



## Research Article

## Acoustic Design and Its Importance in Architecture \_ Teatro alla Scala in Milan

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## ABSTRACT

The Teatro alla Scala (Italian: La Scala), better known as La Scala, in Milan, Italy, is one of the world's most famous opera houses. The theater opened in August of 1778, under the name NoVo Regio Ducal Teatro alla Scala, with a performance of aliare's opera Eloruba Rikonozciota In 1776, a fire burned down the former theater, known as the Ducale, so several wealthy Milanese went at the request of Duke Frederick of Austria, to help them build a new theater. The neoclassical architect Giuseppe Piermarini submitted a preliminary design for the new theater, but it was rejected by the Austrian governor, Count Vermin. The second time, the Empress of Austria, Empress Maria Theresa, accepted that the new theater be built. It was built in the place of the Church of Santa Maria in Scala, from which the theater got its name. The church was demolished, and construction work began, which ended two years later. Then it can accommodate 3,000 spectators, and six booths, as well as the largest podium in Italy.

## 1. INTRODUCTION

Milan, Italy is home to the renowned opera venue La Scala. Teatro alla Scala is the official name. Originally known as the Nuovo Regio Ducale Teatro alla Scala (Nuovo Regio Ducale Teatro alla Scala), the theater opened on August 3, 1778. Europa riconosciuta by Antonio Salieri was the premiere. Over the last 200 years, La Scala has hosted many of the world's top vocalists as well as most Italy's most exceptional opera performers. With the La Scala Theater Orchestra, La Scala Theater Ballet, and La Scala Theater Choir, the theater is still regarded as one of the top opera and ballet venues in the world. La Scala Theatre Academy (Accademia in Italian) is the theater's affiliate college.

Paintings, sketches, statues, costumes, and other materials pertaining to the history of La Scala opera can be found in the Teatrale alla Scala Museum (La Scala Theater Museum), which is accessible from the theater's foyer and a portion of the house. The Academy of Performing Arts (Accademia d'Arti e Mestieri dello Spettacolo) is also housed in La Scala. Its objective is to train the next generation of young dancers, musicians, and technicians (at the Academy's Scuola di Ballo del Teatro alla Scala).

There are three foyer bars at La Scala: two on the third floor "Arturo Toscanini" box foyer, one in the booth foyer, and two more in the second gallery foyer. The curtain is opened both before and after it is drawn. It is not permitted to eat outside the lounge. It is not permitted to eat or drink in the gallery, box, or auditorium. The Ristorante Teatro alla Scala "Il Marchesino," run by renowned Italian chef Gualtiero Marchesi, is located next to La Scala's main entrance. Before and after the play, this restaurant is a great spot for dinner or an aperitif. It is open from early in the morning until late at night, Monday through Saturday. It is advised to make reservations.

## 1.1 History of the theater

During World War II, bombing raids in Milan caused significant damage to the theater. Thankfully, it was feasible to return it to its former splendor with the aid of the few exterior walls that survived. At the start of the twenty-first century, the Teatro alla Scala received a significant makeover. The theater is totally modern in terms of technology, in addition to having renovated architectural and ornamental features.



Fig. 1. shows, Teatro alla scala,  
<https://masteremergencyarchitecture.uic.es/2018/01/17/socio-spatial-workshop-with-casa-bloc-refugees-in-barcelona/>

In 2002, the theater was closed for renovations commissioned by the Swiss architect Mario Botta, and in the meantime, performances were being held at the Degali Archimboldi Theater, which is four and a half miles from the city center. Controversy erupted, for fear of losing historical details in this building, but operagoers said they liked the improvements and sound techniques.

Under the supervision of Maestro Riccardo Muti, Saliare's opera *Eloropa Reconozciota* performed in the house when it reopened in 2004.

The selling of boxes, which their owners lavishly decorated to attract onlookers like Stendhal, paid for the building's expenses. As it became known, La Scala quickly rose to prominence as the premier gathering spot for Milanese aristocrats and affluent citizens. There were no chairs on the main floor, as was customary in the period, and audience members stood to observe the performances. Since the orchestra pit had not yet been constructed, the orchestra was visible.

