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ARCHITECTURAL AND SCENERY DESIGN IMPLEMENTATION FOR THE IMPROVEMENT OF THE SOUNDSCAPE OF ANCIENT THEATRES

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Abstract

The application of contemporary scenery to ancient theatres is necessary for drama performances. Drama, architecture, scenery design and acoustics are examined in an integrated way in this study. Scenery is used to lead the viewer into the imaginary world the play refers to. Previous research has investigated the acoustic effect of scenery, through on-site measurements, computer simulation and scale modeling, indicating basic forms that can improve the acoustic environment of the theatre. Aiming to the multisensory experience of the performance, the term 'soundscape' is introduced for ancient theatres in this study, because of the importance of sound perception, the landscape of ancient theatres and the act of drama. Thus, soundscape involves both physical measurements but also the cooperation of human and social sciences.

This study introduces scenery design as one of the parameters that can affect the soundscape of ancient theatres and of open-air theatres that were created in the 20th century based on the same principles. Previous categorisation and acoustic analysis of sceneries that have been created for drama performances in open-air theatres is discussed and optimised forms of scenery in terms of acoustics are suggested. Also, architectural details applied to new open-air theatre design can improve its acoustics. Apart from the investigation of the acoustic effect of a basic form of scenery design, this paper uses acoustic simulation as a tool for creating scenery design, without limiting inspiration. In detail, during the process of design, simulation can indicate the boundaries and the materials that enhance acoustics, and a skenographer can appropriately adjust the scenery. Moreover, this study provides guidelines for architects, scenery designers, directors and acousticians.

Keywords

Ancient theatre, architecture, acoustics, scenery, soundscape.

1. Introduction

Basic principles of acoustic design of outdoor performance spaces have probably been used for the planning and construction of ancient theatres. In most of the cases the contemporary use is viable, given that their conservation is accompanied by appropriate architectural and acoustic measures. The ability of specific scenery applications to activate the acoustic capabilities of an outdoor performance space was one of the subjects investigated in this study. In the meantime, the individuality of each theatre, either in terms of construction or background noise, can be encountered through architectural and acoustic design.

This study initially examines the importance of perception in open-air theatres and the relationship between architecture and acoustics, regarding scenery design and function. It considers the acoustic aspect of theatre performance and certain principles followed during the design and construction periods. Previous categorisation of applied scenery forms is briefly discussed, based on earlier studies [1]. The effectiveness of the stage building and the scenery design is emphasised [2-4] and the use of acoustic simulation as a tool for selecting appropriate scenery design from the acoustic viewpoint is demonstrated. Then, guidelines for architects, scenery designers, directors and acousticians are provided through the examination of selected case studies.

2. Review on ancient theatre skene types – Perception, architecture and acoustics

2.1 Skene-building birth and evolution

The first performance spaces in rectangular shape appeared long before drama was born (around 1700-1400 B.C.) in the courtyard of palaces in Crete [5]. Because of their use – celebrations called '*ταυροκαθάψια*' – no scenery was involved. The intermediate stage between these performance spaces and the circular layout of later theatre constructions was in trapezium shape, like the theatre of Thorikos (525-480 B.C.), with a background stage wall that may have served as scenery. The plans of these performance spaces are shown in figure 1.

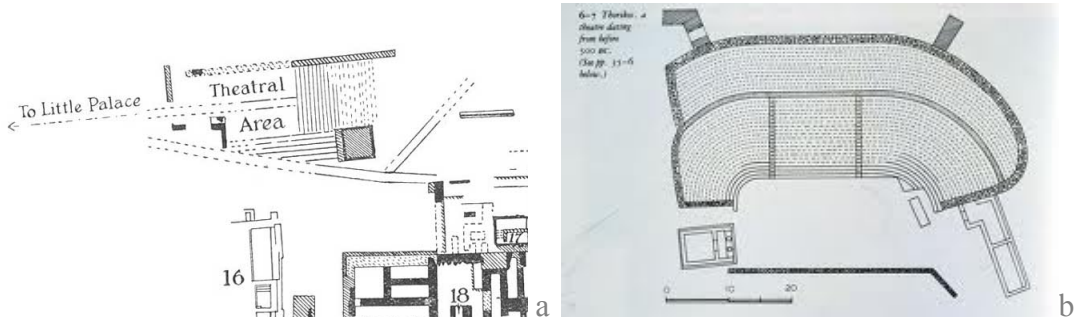

Figure 1 – Plans of early forms of performance spaces. a) The theatre area of the palace of Knossos and b) The theatre of Thorikos.

