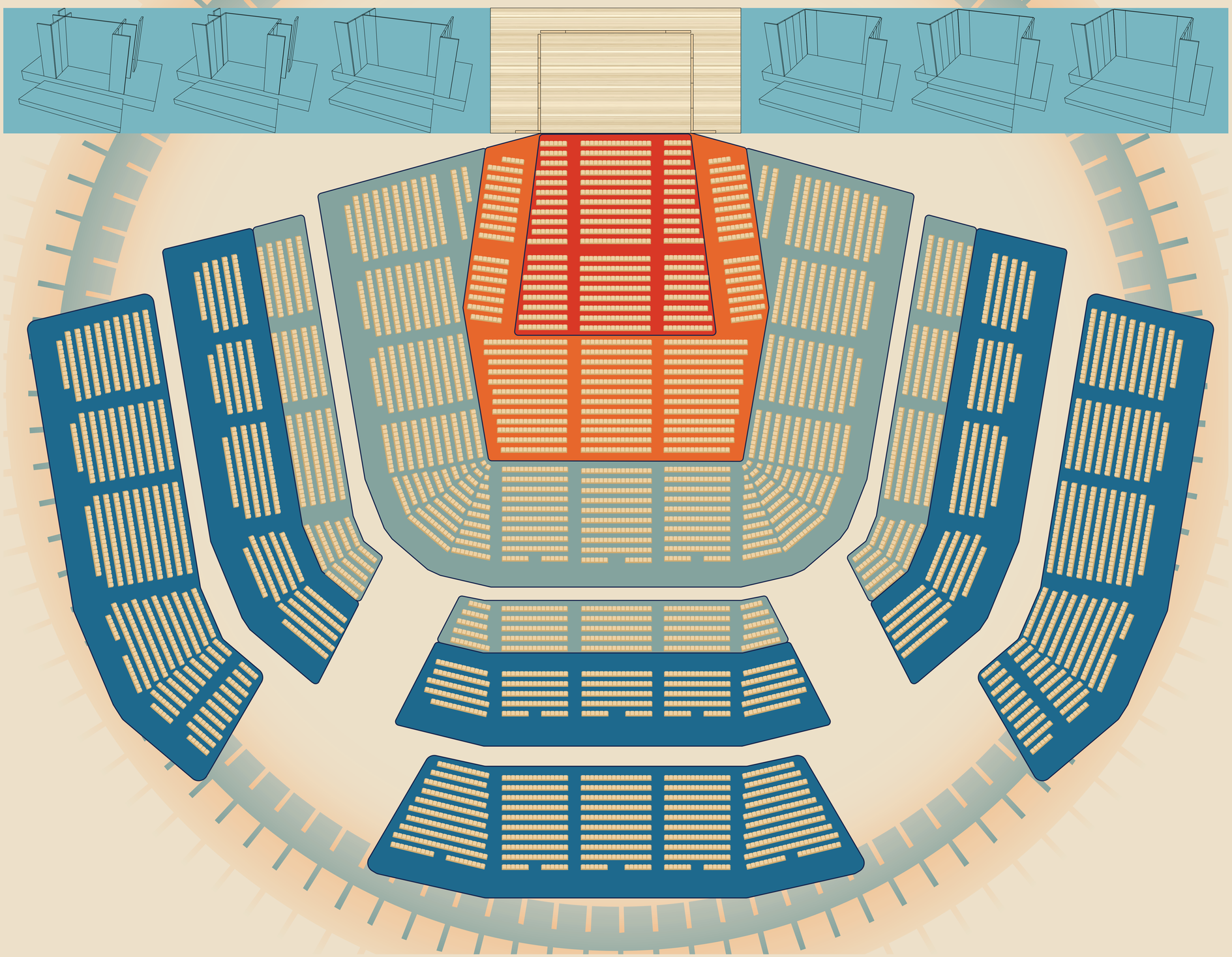
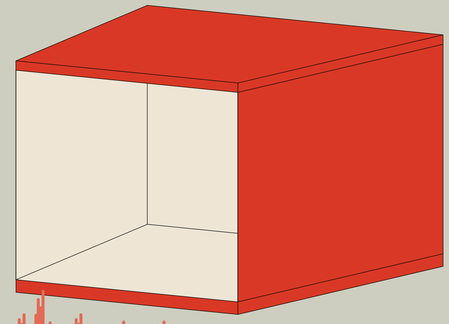
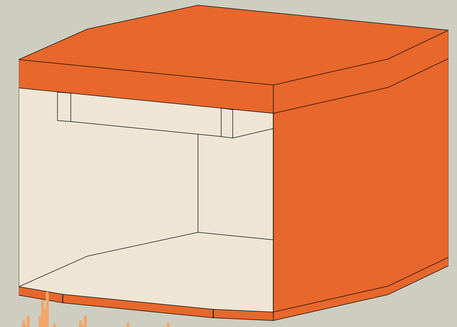
RENAISSANCE
Performance Hall

