



ACOUSTICS IN THE COMPETITION FOR THE CONSTRUCTION OF THE OPERA HOUSE “LA FENICE”: 1789–1790

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From the analysis of the projects presented for the competition held in Venice (1789–1790) and from the judgements of the commission, this paper attempts to synthesize the knowledge of opera house acoustics at the end of the 18th century, so important for the history of music and opera houses. © 2000 Academic Press

1. INTRODUCTION

The fire at the “La Fenice” opera house in Venice on 29 January 1996 and the immediate decision taken by the city municipality to reconstruct the theatre “as it was where it was”, gave rise to studies and investigations on the origins and history of the theatre. The acoustics of “La Fenice” was valued since its opening on 16 June 1792 with the opera “I giochi di Agrigento” by Paisiello. As a consequence, when the theatre was reconstructed by Tomaso and Giambattista Meduna after the fire of 13 December 1836, it was decided to keep the same shape of the hall designed by Gianantonio Selva, the first architect entrusted with the construction of this theatre. The Medunas left a precise description [1] of the design and the materials they used in the reconstruction of the theatre.

These considerations support the idea that the value of the acoustics of this theatre must be sought in its original design.

2. THE COMPETITION FOR THE CONSTRUCTION OF “LA FENICE”

In the last decades of the 18th century, in Venice, seven large theatres and some small private halls were still active with different kinds of performances. These theatres were a heritage of the 17th century, the golden age for these buildings. The only one built in the 18th century, more exactly in 1755, was the Venier in San Benedetto, in the centre of the city. This building was owned by a group of nobles,

joined in the “Nobile Società”, but the ground belonged to the Venier family who, after a trial, in 1787 received back the property. So the “Nobile Società” decided to build a new theatre, the largest and the most important in Venice, between San Marco and Accademia. The chosen area was rather small and had an irregular shape with water along two sides.

The competition for the construction of the new theatre, later called “La Fenice”, was opened on 1 November 1789 and was addressed to national and foreign architects. The notice, printed in the most important Italian newspapers with a drawing of the area for the construction of the new theatre made by Giannantoni Selva, asked for drawings, a scale model, a written report with the description of the project and an estimate of the budget: all the requirements were collected in 14 articles. The seventh article gives precise indications for the main hall which must have five orders of boxes, each one with 35 boxes, all equal in size, with the exception of the central and the proscenium ones which may be wider. None of the articles in the competition program contains acoustics requirements; only in the introduction it is said that “the theatre must have as its main quality that of being most satisfactory for the eyes and for the ears”. In the span of four months, as indicated in the program (later increased to six), 29 projects were presented; 23 complete with drawings and report, of which seven printed and 16 manuscripts, while 11 were also accompanied by the scale model; finally six architects presented only the drawings. Recently, the manuscripts of 15 projects have been found in the Historic Archives of the theatre “La Fenice”, at the moment in the Ugo and Olga Levi Foundation in Venice, which, together with the five printed, make a total of 20 documents. Considering that six projects were presented without any written description, now we have the complete documentation of the competition. The drawings now known are six and are related to the projects of Bianchi, Cossetti, Maina, Morelli, Selva and an anonymous one from Rome. So in a few cases we have the drawings and the reports (Bianchi, Cossetti, Maina, Morelli and Selva), while, in other cases we have only the written descriptions to understand what the project was like.

A commission was established to judge the projects: Simone Stratico, Benedetto Buratti and Francesco Fontanesi were the members of this commission. Simone Stratico had the task of evaluating the acoustic aspects of the projects: he was professor of physics and mathematics at Padua University, well known in Italy as an expert in acoustics. In 1791, he was in Ferrara with Giuseppe Piermarini to give advice on the shape of the new theatre designed by Antonio Foschini.

Benedetto Buratti was a mathematician, expert in history of architecture; Francesco Fontanesi was a famous scene painter representative of the neo-classic current in Italy. It seems important to mention the important role played by Andrea Memmo in the course of the competition. He was an authoritative member of the political life of Venice and an expert in theatre constructions. From the beginning he was the mind behind the organization of the competition, establishing the requirements for the construction of the new theatre; he knew Simone Stratico and had with him many discussions and exchanges of letters and ideas about the acoustics of theatres. He was the anonymous author of a publication entitled “Semplici lumi...” where he gave suggestions to the members of the commission for

the judgements of the projects. It is worth remarking also that this publication was quoted by the commission in its final report to support its evaluations and decisions. A detailed and complete description of the projects and of the final judgements of the commission is in the book by Maria Ida Biggi “Il concorso per la Fenice 1789–1790” [2]. The competition was closed after many discussions and polemics. The architect Gianantonio Selva was entrusted with the construction of the new theatre, but the prize for the best project was given to Pietro Bianchi. The study and the analysis of the projects and particularly the judgements given by the members of the commission are of particular interest as they give an idea of the knowledge of opera house acoustics at the end of the 18th century.

3. OPERA HOUSE ACOUSTICS AT THE END OF 18TH CENTURY

It seems that, at the end of the 18th century, there was not agreement on the best shape of opera halls: there were still very authoritative architects who proposed the bell, like Riccati [3]: the ellipse, like Pierre Patte [4] or the semicircular, like Stratico. His ideas regarding opera house acoustics are clearly exposed in the manuscript of the examination and opinions concerning the competition of “La Fenice” published after the judgement had been expressed, and in the manuscript dealing with the shapes of opera halls where he analyzes three kinds of curves (elliptic, semicircular and oval) and expresses his preference for the semicircular. All these manuscripts are now at the Marciana Library in Venice. From the table of comparison between the 29 projects arranged by the commission itself, it is possible to observe that 21 propose the semicircular curve, five the elliptical one and only three the oval curve. Moreover, four of the five reference theatres indicated in the same table of comparison, i.e. the Argentina in Rome, the “La Scale” in Milan, the “Staatoper” in Berlin and the “San Benedetto” in Venice, have a semicircular curve; only the hall of the “Regio” in Turin has an oval shape. This analysis shows a clear preference for the semicircular curve.

