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Article

The Acoustics of the Choir in Spanish Cathedrals

Alicia Alonso *, Rafael Suárez and Juan J. Sendra

Instituto Universitario de Arquitectura y Ciencias de la Construcción, Escuela Técnica Superior de Arquitectura, Universidad de Sevilla, Seville 41012, Spain; rsuarez@us.es (R.S.); jsendra@us.es (J.J.S.)
* Correspondence: aliciaalonso@us.es; Tel.: +34-954-559-51

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Abstract: One of the most significant enclosures in worship spaces is that of the choir. Generally, from a historical point of view, the choir is a semi-enclosed and privileged area reserved for the clergy, whose position and configuration gives it a private character. Regarding the generation and transformation of ecclesial interior spaces, the choir commands a role of the first magnitude. Its shape and location produce, on occasions, major modifications that significantly affect the acoustics of these indoor spaces. In the case of Spanish cathedrals, whose design responds to the so-called "Spanish type", the central position of the choir, enclosed by high stonework walls on three of its sides and with numerous wooden stalls inside, breaks up the space in the main nave, thereby generating other new spaces, such as the trascoro. The aim of this work was to analyse the acoustic evolution of the choir as one of the main elements that configure the sound space of Spanish cathedrals. By means of in situ measurements and simulation models, the main acoustic parameters were evaluated, both in their current state and in their original configurations that have since disappeared. This analysis enabled the various acoustic conditions existing between the choir itself and the area of the faithful to be verified, and the significant improvement of the acoustic quality in the choir space to become apparent. The effect on the acoustic parameters is highly significant, with slight differences in the choir, where the values are appropriate for Gregorian chants, and suitable intelligibility of sung text. High values are also obtained in the area of the faithful, which lacked specific acoustic requirements at the time of construction.

Keywords: worship acoustics; Spanish cathedrals; choir space

1. Introduction

Throughout history, the development and construction of worship spaces in Europe has been adapted to the different artistic styles of each era. Although the same style can be dated for different centuries in each European country, there is a number of common characteristics as well as formal and constructive aspects that define each typology. It is evident that from the acoustic point of view, the materials, the geometry, and the variety of particularities belonging to each style can exert a significant effect on the evaluation of the sound field of the temple. In this regard, several studies have analysed the acoustic evolution of worship spaces and have focused on the main qualities of each era and characterised the sound field through the analysis of various acoustic parameters [1,2]. However, not only do dimensions, materials, and stylistic considerations determine the acoustic behaviour of a space, but the spatial conception of its interior also constitutes another main aspect that determines the acoustics of the temple. The variation of the use of the temple in terms of the requirements of each epoch has given rise to certain spatial changes undergone over the years, that is to say, the organisation of its component zones: Naves, transept, ambulatory, and choir.

Occasionally, acoustic needs have influenced the formal, artistic, and spatial configuration of the temples. Knowledge on the origin and situation of elements that have influenced the acoustics of the temple allow the way of solving the interior liturgical space to be understood more clearly, thereby enabling the various configurations adopted in each area to be outlined in accordance with the time or type of event developed. The variation in the location of the choral space, apart from its stylistic, constructive, and chronological considerations, has changed the configuration of worship spaces throughout history [3]. Due to its ability to create and transform the indoor space, the choir would become the main enclosure to configure and articulate the spatial relationship of the temple and the location of the clergy and the faithful. Therefore, it is confirmed that the position of this semi-enclosed and privileged area reserved for the clergy occasionally produces major modifications of these indoor spaces.

In Europe, there are several types of churches and cathedrals that establish the choir space in different positions. In this article, the evolution and acoustic impact of the case study of Spanish cathedrals is analysed, in which the central position of the choir stalls fragments the space in the main nave where, unlike other models elsewhere in Europe, the congregation is not permitted to participate in all types of ceremonies. This work concerns the reconstruction of the process by which Spanish cathedrals have a strong personality within the European panorama, by virtue of the location of the choir.

2. The Choral Space in Churches and Cathedrals

From the architectural point of view, the choir enclosure commands a role of the first magnitude in the configuration of ecclesial indoor spaces and thereby constitutes one of the elements that configure the acoustic issue of worship spaces. The cardinal element of the liturgy can also be considered in its spatial development, and the conception of the choir can only be understood in the space for which it was conceived. The hierarchy of the choir constitutes the most faithful portrait of the clergy and responds to a different personality in each diocese [4]. In the case of cathedrals, the choir position has a significant condition in the architectural floor plan, since liturgical functions are developed around the choir. The fact that it is enclosed by high stonework walls on three of its sides, with numerous wooden stalls inside, has a noticeable effect on the sound field.

In the following sections, the historical evolution and the main typologies of European choirs are defined according to how their location affects the interior of the ecclesial space.

