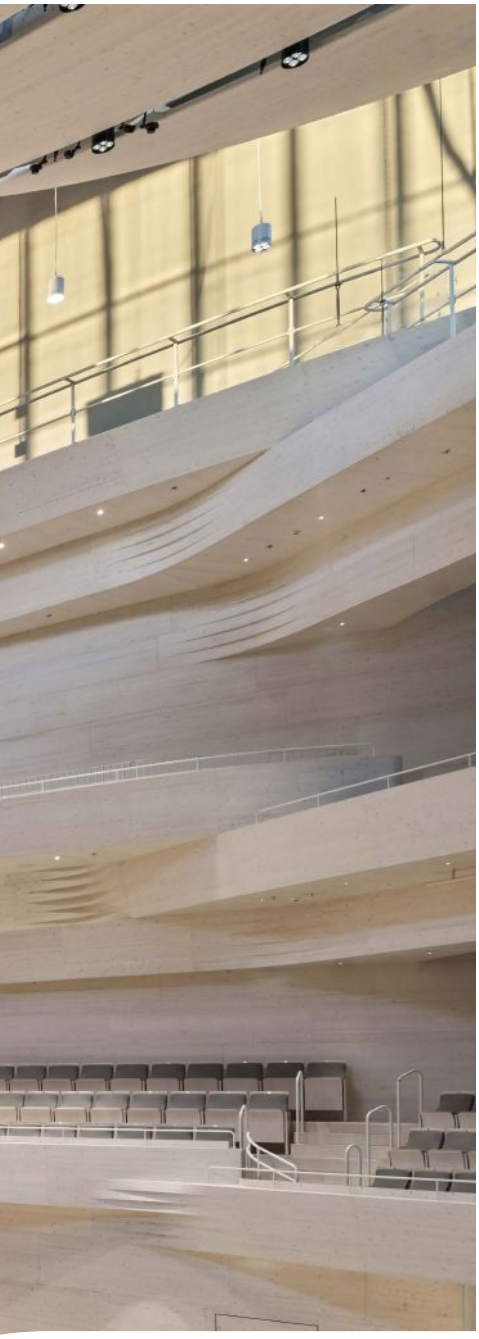
ACOUSTICS
KAHLE ACOUSTICS & AKUKON





Main: The Fuuga concert hall is a hybridisation of the shoebox and vineyard typologies

Inset: Curved balconies wrap around the stalls and stage to create an immersive space for both the audience and the orchestra





Shaped by sound

A reimagined shoebox typology gives the Turku Philharmonic Orchestra's new home an intimate, enveloping sound, with architecture that follows the movement of music

A new music centre has been constructed in Turku, Finland, featuring a 1,342-seat concert hall dedicated to symphonic music, which will serve as the home of the Turku Philharmonic Orchestra. Turku Music Centre Fuuga was designed by PES-Architects, together with Kahle Acoustics and Akukon, who were responsible for acoustics, audiovisual systems and stage machinery. The team took on a unique conceptual approach to the design, established through previous jointly designed performance venues including the Wuxi Grand Theatre and the SCAC Fuzhou, both in China.

The intimate shoebox concept

The Fuuga concert hall was designed to achieve acoustic excellence – with the finest historical shoebox-shaped concert halls as a reference – while also seeking to transform the traditional frontal shoebox typology into a new, more intimate paradigm.

The concert hall is a hybridisation of the shoebox and vineyard typologies, retaining all elements fundamental to the acoustic success of shoebox rooms while improving sightlines, and spatial and visual intimacy.

Aspects such as the moderate width of the hall, the gentle slope of the main floor, the large unoccupied volume in the upper part of the space and the additional volumes created behind the side balconies can all be seen as a legacy of the shoebox-shaped Stavanger Fartein Valen concert hall. In addition, the strong deviations from the rectangular plan, the division of the side balconies into smaller audience blocks and the widespread use of convexly curved walls and balcony fronts are a further development of the concepts employed in the vineyard-shaped Fuzhou concert hall.

Form follows sound

In this venue, the relationship between architecture and acoustics is fundamental. Each surface is oriented and shaped to perform a specific acoustic task. Geometry then becomes a precise means of controlling the sound, determining how widely reflections are spread, how strong they are and which parts of the audience they reach. Some surfaces have complex, warped geometries because their orientation and curvature have been adjusted simultaneously in three dimensions, before being carved from mass-timber. These curves are not simply decorative; they enable crucial early reflections to reach the audience early enough to enhance sound clarity and to be spread over a larger area to prevent them from being too strong or concentrated.

Another major objective of the acoustic design was to create a strong sense of being enveloped by music. This requires more than just an adequate reverberation time and has been optimised by creating additional acoustic volumes behind the side balconies. Four 'acoustic atriums' receive sound both from the stage and from the upper part of the hall through large



Right: The strong deviations from the rectangular plan and the division of the side balconies into smaller audience blocks are inspired by vineyard-shaped concert halls

openings in the balcony floors. The sound is then returned towards the audience from the sides. These spaces act as extensions of the main room, allowing late reverberant energy to reach listeners laterally, as well as from above. The goal is to create a spatially distributed reverberant field – sound that surrounds the listener. The architecture is consequently shaping not only where the early reflections arrive from, but also where the later, more diffuse energy comes from.

The result is a room with unusual geometry that follows the behaviour of sound. In this sense, the visual language of the hall emerges from the same process that determines its acoustic behaviour. The room is a visible expression of the way sound has been designed to move through it.

Enjoying music is a multi-sensory experience where visual and acoustic perception are interdependent. Visual intimacy, natural light and massive timber finishes are architectural features that contribute to an enhanced acoustic experience. Conversely, acoustic excellence also contributes to a sense of wellbeing and architectural beauty.

