

Technical note

Architectural customized design for variable acoustics in a Multipurpose Auditorium

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ABSTRACT

The use of auditoria for more than one purpose is far from new but the conscious design to accommodate more than one acoustic type of performance is relatively recent. It has become increasingly apparent that for economic reasons auditoria dedicated to just one single use are often unrealistic for big companies and also in large cities where a degree of flexibility in use is now becoming the norm from speech or music to theatre, performances and fashion shows.

The possibility to find architectural solutions to control a variable acoustics within a big range is the main interest in this discussion. Construction details are developed and their possible combinations of different customized elements is reported, related to a specific case study: the Calzedonia Auditorium, a shoebox of 10.200 m³.

In literature there are general traditional guidelines to apply for large multipurpose rooms. Because in this space the seats are totally removable and there are design features unique for it, some of these guidelines are accepted and some are changed in relation with the requests of the client and considering also the possibility of a new approach suitable for both speech and music in some special layouts and configurations.

Predicting situations are explained to create a methodological approach, according to the contemporary multipurpose requests.

Numerous configurations, more than 12, with different combinations of the movable architectural element positions have been recorded in the software depending on the number of seats in the room and activities to be deployed.

Measures confirm the acoustic design, the client satisfaction the integrated Architecture.

1. Introduction

In the case study presented, a rectangular hall designed as a multipurpose space, the acoustic answer control according to the single specific use and configuration is requested.

In traditional shoebox auditoria the predominant absorption is due to the fixed stall. In this hall instead, seating and audience are removable, the floor becomes a reflecting surface, absorbent materials and architectural systems with variable positions are added on the other possible room surfaces. The number of seats and the volume change significantly from a use's configuration to the other.

Architectural construction details are developed and their acoustic characteristics are explained to create a methodological approach to find out *variable acoustic architectural systems* useful for multipurpose shoebox halls.

The behavior described is predicted by computer simulation modeling and confirmed with measurements on site.

The reciprocal influence among the numerous variable architectural elements is explained to create an intriguing acoustic behavior according to the multipurpose requests.

General traditional guidelines to apply for large multipurpose rooms [2], some of them are indicated below.

2. The head quarters Auditorium

The origins of the Auditorium of Calzedonia, the Italian-made underwear known throughout the world, lie in precise design instructions. A space that reflects the company, one that is dynamic and sensitive to the changes in society, a place which is capable of transmitting passion and experience and stimulating creativity and inventiveness. Starting from an empty space a new interior architecture was requested, which had to be an expression of the new necessities.

The designer Enrico Moretti chose to interpret the outer wall as a container of a dynamic space, a walled box made up of a parallelepiped

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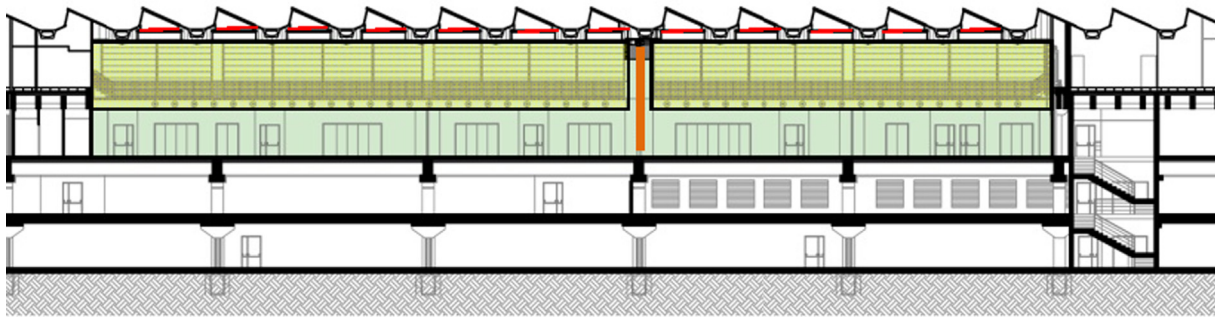


Fig. 1. longitudinal section (the Auditorium Space is coloured green, curtains are coloured red, the foldable tent is coloured orange; the yellow area represent the pivoting panels).



Fig. 2. first floor plan (the Auditorium Space is coloured green).

of 10.200 m³ ca. (Fig. 1), the typical shape of a shoebox, that can be divided into a two intercommunicating spaces (a first volume of 5.600 m³ and a second volume of 4.600 m³) or remain a unique one (Fig. 2).

Architectural elements and scene machinery are integrated as acoustic solutions with which the other planning details interact.

The experience of a dynamic space is expressed through countless possibilities that arise from mobile bridges and pivoting panels to automatic curtains and a retractable wall. The Auditorium can house maximum 1000 people, and it is characterised by a length of 60 m, width of 19 m and it is 9 m height with lateral balconies on the left and right lateral walls at the height of 3,7 m.

It is an extremely flexible approach that makes this area genuinely multipurpose (Figs. 3 and 4), and which mean it is constantly in touch with the sometimes very varying requirements of a large company.

In the centre of the volume there is an enormous hidden closure in the ceiling, a kind of foldable tent made of stiff panels. It lowers to divide the parallelepiped into two separate rooms, thus creating two spaces which are independent in function and don't disturb one another. Two main positions have been selected to house large removable stages and there is no lack of trusses, projectors and sophisticated automated lighting systems for the show.

The green lines represent the public, the violet area represent the

stage with the speaker table)

Light can enter from the skylights on the roof, while the other elements can show differently coloured sides, which are white and black. The pivoting panels can turn and change colour in a constructive juxtaposition.

The colour transformation also encapsulates sound transformation. Especially in the passage from the white side to the black side, the pivoting panels take on different angles that influence the sound field.

On the horizon of this evocative suggestion by Kandinsky, a project which is integrated in all its parts has been developed to create a new idea of sound space. Losing the single focal point for the scene and the clear distinction between space for the speakers and audience, which is typical in conference environments, in the Auditorium the acoustic quality is reached, independently of the position of the sound source and the audience.

Faced by the idea of the changeability of the space a new scenario of timbre is created, which is more complex than that of a traditionally-conceived space.

One rear wall borders with the foyer and the other with the back stage.

At the sides of the Auditorium, other activities in other volumes take place. They are independent in function and they don't disturb each another. In the preliminary design concept the lateral spaces were

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