2.1. European Typologies of European Cathedrals

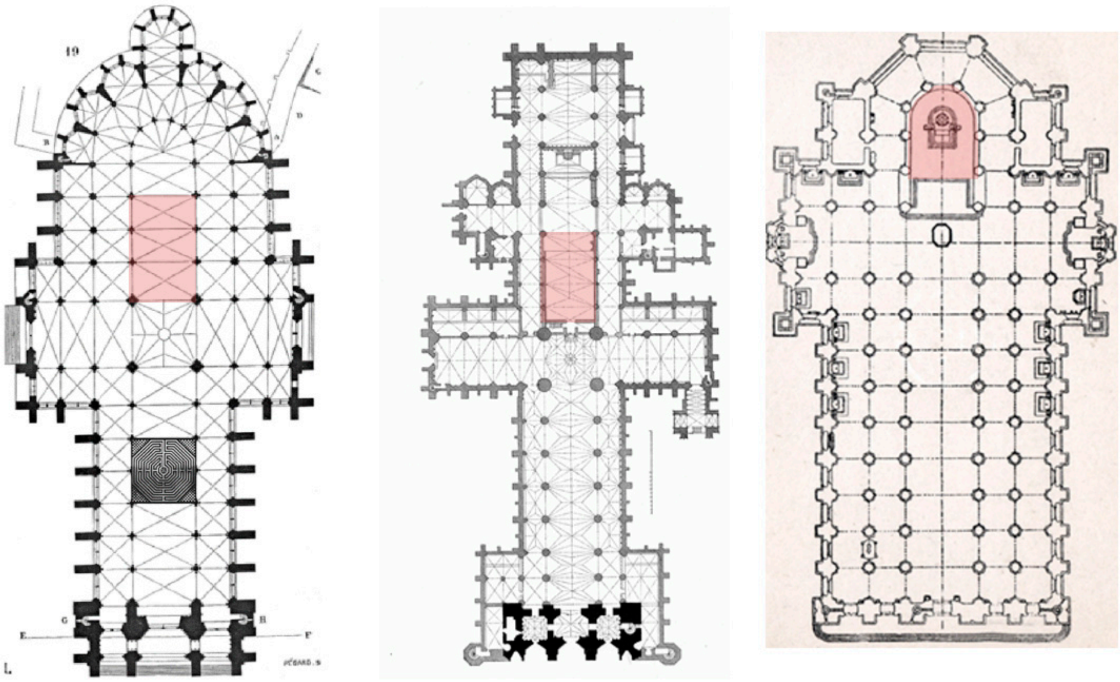
Ever since the construction period of the first Christian churches, the presence of a space reserved for the clergy has stood out, which would be used for the recital of the word in the form of singing. At first, it was located at the head of the temple and later, in its central nave, facing the presbytery, which then led to the schola cantorum, or choir enclosure, in early Christian basilicas [1].

The first position of the choir was later altered in European cathedrals, whereby that central area disappeared and the grouping of spaces for the clergy, altar, and choir were established, thereby creating a deep head in the temple. In Europe, various models and typologies, which are shown in Figure 1, were established, depending on the location of the choir:

- French typology. At first, the choral space was established at the head of the temple around the High Altar, changing its name to choeur. In this regard, the French model had a deep head of the temple to lodge the High Altar and the choir, which, in certain cases, was later moved to the centre for functional reasons. This model corresponds to the initial state of great French cathedrals, such as those of Reims, Amiens, Chartres, and Notre Dame. This opacity and the choir–presbytery represented, to a certain extent, an enclosed canonical church within the cathedral space, and hence the solemn liturgy could not be seen but could be heard by the faithful. As mentioned previously, this typology was an innovation with respect to the Romanesque churches, whose position of the choral space was in the centre of the nave following the model of Cluny Abbey [5]. In the central nave, the sequence followed was that of altar–choir–faithful.

- English typology. English choirs, such as those in the cathedrals of York and Lincoln, created a large private enclosure and were totally closed off to the faithful, and were located within a very long header. Among many other aspects in relation to the arrangement of the floor plan, form, and use of the cathedral, the processional entrance to the choir led through the door that opened into the retrochoir (trascoro). The sequence followed was that of altar–choir–faithful.
- Italian typology—Trentino model. The Schola cantorum of early Christian basilicas preserved throughout the Middle Ages has its origin in Italy. In accordance with major reforms enacted in the Council of Trent (16th century), decisive actions affecting the interior space and the liturgy of the cathedral were carried out. For this reason, renovation work based mainly on the transfer of choral space was promoted in certain European cathedrals, in order to strengthen this estranged relationship between the clergy and the faithful. This typology responds to the solution funded by Carlos Borromeo in the cathedral of Milan, in which the choir is located behind the main altar, taking this intermediate position between the choral space and the faithful. In the central nave, the sequence followed was that of choir–altar–faithful.