Like the majority of theaters during that era, La Scala doubled as a casino, with patrons seated in the lobby. The opera enthusiast may also find the auditorium's conditions frustrating, as Mary Shelley found out in September 1840:

Otto Nicolai Templario was being presented at the Opera. The snatches of melody that one can catch are few and far between because, as is well known, the La Scala theater not only acts as the universal gathering place for Milanese society, but it also conducts all types of trading activities, from stock jobbing to horse dealing.

Eighty-four oil lamps were initially installed on the stage of La Scala, and another thousand were placed around the theater. Hundreds of buckets of water were placed in various rooms to lessen the chance of a fire. Gas lighting eventually took the role of oil lamps, and in 1883, electric lights finally took their place.

## 1.2 Opera Theater

The hall was executed in the form of a huge horseshoe (100 x 38 m), equipped with a classic tiered model of the arrangement of chests (5 tiers and almost two hundred chests). Considering that each box can receive up to 10 visitors, the theater's total capacity was impressive. The external austerity of the theater building emphasized the richness and beauty of the interior decoration. The decoration, made in light and warm golden colors, was striking in its beauty. Meanwhile, the building's interior provided a number of entertainments for the intelligent audience, such as gambling rooms and buffets.

The theatre had a total of "3,000 or so" seats organized into 678 pit-stalls, arranged in six tiers of boxes above which is the 'loggione' or two galleries. Its stage is one of the largest in Italy (16.15m d x 20.4m w x 26m h).



Fig. 2. Open Halls of the Theater

<https://masteremergencyarchitecture.uic.es/2018/01/17/socio-spatial-workshop-with-casa-bloc-refugees-in-barcelona/>

### 1.3 Architecturally

The architect of the La Scala opera house was Giuseppe Piermarini. According to his project, in just two years, from 1776 to 1778, the neoclassical theater building was built, which was considered one of the most elegant and beautiful in the world. It was opened on August 3, 1778. The Teatro alla Scala is built in a neoclassical style and its facade looks rather restrained. But inside the theater amazes with its luxury and splendor. It has everything a theater should have huge mirrors that reflect the richly decorated interior, gilded ornaments on the walls, skillful plasterwork, and velvet-covered seating. The elegant setting of the theater immerses the viewer in an atmosphere of aristocratic brilliance in the best traditions of Italian opera. World stars and true art connoisseurs come to enjoy the perfect performance of a famous opera by the early artists of our time at La Scala.

