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## CITIZEN SCIENCE TO ANALYSE THE RELATIONSHIP BETWEEN SOUNDS AND SPIRITUALITY IN A MONASTERY

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### ABSTRACT

The acoustic environment of a monastery represents a unique context that reflects its capacity to evoke feelings of spirituality and transcendence. This paper is based on the ongoing research project *Sons als Monestirs*, which examines the soundscape as a key factor in shaping spiritual experiences and fostering a connection between individuals and sacred spaces, particularly monasteries. In this work, a soundwalk was conducted at Pedralbes Monastery, located in Barcelona, a site historically associated with the Order of Clarisses, a religious community of nuns that places great importance on silence. This study aims to analyze the relationship between the monastery's acoustic environment and spirituality, based on participants' perceptions. Qualitative data were collected through a questionnaire using a 5-point Likert scale to assess the extent to which various sounds elicit feelings of spirituality. In addition, quantitative data were gathered to describe the different events during the soundwalk. The results indicate that sounds such as birdsong, flowing water, the reverberation of footsteps, and silence are associated with spiritual feelings, with the cloister being the location that received the highest average ratings. This study contributes to a deeper understanding of how the soundscape influences individuals' perceptions of spirituality.

**Keywords:** *soundwalk, spirituality, soundscape, citizen science, monastery, quiet zones*

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### 1. INTRODUCTION

Monasteries represent a distinctive type of sacred space where architecture, landscape, and silence converge to create an environment conducive to contemplation and spirituality. The characteristic trait of monasteries is that they often consist of both enclosed indoor spaces as well as outdoor areas. This duality of environments offers a rich soundscape that may shape the spiritual experience of those who visit or reside within these spaces.

The soundscape of sacred places has been studied before and has emerged over the past decade [1]. Previous research has examined the acoustic environments of various places of worship, including the Fatima Masumeh Shrine—an important pilgrimage site for Shia Muslims [2]—as well as Catholic cathedrals and Buddhist temples through soundwalk methodologies [3]. Additionally, studies have explored the soundscape of Hindu temples, such as the Shiva temple [4]. In Japan, a soundwalk using smartphones was performed at Itsukushima Shrine located on Miyajima Island [5]. These investigations highlight the role of sound in different religious experiences across different traditions.

Given that Christianity is one of the most influential religions worldwide, scholars across the globe have placed significant emphasis on the study of church soundscapes. The important relationship between sound and spirituality can be seen in at least two fundamental aspects of the life of a Catholic monastery: the centrality of silence and the significance of singing as an expression of a liturgy that expresses the harmony of all Creation.

In several places in his Rule, since the year 516, Saint Benedict of Nursia insistently exhorts monks to be silent [6]. As the theologian Louis Bouyer remarks, “Ev-





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every monk should constantly remind himself that there is hardly any treasure more foolish to squander than that of silence” [7]. This silence emphasizes the vigilance over what is said and sung, so that everything that comes from the voice aligns with the heart and the acts, in such a way that the word expresses faith and faith is proven by actions [6, 8–10]. It is the monk’s very life that becomes a song of praise when these elements are in harmony. And, at the same time, the Christian’s song is called to be “a participation in the song and prayer of the great liturgy that encompasses all of creation” [11]. It is Saint Francis of Assisi himself, founder together with Saint Clare of the order of the Poor Clares, who admirably evokes in his hymn entitled *Canticle of the Creatures* how the praise of God in religious life is united with the praise of all Creation [12]. The reflection of God in all that exists, and which Saint Francis’ hymn expresses, also highlights the importance of the relationship between the expression of faith and the place and geographical environment—in this case the monastery—in which it is lived [13]. His organization of space and time, of the rhythm of the singing of the hours and the silences, represents an intersection that is both historical and symbolic, which welcomes from the external experience a deeply interior experience [14].

Despite the notable relationship between spirituality and sound, most existing research has focused on objective analyses when studying sacred places [15–18]. As noted by [1], the majority of studies in Catholic churches focus on measurements of sound levels, reverberation, and often employ simulations for the analysis of acoustic parameters [15, 19, 20]. In contrast, investigations into individuals’ perceptions and emotional responses to the sound environment within these spaces are more pronounced in Buddhist temples [3, 21, 22]. The study by [3] is one of the few that analyzes the perception of sound through a soundwalk, presenting a comparison between a Catholic cathedral and a Buddhist temple. The results indicated that the functions of religious activities related to sound elements are emphasized in the Buddhist temple.