These European models (Figure 1) allow the congregation to be accommodated throughout the central nave in all kinds of celebrations.



(**a**) (**b**) (**c**)

Figure 1. European models. (**a**) French typology, cathedral of Reims (13th century); (**b**) English typology, cathedral of Lincoln (14th century); (**c**) Italian typology—Trentino model, cathedral of Milan (16th century). Red zone: Choir stalls.

2.2. *Historical Evolution of the Choir Space in Spanish Cathedrals*

In Spain, the choir is usually placed in the middle of the central nave, thereby responding to the old tradition of monasteries, and these, in turn, respond to the schola cantorum of the early Christian basilicas [1,3]. Thus, the chancel and the choir, closely united, became a church for the clergy within the cathedral itself, where the congregation was excluded. In the Spanish typology, the position of the choir generated a division of the central nave into two differentiated zones: On the one hand, the solemn space of the great liturgy and, on the other hand, the space where the ordinary religious ceremonies were developed. This configuration delimited a space for preaching in front of the presbytery, to which the voice could be reached from the pulpits. Moreover, the central position of the choir stalls fragmented the space in the main nave and generated other new spaces, such as the trascoro. As previously indicated, this arrangement of the choir responds to the old tradition of Early Christian basilicas in which the schola cantorum had a similar disposition. In this case, the sequence adopted in the central nave was that of altar–faithful–choir–trascoro–faithful. In the Spanish model, the development of both the word and the musical liturgy is supported by a series of celebratory sources, such as the choir. Longitudinally, the choir space has the dimension of two intercolumniations. Throughout history, the celebration of certain events has required the transfer of this space to other areas of the interior, such as the trascoro, a space that becomes a new stage for music, thanks to its spatial amplitude.

A brief description is made of the course of the evolution of the choir space in Spain, whereby a description is given of the spatial configuration of some of the main cathedrals, both for their outstanding heritage character and the influence of their architectural configuration, transferred to other Spanish and New World cathedrals. Figure 2 shows various floor plans of Spanish cathedrals. Table 1 summarises the data of the main dimensions of the cathedrals under study and their choir spaces.

The tour of historical evolution of the choir space starts with the Latin cross floor plan of the cathedral of Santiago de Compostela (12th century), which is based on monastic buildings such as Cluny Abbey, with a shallow presbytery and a wide stone choir in the central nave [5,6]. This choir space is located in the first three sections of the nave from the transept, with a fourth section assigned to the leedoiro, a high tribune used for sermons in ceremonies. It was in the cathedral of Santiago where the location of the choir between the altar and the faithful in the centre of the nave was first made in Spain. The choir typology of this cathedral played a role of obligatory reference for future Spanish temples. It should be noted this typology generates a problem that has been analysed in other studies, which is the need to look for a configuration that accommodates a large congregation, since its position prevents the use of the depth of the central nave [7]. Although in many Spanish cathedrals, the architectural project raised the location of the choir in the main nave, it should be noted that in certain cathedrals, such as the cathedrals of Burgos and of León, the French model was initially followed. However, later work was carried out in order to restructure the model and move the choir to the central location. These proposals for the transfer of the choir to the nave obey no aesthetic reasoning, but rather a desire for ecclesial renewal.

In the cathedral of Toledo (14th century), the model of the cathedral of Santiago is followed, where the choir, named compostelano [4], is positioned in the centre of the temple, in this case at a double height. Its artistic style is varied and cannot be associated to a single period, since it was built in various stages.

In the case of the cathedral of Seville (15th century), following the previously established model, the choir space is also located in the middle of the central nave, facing the presbytery. It should be noted that the floor plan of the cathedral of Seville was the cathedral model exported to Ibero–America, that of a rectangular church with a straight ambulatory, thus ensuring the continuity of the processional space.

Unlike the other cathedrals, in the cathedral of Granada (16th century), there have been major interventions that have involved the modification of the situation of the choral space. At first, the choral space was located at the centre of the main nave, used mainly for the performance of instrumental music and singing. In the early 20th century, as in the case of the cathedral of Santiago, the choir was moved to the head of the temple, thereby enabling an optimal space-functional relationship by recovering its position at the High Altar. The last intervention, carried out at the end of the 20th century, completely suppressed the choir by distributing the stalls throughout the temple.

