Learning the Science:
Kleinhans Music Hall, Buffalo, 1940

The early twentieth century brought, in many ways, an age of reason inspired by an age of fantasy: politicians worked toward a progressive ideal that attempted to bring science to politics. Science and industry revolutionized transportation with the automobile and the airplane. Motion pictures, sound recording, and radio revolutionized the entertainment industry, and public imagination inspired by World Fairs became obsessed with what the future would bring. After Symphony Hall, the idea of incorporating acoustic science into concert hall design became the norm, instilling the public with the notion that science had resolved yet another uncertainty. These social trends effected concert hall design and the way critics reacted.

The turn of the century also brought a musical revolution in harmony. With many feeling trapped within traditional consonances, composers such as Ferruccio Busoni, Arnold Schoenberg, Luigi Russolo, Pierre Schaeffer, Igor Stravinsky and many others began treating dissonances with the respect earlier composers had reserved for consonant sonorities. Composers began using rhythm as a structural element. The emerging acoustic architecture reacted to these new composers with a new standard of concert hall different from Symphony Hall; new halls would be better suited for detailed listening and
rhythmic clarity. This new type of hall emerged from a “widespread use of sound-absorbing materials, the desire to eliminate noise and reverberation, scientific research on the intelligibility of speech, and enthusiasm for outdoor sound.”

Sabine had visualized acoustics as a flux of reverberant energy that gradually dissipated, and he expressed that concept with the shoebox-shaped hall. Another school of thought had emerged after Dankmar Adler and Louis Sullivan built the Auditorium in Chicago in 1889. That school of acoustics visualized the propagation of sound as reflected rays. In the 1920s, American Acoustician Floyd R. Watson mixed the ray paradigm with Sabine’s reverberation studies to develop a hall suited to the emerging new music. In his *Acoustics of Buildings* published in 1923, Watson observed that nearly all acoustic defects are the result of reflected sound, and that speakers and musicians are aided by nearby reflective surfaces. His solution for indoor auditorium acoustics can be distilled into two rules: “1, Provide a stage with suitable reflecting surfaces so that performers can hear themselves. 2, Design the auditorium for listening so that the reflected sound will be reduced to be comparable with outdoor conditions.” These rules call for a maximization of reflection on the stage and a near elimination of reverberation in the audience seating area.

With this paradigm, the acoustic consequences of a hall’s floor shape had less importance than it usually did because little sound was reflected. With the advent of the cinema in the 1920s, where acoustic requirements played little or no importance in silent films, the fan-shaped floor became the obvious choice for maximizing the audience

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1 Emily Thompson, *The Soundscape of Modernity* (Cambridge, MA, 2002), pp. 248-249
seating area. With Watson’s new concept and with managers around the country looking to bring more of the people to concerts, it did not take long for new concert halls to adopt the fan shape as well.

Watson’s acoustic ideal fit in with the public mood of the time as well as the requirements of contemporary music. Aside from accommodating larger audiences, the fan shape also allowed for roomier seats. The desire for low reverberation time in the audience encouraged the use of soft upholstery on the chairs. At the same time, the halls created a high fidelity intimacy and clarity, similar to that of a recording studio or a hi-fi sound system in a comfortable living room. The reflective stage enclosure at the apex of the auditorium’s fan led to further sound recording analogies that appealed to the public, including the visualization of the entire hall as a horn on a phonograph. The trend also called for the absorption of low frequency reverberation associated with warmth, giving the halls a hard, crisp edge. This edge, along with overall low reverberation times, made Watson’s acoustic theory ideal for the performance of new music’s percussive and rhythmic dissonances, ensuring each attack would sound clean and distinct.

The 1920s through World War II saw a rash of institutional and concert halls built to these criteria. The same year Watson published his book, the Eastman Theater in Rochester was completed, and “although the interior style was most unsuitable for music, it coincided nicely with the Watsonian philosophy.” During that time, many similar halls appeared around the world, including the 1935 Konserthaus in Göthenburg, the 1938 Tanglewood Music Shed in Lenox, 1939 Philharmonic Hall in Liverpool, the 1941

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5 Thompson, op. cit., p. 248
6 Forsyth, op. cit., p. 259
[Indiana] University Auditorium in Bloomington, the 1945 Radiohuset Studio 1 in Copenhagen, the Konserttisali in Turku, the 1954 Aula Magna in Caracas, the 1956 Tivoli Koncertsal in Copenhagen, the 1957 Mann Auditorium in Tel Aviv, and the 1957 Alberta Jubilee Auditoriums in Edmonton and Calgary.