Furthermore, it is well known that sounds play a significant role in shaping spatial perception; however, there is less understanding of how they evoke emotional responses and spirituality. Few studies [22, 23] have demonstrated that the acoustic characteristics of a space can enhance the emotional impact in places of worship. This gap highlights the necessity for further research on how soundscapes influence individuals’ perceptions.

In this study, we explore the role of a Catholic monastery’s acoustic environment in shaping perceptions



**Figure 1.** Participants answering the questionnaire in the second stop, next to a fountain.

of spirituality. To achieve this, we employ a soundwalk methodology at the Pedralbes Monastery in Barcelona. This approach allows us to examine both indoor and outdoor acoustic elements, offering insights into how different sonic components contribute to the monastery’s spiritual atmosphere. By analyzing participants’ perceptions and responses to the soundscape in these distinct environments, our research seeks to deepen the understanding of the connection between monastic soundscapes and spiritual experience.

## 2. METHODOLOGY

The soundwalk took place at the Pedralbes Monastery on November 16th, 2024. Participants were initially gathered at a designated starting point, approximately a five-minute walk from the monastery, ensuring that the site remained unseen at the outset. Prior to beginning, the soundwalk methodology was explained to the participants, who were encouraged to engage in active listening and maintain silence while walking towards the first stop.

At each of the stops along the soundwalk, a structured sequence of activities was carried out to foster both individual experience and data collection (Figure 1). First, participants were given a couple of minutes to quietly immerse themselves in the surroundings. Second, a brief pre-selected text, aimed at encouraging spiritual reflection and thematically connected to each specific stop, was read aloud. Third, participants completed a paper-based questionnaire, designed to avoid the need for mobile de-





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**Figure 2.** Five points of the soundwalk (from top to bottom, left to right): Stop 1 - participants responding to questions in the square; Stop 2 - the fountain in the cloister; Stop 3 - participants in the Chapterhouse; Stop 4 - participants listening to explanations in the refectory, with Latin messages on the walls encouraging silence; Stop 5 - the medieval vegetable garden.



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vices. However, they were invited to record a short 30-second video to capture the soundscape if they wished. This video-based documentation approach draws upon the methodology of the Sons al Balcó project [24]. In parallel, ambient sounds were recorded using a Zoom H5 recorder, ensuring a detailed sonic documentation of each location. This way, at the end of the soundwalk, researchers have two sources of materials for further analysis: the videos—which also contain the audio that the participants were hearing while answering the questionnaire—and a longer 10 minutes recording from each stop.

The points of the soundwalk (depicted in Figure 2) were:

- First stop: the square in front of the monastery (located at coordinates 41°23'46.1"N 2°06'46.2"E). At this stop, participants had an open view of the entire Monastery from the outside, with benches arranged in a circular formation, allowing them to contemplate the site's architecture. Unlike the other stops, where a text was read to evoke feelings of spirituality or transcendence, the soundwalk leaders instead provided historical context about the Monastery, offering details about its past and significance. After the explanation, participants filled the questionnaire and recorded videos as in the other stops.
- Second stop: the cloister. Built in the 14th century, the cloister of the monastery is considered one of the largest Gothic cloisters in the world [25]. In this monastery, the cloister is a spacious outdoor area surrounded by three levels of columns supporting pointed arches. In the centre, it features a large central fountain surrounded by abundant vegetation. The area is enriched with trees and vegetation that host medicinal plants, contributing to the tranquil atmosphere of the space. Additionally, there is a smaller fountain and a well located in another section of the cloister, enhancing the overall aesthetic and serene environment of the site. In this stop, the first text to promote the feeling of spirituality was read aloud next to the central fountain, moments before the participants were asked to answer the questionnaire while sitting on benches next to the second fountain and the well (see Figure 1).
- Third stop: the Chapterhouse. The Chapterhouse of the Monastery of Pedralbes was traditionally used for meetings of the monastery's religious

community. This indoor room, placed next to the cloister, is characterized by its Gothic design, featuring high vaulted ceilings supported by slender columns. The space is also notable for its simplicity and solemnity. Currently, it has no furniture on it, which contributes to the reverberation of sound on the stone walls. Additionally, this space served as an opportunity for all the nuns to speak, which was unusual within the monastery, as they followed the way of life of the Clares, who lived mostly in silence.

