

Increasing the Acoustic Volume of Performance Spaces without Altering the Internal Dimensions

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Abstract:

Diffraction phenomenon is 350 years old. It was born with C. Huygens in optics field and also was developed by J. W. S. Rayleigh 1896. During several decades several works were developed by several researchers of International Community, between them M. Schroeder proposed sound diffuser for the first time. After, have arose many papers of scattering directed by P. D'Antonio and T. Cox. Here in this paper we present a novel acoustic labyrinth that increases the effective volume of a performance space without increasing the internal dimensions. Two examples of the device will be described: one in the orchestral rehearsal room at the Liceu Theater (Great Theatre Liceu), and one in the Tonhalle St. Gallen. Both in Liceu and St. Gallen musicians and audience report a substantial increase in subjective room volume and clarity. Conventional acoustic measurements verify these reports. In Liceu, where the labyrinth covers nearly the entire ceiling, the reverberation time (T_{30}) at 500 Hz increased from 1.1 seconds to 1.9 seconds. The musicians find the conditions in the rehearsal room - previously deemed difficult to impossible - optimal and nearly identical to the acoustics of the Gran Theatre. In the Tonhalle St. Gallen the diffuser occupies proportionally less area, but RT, EDT, and G all increased, and the response by musicians, audience, and critics has been overwhelmingly favorable. Further research is needed to elucidate the mechanisms by which the labyrinth achieves these improvements, but the results in these venues suggest that this type of structure has an important role to play in acoustic design, particularly in smaller venues.

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