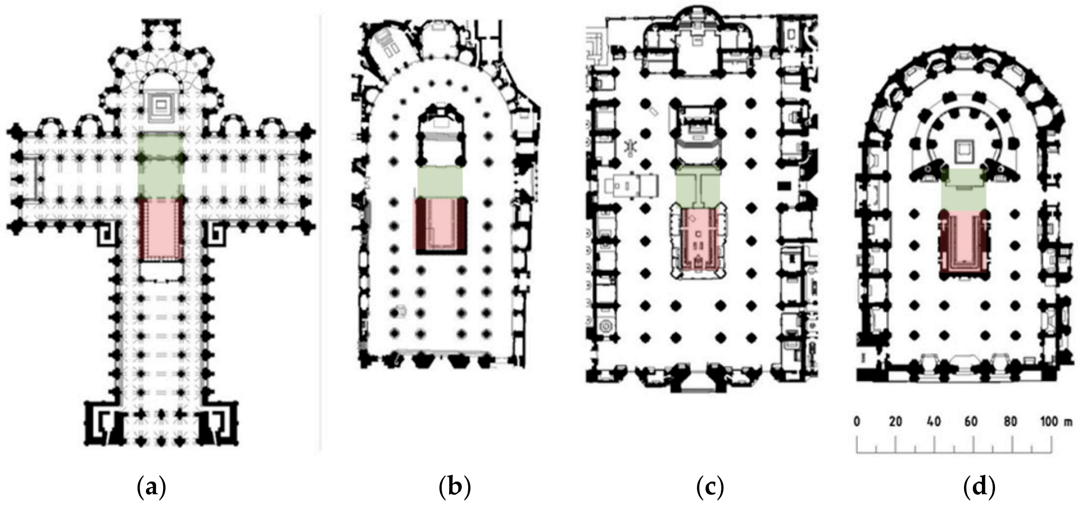


Figure 2. Spanish typology. Floor plans of: (**a**) Cathedral of Santiago de Compostela (12th century); (**b**) cathedral of Toledo (13th century); (**c**) cathedral of Seville (15th century); (**d**) cathedral of Granada (16th century). Red zone: Choir stalls; Green zone: Area of the faithful.

Table 1. Dimensions of Spanish cathedrals under study and their choir spaces.

Cathedral	**Dimensions**			
	Long (m)	**Width (m)**	**Height (m)**	**Volume (m^3)**
Santiago	174	40 (130 transept)	20 to 43	48,000
Choir	30	16	6.5	-
Toledo	108	55	19 to 31	125,000
Choir	19	11.5	6	-
Seville	116	76	35 to 40	205,000
Choir	22	13	8	-
Granada	106	63	25 to 32	160,000
Choir	20	11.5	7	-

3. Methodology

In order to analyse the acoustic environment of the Spanish cathedrals when the sound source is located in the choir space, two different techniques were carried out, depending on the case study: On the one hand, onsite acoustic measurements were carried out in two of the cathedrals that are preserved as they were built centuries ago (Toledo and Seville); and on the other hand, an archaeoacoustics procedure was developed, that is to say, a virtual acoustic reconstruction of the configuration of the spaces in the past using acoustic simulation tools (Santiago and Granada). However, the cathedral of Granada was also acoustically measured, since this procedure enabled the calibration of the virtual model that faithfully represents the current indoor acoustic environment, a procedure that is studied in Alonso et al. [8]. Once the model was calibrated, spatial transformations were incorporated that reproduce the acoustic sound field of the cathedral in the past with a different ancient choir. This technique, in which onsite measurements and computer simulation are used as a method of evaluation of the acoustic quality of worship spaces, is evidenced by other previous studies [2,7–9].

3.1. Onsite Measurements

An experimental technique was carried out based on onsite measurements to obtain room impulse responses (RIRs) of the cathedrals of Toledo, Seville, and Granada [7–9]. The measurements were carried out within two research projects, each of which lasted for 3 years, financed by the National Plan, in order to meet the objectives that were set out in the project, in which the recovery of the intangible heritage was proposed, as was the addition of possible solutions for the improvement of the acoustic behaviour of the cathedrals. The results of these research projects are published in several studies [7–10]. The RIR reflects the behaviour of a space between the point of emission and that of reception and can be used to calculate the acoustic parameters. Measurements were conducted at night in the unoccupied temple and followed the standard ISO 3382 [11] and guidelines established by Martellotta [12]. Temperature values and relative humidity were monitored, and the values of each cathedral are shown in Table 2.

Table 2. Data monitored during measurements in each cathedral.

Cathedral	Temperature (°C)	Relative Humidity (%)
Toledo	15.8–18	53–66.7
Seville	25–25.5	55–58
Granada	11.7–12.5	36–43

High impulse-to-noise ratio (INR) values require the adjustment of the level and duration of the measured signal and determine a suitable quality of the signal recorded, which provides reliable results of the main acoustic parameters. Since background noise during the measurements was low, it was possible to obtain INR values above 45 dB.