- Forth stop: the refectory. This is the indoor room where all the nuns used to have their meals in silence. The only vocal sound that was heard was a nun reading aloud. Actually, the stone walls are decorated with Latin messages that encourage silence, such as *Silentium* (Silence) or *Audi tacens* (Listen to the silence), as can be observed in Figure 2, specifically in the refectory sub-image. The leader of the soundwalk is pointing to the message on the wall. In the background, a crucifix hangs on the wall too.
- Fifth stop: the medieval vegetable garden. It is an outdoor walled space of almost 3 000 square meters [26]. It was historically used by the nuns to grow food, contributing to the monastery's self-sufficiency. Today, it remains a peaceful space, with an irrigation system that creates a soothing sound of running water.

In the paper-based questionnaire, participants were expected to assess the acoustic environment and express their perceptions by answering questions using a 5-point Likert scale (e.g., rating aspects such as cleanliness, beauty, the overall impression of the stop, and the soundscape specifically). Additionally, an open-ended question was included, specifically asking which sounds they perceived to evoke a sense of spirituality and transcendence.

### 3. RESULTS

The sample consisted of nine participants: five male and four female. The age range spanned from 27 to 66 years, with five participants between the ages of 27 and 35. Participation was voluntary, as the activity was promoted as part of 29<sup>a</sup> La Setmana de la Ciència (29<sup>a</sup> Science Week), an annual event in Catalonia, Spain, dedicated to promoting science and technology among the public and the broader citizens.







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**Table 1.** Ratings of the different spots obtained by the questionnaires.

Stop	Cleanliness	Beautiful	Rate	Sound environment
1	3.89	4.67	4.44	4.22
2	4.56	4.78	4.89	4.78
3	4.67	4.11	3.89	4.33
4	4.56	4.44	4.33	4.22
5	4.11	4.44	4.44	4.22

Table 1 shows the average of the participants' results to the questions about the cleanliness, appearance, rating and sonic environment of each stop. Specifically, the participants answered the following questions, each one related to one of the columns of Table 1:

- "Is this place clean?" (1- Very dirty, 5- Very clean).
- "Do you think the place is beautiful?" (1- Very ugly, 5- Very Beautiful).
- "What rating would you give to this place?" (1- Very bad, 5- Very good).
- "How would you describe the sound environment?" (1- Very bad, 5- Very good).

Therefore, answers close to 5 are associated with positive attributes while answers close to 1 are associated with negative attributes.

As can be seen, all the stops received good overall ratings, with all the mean values above 3.80. The stop that received the best ratings for all the questions—except for Cleanliness—is the cloister (the second stop), with a special mention of the sonic environment. At that stop, there are multiple sounds typically associated with pleasant experiences, such as the water from both fountains, water drops inside the well, birds singing, and the sound of vegetation moving. Since the cloister is at the centre of the monastery, traffic noise are barely audible.

Participants found that the less clean area was found at the first stop—outside of the Monastery. However, they still rated this stop better than the indoor areas, finding it more beautiful. Actually, the indoor areas (stops 2 and 3) the ones that received less ratings in the categories related to appearance. Nevertheless, they still received almost the same punctuation as the outdoor areas about the sonic environment, with the Chapterhouse (third stop) receiving

**Table 2.** Participants' results to the questions that link the sonic environment and the spirituality.

Stop	Spirituality	Sounds
1	2.56	Birds (4), vegetation (3), bells, sound of the earth
2	3.75	Water (6), silence, birds, vegetation
3	3.25	Silence (4), reverberation of footsteps (3), sound and visual connection, echo of the voice with the reading, bells
4	3.25	Silence (3), footsteps (2), noise of people, reading
5	3.29	Water (5), sound of the earth, feet on the ground, silence

the second highest punctuation in that matter. From these results, we can infer that the participants of the soundwalk did not prefer the outdoor soundscape to the indoor one, having each spot unique characteristics.

Table 2 shows the results of the participants related to the sensation of spirituality at each of the stops. Specifically, the two questions related to sound and spirituality were framed as follows:

- "Does this space evoke in you a sense of spirituality or transcendence?" Participants were expected to respond on a 5-Likert scale, ranging from 'very little' to 'very much'.
- "Which sounds have evoked in you a sense of spirituality or transcendence?" Participants were invited to provide an open-ended response.