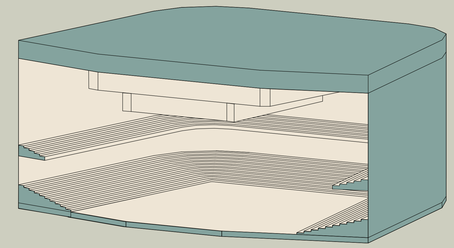




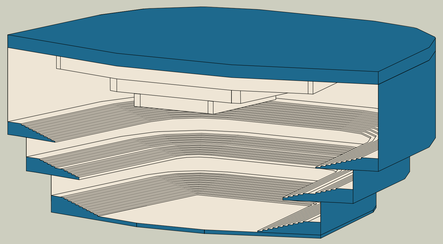
Hall 1
Capacity: 480 to 620
Uses: Opera, Ballet, Speaking,
Theatre, Soloist Performances



Hall 2
Capacity: 1300 to 1450
Uses: Opera, Ballet, Speaking,
Theatre,Soloist Performances,
Symphony, Orchestra

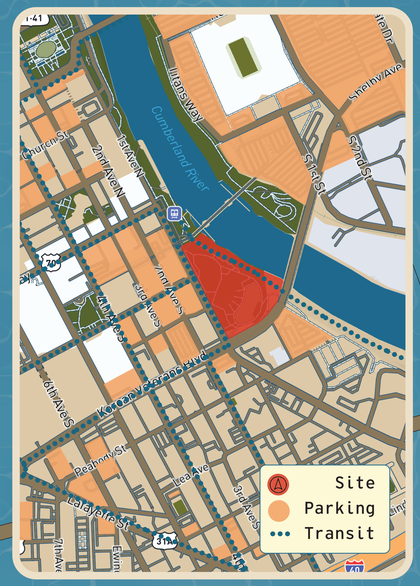


Hall 3
Capacity: 2350 to 2500
Uses: Theatre, Soloist Performances
Classical Music, Symphony,Orchestra



Hall 4
Capacity: 4700 to 4850
Uses: Pop/Rock Concerts, Theatrical
Performances, Soloist Performances,
Speaking

VERSATILE VENUE: HOW CAN THE ACOUSTICS OF A SPACE BE OPTIMIZED FOR VARIED PERFORMANCES



Nashville, TN

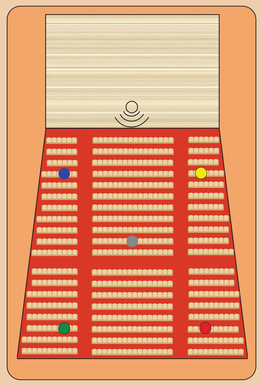
What are the ideal parameters for designing a concert hall, and how can these be integrated into a versatile venue? This is the main goal this research report aims to solve. Case studies, literature, and simulation help to form a clear thought for design, and venue that can accommodate and maximize acoustical performance of the space. When designing and constructing a performance space there are a wide variety of factors that influence the overall design of the venue. Shape, volume, materials, location, all contribute to the acoustics of space. Each aspect must synchronize with the others to achieve desired acoustics.

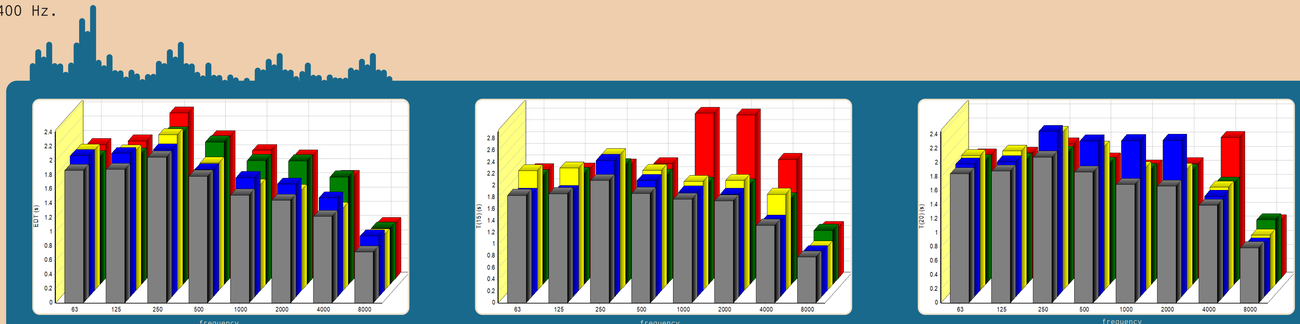
Measures of Acoustic Performance
Aside from just sound, acoustics consist of many other factors. Each hall has different performance requirements for the space, so acoustician's measure sound to create the ideal performance venue.

