
The Soundscape of Sixteenth-Century Istanbul Mosques: Architecture and Qur'an Recital

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The Soundscape of Sixteenth-Century Istanbul Mosques

Architecture and Qur'an Recital

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In 1557, at the height of his power, Sultan Süleyman the Magnificent (r. 1520–66) had an imperial scribe draft an endowment deed that specified the duties and tasks of the employees of his newly erected mosque complex in Istanbul, the capital of the Ottoman Empire.¹ Among these employees were more than a hundred reciters who were to fill his mosque with the chanted words of the Muslims' most holy text, the Qur'an. In 1583, Nurbanu Sultan, mother to the incumbent Sultan Mehmet III (r. 1574–95), stipulated in another preserved endowment deed to her mosque complex, also in Istanbul, that 113 Qur'an reciters each "with a soul-caressing and beautiful voice that will awake pleasure in the listener" were to be appointed.² These two endowment deeds are not exceptional: many comparable documents related to other Ottoman mosque complexes are preserved in different archives in Turkey; these documents describe similar stipulations concerning the appointment of reciters who effectively turned mosques into stages for the melodic rendition of the Qur'an, or, one might say, sound boxes resonating the holy text.

In spite of the significance of sound in Islamic cultures—whether in the form of Qur'an recital, the call to prayer, or poetry recital—historians of Islamic architecture generally have neglected acoustic qualities of the built environment, probably because even in the visual realm so much basic historical research remains to be done.³ The few research projects and publications concerning mosque acoustics have focused on foundational quantitative meas-

urements; they do not address religious or ideological meanings or suggest how a focus on sound might open new avenues for the study of architectural history.⁴ I intend here to concentrate on the two above-mentioned sixteenth-century texts. Several passages in Nurbanu Sultan's endowment deed drew my attention to auditory aspects of Muslim worship in general and the sonic dimension of Ottoman mosque architecture in particular. In order to examine the soundscape of the Süleymaniye Mosque of Sultan Süleyman the Magnificent and the Atik Valide Mosque of Nurbanu Sultan in terms of Qur'an recital, I begin by mining the documents for greater detail, then elucidate the significance of the Qur'an as spoken and chanted word of God, and conclude by describing the acoustic properties of Ottoman mosque architecture.

Recitation in the Süleymaniye and the Atik Valide Mosques

Süleyman's mosque, planned and built in 1548–59 under the supervision of the imperial master architect Sinan (circa 1490–1588), was surrounded by a vast complex. It consisted of the mosque itself, two tombs, a hospital, a soup kitchen, an inn, and several buildings housing a primary school, theological seminaries—including a school teaching Qur'an recitation—and a medical school (Figures 1–3). The importance of Qur'an recitation in this major site of worship and center of higher learning can be gathered from the endow-

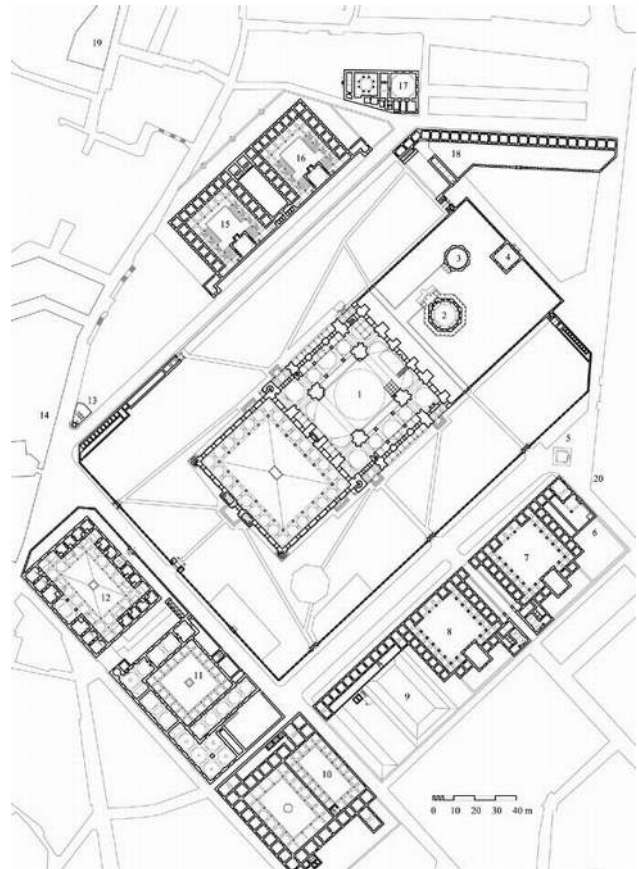


Figure 1 Sinan, Süleymaniye Mosque, Istanbul, 1548–59

Figure 2 Süleymaniye Mosque complex, ground plan

ment deed: out of a total of 213 reciters, eulogists, and salaried worshippers, 174 were hired to make the mosque's interior resound with specific verses and suras (chapters) of the Qur'an (Table 1). Each employee received a daily stipend, ranging between 2 and 7 *akçe* (silver coins) per day, based on their rank, and they were entitled to daily meals cooked in the complex's soup kitchen. Every day the endowment expended 570 *akçe* for the 213 employee salaries, a substantial sum by the standards of the time.