From the table, the most remarkable result is that the places in which the participants found a higher sense of spirituality are the ones that are outdoors but inside of the monastery (the cloister and the medieval vegetable garden). The lowest result was obtained outside the monastery, at the first stop, followed by the indoor stops. The results are surprising, considering that the indoor spaces contained religious symbols that are not found in the outdoor stops such as the big crucifix of the refectory (see Figure 2). A fact that must be considered too is that



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the stop that received the worst punctuation and which was located outside of the monastery, is the only place where the motivational text to evoke a sense of spirituality was not read aloud.

When linking these punctuations to the open-answer question, some patterns can be observed too. The places where water is present and noticed by participants (stops 2 and 3) are the ones that received the highest rating. In the cloister, 6 participants answered that water was the sound that evoked a sense of spirituality, and in the medieval vegetable garden, 5 participants answered the same.

In the indoor places (the Chapterhouse and the refectory), Silence was written as the “sound” that evoked a sense of spirituality or transcendence, but then the overall rating is lower.

Therefore, these results suggest that water is the sound that evokes the most sense of spirituality for most of the participants.

The link between water and spirituality evokes again the harmony with creation to which monastic life is called, which is even more remarkable in the Franciscan order and the Poor Clare nuns. The link between silence and spirituality, for its part, accentuates what we also noted in the introduction from a theoretical point of view: as the Rule of Saint Benedict itself maintains [6] or as the theologian Louis Bouyer had remarked [7], he who devotes himself to monastic life in search of God must have silence as one of his most precious treasures.

The obtained results match the existing literature on the relationship between spirituality and sounds. As demonstrated by Goldsby in [27], significant correlations were found between improvements in scores of spiritual well-being and sounds. Furthermore, the research presented in [28] revealed that sound pressure levels were effective in enhancing a sense of spirituality. Consistent with these studies, the findings of the current research indicate a positive relationship between sounds and spirituality.

## 4. CONCLUSIONS

This study underscores the impact that the sound environment within a Catholic monastery has on shaping perceptions of spirituality. The results suggest that natural sounds, particularly the sound of water, play a role in evoking feelings of transcendence and spirituality, especially in outdoor spaces like the cloister and the medieval vegetable garden. While silence is also perceived as spiritually significant, its effect seems to be less engaging

compared to more dynamic sounds, such as flowing water. Additionally, the findings highlight the importance of the physical setting in influencing spiritual experiences, with outdoor areas receiving higher ratings for spirituality compared to indoor spaces, even in the absence of religious symbols.

The main limitation of this study is the number of participants in the soundwalk. Even though it is recommended that these types of soundwalks are carried out with few participants—the presence of too many people could influence on the results, especially in the smaller areas such as the indoor spaces—, more answers are needed to validate the findings of this paper.

Future research should explore how the sonic environment is perceived by individuals of different religious backgrounds, comparing the experiences of religious or practicing individuals to those of non-religious participants.

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## 6. REFERENCES

- [1] D. Zhang, Y. Shan, X. Chen, and Z. Wang, “Soundscape in religious historical buildings: a review,” *Heritage Science*, vol. 12, no. 1, p. 45, 2024.
- [2] S. Eslami, B. Zamani, and H. Nooraei, “Evaluation of the soundscape in the territory of sacred places, case study: the peripheral territory of the shrine of hazrat masoumeh,” *Armanshahr Architecture & Urban Development*, vol. 16, no. 43, pp. 53–72, 2023.