The Classic Greek theatre was composed by the orchestra, the altar, the parodoi and the koilon, later with wooden seats facing the temple. It is indicated that for the first drama performance by Aeschylus in the theatre of Dionysus in Athens a stage, a few steps higher than the orchestra, had been created to draw attention to the actor and distinguish him from the chorus. The evolution of the theatre adapted changes in drama

and advanced technologies, with changes in materials, more functional permanent structures, modifications in the architectural design with higher inclinations, more decorative facades and bigger skene-buildings, as shown in figure 2. In the Hellenistic theatre the skene-building had two stories, accommodating larger groups of performers (up to three leading actors instead of one), while the Roman theatre type in semicircular shape had a narrow stage and a high skene-building [6].

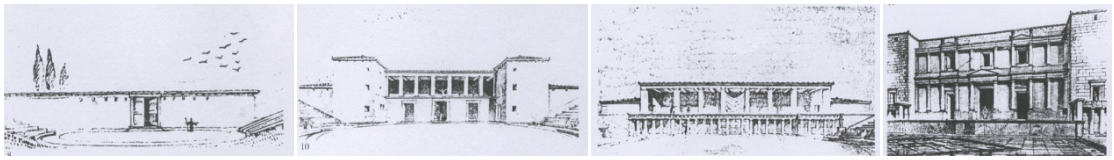

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Figure 2 – Skene-building evolution, theatre of Dionysus. a) First skene-building, b) Classic period, c) Hellenistic period and d) Roman times [source: Fiechter, 1914].

2.2 Perception, architecture and acoustics

Initially, the soundscape of the theatre was based on direct sound, the polyphony of the chorus, the enhancement of the voices through reflections of the orchestra and the external sounds from the surrounding area. Several innovations have been observed in later theatres, which were related with new performances and the introduction of scenery. The birth and development of scenery and skene-building enabled conventional use of the visible-invisible, outside-inside, close-far, approachable-unapproachable, while the dramatic action slowly moved from the orchestra to three levels of the stage building, the logeion, the front of the second floor and the roof. Although the move of the leading actor to a higher level was beneficial for acoustic purposes, due to relative source-receiver heights, the positioning of the 'god' at the roof of the skene-building was disadvantageous because of the lack of a background reflective surface.

The stone skene-building of the 4th century B.C. allowed low sound absorption compared to previous wooden constructions. In later theatre types it was enlarged, risking the appearance of delayed reflections off the orchestra, with higher reverberation and lower intelligibility. This was encountered by the decorative facade with statues, niches and other objects to allow diffusion. Its position opposite the audience area in Roman theatres created an enclosed autonomous shell that increased reverberation, and prevented urban noise from interfering in the performance. However, the three basic elements of the Greek theatre, namely the orchestra, the skene-building and the koilon were unified in the Roman, creating an architectural whole, whose size consequently diminished the actor. In terms of perception, the audience's role during the performance and the dialogue between them and the actor became a confrontation.

3. Scenery Categorisation

Based on sceneries applied to open-air theatres in the 20th century, four generic categories of scenery design, namely background scenery wall, large geometric objects, small orchestra objects and orchestra material and height, were created and studied, to identify their acoustic effect. Three ancient theatres were used for this analysis; Mieza, Philippi and Dion [3]. Several variables were investigated from the viewpoint of acoustics, including source positions.