Early Decay Time
(EDT, also early reverberation time) This is the time that it will take for a sound to decay 10 decibels after being stopped. This is then multiplied by a factor of 6 which allows comparison of EDT and RT. EDT is an indicator of acoustical quality, because instruments are typically playing notes a in rapid consecutive order, which does not always allow for reverberation time to be heard, dependent on the type of performance taking place.

Reverberation Time
One of the more flexible variables is reverberation time (RT). This is the number of seconds it takes for a sound to decay 60 decibels after being stopped, or the time it takes for a sound in a hall to become inaudible after the sound is stopped. Halls that have been deemed acoustically superior typically have a RT of 1.8 to 2.0 seconds when fully occupied. The RT of a hall also changes with an audience as the sound is absorbed and reflected off them. RT is not a fixed goal; it is a tool that can be used to enhance the sound of a space whatever way is seen fit. However, if the time is off or doesn't compliment the performance it can become easily noticeable to the listener and make their experience less enjoyable. RT is only experienced in indoor venues; in outdoor environments sound will continue to travel outward becoming weaker. When a single note is played on the stage of a concert hall it radiates in all directions reflecting off the surfaces that enclose the space.

A listener hears the first direct sound wave, followed by a series of reflection waves. A listener will experience various waves of sound when listening to a performance. The first one being the direct sound. This is the sound that travels directly to the listener from an instrument or soloist. This is followed by the early sound wave, which is a combination of all the direct and reverberant sound a listener hears in the first 80 milliseconds. This is followed by the reverberant sound which encompassed all the reflections heard after the first 80 milliseconds. In one second these reflections can occur around 20 times. The sounds continue reflecting off the surfaces until it gradually reaches inaudibility. Longer reverberation times result in what is called a 'live' hall. Liveness is a broad term that refers to frequencies that fall between 350 and 1400 Hz.

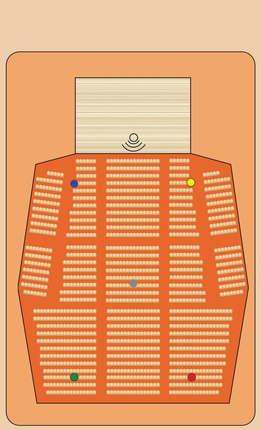


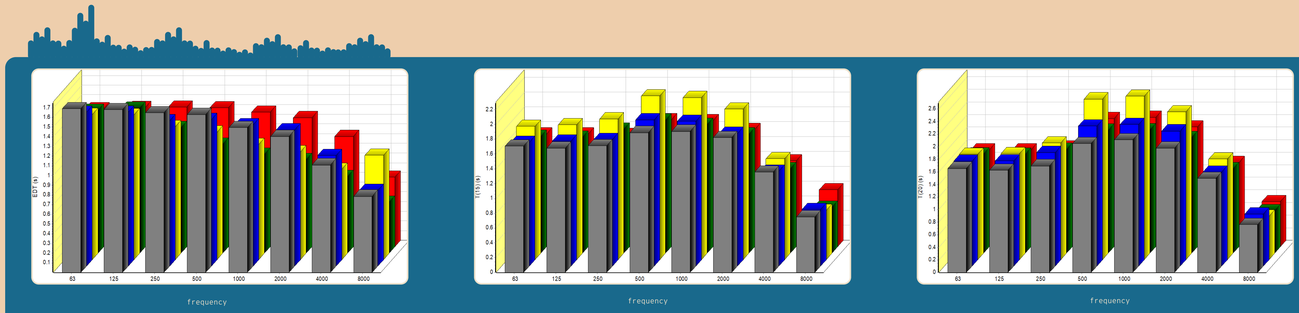


Hall 1: Unamplified

This is the smallest of the halls and is intended to provide users with the most intimate listening environment. It can seat between 470 and 620 depending on the configuration of the stage. The hall has an average RT of 1.84 and EDT of 1.34. The RT falls within the desired range of 1.7-2.0, making it acoustically strong. The hall's shape was inspired by the popular shoe box design, due to its consistency and performance over time.

The graphs above show the EDT, RT(15), and RT(20) of 5 response points throughout the hall. This testing was done in Odeon to see how consistent the acoustics were across the hall. The points all responded relatively well and indicate that no matter were you sit in the hall the listeing expirence you wll have will be similar to most within the hall.





Hall 2: Unamplified

This is the second smallest of the halls and is intended to provide users with a more grand listening experience. It can seat between 1300 and 1450 depending on the configuration of the stage. The hall has an average RT of 1.95 and EDT of 1.56. The RT falls within the desired range of 1.7-2.0, making it acoustics strong as well. The hall's shape was created by pushing the boundaries to the maximum size of an unamplified allowing the space to host a wider range of events.

The graphs above show the EDT, RT(15), and RT(20) of 5 response points throughout the hall. This testing was done in Odeon to see how consistent the acoustics were across the hall. The points all responded well, similar to the fist test, and indicate that no matter where you sit in the hall the listening experience will still be similar to your peers.