at Northwestern University, Evanston, Illinois. I have a recurring role as an invited lecturer and advisor for the third-year architecture studios at the Illinois Institute of Technology, Chicago, Illinois.

I continue outreach efforts as an invited speaker focusing on the topics of music and architecture for the Los Angeles Philharmonic Music for Elementary Educators Series, Los Angeles, California, on the exploration of sound in architecture for the Southern California Institute of Architecture, Los Angeles, and bringing midcentury masterpieces back to life at the International Theatre Engineering and Architecture Conference. As the Covid-19 pandemic entered its second year, Scott Pfeiffer and I shared our knowledge with the League of American Orchestras, New York, New York, on the topic *Balancing Acoustics and Physical Distancing as Orchestras Return to Their Halls*.

I am currently chair of the Concert Hall Research Group (CHRG) (see chrgasa.org), a subcommittee of the Acoustical Society of America (ASA) Technical Committee on Architectural Acoustics (TCAA). CHRG's mission is to advance the knowledge and understanding of acoustic design for music performance spaces. I have cherished my roles in co-organizing the 2003, 2014, and 2019 CHRG Summer Institutes. These Summer Camps for Acousticians are week-long conferences held at an outdoor music facility to facilitate the exchange of ideas between practicing acoustic consultants in performing arts, faculty and researchers in architectural acoustics, and college students studying or interested in architectural acoustics, with a goal of furthering research into the subjective preferences of listeners and improving our tools for design and analysis in acoustic modeling and measurement methods.

Through the ASA, I am currently serving my second term as a voting member on the ASA Books Committee, representing the TCAA and am cochair of the Newman Student Award Fund where I maintain the Student Design Competition (see bit.ly/3AGmPA5).

I am a co-author of *Classroom Acoustics: A Resource for Creating Learning Environments with Desirable Listening Conditions* (see bit.ly/3cEBIuM). This ASA booklet is intended to raise awareness of the impact of the aural environment on learning and was created to be a supplemental resource for architects, educators, and school planners. It provides a general overview of classroom acoustics problems and their solutions for both new school construction and renovation.

What do you think are the most pressing open questions that you would like to focus on over the next 5-10 years?

When I was introduced to the world of acoustics by Bob Coffeen in my first architectural acoustics course at university, I thought it kismet to have found a profession where I could bring together a seemingly disparate set of skills and interests into a profession that would allow me to endeavor to improve the human condition. It is energizing to know that with each project I am able to help people: help them more easily communicate and learn; improve their ability to focus; reduce their stress; and facilitate the creation and enjoyment of art that can elevate the human experience.

But there is another awesome, if not necessarily obvious, aspect of working as an acoustician in the building industry I treasure. It is understanding that my job allows me to spread my impact far beyond the projects on which I have the privilege to work. With a project, I have the opportunity to advocate for our aural environments and to share my knowledge with my architect, engineer, and contractor colleagues so that they can learn it for the project at hand and carry that knowledge forward onto the next project.

Reference

Kleiner, M., Dalenbäck, B. I., and Svensson, P. (1993). Auralization — An overview. *Journal of the Audio Engineering Society* 41(11), 861-875.

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