Generally, the most beneficial scenery application from the acoustic viewpoint is the background scenery wall, either combined with another category or solely used. Clarity and reverberation is influenced by its material and its height, especially for the rear seats of the koilon and in occupied conditions. Nevertheless, in theatres with no remains of the skene-building the effect of the wall's presence is high, even in SPL, as shown in figure 3. Dense orchestra objects are equally effective. The height of the orchestra floor offers flexibility to a designer, since it can influence the acoustic indices, while material characteristics affect mostly high frequencies.

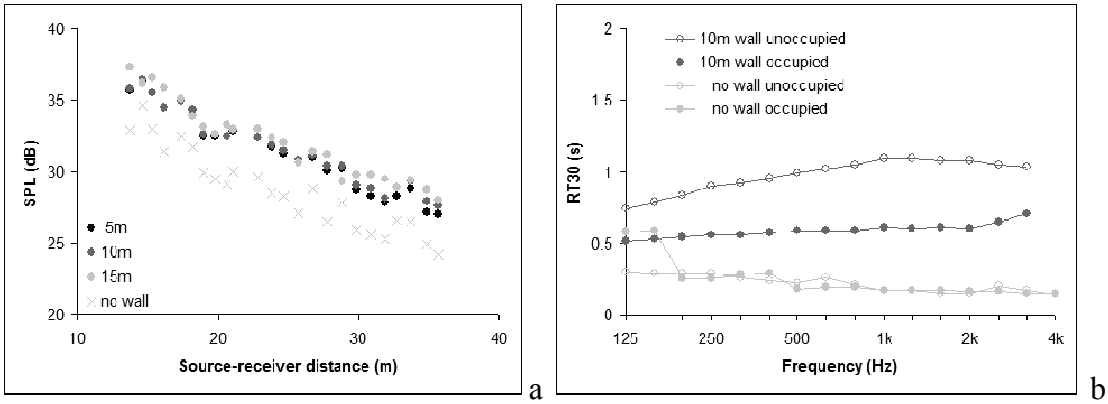

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Figure 3 – The theatre of Philippi with background scenery wall. a) SPL (dB) for the receiver line at 500Hz, b) RT30 (s) for the typical receiver at the range of frequencies.

4. Acoustic simulation as a design tool

In this section, the possibility of finding optimum shapes of sceneries from the acoustic viewpoint and simplifying scenery representation to facilitate the acoustic simulation was explored.

Especially regarding the plain background wall a schematisation was achieved by the use of acoustic simulation through colour maps of direct sound and SPL, in relation to reflections paths and energy responses during the design process. It was suggested that it is possible to maintain the area of the wall that is beneficial regarding useful reflections and create sceneries that will take a desired form, as shown in figure 4. In this way, acoustically effective scenery areas could be kept, with more complicated scenery shapes. Moreover, through this examination it was found that the cylindrical thymele, the altar positioned at the middle of the orchestra, may have contributed to more even distribution of sound, in addition to the original skene-building of antiquity.

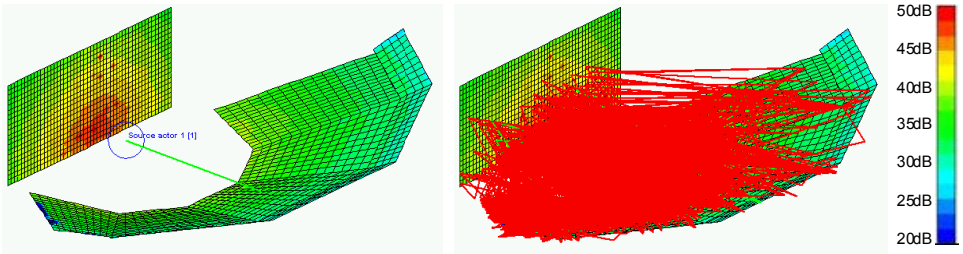

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Figure 4 – Scenery colour maps at the theatre of Mieza. a) SPL (dB), b) Reflection paths for 10 receivers at different areas of the koilon.

5. Design guidelines

This study aimed to assist individuals, stage designers and directors, to comprehend how stage/scenery design can affect the perception of a performance, namely its soundscape. Temporary architectural elements of each performance can help identify and adjust the intended feeling leading to the overall experience.