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- [3] J. Y. Jeon, I. H. Hwang, and J. Y. Hong, "Soundscape evaluation in a catholic cathedral and buddhist temple precincts through social surveys and soundwalks," *The Journal of the Acoustical Society of America*, vol. 135, no. 4, pp. 1863–1874, 2014.
- [4] C. Guillebaud, "Soundwalks in shiva temple: A situated approach to perceived ambiance," in *Worship Sound Spaces*, pp. 104–121, Routledge, 2019.
- [5] H. P. Lee, K. M. Lim, and S. Garg, "A case study of recording soundwalk of miyajima and itsukushima shrine using smartphone," *Acoustics Australia*, vol. 46, pp. 349–361, 2018.
- [6] B. of Nursia, *Regula Sancti Benedicti (Saint Benedict's Rule for monasteries)*. Passerino, 2021. Translated by L. J. Doyle.
- [7] L. Bouyer, *Le sens de la vie monastique*. Cerf, 1950.
- [8] S. Augustine of Hippo, *Praeceptum (Rule of Saint Augustine)*. 1976. II, 3. Translated by R. Russell. Full text available at <https://faculty.georgetown.edu/jod/augustine/ruleaug.html> (Accessed: 06-03-2025).
- [9] S. Augustine of Hippo, *Epistulae (Letters of Saint Augustine)*. Translated by J.G. Cunningham. Full text available at <https://www.newadvent.org/fathers/1102.htm> (Accessed: 06-03-2025).
- [10] J. D. García Bacca, "Música sagrada," in *Filosofía de la música*, p. 65 and following, Barcelona: Anthropos, 1989.
- [11] J. Ratzinger, *Theology of the Liturgy: The Sacramental Foundation of Christian Existence*. San Francisco: Ignatius Press, 2014.
- [12] S. Francis of Assisi, *The Writings of St. Francis of Assisi*. The Franciscan Archive, 1999.
- [13] P. Francis, "Encyclical letter laudato si' on care for our common home." <https://www.laudatosi.org/the-letter/>, 2015. Accessed: 06-03-2025.
- [14] A. Pego Puigbó, *Poética del monasterio*. Madrid: Encuentro, 2022.
- [15] M. Carrillo and H. Carreón, "Study of the degradation effects on aged wood beams from the cathedral of morelia, mexico by acoustic birefringence measurements," *Russian Journal of Nondestructive Testing*, vol. 56, pp. 1042–1049, 2020.
- [16] M. Sender, A. Planells, R. Perelló, J. Segura, and A. Giménez, "Virtual acoustic reconstruction of a lost church: application to an order of saint jerome monastery in alzira, spain," *Journal of Building Performance Simulation*, vol. 11, no. 3, pp. 369–390, 2018.
- [17] S. Girón, L. Álvarez-Morales, M. Galindo, and T. Zammarreño, "Acoustic evaluation of the cathedrals of murcia and toledo, spain," in *Proceedings of the International Congress of Sound and Vibration (ICSV24)*, London, UK, pp. 23–27, 2017.
- [18] E. Alberdi, M. Galindo, and Á. L. León-Rodríguez, "Evolutionary analysis of the acoustics of the baroque church of san luis de los franceses (seville)," *Applied sciences*, vol. 11, no. 4, p. 1402, 2021.
- [19] L. Álvarez-Morales, M. Lopez, and Á. Álvarez-Corbacho, "The acoustic environment of york minster's chapter house," in *Acoustics*, vol. 2, p. 3, MDPI, 2020.
- [20] L. Tronchin and A. Bevilacqua, "Evaluation of acoustic similarities in two italian churches honored to s. dominic," *Applied Sciences*, vol. 10, no. 20, p. 7043, 2020.
- [21] D. Zhang, M. Zhang, D. Liu, and J. Kang, "Soundscape evaluation in han chinese buddhist temples," *Applied Acoustics*, vol. 111, pp. 188–197, 2016.
- [22] H. Xie, Z. Peng, J. Kang, C. Liu, and H. Wu, "Soundscape evaluation outside a taoist temple: A case study of laojudong temple in chongqing, china," *International journal of environmental research and public health*, vol. 19, no. 8, p. 4571, 2022.
- [23] A. Algargoosh, B. Soleimani, S. O'Modhrain, and M. Navvab, "The impact of the acoustic environment on human emotion and experience: A case study of worship spaces," *Building Acoustics*, vol. 29, no. 1, pp. 85–106, 2022.
- [24] R. M. Alsina-Pagès, F. Orga, R. Mallol, M. Freixes, X. Baño, and M. Foraster, "Sons al balcó: Soundscape map of the confinement in catalonia," *Engineering Proceedings*, vol. 2, no. 1, p. 77, 2020.
- [25] Monestir de Pedralbes, "El claustre," 2025. Available at: <https://www.monestirpedralbes.barcelona/ca/monestir/lespai/claustre>, Accessed on: 24-02-2025.



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- [26] Monestir de Pedralbes, “The medieval vegetable garden,” 2025. Available at: <https://www.monestirpedralbes.barcelona/en/exhibitions/medieval-vegetable-garden>, Accessed on: 24-02-2025.
- [27] T. L. Goldsby, M. E. Goldsby, M. McWalters, and P. J. Mills, “Sound healing: Mood, emotional, and spiritual well-being interrelationships,” *Religions*, vol. 13, no. 2, p. 123, 2022.
- [28] A. De Cesaris and A. Sadeghi habibabad, “The role of sound on spirituality in religious environments and islamic architecture by using eeg,” *Journal of Psycholinguistic Research*, vol. 52, no. 5, pp. 1755–1784, 2023.