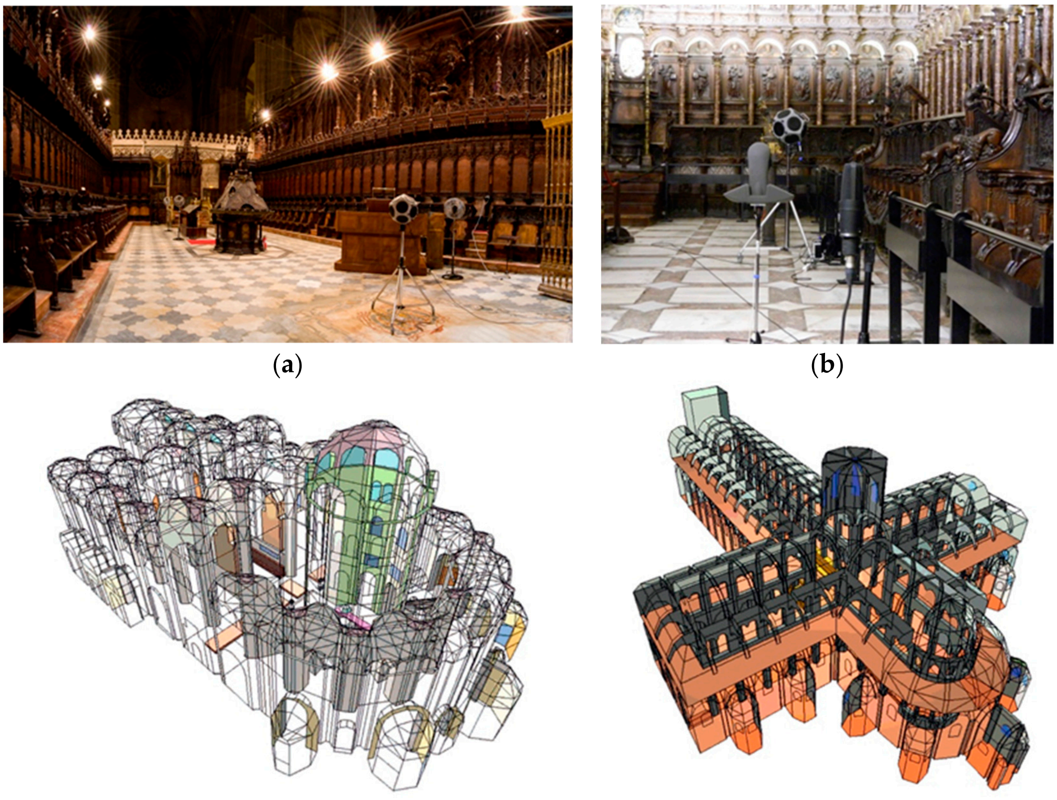
The measurement process started with the excitation response of the cathedrals by issuing sine sweep signals, emitted by an omnidirectional dodecahedron sound source (AVM do-12), raised up to 1.5 m from the floor or support surface, with frequency increasing exponentially over time. The duration of the sweep was set to 20 s and covered the octave bands from 63 to 16 kHz with a power amplifier (B&K 2734). In the case of the cathedral of Seville, a self-amplified Beringher Eurolive B1800D-Pro subwoofer was incorporated in order to improve the low-frequency results. A single output channel was used, since the signal is sent to the subwoofer, which is self-powered and has a high-pass filter (cut-off frequency at 90 Hz) that allows the signal to be sent up to the dodecahedron [13].

The signal generation, acquisition, and analysis were performed using the WinMLS2004 software tool together with an audio interface EDIROL UA-101 in the case of Seville and Granada, and the commercial software EASERA v1.2 with AUBION x8 multichannel sound card in the case of Toledo. Consequently, RIRs were acquired using a multipattern microphone Audio-Technica AT4050/CM5 that can be easily changed from omnidirectional to figure-of-eight in order to simulate the spatial impression of the listener through the lateral acoustic energy perceived, and whose amplifier and polarisation source is Earthworks Audio LAB1. In this study, acoustic parameters were considered when obtained only from omnidirectional directivity characteristics. The microphone was placed at a height of 1.2 m from the floor, which is the approximate ear level of a seated person, at each of the reception points throughout the audience area, with direct vision from the sound source. For the binaural RIRs, a Head Acoustics HMS III (Code 1323) dummy head was used. A moment of the measurement procedure in the choir space of the cathedrals of Seville and Toledo is captured in Figure 3a,b.

3.2. Simulation

Acoustic simulation is a highly useful tool, both for the prediction of the acoustic behaviour of an enclosure in the design stage and for the recovery of the sound of the past in spaces of worship that no longer exist. In this regard, simulation software also enables the characterisation of ancient acoustic conditions by offering the possibility of listening to the acoustics of the space of another era [13]. This is the case of the cathedral of Santiago since the old stone choir space, executed by Master Architect Mateo, was removed from the cathedral in the 17th century to be replaced by a wooden choir in the central nave. Since in the 20th century, it was also decided to dismantle the wooden choir, there is a need to use acoustical prediction tools to analyse the acoustic environment of the temple in past eras. Virtual acoustic models of the cathedral of Santiago and the cathedral of Granada were created in order to reconstruct these spaces from the past.