5.1 General guidelines

Several measures can be taken during the design of an open- air theatre/performance space, while solutions can be also provided for ancient theatres that lack acoustic quality. The general layout of the theatre is extremely important since, despite the arcs that usually exceeded 180^{o} in antiquity, the audience prefers relatively central seating positions. The cardioid shape that is used lately is more appropriate. Also, a major concern of the architect/acoustician would be to try not to weaken the direct sound. This can be achieved by appropriately orientating the theatre to protect it against wind and background noise and at the same time to take advantage of the wind from the actor towards the audience. The direct sound should be enhanced by early reflections, in less than 50ms after the emission of the former. The orchestra should preferably be clear and covered by a relatively reflective material, although contemporary trends in scenery design involve the use of fabrics that cover the orchestra's floor.

Apart from the purposely-designed scenery, in a variety of shapes, based on the categorisation discussed in section 3 and the combination of different materials, categories, and surface effects, other parts of the theatre can be used. For example the parodoi, the entrance and exit of the theatre provided useful reflections for the sides of the audience area in antiquity and can be re-placed by using contemporary light boards. The acoustics of the last rows of the audience area can also be optimised by appropriately designing an inclined reflective surface at the back, resembling the perimetric corridor of the Roman theatres. However, they should be carefully designed to avoid delayed reflections reaching the front seats. Some design prerequisites, like the low parapets at the perimeter of the koilon are planning restrictions that can provide lateral reflections.

The basic distinction between outdoor and indoor performance spaces is that the latter are acoustically designed to provide appropriate index values and have padded seating to balance the difference between occupied and unoccupied conditions. Treating the uncontrolled acoustics of outdoor theatre could mean to control the way absorption, reflection and diffusion is distributed, possibly by controlling audience seating arrangements. By identifying the parts of the koilon that contribute to useful reflections in advance, one could arrange the audience, so that useful reflective surfaces will not be obstructed and absorption will be provided at specific seating areas.

Finally, for new theatre structures, the performance style intended for the specific theatre should preferably be identified, to provide the preferred acoustic quality, which can then be altered accordingly, by applying temporary scenery design. The audience area should have seats with relatively high backs, so that sound can be reflected. This is easily achieved without affecting the visual sightlines, since the inclination is or can be quite increased.

5.2 Scenery guidelines

This study suggests that scenery design, either in the form of the ancient stage building, or as contemporary scenery applications contributes to the improvement of the soundscape of ancient theatres. Conventional use of scenery has been established in ancient drama performances. Scenery is meaningful for performances, not only for its aesthetic attributes but for its functional use in terms of entrances, exits and actors' positions. Standardised scenery and props are commonly used as well.

The materials and design of the scenery can be appropriately chosen to enhance the actor's voice, or alternatively diminish its strength. For example, since the position of the actors and the protagonists are usually pre-defined, the king's sound level can be enhanced by appropriate acoustic design.

Also, a simple, low in height, not aesthetically obtrusive, lightweight background wall, can be use to enable useful reflections and improve the soundscape. It may be an adjustable structure that can be used in relation with other scenery objects and props. This boundary can nevertheless be created by glass. Stage enclosures are also successful. As previously mentioned, to avoid delayed reflections and noise coming from the audience, the background wall should not exceed the height that is useful for early reflection distribution. Alternatively, absorption and diffusion should be applied to the higher parts of the wall.

6. Conclusions

This study examined the effect of scenery on the soundscape of ancient theatre. The evolution of the skene-building and the relationship between architecture, acoustics and perception was briefly discussed. A background scenery wall and dense objects were identified as optimised scenery forms, while acoustic simulation was used as a tool for acoustic prediction and scenery formation. Also, design guidelines were provided, from the viewpoint of architecture and acoustics. It would be possible for an architect/skenographer to use these recommendations as a guideline for theatre and scenery design in order to exploit the essential reflections and produce the desired acoustic environment during a performance of ancient drama.

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