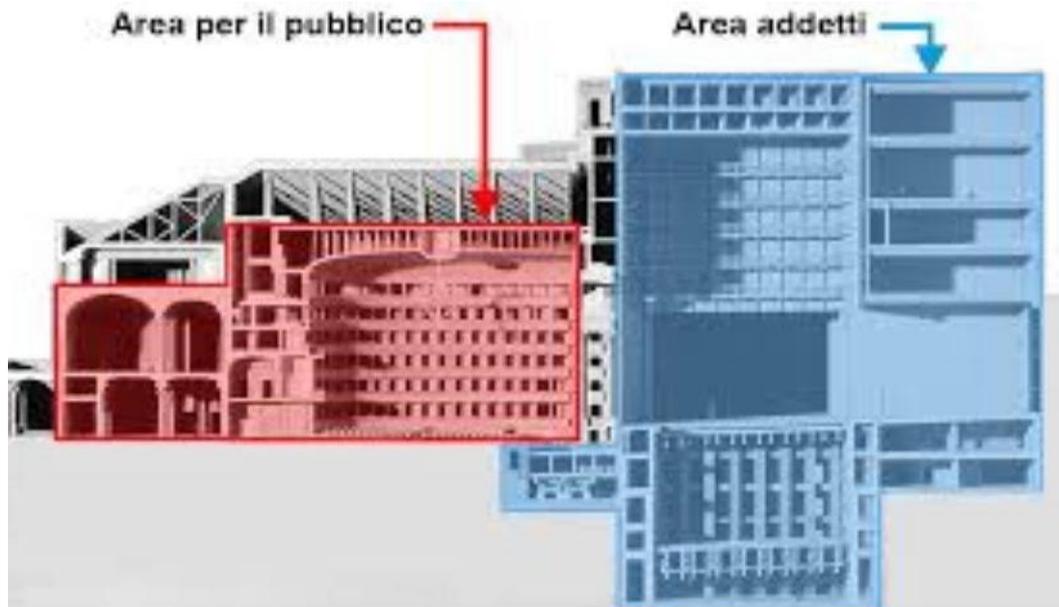


Fig. .3. shows, Teatro alla scala,

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### 1.4 modern look

In the post-war years, the Teatro della Scala underwent several renovations. The last one was started in 2001 by architect Mario Botta and ran until 2004. In particular, the main stage was redesigned for the theatre, which can now accommodate up to three acts simultaneously. In addition to construction work and restoration of the interior, the total number of spectator seats in the theater was reduced. Modern fire safety requirements 2030 left a seat to the public

The horseshoe in the hall runs along the royal chest, the role of the warehouse and five tiers of chests. True connoisseurs of opera prefer to settle in galleries, where, in their opinion, the best acoustics are noted.

## 2. ACCOUSTICAL FEATURES

The acoustic architecture, the initial concept was showcased during the 1996 Opera Acoustics meeting in Torino. It was a traditional circular chamber. The goal was to reduce the distance between the audience and the stage as much as possible, offer a significant degree of diffusion, and get a loud enough sound for an audience of about 2400.

This concept is a modern take on the classical opera house, modeled after Munich's Stascope, which doubles as a real music theater with its orchestra shell. The audience, even those in the stalls, benefit from early reflections, which are a crucial component of opera, when this form is used.

A lot of spread may be created with the help of the side boxes. To ascertain whether the reaction was sufficient across the hall and that the sound distribution was as uniform as possible, this first concept was thoroughly evaluated using computer simulations and a 1/16 scaled model.