Kleinhans Music Hall in Buffalo, New York, is a fine example of Watson’s concept. In 1934, Edward L. and Mary Seaton Kleinhans left their estate to the Buffalo Foundation on the condition that it would be used towards the construction of a concert hall. The Kleinhanses wanted to create a new music space that would be inviting to the community and serve as an object of community pride. Four years after their donation and with additional money from a Works Projects Administration grant,\(^8\) architect Eliel Saarinen signed a contract to design the concert hall. Kleinhans was Saarinen’s first important project during his residence in the United States outside the campus of the Cranbrook School which he headed.\(^9\) It was also the first project in which he collaborated with his son Eero, just out of the Yale School of Architecture.\(^10\)

From the beginning of the design process, acoustics played a vital role in every consideration for Kleinhans. The Saarinens were asked to create three performance spaces, a main hall to seat 2,839, a smaller chamber hall (the Mary Seaton room), seating about 800, and a rehearsal space to have acoustic qualities similar to that of the full main hall.\(^11\)

\(^8\) “With Some Orchestras,” *New York Times*, October 6, 1940, p. 139
\(^10\) Albert Christ-Janer, *Eliel Saarinen* (Chicago, 1979), p. 91
\(^11\) One of the main contributions of Eero, the future architect of projects such as the TWA Terminal at Kennedy Airport and the St. Louis Westward Expansion Memorial Arch, was the innovative seating design he did with Charles Eames for the Mary Seaton chamber music hall in Kleinhans. Matthew Ginal, “Preservation: The Saarinens in Buffalo,” *Progressive Architecture* (June 1990), p. 28
The science-driven mood of the first half of the twentieth century also brought about modern architecture, intended to express a notion that a structure’s form ought to express the structure’s function. This “form follows function” idea led to Kleinhans and many similar halls’ designs that reflected their functions as concert halls. Kleinhans in particular took cues from European modern architectural trends including an elimination of ornament, a use of bold and massive exterior forms, and an internal spatial simplicity that emphasized movement. The Saarinens looked at the project with analogies to musical instrument design, attempting to maximize functionality within an aesthetic concept. Eliel Saarinen said:

The shape of the violin has not derived from a preconditioned style form. It has derived from and through its own function as a musical instrument and with distinct requirements as to the quality and carrying capacity of its sound, and as to how it is handled by the player. That is, the shape of the violin is based on both musical and human qualifications. And as a concert auditorium to its most nature is a musical instrument, its formation must be derived accordingly.\textsuperscript{12}

\textsuperscript{12} Christ-Janer, op. cit., p. 92
The analogy to musical instruments carried into the layout of the building; the floor plan has aspects similar to an abstracted violin (figures 2.2 and 2.3). One architectural critic compared the hall to a Steinway piano.  

Figure 2.2: Architectural model of Kleinhans with the Seaton Room to the right of the main hall. Note the abstracted violin shape.

Saarinen’s concept depended on an overall spirituality within the building. For him, the building’s spirituality grew from a harmony between the technical requirements and aesthetic conditions: responding to acoustical necessities, the relationship between the audience and the musicians on stage, and lighting considerations. Once he had developed the technical and aesthetic relationship, he expanded the relationship to the larger building form. One way Saarinen achieved that was with the hall’s reflection pool around the outside of Mary Seaton hall. The pool added psychological volume to the smaller side of the building, increasing its apparent proportion to balance the much larger

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13 “A Steinway surely: as arduous and precise in structure, as immediate in adaptation of means to end, and with the same technological elegance. And yet no instrument was ever molded more completely by techniques so numerous and so difficult to coordinate.” Hudnut, op. cit., p. 39
14 Christ-Janer, op. cit., p. 94
main hall. Finally, his craftsman approach to interior details regarding proportions, color, and textures filled out his concept of spiritual unity. The interior also adhered to the contemporary trend of roomy seats with an average of 7.4 square feet per audience member (figure 2.4).