A musical instrument

A concert hall is not a musical instrument in a literal sense. Still, its physical form determines how musical energy is transformed and experienced. Musicians produce the sound and it is the architecture that determines how that sound is reflected, distributed throughout the space and returned to the performers and listeners.

In Turku's new concert hall, this relationship has been taken unusually far: each geometrical detail having been shaped and tuned to actively contribute to the musical experience. Furthermore, the sound experience on stage has been carefully designed to provide musicians with necessary acoustic feedback to enable them to adapt their performance to the acoustic response of the concert hall. The hall could therefore be seen as an acoustic instrument played by the orchestra, an instrument whose 'notes' are produced by the complex interaction between performers, sound, space and architecture.

Versatility without compromise

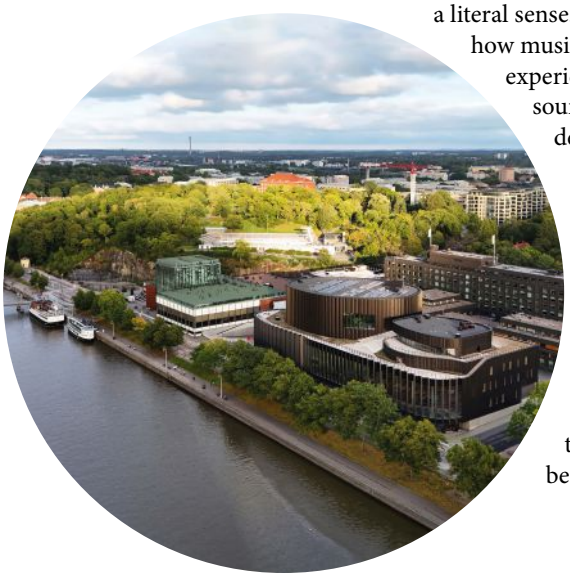
In contemporary music venues, audiences increasingly encounter hybrid artistic formats, where acoustic instruments coexist with electronic sound, projected imagery, broadcast media and immersive visual content. Turku Music Centre Fuuga is no exception.

Combining outstanding acoustics with a wide range of artistic possibilities required a close integration of architectural acoustics and technical systems: sound reinforcement, stage machinery, performance lighting, projection systems and broadcast infrastructure. All technical equipment has been detailed to remain as discreet as possible. This is particularly important for moving lights, whose operational noise can easily become audible in a highly sensitive concert hall environment.

The relationship between acoustics and technology extends equally to the reproduction and distribution of amplified sound. While the hall is primarily designed for symphonic concerts, a significant proportion of its programme consists of amplified music and spoken-word events. The sound reinforcement system therefore has to support vastly different acoustic conditions, ranging from the subtle dynamics of speech to the high sound pressure levels of contemporary music performances.

Detailed acoustic modelling was used to identify the best loudspeaker locations and orientation angles to achieve a uniform coverage throughout the audience area, while reducing unwanted reflections from surrounding surfaces. The results were then brought to life through

Below: The Turku Music Centre Fuuga, located on the banks of the Aura River, is home to the Turku Philharmonic Orchestra



Images: Marc Goodwin; Akukon Oy

auralisation studies, to experience the sound of the proposed solutions and understand their implications before the design was finalised.

Both technical requirements and architectural objectives were treated as components of a common design process. In this sense, the appearance of the loudspeaker system became as important as its acoustic behaviour.

Focus on operations

A similar approach guided the operational planning of the venue. The design team's role extended beyond acoustics and technical system design to include theatre planning and project management throughout the development process. This broader perspective enabled operational requirements, user expectations and technical solutions to be considered simultaneously rather than sequentially.

To achieve this, operational scenarios were analysed through dynamic modelling and detailed functional studies. This process helped reveal potential logistical and ergonomic challenges at an early stage while reducing overlaps, inefficiencies and conflicts before they could become embedded in the final design.

The result is a venue capable of accommodating a remarkable diversity of uses while maintaining a clear architectural and acoustic identity. The same hall can support the intimacy and acoustic precision required for a symphony orchestra, the technical demands of a broadcast production, or the flexibility expected for contemporary multipurpose events. Rather than treating these requirements as competing priorities, the project sought to reconcile them within a coherent whole.

The project's final objective was to make neither the technical infrastructure nor the acoustic design visible, but to ensure that architecture, sound, technology and operation work together seamlessly, enabling artists and audiences to focus on the shared experience of the performance. ■

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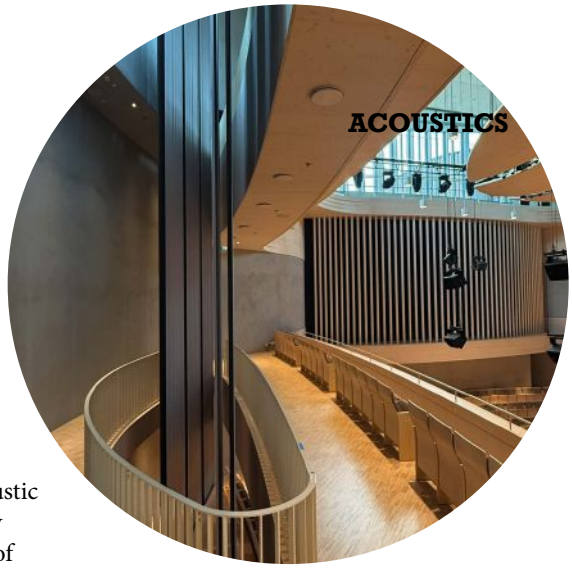

Above: One of the four acoustic atriums, which act as extensions of the main room, allowing late reverberant energy to reach listeners laterally as well as from above, thereby enhancing the sense of being enveloped by music