In specifying the times and particular parts of the Qur'an to be recited in the mosque, the endowment deed allows us to partially reconstruct the building's soundscape (Table 2). Every day, following the first call to prayer at dawn and the morning prayer, one reciter climbed on a small moveable wooden pulpit in the mosque and chanted the 83 verses of Sura 36 (*Ya Sin*).⁵ Twenty salaried worshippers assembled to each recite the creed of Islam ("There is no God but God, and Muhammad is his Prophet") 3,500 times to accumulate the blessings of 70,000 recitals of the phrase for the benefit of the sultan.⁶ Two groups of thirty reciters recited one-thirtieth portion of the Qur'an in two separate sessions one after another. After morning prayer, another set of ten salaried worshippers started to perform 1,000 prayers for the benefit of the Prophet Muhammad, filling the mosque with the mumbled formulas accompany-



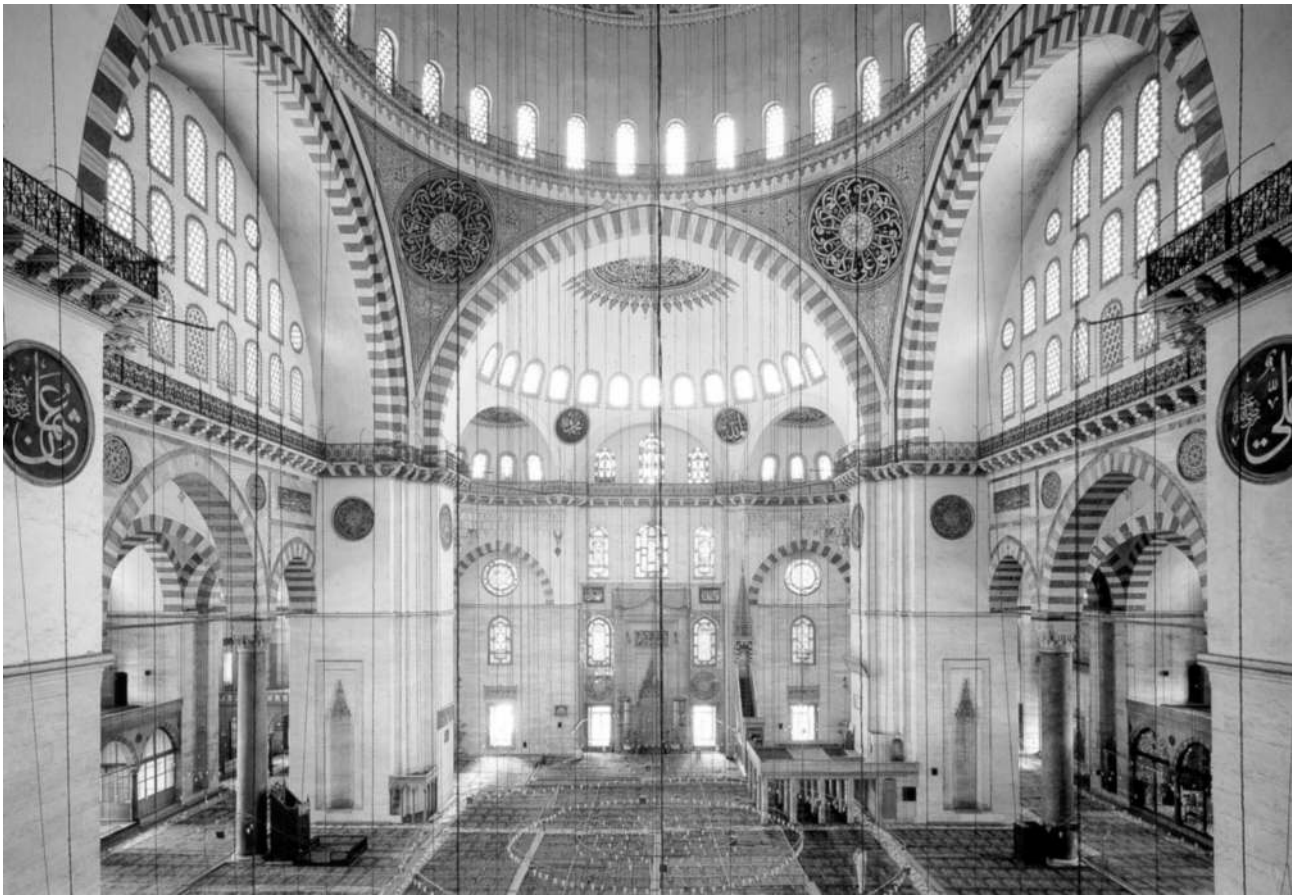


Figure 3 Süleymaniye Mosque, interior

ing prayer and the rustling of their clothes. The noon prayer was followed by the recital of yet another group of thirty readers of one-thirtieth of the Qur'an, as was the afternoon prayer. Following the afternoon prayer, moreover, one reciter sat on the pulpit to read the 200 verses of Sura 3 (Al 'Imran). The endowment deed furthermore stipulated that forty-one reciters should chant the 165 verses of Sura 6 (al-En'am) every day, without mentioning a specific time. The time of daily recital is also omitted for the chanting of the 30 verses of Sura 67 (al-Mülk) from the pulpit, but the placement within the document suggests it occurred after the noon prayer. In between the canonical prayer times, six salaried worshippers were to perform twenty prostrations. (The customary prayer consists of a number of prostrations during which worshippers first bend at the waist, then lower themselves to the knees, and finally touch their foreheads to the ground to symbolize both spiritual and physical submission to God. The number of prostrations changes according to the time and day of prayer.)

