

ART / ARCHITECTURE

Building a Better Soundtrap

By ANDREW BLUM

IN his classic book "The Experience of Place," Tony Hiss describes the sensation of stepping into the concourse at Grand Central Terminal: "I felt as if some small weight suspended several feet above my head that I had not till then even been aware of, had just shot 15 stories into the air." But, Mr. Hiss stresses, he knew this not by sight but by sounds, smells, even a subtle change in his own breath.

For architects, the problem has always been that those atmospherics, so hard to quantify, are exceedingly difficult to predict. Acoustics, in particular, are a crucial part of the experience of a building — concert halls and corporate offices alike. But as the long, sad history of acoustical missteps proves, perfecting a sound aesthetic is easier said than heard. Most architects are forced either to make an educated guess about the play of sound or begrudgingly consult acousticians, who have technical expertise but few practical ways to demonstrate their ideas.

In the 1960's, the acoustician Paul Veneklasen developed a crude "auditorium synthesis" system to simulate a room's sound. In the early 1990's, Charles M. Salter began using a small, specially built theater to recreate key sound characteristics in a controlled environment. Both were significant advances, but, limited by the available technology, they could offer only an approximation of what a room's sound would be like.

A new "auralization room" called the SoundLab developed by Arup, the international engineering firm, has begun to change that. At Arup's New York offices on the edge of SoHo, the SoundLab is a 150-square-foot windowless space, with a worn oriental rug covering a wooden floor, a pair of computers in the corner and a tall stool placed right in the middle. Here and in similar rooms in London and Melbourne, Australia, the walls are lined with 12 speakers, loosely arranged in a sphere,

After centuries of guesswork, architects have a high-tech way to hear the acoustics of buildings they haven't yet built.

that create a three-dimensional sound field.

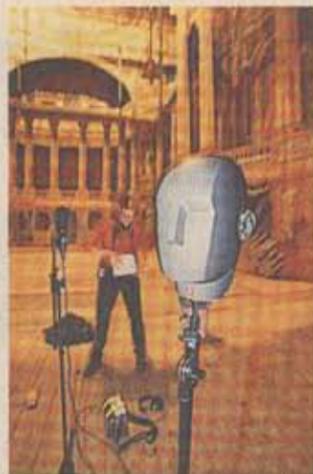
For a demonstration recently, Neill Woodger, a principal at Arup Acoustics who led the development of the SoundLab, projected a slide of the Concertgebouw, the famed Amsterdam hall, on a screen. At a pre-arranged signal to his assistant, Alban Bassuet, a recording of Handel's "Water Music" came over the speakers. The music had been recorded in an anechoic chamber, a "dry" room free of sound reflections. Then, through a mathematical process called convolution, the computers in the SoundLab combined the music with the "acoustic signature" of the Concertgebouw, derived from a three-dimensional computer model that had been calibrated with recordings made in the actual hall with a special four-track microphone.

For a visitor sitting at the center of the room, it felt like entering a palpable sphere of sound. The acoustical "halo" of the Concertgebouw was distinct, as if this little soundproof room itself had radically shifted dimension. A few bars of Handel later, the slide on the screen changed to the Musikvereinsaal in Vienna. The acoustics followed, forming an otherwise impossible duet of two of the world's greatest concert halls. The room felt as if it had opened up, as if the ceiling had lifted.

Unlike the "arena" and "jazz club" settings on some low-end stereos, the dominant sensation in the SoundLab is of changing space, not sound. "The architectural experience and the acoustic experience are completely and utterly intertwined," Mr. Woodger explained. "You can't have a big fat room that sounds like a thin room, and you can't have a thin room that sounds like a fat room. In choosing the architecture you are also choosing the sound aesthetic."

The people at Arup hope that SoundLab will trans-

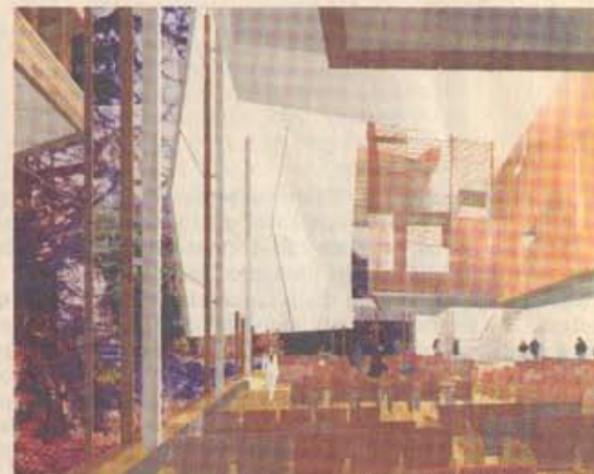
Andrew Blum writes about architecture for *Dwell*, *Metropolis* and *Architectural Record*.



