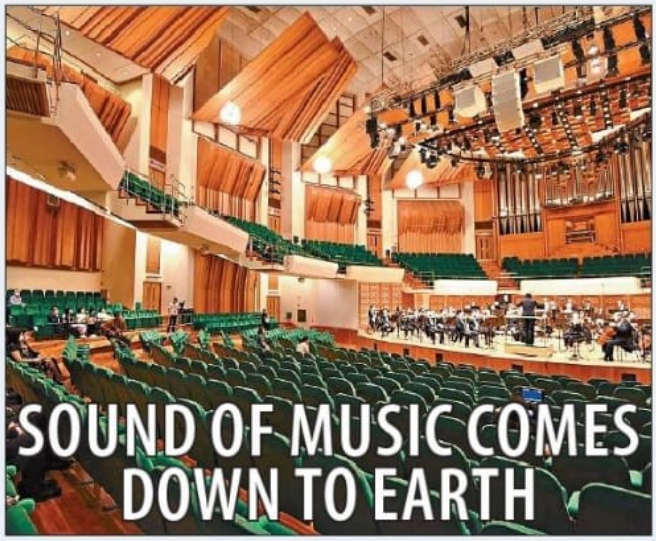
# City Talk



## SOUND OF MUSIC COMES DOWN TO EARTH


At this festive time of the year, many of us may attend concerts and variety shows.

But what are the technical features of a concert hall, and what makes an excellent venue?

Most multipurpose halls are built as a rectangular structure, as this is the most space-efficient enclosure for allowing a lot of people to attend, but it is seldom the most effective.

First, to allow everyone to view the performance, seats should be arranged on a sloping floor and staggered in alternate rows. This is to ensure that most of the people in the seats can have uninterrupted sight lines of the stage.

But this involves the use of a space two to three stories tall, which may be an expensive luxury for a space-deficient city like Hong Kong. The empty void below the sloping floor cannot be used efficiently other than for storage.

Second, but probably more importantly, the concert hall enclosure needs to be of a shape best suited for acoustics. However, this aspect is much more difficult to measure.

Sound waves travel in straight lines and can be reflected by flat surfaces, causing echoes. A rapid succession of echoes produces reverberations, which die down after a while. Reverberations usually make musical quality rich and mellow, but too much of them and they will get mixed with the subsequent musical notes, making the musical piece unclear.

Hence, apart from ensuring that all positions in the hall can hear every musical note with sufficient loudness, acoustic engineers spend a lot of effort optimizing the reverberation time, but very often the actual results deviate from theoretical expectations.

This is because the way sound travels in an enclosed space is extremely complicated.

In theory, reflective boards of predetermined geometry, surface properties and orientation can reflect sound to cause appropriate reverberation. But in real life, a lot depends on many other factors.

The surface of the wall covering, the fabric on the seats, the hardness of the floor, both on stage and in the hall, and the shape and covering materials of the ceiling, including hanging curtains, all contribute to the hall's acoustic quality.

A typical example is Sydney Opera House.

Meticulously designed by a renowned architect, it was supposed to produce a concert hall of outstanding performance.

Unfortunately, when it was first opened, the acoustic quality as perceived by both musicians and audience was disappointing. In the end, they had to hang many acoustic panels and curtains in the ceiling to tune the acoustics to a more acceptable level.

A similar phenomenon also occurred at Carnegie Hall.

Upon renovation, the acoustic quality had changed, and it took quite a while to find the culprit was the concrete floor of the stage which replaced the previous wooden floor that vibrated in unison with instruments of low frequencies, such as cellos and double bass, giving the hall the unique warm musical tone.

The concrete floor was soon dismantled and replaced with a wooden floor to restore the acoustic quality.

It is interesting to note that, even with state-of-the-art computerized simulation and analysis, complex acoustic tuning still requires a lot of human touch to bring it to perfection.

It will be quite a while before we can simply rely on technical calculations to achieve satisfactory results on complex matters such as acoustics.

**Veteran engineer Edmund Leung Kwong-ho casts an expert eye and ear over features and forces in modern life**