They dedicated the blessings of their prayer—blessings augmented by the prayers' supererogatory nature due to their performance at nonrequired times—to the sultan's deceased family members. On Fridays, after the canonically required congregational prayer, the additional performances of ten reciters each chanting 10 Qur'anic verses from the mosque's gallery, a eulogist, and a salaried worshipper praying for the benefit of the Ottoman dynasty marked the day as holy.

The document does not permit the historian to answer such questions as: did the recitals and prayers overlap with each other? Would one reader wait until another had completed his verses or the salaried worshippers had recited their thousands of creeds? Would the reciters and worshippers begin and end at the same time, in a kind of a choral arrangement, or would they each perform individually? Where exactly would each person sit, and how would their placement affect the volume and audibility of their voice? In any case, the soundscape that emerges from the archival sources is rich and textured, the effect inside the mosque

Table 1 List of employees of the Süleymaniye Mosque, compiled from the title deed of Süleyman the Magnificent's charitable endowment, 1577, Ankara Vakıflar Genel Müdürlüğü Arşivi (Archive of the General Directorate of Endowments), no. 52 (reprinted in Kemal Kürkçüoğlu, *Süleymaniye Vakfiyesi* [1962])

TITLE	FUNCTION	NUMBER	DAILY SALARY IN AKÇE	
			Per Person	Total
Hatip	Orator holding sermons	1	30	30
Devirhan	Reciter of ten verses of the Qur'an on Friday	9	3	27
Ser mahfil	Leader of the above-mentioned devirhan	1	5	5
Meddah	Eulogist speaking after the devirhans' performance	1	6	6
Muarrif	Salaried worshipper praying for continuation of the Ottoman dynasty	1	6	6
Cüzhan	Reciter of a section of the Qur'an	116	2	232
Cüzhan	Leader of the above-mentioned cüzhan	4	3	12
En'amcı	Reciting sura al-En'am	41	3	123
Mühellil	Reciting the şehade (creed)	19	2	38
Mühellil	Leader of the above-mentioned mühellil	1	3	3
Salavathan	Salaried worshipper	9	2	18
Salavathan	Leader of the above-mentioned salavathan	1	3	3
Musalli	Salaried worshipper praying 20 prostrations for the sultan's deceased family members	6	7	42
Yasinhan	Reciting sura Ya Sin after morning prayer	1	6	6
Tebarekehan	Reciting sura al-Mülk	1	5	5
'Amhan	Reciting sura Al 'Imran after afternoon prayer	1	4	4
Total		213		570

Table 2 Schedule of Qur'an recitations in the Süleymaniye Mosque, compiled from the title deed of Süleyman the Magnificent's charitable endowment, 1577, Ankara Vakıflar Genel Müdürlüğü Arşivi, no. 52 (reprinted in Kürkçüoğlu)

FRIDAY

Morning prayer

20 mühellil each reciting the creed 3,500 times
 10 salavathan praying 1,000 prayers for Prophet
 1 reciter reading sura Ya Sin
 30 cüzhan reading a section of the Qur'an
 30 cüzhan reading a section of the Qur'an

Noon prayer

30 cüzhan reading a section of the Qur'an
 10 devirhan reciting ten Qur'an verses
 meddah reciting eulogies
 muarrif praying for Ottoman dynasty

Afternoon prayer

30 cüzhan reading a section of the Qur'an
 1 reciter reading sura Al 'Imran

Evening prayer

Night prayer

41 reciters reading the sura al-En'am every day for the benefit of the sultan
 6 musalli praying 20 prostrations every day at a time suitable for supererogatory prayer for the benefit of the sultan's deceased family members
 1 reciter reading sura al-Mülk every day at unspecified time (probably after the noon prayer)

SATURDAY-THURSDAY

Morning prayer

20 mühellil each reciting the creed 3,500 times
 10 salavathan praying 1,000 prayers for Prophet
 1 reciter reading sura Ya Sin
 30 cüzhan reading a section of the Qur'an
 30 cüzhan reading a section of the Qur'an

Noon prayer

30 cüzhan reading a section of the Qur'an

Afternoon prayer

30 cüzhan reading a section of the Qur'an
 1 reciter reading sura Al 'Imran

Evening prayer

Night prayer

being one of several multifocal layers of sound, marking both holy time and holy space.

The specific suras of the Qur'an emphasized in the endowment deed consist of ones also frequently chanted in other mosques. Sura 36 (Ya Sin), read after every morning prayer, is considered the heart of the Qur'an since it concerns the central figure in the teaching of Islam—the Prophet Muhammad—and the central doctrine of the Revelation and the Hereafter. The 200 verses of Sura 3 (Al 'Imran), recited before evening prayer, give a general view of the religious history of mankind, with special reference to the People of the Book (Jews, Christians, and Muslims) and the birth of Islam. Furthermore, this sura exhorts Muslims to remain true to their faith, pray for guidance, and maintain spiritual hope for the future. Sura 67 (al-Mülk), also recited every day, is comparable to the hymns or psalms of other faiths; it contrasts this world and its superficiality with the Hereafter, describing the spiritual in terms that humans can understand. These three suras were chosen for their specific message to the audience and, taken as a whole, emphasize the role of Islam within human history, Muslims' responsibilities, and the Hereafter.