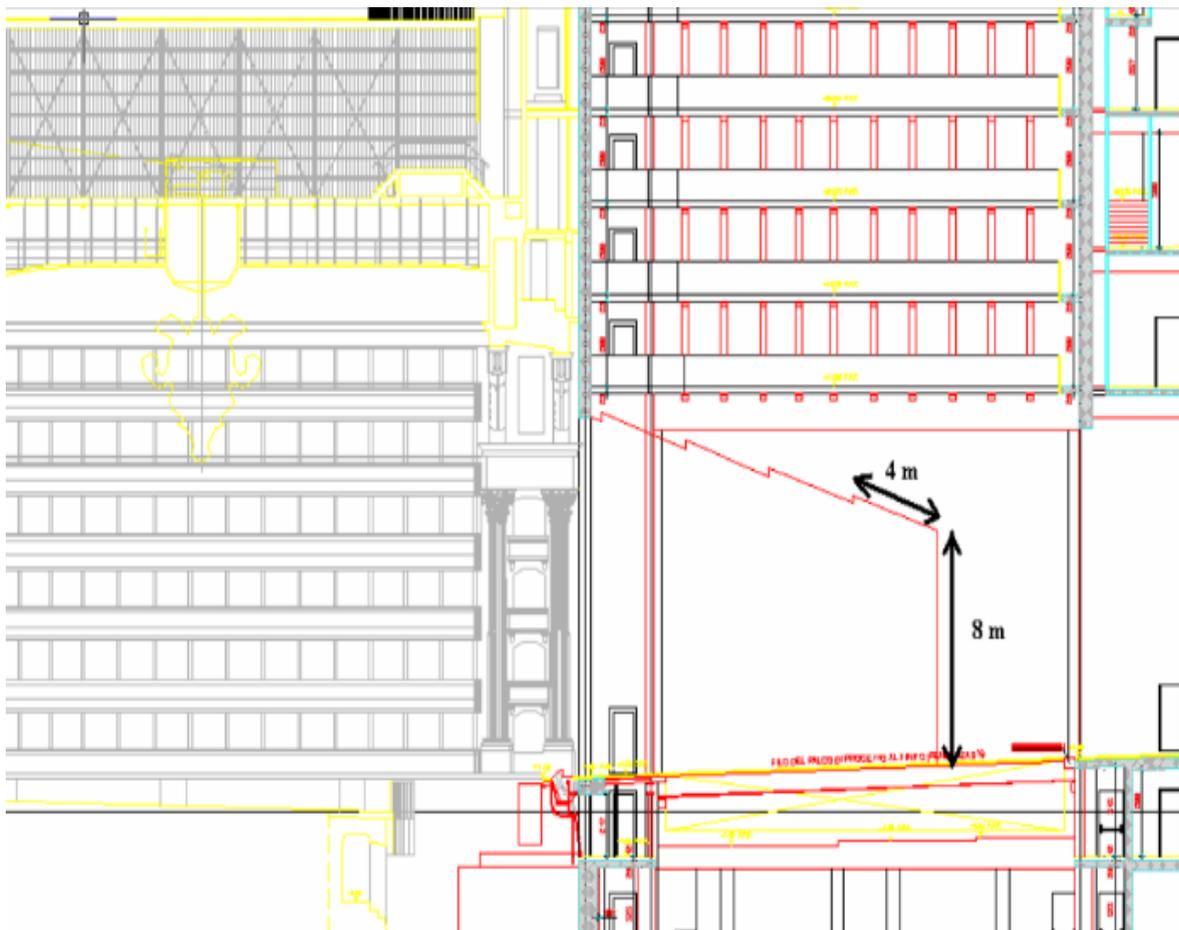


Fig. 4. shows, Section of the Hall,  
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### 3. SOME SPECIFIC CONSTRUCTION FEATURES

We created a floor that is elastically floating and directly and structurally absorbs sound. The superior plate then begins to vibrate, producing a flexion wave that, in a very short period of time, is communicated to the entire audience area, which is positioned on the main stalls. Through re-irradiation from the floor, this vibration transmits sound directly to the audience. This phenomenon happens because of the top wood layer's longitudinal sound speed being roughly 10 times quicker than the air's sound speed. An extra and unanticipated consequence is that everyone seated in the main stalls hears a vertically radiating sound created by several plane waves that arrive almost simultaneously from the floor.

Because the non-porous and elastic material is a harmonically resonant box, the rising sound ultimately reaches the audience nearly simultaneously. Many antique theaters contain an air chamber that functions as a spring, but it also produces a very significant absorption of sound in the low frequency that is typically not desired and is not generated in our situation. By forcing air from the floor to the ceiling, this is comparable to the air climate of a hall.

#### 3.1 The principles that were applied in the acoustic design

This enormous hall's mild fan shape was intended to optimize intimacy.

Create a comparatively high volume so that the listeners can be engrossed in the song as it develops. Since opera is the hall's primary use, it gets a comparatively long response that corresponds to a comparatively long reverberation period without going overboard.

Arcimboldi differs greatly from the Teatro alla Scala in this regard. Give everyone access to lateral reflections that enhance the music's clarity and the lyrics' comprehensibility. Among other things, the back of the orchestra level and the sides in particular disperse the sound over the entire audience and, more precisely, to the middle of the hall.

### 4. CONCLUSION

The acoustic design of the Teatro alla Scala in Milan exemplifies the intricate blend of architectural and acoustic considerations essential in creating a world-class opera house. The theater's evolution from its neoclassical beginnings to modern renovations reflects a commitment to preserving historical value while enhancing acoustic quality. Key acoustic principles, such as minimizing distance between the audience and the stage, ensuring sound diffusion, and using specialized materials to maintain resonance, contribute to an immersive auditory experience that has solidified La Scala's reputation. This architectural marvel demonstrates how thoughtful acoustic design is integral to the theater's ability to deliver an authentic and engaging experience, making it a timeless venue for opera enthusiasts globally.

#### Conflicts Of Interest

None

#### Acknowledgment (Heading 5)

None.

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