Greater agreement is found in the use of material: wood is indicated as the most convenient in order to obtain a “resonant” theatre because of its elastic properties. Francesco Algarotti, in his essay “Saggio sopra l’opera in musica” printed in Livorno in 1763, proposes wood as the best material for the interior of a theatre and warns against the use of hard materials such as bricks, which reflect the sound too harshly. The same considerations are made by Pierre Patte in “Essay sur l’architecture théâtrale”, in 1782.

In most of the projects for the theatre “La Fenice”, wood was suggested as the most convenient material. Domenico Cossetti, architect and professor in Parma, proposed the use of wood not only for the boxes but also for the whole ceiling of the theatre which had to be almost flat. Also the architect Benedetto Feroggio, who took part in the construction of the Carignano theatre in Turin, proposed the use of thin wooden boards for the walls of boxes; Gianantonio Selva too recommended this material as the best for its elasticity. Because of the risk of fire, many authors proposed an extensive use of bricks which also increase the sound reflections from the walls of the theatre: this was the opinion of the architect from Cremona,

Faustino Rodi, who affirmed that every part must be in brick, except the walls inside the boxes. Vincenzo Lamberti, in his book “La regolata costruzione dei teatri”, Napoli 1787, preferred bricks covered with smooth plaster instead of wood which is sensitive to the change of temperature and humidity.

The use of soft materials, such as carpets, was discouraged: Andrea Bon proposed paintings as decorations, as did Cosimo Morelli.

The surfaces exposed to the sound had to be as smooth as possible in order to allow the propagation and reflection of the waves without distortion. This was the opinion of Ferrante Rossetti, an architect from Vicenza, who affirmed that it was important to avoid angles in the walls in order to allow a better propagation and reflection of the waves. He suggested avoiding thick decorations and stuccoes which could be replaced by paintings.

Curved surfaces were preferred: F. Riccati [3] proposed curved walls also between the boxes.

As happens for light, the angle of the incident wave is equal to the angle of the reflected wave: starting from this hypothesis, geometrical acoustics was extensively used to investigate the sound reflections in the hall. Simone Stratico considered this hypothesis as an approximation in the case of real bodies like wood, stone and bricks.

Some authors considered of some importance the delay time of the reflected sound in order to avoid echo. Generally, it was established that small rooms had better acoustics: this was the case of Pietro Recchia, a Venetian architect, who designed the rebuilt theatre of “San Benedetto” (1774) and the theatre of “San Luca” (1776) in Venice. For this architect, a large hall is the cause of many problems for the harmony of the voice.

An empty volume under the orchestra floor and under the stall was considered to be essential for many participants in the competition like Gianantonio Selva. Sante Baseggio and Andrea Bon. This last architect supports the idea of an elevated hall over large arches to obtain better acoustics, like in the theatres in Berlin and in Turin. However, the commission did not appreciate this opinion and refused the project.

Disagreement still existed regarding the ceiling shape and construction: flat or concave, airtight or with a plenum which may be open or closed to the main hall. For example, Pietro Bianchi added two fans to change the air inside the theatre, because opening the ceiling was not convenient for good acoustics. Giuseppe Pistocchi, who built the “Teatro Comunale” in Faenza, still in existence, designed a ceiling like a sky, with irregularly spread holes as stars, considering that their interaction with the volume under the roof may have had a positive effect on the acoustics of the hall. The commission refused this idea as useless: it considered that holes in the ceiling were dangerous for the acoustics of the hall because of sound absorption. If they were necessary for air ventilation and for the movement of the chandeliers, it was proposed to have these holes laterally in the ceiling and not in the centre of it.

Proscenium boxes were believed to be dangerous because they absorb sound: some authors proposed the use of large columns and an architrave in the proscenium in order to improve the sound propagation from the stage and the

orchestra toward the audience: for example in his project of “La Fenice”, Ferrante Rossetti used large pillars supporting the proscenium arch, instead of proscenium boxes. According to Simone Stratico and the commission, the dimensions of the stage and the proscenium seemed to be very critical for good visibility and for the acoustics: for example, many projects were rejected by the commission because they were too large or too small in comparison with a proscenium width of 40 “Venetian feet” (13.9 m) considered to be an optimum value.

The movement of the air in the theatre improves the acoustics if the air moves from the stage toward the audience. Worse acoustics is expected if the air moves from the audience to the stage: this was the opinion of Vincenzo Lamberti.

In spite of the efforts made by many authors in order to justify, from a scientific point of view, all the proposals and the options to obtain good acoustics in the theatre, many of them concluded their report with the consideration that this goal was often the result of common sense, of comparison with other tested and good solutions, and of experience. It could be observed that this conclusion is still acceptable today.

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REFERENCES

1. T. MEDUNA and G. MEDUNA 1849 *Il Teatro La Fenice in Venezia edificato dall'architetto Antonio Selva nel 1792*, Venezia.
2. M. I. BIGGI 1997 *IL concorso per La Fenice 1789–1790*, Marsilio Editori.
3. F. RICCATI 1790 *Della costruzione dei teatri secondo il costume d'Italia*, Bassano.
4. P. PATTE 1782 *Essai sur l'architecture théâtrale*, Paris.