Sura 6 (al-En'am), which describes the nature of God and the emptiness of this world's life in contrast to God's creation and reminds that the rebellious and obstinate will be punished, plays a particular role due to several factors: the endowment deed stresses the melodic aspect of the recital; it dwells on dedicating the recital's blessings to the "strengthening of the eternal sovereignty"; and it appoints a large number of chanters for its recital.⁷ A crowd of forty-one reciters would assure that this sura was heard either continually (if they recited one after another) or in an overlapping manner or at a particularly loud volume (if they all chanted at the same time). It is the emphasis on sounding this very sura that reveals some of the potential ideological implications of Qur'an recital, in addition to the obvious religious merit accumulated by the person in whose name it was read. The first verse of Sura 6 praises God as omnipotent creator: "Praise be to Allah who created the heavens and the earth, and made the darkness and the Light."⁸ The last verse gives divine legitimization to secular power: "It is He [Allah] Who hath made You (His) agents, inheritors of the earth: He hath raised you in ranks, some above Others."⁹ Thus, in the context of Süleyman's mosque this sura was an auditory reminder of God's absolute and of the sultan's God-given power.

Conveying a message as weighty as this one necessarily poses the question of whether the intended recipients would be able to decode its language, in this case Qur'anic Arabic. The majority of Istanbul's Ottoman Muslims spoke Turkish in

daily life, and only those who had a higher education would have been fluent in Qur'anic Arabic. Since the Süleymaniye complex housed numerous institutions of higher learning, a large portion of the congregation would not only have understood the language but also would have been able to chant along from memory, since knowing the holy book by heart was an admission requirement to the theological seminaries.¹⁰ Many Ottomans without higher education also had this ability, since as children most had been sent to the mosques' primary schools where they committed to memory a number of suras. The childhood training enabled them to recall previously memorized verses and their meaning when prompted with aural or visual cues. Visual cues were abundant in the Süleymaniye, with its copious inscriptions almost exclusively drawn from the Qur'an (see Figure 3).¹¹

The Süleymaniye was not exceptional, as many other mosques had complex inscription programs and employed a large number of reciters. Nurbanu Sultan's mosque complex in Üsküdar, also built by Sinan between 1571 and 1586, included numerous dependencies—schools, convent, inn, hospital, and bathhouse—and provided a place of worship and education (Figures 4–6). The mosque employed 148 persons to recite the Qur'an and to perform daily prayers (Table 3). Of these 148 persons, 112 recited the Qur'an either in whole or in part; some devoted the blessings accumulated by the act of recitation to specific persons. Six persons performed prayers, praising the Prophet Muhammad, the sultan, and the patron of the mosque, and thirty recited the creed, counting the number of recitations with the help of prayerbeads. The salaries paid to the reciters and professional worshippers amounted to between 2 and 4 *akçe* per person per day, amounting to a total of 352 *akçe* per day.

Thanks to the endowment deed's description of employee duties, it is possible to reconstruct which parts of the Qur'an were to be recited at which times (Table 4). The morning prayer at dawn was followed by the recitation of Sura 36 (Ya Sin) and by ten salaried worshippers reciting the creed 1,000 times each, their prayer beads clicking with each completed one. Thirty readers recited one-third of the Qur'an. The noon prayer was again followed by 1,000 recitations of the creed and the recital of the second third of the Qur'an, as was the afternoon prayer. Before the evening prayer, one reciter chanted Sura 3 (Al 'Imran), and the day was concluded after night prayer with the recitation of Sura 67 (al-Mülk). On Fridays, there were additional recitations of select Qur'an verses and of verses extolling the Prophet. In addition to these scheduled recitations, the endowment deed also mentions further reciters who would read the entire Qur'an aloud every single day, as well as worshippers performing twenty-five prostrations during each prayer. Hiring worshippers for



Figure 4 Sinan, Atik Valide Mosque complex, Istanbul, 1571–86

Figure 5 Atik Valide Mosque complex, ground plan

canonical prayer can be partly explained by the fact that the mosque had been erected in a mostly uninhabited area, probably with the intent to develop it and to attract residents to the hills beyond the Asian shore of the Bosphorus. Thus, Nurbanu Sultan might have felt it necessary to augment the congregation with the help of hired attendees. A mosque empty at prayer time not only lacks the appropriate ambience but also has acoustic characteristics entirely different from a mosque full of people.

In both Süleyman's and Nurbanu's building complexes, the mosque was not the only building that resounded with the chanted verses of the Qur'an: children memorized verses of the Holy Book in the primary school; in Nurbanu's complex, the mystics who resided in the convent held rituals involving chanting; and both complexes included a school for Qur'an reciters. Süleyman's endowment deed is mostly silent about the reciters' school in his complex, but Nurbanu's stipulations are rather explicit. While the school's physical location can no longer be determined with any certainty, we do know that a sheikh was to teach the art and science of recitation to ten carefully selected disciples. Again, the document provides quite specific instructions as to which styles of recitation were to be taught and which texts to be used.¹²