In the case of Santiago, documented floor plans researched by Conant [6] were used and the model contained 5600 planes and a volume of 48,202 m^3, and in the case of Granada, almost 5000 planes were used to create a volume of 160,000 m^3. After having created the models using SketchUp 3D modelling software, they were then exported to CATT-Acoustic v9.0c [14]. The predicted values were provided using the calculation engine TUCT v1.1a, incorporated in the acoustic software. On the one hand, the data collection of sound absorption/scattering coefficients was carried out by categorising the existing materials in the space after a visual inspection [15]; and on the other hand, coefficients of materials of inexistent enclosures, such as the choir space, were based on documented bibliography. The sound source was located in the choir space, corresponding to the liturgical use that is the object of study, and the receivers were positioned according to occupation. The acoustic model simulations provided the RIRs, which led to the calculation of the most significant acoustic parameters of the cathedral. Virtual models of the cathedral of Granada and Santiago, into which the inexistent choir space was incorporated, are shown in Figure 3c,d.



(**a**) (**b**)

(**c**) (**d**)

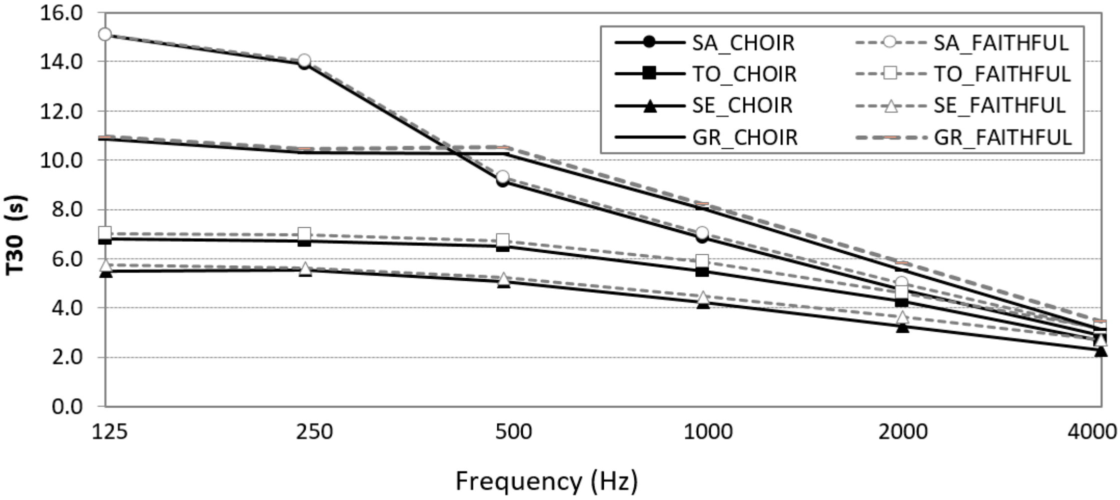
Figure 3. Acoustic measurements conducted inside cathedrals: (**a**) Choir stalls of the cathedral of Seville; (**b**) choir stalls of the cathedral of Toledo. Virtual models in which the choir space was incorporated: (**c**) cathedral of Granada; (**d**) cathedral of Santiago.

4. Acoustical Assessment of the Choir Space in Spanish Cathedrals

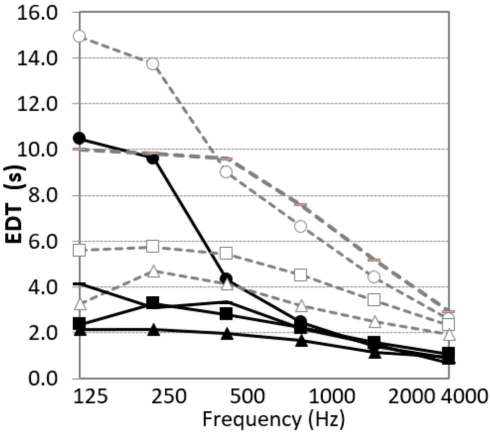
This study analysed the acoustic environment of Spanish cathedrals when the sound source is located in the choir stalls. The sound field of the Spanish cathedrals under study was evaluated through the analysis of the RIRs measured or predicted at the receiver points with direct sound from sources located in the choir and in the main altar. In this regard, a comparison of the values obtained was established in order to evaluate the acoustic impact of locating the sound source in the choir space, while considering different groups of receiver positions: One group located in the choir space itself, and another group located in the area of the faithful. This latter group was located in the area between the main altar and choir stalls, with a distribution of between 3–6 receiver points, depending on the cathedral studied. In order to correctly obtain the acoustic parameters, it was ensured that all the receiver points analysed guaranteed the arrival of direct sound. As previously stated, in relation to the acoustics, it is known that the choir constitutes one of the elements that configures the acoustic issue of cathedrals. This analysis enables the different acoustic conditions existing between the choir itself and the area of the faithful to be verified, while also noting the significant improvement of the acoustic quality in the choir space. The experimental results are shown in the various forms explained below.

