

Acoustic behaviour of polychoirs in the Baroque church of Santa María Magdalena, Seville

Abstract

In addition to its other virtues, Baroque music was a means of expression and representation of the spirit of the Counter-Reformation, introducing an aesthetic which revealed theatricality, drama and splendour. The polyphonic style of the Renaissance gave way to a polychoral style, with the presence of several choirs or instruments placed in different locations within the church (*cori spezzati*). The aim of this study is to recreate the use of polychoirs, using simulation techniques in the Baroque Church of Santa María Magdalena, Seville, after testing the acoustic model in CATT-Acoustic software. The research shows that only the execution in unison of the upper choir and organ sound sources positions provides an equivalent sensation of musical and oral clarity and a better subjective reverberation than the other combinations. However, the use of different combination of sound sources positions worsens the overall sound sensation compared to the sound/music emitted from the position of organ alone.

Introduction

Baroque churches show the spirit of the Counter-Reformation, as a triumphant expression of the Catholic Church. The search for dynamism and theatricality in architecture through the use of resources such as curved plan layouts, the alternation of concave and convex shapes and the noticeable contrasts between light-dark or straight-curved characterize these church spaces. In acoustic terms, the conditions in Baroque churches represented a major improvement on their medieval and Renaissance predecessors, as their smaller dimensions and more ornate decoration avoided extremely long reverberation times [1], [2].

In the musical field, Baroque music was also a means of expression and representation of the spirit of the Counter-Reformation and introduced an aesthetic which revealed theatricality, drama and splendour. Among other changes, in the field of religious music the polyphonic style of the Renaissance gave way to a polychoral style characterized by the presence of several choirs or instruments in different locations within the church (*cori spezzati*).

Howard and Moretti [7] conducted an exhaustive work in which architectural design is related to the sacred choral music of the 16th century in Renaissance Venice. In their book it is shown the work on 12 churches: the ducal chapel of San Marco, two monasteries, three convents, three parishes and three state hospitals, with a more particular study on the churches designed by Sansovino and Palladio. A detailed historical, liturgical, ceremonial, acoustic and musical study was carried out in all of them, based on musical pieces corresponding to the repertoire of the *cori spezzati*. The research made it possible to identify in each temple the best source-receiver combinations and the best positions of receivers and sources. In addition, a series of concerts was held where different choral pieces were performed together with the organ as the only instrument. During these concerts, a subjective questionnaire of audience's sound perception was developed, which constitutes the first investigation on polychorality. The results allow to qualify different listener's subjective attributes of sound perception, as well as a general assessment of the enclosures.

Romero et al. [8] found that in the churches with three sound source positions emitting at the same time (choir and 2 sound sources on either side of the transept), the sound field is close to the diffuse sound field and the distribution inside the churches is acceptable. The clarity index C80 presents acceptable values for all areas meant for hearing and interpretation. Finally, word intelligibility, using the STI index, can be considered fair or poor depending on the church.

The church of Santa María Magdalena, in the city of Seville, is a clear example of how architecture responds to the need to establish different positions for musical performance during large celebrations. This study analyses the repercussions of polychoral music on the acoustics of the church of Santa María Magdalena, identifying several source positions emitting simultaneously. To do this, the acoustics of the church were characterized through *in situ* measurements. Subsequently, the three-dimensional acoustic model of the space is generated and adjusted to ensure that the simulated behaviour was as faithful as possible to that measured. Finally, once the desired setting was achieved, the use of polychoirs was recreated in relation to the position of music sound sources during the religious service.