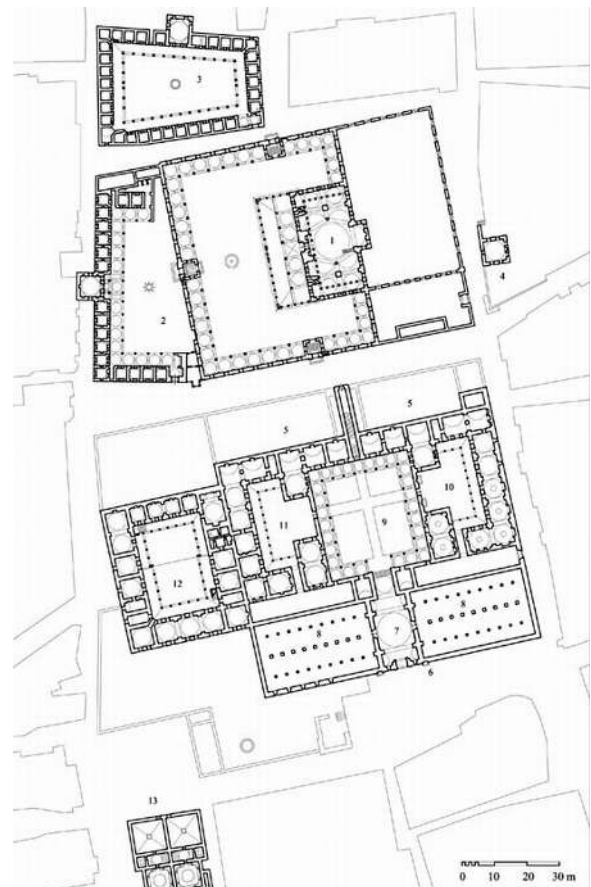




Figure 6 Atik Valide Mosque, interior

Table 3 List of employees of the Atik Valide Mosque, compiled from the title deed of Nurbanu Sultan's charitable endowment, 1583, Ankara Vakıflar Genel Müdürlüğü Arşivi, D. 1766

TITLE	FUNCTION	NUMBER	DAILY SALARY IN AKÇE	
			Per Person	Total
Hatip	Orator holding sermons	1	20	20
Musalli	Salaried worshipper	5	4	20
Hafız	Qur'an reciter	9	3	27
Ser mahfil	Leader of the above-mentioned Qur'an reciters	1	6	6
Na't-i şerif okun	Salaried worshipper extolling the Prophet	1	5	5
Muarrif	Salaried worshipper extolling the Prophet, the sultan and the patron	1	5	5
Tesbihhan	Salaried worshipper reciting the creed 1,000 times with the help of prayer beads	27	2	54
Ser tesbihhan	Leader of the above-mentioned tesbihhan	3	3	9
Cüzhan	Reciter of one-third of the Qur'an	87	2	174
Ser mahfil	Leaders of the above-mentioned cüzhan	3	3	9
Cüzhan	Reciter of one-third of the Qur'an for the benefit of the Prophet, his wife Ayşe and his daughter Fatima	6	2	12
Kirat eden	Reciter of the last two verses of al-Bakara after Friday prayers	1	2	2
'Aşrhan	Reciter of ten Qur'an suras	1	2	2
Yasinhan	Reciter of Ya Sin after morning prayers	1	2	2
Mülkhan	Reciter of al-Mülk after evening prayers	1	2	2
'Amhan	Reciter of Al 'Imran after noon prayers	1	2	2
Total		149		352

Table 4 Schedule of Qur'an recitations in the Atik Valide Mosque, compiled from the title deed of Nurbanu Sultan's charitable endowment, 1583, Ankara Vakıflar Genel Müdürlüğü Arşivi, D. 1766

FRIDAY

Morning prayer

10 tesbihhan praying and reciting 1,000 creeds
 1 reciter reading sura Ya Sin
 30 cüzhan reading first third of Qur'an
 5 hafız reciting Qur'an verses
 1 reciter reading nuut-u nebeviyye

Noon prayer

10 tesbihhan praying and reciting 1,000 creeds
 30 cüzhan reading second third of Qur'an
 1 reciter reading from sura al-Bakara
 10 tesbihhan praying and reciting 1,000 creeds

Afternoon prayer

10 tesbihhan praying and reciting 1,000 creeds
 30 cüzhan reading last third of Qur'an
 1 reciter reading sura Al 'Imran

Evening prayer

Night prayer

1 reciter reading sura al-Mülk
 5 persons praying 25 prostrations during each prayer
 1 muarrif reading hymns and praise of the Prophet
 5 reciters will read the entire Qur'an every day
 1 person to read ten verses from the Qur'an in a beautiful voice

SATURDAY-THURSDAY

Morning prayer

10 tesbihhan praying and reciting 1,000 creeds
 1 reciter reading sura Ya Sin
 30 cüzhan reading first third of Qur'an

Noon prayer

10 tesbihhan praying and reciting 1,000 creeds
 30 cüzhan reading second third of Qur'an

Afternoon prayer

10 tesbihhan praying and reciting 1,000 creeds
 30 cüzhan reading last third of Qur'an
 1 reciter reading sura Al 'Imran

Evening prayer

Night prayer

1 reciter reading sura al-Mülk

Sounds of the Qur'an

In Islam, the concept of scripture cannot be separated from its acoustic rendition. In fact, the first verses revealed to the Prophet Muhammad around the year 610, as orally conveyed through the angel Gabriel, were the following: "Recite! In the name of thy Lord and Cherisher who created."¹³ Muhammad, who was illiterate, orally reproduced the verses to a society with a highly developed oral poetic tradition. The name "Qur'an" itself means "recitation," and it was not until 650 that its verses were compiled and codified into an authoritative written version, which nevertheless could not surpass the authority of oral transmission. The Qur'an was, and still is, meant to be recited loudly in a reenactment of the initial revelation, in the way in which God first conveyed it to Muhammad.