Arup



Computer rendering by Armin Hess



Mack Scogin Merrill Elam Architects

At left, a dummy head fitted with microphones is used to help capture the "acoustic signature" of a room for use in the SoundLab system. SoundLab simulations were used to test the acoustics during the design of the Akron Art Museum, center, and a student center at Wellesley College.



A SoundLab listener hearing Handel's "Water Music" as it would sound in Vienna's Musikvereinsaal.

form acoustical design in the same way that three-dimensional computer animations have transformed visual design. Earlier technologies used in architectural consulting either did not create an ambisonic, or three-dimensional, sound field, or required users to wear headphones, limiting the ability of architects and their clients to stand together, experiencing and discussing the acoustics of a space not yet built. But by allowing different options to be compared from the 3-D computer models that have become standard design tools today,

the SoundLab transforms acoustics into a predictable and negotiable part of the building process.

Tom Wiscombe, chief designer at Coop Himmelb(l)au, the Austrian architectural firm, used the SoundLab to reassure his clients at the Akron Art Museum in Ohio about the lobby pavilion he designed as an addition to the existing building. The museum's director, Dr. Mitchell Kahan, was concerned that its hard glass surfaces would make the room too loud for lectures, live music and parties. Working from a three-dimensional

computer model of the space, Mr. Woodger and Mr. Bassuet developed — over about a week, and for a fee Arup says is in line with those of typical acousticians — a digital model that could simulate different uses of the space. Files from Rhino, a standard 3-D drawing program, were transferred to CATT, specialized acoustical modeling software that simulates the sound-absorbing and -diffusing characteristics of different building materials. Finally, using a system developed by Arup, Mr. Woodger and Mr. Bassuet played the results in the SoundLab.

After listening to simulated parties, lectures and music in the room as originally designed and then with the addition of sound-absorbing materials, both architect and client agreed that only minor changes would be necessary. "The assumption is that an acoustician is there to quell your fears that a space is going to be too loud, rather than saying, 'This is what it'll sound like,'" Mr. Wiscombe said by telephone from Vienna.

Mack Scogin, a principal of Mack Scogin Merrill Elam Architects in Atlanta, had a similar experience with the SoundLab, which he used in the design of a tall, irregularly shaped central room at the new student center at Wellesley College. The space had to accommodate a range of functions including seminars, concerts and huge student parties. Modeled in the SoundLab for Mr. Scogin and his clients, the room as originally designed worked uncannily well for classical music but not for conversation: individual voices were almost inaudible. Slightly altering the design balanced the acoustics for both, without diminishing the power of the architecture. "It was really a great lesson," Mr. Scogin said, "in how architects can be liberated from the relentless insistence that form follows acoustical function — that you have to do a particular shape to achieve a particular sound."

Norman Foster & Partners, who have long collaborated with Arup's engineers and acousticians, used the SoundLab to check the design of the new Greater London Authority building. For their Gateshead Music Center in Newcastle, England, which is to open in December, the Arup acoustician Raj Patel used an early version of the SoundLab for building design and recently has begun a second round of "tuning" on the now nearly complete structure. The exercise has proved reassuring. "If Gateshead sounds like what I hear," said Spencer de Grey, a director at Norman Foster & Partners, "I shall be absolutely thrilled."

Indeed, for Mr. Woodger, who like many acousticians is trained as both a classical musician and an engineer, the greatest thrill of the SoundLab is getting back to the sound itself. "Before we had this room, we were doing more calculations and analytically looking at the design to work out whether it's going to sound good. Now we listen to it and see if it's going to sound good. When you actually start listening, it's much more musical, it's much more about the art, and about bringing it back into a natural balance."

It also means they no longer have to be stern in their recommendations. "I no longer need to force my point," Mr. Woodger said. "I can say, 'Don't trust me, go and have a listen in the SoundLab.'" □