Like Symphony Hall, Kleinhans was an example of harmonious interaction and coordination among all those who worked on the project. The site for Kleinhans was ideal, with plenty of space and a wealth of natural vegetation. The construction committee allowed the architects a great deal of artistic freedom and had the financial resources to complete the project as the Saarinen’s had envisioned it. Acousticians C. C. Potwin and J. P. Maxfield worked with the architects from the beginning to ensure that the architecture expressed the desired acoustic environment. Saarinen reviewed his plans and concepts with the construction architects for the project, F.J. & W.A. Kidd.

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15 Loc. cit.
17 Christ-Janer, op. cit., p. 95
When the hall opened in October 1940, the public loved it. A few had minor criticisms of the modern architecture, but the acoustics sounded true to contemporary acoustic trends. As a fixture in the community and a performance space, Kleinhans performed perfectly. Architectural critic Joseph Hudnut wrote, “If I had my way, every city in America should have a Kleinhans Music Hall, fitted like a garment to the idea of music as popular solace and enlightenment — an act of faith made express and visible.”

Leo Beranek in his 1962 book *Music, Acoustics, and Architecture* described the 1.32-second reverberation time in the hall as working toward a sense of “stage liveness” (rather than the “hall liveness” in Symphony Hall), giving the effect of listening to a high quality recording in a comfortable carpeted room. He also unveiled the results of an

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18 Hudnut, op. cit., p. 41
19 Beranek, op. cit., pp. 99, 102
audience and musician survey he conducted at Kleinhans. Eighty per cent of those surveyed indicated that the loudness, brilliance, and liveness of the hall were “very good.” The $1,500,000 hall was immediately recognized as one of Eliel Saarinen’s masterpieces.

As is often the trend in new scientific fields, state of the art becomes old state of the art. As the audience for serious music became more conservative after World War II, music programmers felt less inclined to perform the contemporary compositions for which Watson’s acoustics had been optimized. As the field of architectural acoustics matured, experts began criticizing the fan shape for elements such as the inevitable concave back wall of a fan that focuses reflections back at the stage and the lack of early lateral reflections for audience members far from side-walls; likewise, the acoustics of

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the early twentieth century have been further discounted because of the trend’s philosophy of one “perfect acoustics” for all applications, implying one standard for both music and speech.\textsuperscript{21}

The analogy of the concert hall to an instrument is a simplification that caused problems in the halls of the early twentieth century. The analogy inspired architects and acousticians to line concert halls with thin wood paneling, like that on a violin, in the hope of exploiting resonances that instruments with similar treatment passes; however, when one considers the amount of sound energy required to set a concert hall into violin-like vibration, it becomes clear that the analogy works better as a tool for visualization than as a design.\textsuperscript{22} Kleinhans has thin primavera wood lining along the interior.\textsuperscript{23} Today, acousticians know that thin wood paneling actually absorbs sound, or as Forsyth elaborates, “The lower frequency sound energy is dissipated as frictional heat as it sets the thin paneling into vibration.”\textsuperscript{24} In many of the halls from that era, such paneling has contributed to a perceived lack of warmth.

After World War II, Watson’s acoustic paradigm began coming into question, and when the Philharmonic Society wanted to build a new hall in New York, they requested that it sound as much like Symphony Hall as possible, and dismissed Buffalo, stating that “the acoustics in Kleinhans Hall… are disappointing, whether due to the fan shape of the hall or the shortness of the reverberation times, we are not prepared to say.”\textsuperscript{25}

\textsuperscript{21} Barron, loc. cit.
\textsuperscript{22} Forsyth, op. cit., p. 260
\textsuperscript{23} Beranek, op. cit., p. 99
\textsuperscript{24} Forsyth, loc. cit.
\textsuperscript{25} From a letter from the Philharmonic Society to architect Max Abramovitz (April 20, 1959) as quoted in “Acoustics of Philharmonic Hall, New York, during its first season,” \textit{Journal of the Acoustical Society of America} 36, num. 7 (July 1964), p. 1247