The oral nature of the Qur'anic text is evident in a number of characteristics. Phrases and patterns frequently repeat themselves, rhyme allows for relatively easy memorization and recall of the text memorized, and oaths and exhortations presuppose a present listening audience. The Qur'an's orality is also evident in what Michael Sells has called "sound figures" or "sound vision."¹⁴ Its complex sound patterns stretch over lengthy passages of the text, accentuate theologically critical moments,¹⁵ and create bridges to preceding and following passages; they create an effect in which sound and meaning are intertwined. For example, the Arabic sound *hā* denotes a female pronoun, but it can also be an interjection of surprise, wonder, or sorrow, and often ties together key rhymes.¹⁶ These complex sound patterns also account for the Qur'an's resistance to translation into languages other than Arabic. In his groundbreaking study of the Qur'an as an aesthetic experience, Navid Kermani has argued that Islam spread so quickly throughout seventh-century Arabia due to the sophisticated beauty of the Qur'anic text, which the detractors of Islam failed to surpass in their poetic attempts to disprove its divine nature.¹⁷ In Kristina Nelson's words, "the significance of the revelation is carried as much by the sound as by its semantic information. In other words, the Qur'an is not the Qur'an unless it is heard."¹⁸

This explicit orality of the sacred text led to two consequences that need to be emphasized here. Because the reception of the revelation is an auditory process, the ability to hear has become conflated with the ability to understand the revelation. This is demonstrated in the usage of the Arabic verb *sam'* (the physical act of hearing) for either of these two acts.¹⁹ Thus, it is not enough to read the Qur'an with one's eyes; one needs to perceive the text acoustically in order to understand its message. Ideally, one

should read and hear the text at the same time, bringing together two different modes of perception for a multisensorial communication of the message.²⁰ However, even a cursory acoustic perception of the Qur'an in the background will bestow blessings upon the hearer.

The second consequence is the formation of a system that determines how the Qur'anic text should be read "in terms of rhythm, timbre, sectioning of the text, and phonetics."²¹ This system is interchangeably called *'ilm el-tecvīd* and *'ilm el-kirāat*, and was also taught in the abovementioned reciters' schools of Süleyman's and Nurbanu Sultan's mosque complexes. Different manners of recitation were based on the authority of famous Qur'an reciters who each established a substantial following, resulting in seven major and three minor canonical readings, each associated with a famous reciter's name. (Nurbanu Sultan's endowment deed mentions each of these reciters, making sure that all styles would be taught.) Reciters chanting the Qur'an in mosques usually use a melodic style called *tecvīd*—in contrast to *tertil*, a steady even chant without flourishes. Having committed the entire Holy Book to memory, reciters do not impose a melody on the text but rather allow the text's rhythmic qualities to suggest musical ornamentations. Together with the notion of the text's divine origin, this primacy of text over melody accounts for the fact that Qur'an recitation is *not* considered music. However, not unlike a musician, a skilled reciter uses such effects as extension of phonemes, nasalization, pauses, and repetition in a way that will emphasize specific passages, suggest multiple meanings, and increase dramatic tension. Thus the reciter enhances the listeners' emotional participation in the text-as-event and involves them affectively, intellectually, and spiritually. The effects of recitation on the listeners can be classified into a variety of responses: quiet weeping is even mentioned in the Qur'an itself as an appropriate response.²² More extreme reactions, as reported in medieval Islamic sources, included fainting, ecstasy, and even death brought on by fear of hell as described in the Qur'an's sound figures.²³ Islamic mystics held the view that an ultimate union with God could only be attained through the auditory process, since the highest manifestation of God was conceivable not in words or images but in pure and abstract sound.²⁴

This emphasis on the experience of Qur'anic recitation must have been known to the builders and architects who designed and erected mosques wherever Islam spread, in the sixteenth century as today. Although the Qur'an can be recited anywhere and on many different occasions, a recital's most appropriate setting is the mosque. Therefore, mosque space is not only a place for the community to gather, or a visual emblem for the presence of Islam, but also a stage for

the performance of the Qur'anic text-as-event and the reenactment of the initial, oral revelation. Builders and architects must have thought of ways to optimize the sensual, and in particular the acoustic, experience of this ritual performance. That some sixteenth-century Ottomans considered the quality of the performance in one particular mosque as superior to that in others—probably due both to the ability of the reciter and the enhancing qualities of the performance space—can be gathered from a legal ruling of Süleyman the Magnificent's grand mufti, Ebussuud Efendi. In this document, the mufti ruled it canonically impermissible to attend congregational Friday prayer in a mosque other than the one in the worshipper's residential quarter if the reason for attending the different mosque was to listen to a better recital.²⁵

