

Fine-Tuning a Hall to Hit the Right Notes

Selected characteristics of the Tokyo Opera City concert hall illustrate how daring architecture can mesh with precise acoustics.

DIFFUSION

If a hall diffuses sound properly, it softens the sound field as it is reflected off different surfaces.

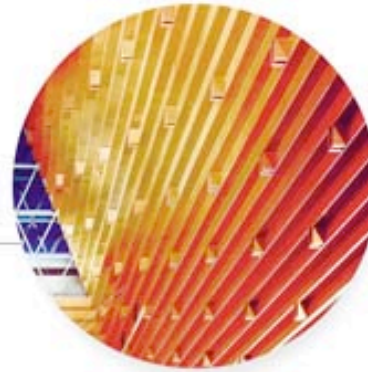
LARGE-SCALE DIFFUSION

Tests revealed that the reflected sound was best when balcony fronts were sloped forward and stepped. The curved bottom edges help distribute the sound uniformly out to the audience.

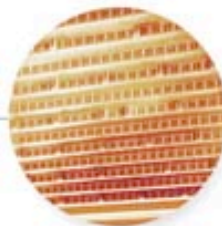


FINE-SCALE DIFFUSION

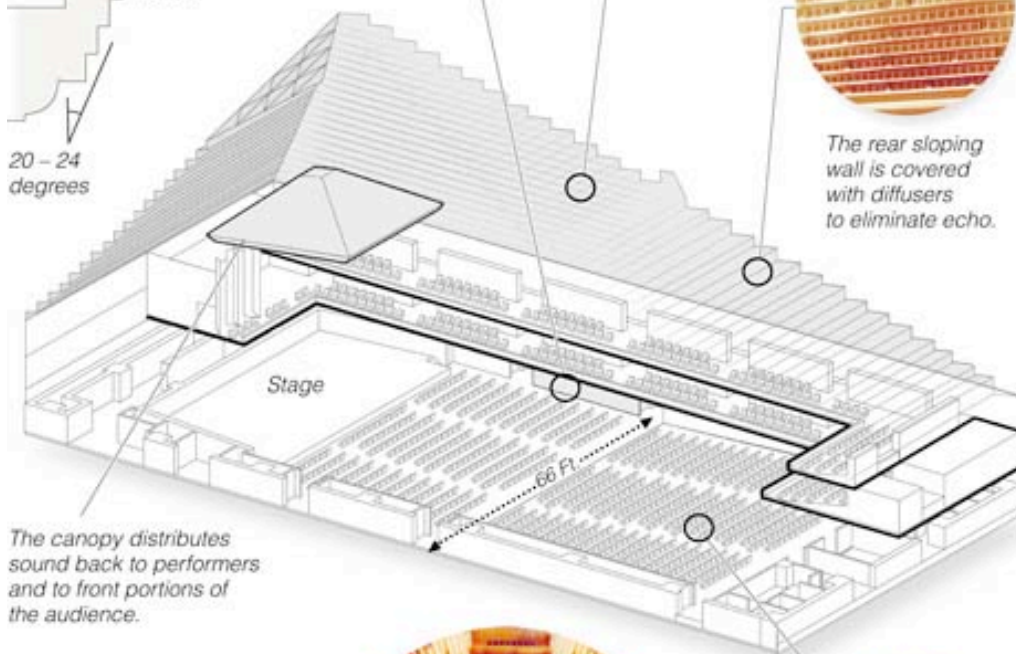
Small irregularities on the lower side and rear walls scatter high frequency sound and reduce "acoustical glare" that can occur with smooth surfaces.



Sound-reflecting blocks scatter the sound laterally where it strikes other parts of the ceiling to further diffuse the sound.



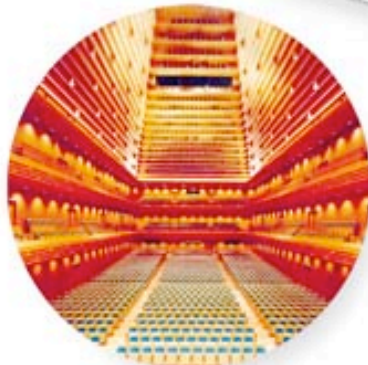
The rear sloping wall is covered with diffusers to eliminate echo.



The canopy distributes sound back to performers and to front portions of the audience.

INTIMACY

The closeness that an audience feels toward performers can be attributed to a short gap in time between the initial sound and the arrival of the first reflected sound. The hall's 66-foot width keeps this gap within an optimum range.



SPACIOUSNESS

The sense of being enveloped by sound reverberations is aided by the open space above the balconies in combination with the narrowness of the lower hall, where sound can reflect laterally toward listeners.



BASS RATIO

It is a measure of the strength of reflected bass tones. Since the wood surfaces absorb more bass than plaster, seats were chosen that absorbed less bass, and no carpets or other absorbent materials could be present.

Sources: Acoustical Society of America; Dr. Leo L. Beranek; Takayuki Hidaka, Takenaka R & D Institute

The New York Times/ Photographs courtesy of Tokyo Opera City Arts Company