Figure 4a–d depicts the acoustic parameter values, spatially averaged, versus frequency octave-band when the sound source is located in the choir and the receiver points are located in both positions of the choir and the area of the faithful. Table 3 provides a summary of spatial average values (500–1000 Hz) of the acoustic parameters analysed in the study, in accordance with Table A.1 ISO 3382 [11]. On the other hand, Table 4 shows the comparison in terms of the Just Noticeable difference (JND) of acoustic parameters between values of points located in the choir space and in the area of the faithful, when the sound source is located in the choir.

It can be observed from Figure 4a that T_{30} values are independent of the position inside the cathedral, since the reverberation time is obtained by calculating the time the signal needs to drop by 30 dB. In terms of early decay time (EDT), the calculation is performed using the first 10 dB, thereby raising the importance of the variation of the first reflections. This fact means that there is probably a difference in the results when the sound receivers vary the position and, therefore, vary the existence of the closest surfaces. Moreover, the choir enclosure is surrounded by high stonework walls on three of its sides and with numerous wooden stalls inside, which varies both the absorption and scattering coefficients. This study also centres on the values provided by parameters such as clarity (C_{80}), which measures the range of the listening perception for musical use, the centre time (Ts), which is related to the balance between early and late energy reaching the receiver, and definition (D_{50}), which shows the capacity of the enclosure to generate precision in the articulation of vocal sounds. All these factors lead to a noticeable effect in the sound field when the receiver points are located inside the choir space, as can be seen in Figure 4b–d and Table 4. It becomes apparent that the spectral values of EDT at mid-frequencies, spatially averaged, present a significant difference, greater than 10 JNDs in all cases, and more than 2 JNDs for C_{80}.



(**a**)



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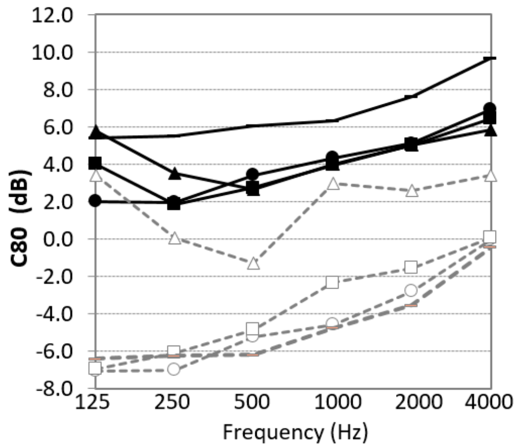

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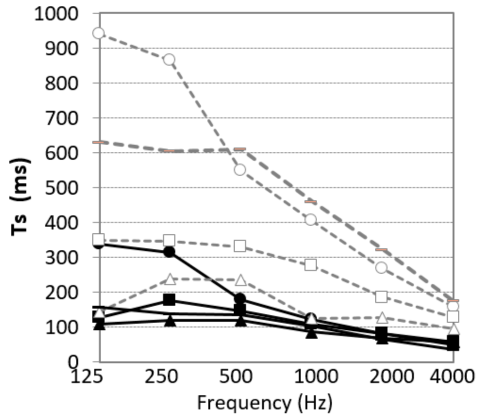

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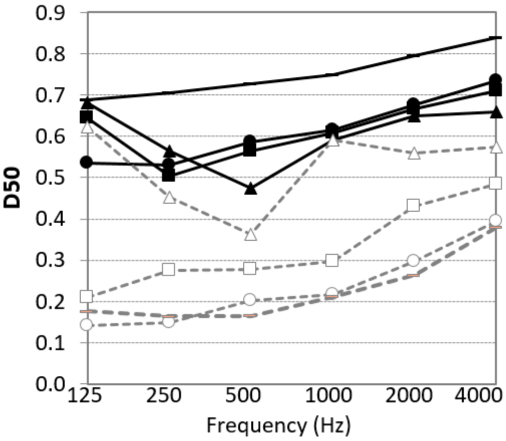

(**e**)

Figure 4. Acoustic parameter values, spatially averaged, versus frequency octave in the unoccupied cathedrals studied when the sound source is located in the choir and in the altar: (**a**) T30 (s); (**b**) EDT (s); (**c**) C_{80} (dB); (**d**) Ts (ms); (**e**) D_{50}. SA = Santiago, TO = Toledo, SE = Seville. EDT: Early decay time.