While acoustic dimensions of Islamic cultures other than Qur'anic recitation deserve a lengthy treatment of their own, only a few words will be said here about the call to prayer. Like village bells, the prayer call, as it resounds from minarets five times a day, unifies any Muslim community and serves as a territorial marker as well as a marker of time.²⁶ Containing a key passage of the Qur'an, the call to prayer epitomizes the sound quality of recitation and draws Muslims out of their daily life and into the mosque, where they will experience the Qur'anic text-as-event in a more extended manner. The sound of the call to prayer not only demarcates a smaller, local community of Muslims through its shared auditory space, but it also relates them to the Islamic community at large, everywhere and at every historical moment.²⁷ The centrality of the recited Qur'an and call to prayer for the communal identity of Muslims led Oleg Grabar, one of the founding figures of Islamic art history, to remark: "Islamic culture finds its means of self-representation in *hearing* and acting rather than in seeing . . . [for] it is not forms which identify Islamic culture . . . but *sounds*, history, and a mode of life."²⁸

Acoustic Dimensions of Ottoman Mosques

Currently, the acoustic dimensions of architecture or other art works do not receive the same attention that must have been bestowed on them at the moment of their creation and during their use in earlier centuries. With the exception of several rather technical studies conducted by engineers and acousticians, the study of Ottoman mosque architecture has not yet transcended the focus on visual properties.²⁹ Until recently, the visual qualities of Ottoman mosque architecture have been analyzed based on an evolutionary paradigm. Accordingly, Sinan was driven by an impulse to create the perfect centralized scheme modeled after the Byzantine

church of Hagia Sophia. The Süleymaniye mosque complex, for example, was "widely regarded as the climax of the evolutionary process of Ottoman imperial mosque architecture in Istanbul."³⁰ This notion of a linear evolution toward an ideal, centralized space has been challenged by several scholars. Gülru Necipoğlu, in her seminal *The Age of Sinan: Architectural Culture in the Ottoman Empire*, argues for the existence of a rigid etiquette of architectural patronage and, hence, the overbearing significance of social factors (such as the patron's status and personality) for determining formal characteristics.³¹ Lucienne Thys-Şenocak has convincingly argued that the seventeenth-century Yeni Valide mosque complex, whose asymmetrical layout has often been considered a sign of declining architectural skill, was in fact organized along an optic paradigm that allowed the royal female patron to visually access parts of the complex that she could not physically access.³² These innovative and challenging studies have done much to develop our understanding of Ottoman architecture, but they continue to rely solely on vision at the expense of the other senses; this is not surprising since these studies come from a discipline that has not been able to shake the Kantian notion of disinterested contemplation.

A third art historian, Jale Erzen, has approached mosque architecture in a way that challenges the distancing between the viewer and the object. She argues that Ottomans related to art not so much on a theoretical level, but on an experiential level; therefore, sixteenth-century Ottomans approached architecture not as linear space but as a space with a strong theatrical quality.³³ In her words, "the Ottoman, in its particular attention to the 'performative' character of expression, has created spaces where it is not the physical attributes, but rather the atmosphere and the whole activity that takes place become the event . . . and where everybody becomes an actor."³⁴ Following her line of argument, it was not so much the mosque's architecture (whose decoration is kept relatively plain as required by the religious law, the shari'a) that mattered to the Ottoman viewer, but the experience of being in that space—a spiritual *experience* based primarily on the auditory and only secondarily on the visual reception of the word of God. Thus, an Ottoman mosque was a synesthetic *Gesamtkunstwerk* to be experienced with the entire sensorium:³⁵ the sounds of the call to prayer, Qur'an recitations, eulogies, sermons, prayers, and the clicking of prayer beads; the physical building and its furnishings, such as the pulpit, rugs, tiles, lamps, Qur'an copies, and Qur'an stands; the movements of the worshippers prostrating, Qur'an reciters rocking back and forth in rhythm with their chanting; and even the smell of the incense with which a specially appointed employee per-

fumed the mosque on Fridays.³⁶ Hearing, seeing, feeling, smelling, and participating in all of these aspects would lead to an experience greater than the sum of the separate sensory perceptions; ideally it would lead to a multisensorial experience of the divine.³⁷ As in so many buildings with religious functions, the architecture did not exist merely as a medium for the contemplation of but for the sensory participation in the sacred.³⁸

The way in which Sinan conceptualized his designs underscores the validity of framing mosque architecture as experiential space. Sinan was a sensualist in that he acknowledged the subjectivity of his buildings' users, for example creating multiple viewpoints to accommodate the vision of a moving user. According to Necipoğlu, his approach to architectural design was "elastic": he seemed to have first conceived of an interior space, with a certain experiential quality, that he then enveloped with walls and domes.³⁹ That Sinan was most concerned with the experiential quality of his interior spaces becomes obvious from his conscious use of building elements and technical means to create an acoustic space appropriate for Qur'an recitation and other worship activities.⁴⁰ Ideally, a mosque affords users from all points in space good audibility and visibility of the *qibla* wall facing the direction of Mecca. Good audibility depends on an even dispersion of the initial sound reflections, a good reflection of all frequencies, and an even decay of sound during reverberation time. The reverberation time requires a careful balancing so that, on the one hand, it is long enough to amplify sound and afford the sound a numinous character while, on the other hand, it is short enough to make spoken and chanted speech intelligible.⁴¹