Table 3. Summary of average values (500–1000 Hz) of acoustic parameters analysed, in accordance with Table A.1 ISO 3382 [11]. Spatial average values by zone: Choir space and area of the faithful.

	T_{30} (s)	EDT (s)	C_{80} (dB)	T_S (ms)	D_{50}
SA_CHOIR	7.99	3.37	4.28	150	0.60
SA_FAITHFUL	8.15	7.81	−4.21	477	0.21
TO_CHOIR	6.01	2.50	3.89	128	0.59
TO_FAITHFUL	6.31	4.97	−2.93	302	0.29
SE_CHOIR	4.65	1.83	3.88	102	0.53
SE_FAITHFUL	4.84	3.66	1.42	181	0.48
GR_CHOIR	9.14	2.75	6.67	119	0.74
GR_FAITHFUL	9.37	8.59	−4.83	535	0.19

Table 4. Differences in JND of acoustic parameters between values of receiver points located in the choir space and in the area of the faithful, when the sound source is located in the choir.

	T_{30} (s)	EDT (s)	C_{80} (dB)	T_S (ms)	D_{50}
SA	0.4	26.3	5.7	29.2	3.9
TO	1.0	19.8	3.8	18.2	3.0
SE	0.8	11.2	2.6	6.4	0.6
GR	0.5	42.4	46.7	7.7	5.5

The variations of the EDT parameter are highly significant, with slight differences in the choir, where the values are appropriate for the Gregorian chant, and high values in the area of the faithful. The Gregorian chant is characterised as being a prayer sung with a prosodic rhythm, centred on intonation. This is a plainchant and a purely melodic, monodic song into which more complex developments, such as organum parallelum, have been incorporated. The relevance of the Gregorian chant is justified due to the importance of ecclesiastic chant at the liturgy and owing to the significant role played by choirs in cathedrals. In the case of D_{50}, the situation is similar, whereby adequate intelligibility is attained of the text sung in the choir.

Another influential factor is that of the acoustic quality of the cathedral, since the differences observed are lower when the acoustic conditions are better and the reverberation is lower. In the case of the cathedral of Seville (4.79 s), whose values of T_{30} are drastically lower than those of Granada (9.14 s), the differences in certain parameters are extremely small when the source is located on the altar and in the choir. In the cathedral of Seville, mostly rough and highly porous limestone, as well as the ornate decoration, exert considerable influence on the sound absorption by the venue, and, by extension, on its acoustic parameters [7]. It is interesting to observe that with the exception of the cathedral of Seville, the results reflect very similar sound conditions in the choir area, identified as the church of the clergy, with greater acoustic requirements for the chant. In the same way, the significant differences between the results of the two areas are shown, as influenced by the conditions of the enclosure. The area of the faithful represents the church without the many current acoustic requirements.

In addition, it should be noted that the JNDs in the cathedral of Granada are highly significant; however, this fact is justified by the great reverberation and the diffuse sound of the cathedral in the area of the faithful, which contrasts with the excellent acoustic conditions of its choral space. With the exception of the cathedral of Santiago, the subjective reverberation values in the choir are below 3 s, and the clarity values are in the range 2–4 dB, which is considered optimal for large-scale spaces [16].

5. Conclusions

The choir enclosure is one of the elements that structures and influences the acoustic issue of worship spaces, since it plays a role of the first magnitude in the configuration of ecclesial indoor spaces. From a historical point of view, the choir is a private, semi-enclosed, and privileged area reserved for the clergy. The spatial complexity of cathedrals responds to liturgical requirements. In this regard, in Europe, different models and typologies are established, depending on the location of the choir. In the case of most Spanish cathedrals, the central position of the choir stalls fragments the space in the main nave.

In this article, a grand tour is developed regarding the acoustic impact of the case study of Spanish cathedrals: Santiago, Toledo, Seville, and Granada. A noticeable effect is perceived in the sound field when the source is located inside the choir space since, in relation to the acoustics, it is known that the position of the choir is one of the elements that influences the acoustic issue of cathedrals.

When analysing the evolution of the acoustic impact of the choir in the Spanish cathedrals, it is not possible to establish an improvement in acoustic quality over time, since factors, such as the dimensions of the enclosure and the height of the walls, can influence the results. This analysis has successfully confirmed the various acoustic conditions existing between the choir itself and the area of the faithful, whereby the significant improvement of the acoustic quality in the choir space, identified as the church of the clergy, can be noted. The variations in the acoustic parameters are highly significant, with slight differences in the choir, where the values are appropriate for the Gregorian chant, with EDT values in the range of 1.8–3.3 s, and suitable intelligibility of sung text, with D_{50} values higher than 0.60 and C_{80} in the range of 3.8–6.6 dB. On the other hand, high values are obtained in the area of the faithful, which represents the congregation of the church, without the many current acoustic requirements.

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