Sinan's Acoustics

Sinan's aesthetic preference for centralized spaces crowned by domes might have worked to the acoustics' disadvantage. While a centralized, dome-capped space affords good sight lines allowing all worshippers inside an edifying visual experience, a concave ceiling does not reflect sound evenly. Domed ceilings cause sound reflections to converge in one single point and thus create listening spots in an otherwise less than satisfactory acoustic space, particularly if the focus of the curve is too close to the floor.⁴² Another acoustic problem posed by square or rectangular mosque spaces, even if dome-capped, is the occurrence of standing waves as a result of sound reflected from two parallel walls, potentially creating a destructive interference.⁴³

Sinan expertly used the available technology to counteract these acoustic disadvantages and enhance the Qur'an recitations described in the historical sources. As a first step

in acoustic design, Sinan would have been able to manipulate the volume of the mosque interior—as much as the requirements of statics, the assigned plot of land, and the imperial building regulations allowed—by means of adjusting the height and the circumference of the dome. A larger volume results in a longer reverberation time; the Süleymaniye with its height of approximately 48 meters and volume of circa 115,000 cubic meters is a case in point.⁴⁴ Apart from the outer shell of the building, the distribution of building elements in the interior and the articulation of the walls also provided a structural means to manipulate reverberation time and to ensure homogenous sound distribution. Not only for visual and structural but also for acoustical effect—that is, in order to refract and diffuse sound—the architect added abutting half-domes and smaller lateral domes, inserted windows in the walls, and applied *muqarnas* in the domes' transition zones (Figure 7). He also chose four enormous columns to serve as the load-carrying structural elements surrounding the central unit. Thereby, Sinan created both a visual and acoustic continuity between the side wings and the central space and effectively counteracted the formation of standing waves.

The quality of the ceiling, walls, and floor also played an important role in determining reverberation time. While the *borasan* plaster applied to the brick dome and most of the walls is quite sound absorbent and, due to its flax or hemp fiber content, works like a panel resonator, tiled surfaces, which are interspersed throughout, are highly sound reflective.⁴⁵ Covering the floor with rugs not only provided a softer surface for the worshippers to kneel and to prostrate, but also served as a significant sound-absorptive measure, as has been shown in a quantitative study by Nicola Prodi and Matteo Marsilio.⁴⁶ According to the same study, it appears that Sinan also took into consideration the sound-absorbing qualities of the worshippers' bodies, which could number as many as 4,500.

The most obvious evidence for Sinan's conscious manipulation of mosque acoustics is his usage of sounding vessels, also known as Helmholtz resonators (Figures 8, 9). According to the accounting books detailing the mosque complex's construction expenses, 255 clay jugs were ordered for the mosque's dome.⁴⁷ The number of sounding vessels inserted into the brick dome is unclear, as in the course of restorations the mouths of the jugs have been plugged and plastered over.⁴⁸ Also, it is possible that Sinan ordered more vessels than necessary, calculating possible breakage. Because of the vessels' location and state of preservation, I can not draw any conclusions about their absorptive and resonant qualities, which depend on such factors as the volume and length of the vessel as a whole and the diameter of

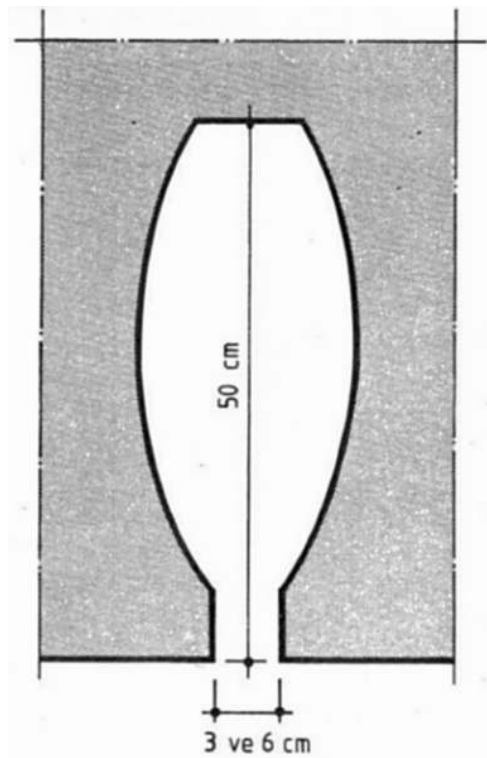


Figure 7 Süleymaniye Mosque, interior view showing Sinan's treatment of the domes' transition zones

Figure 8 Cross section of a sounding vessel, Sultan Ahmet Mosque, early seventeenth century; sounding vessels in the Süleymaniye were probably similar in shape and size

the neck. In any case, it is well known that Helmholtz resonators reradiate sound that they do not absorb in a hemispheric distribution. Thus, with the help of the clay jugs, Sinan was able both to absorb undesirable frequencies and diffuse sound in the otherwise problematic dome, avoiding acoustical hot spots.

The overall results of these combined measures to manipulate the acoustic space for an optimal, spiritual listening experience are that the interior of the Süleymaniye mosque constitutes a very reverberant, "live" space that gives the audience a feeling of majesty and grandeur. While the lower frequencies of around 500 hertz have a reverberation time of 8 seconds and, therefore, interfere with speech intelligibility, higher frequencies of around 1 kilohertz have a reverberation time of 5.9 seconds.⁴⁹ Since Qur'an reciters usually chant in a fairly high register and exploit sound effects, such as nasalization or humming, the resulting reverberation time of 5.9 seconds affords intelligibility and, at the same time, leads to a particular timbric effect.⁵⁰ This timbre would have lent the performance of the more than



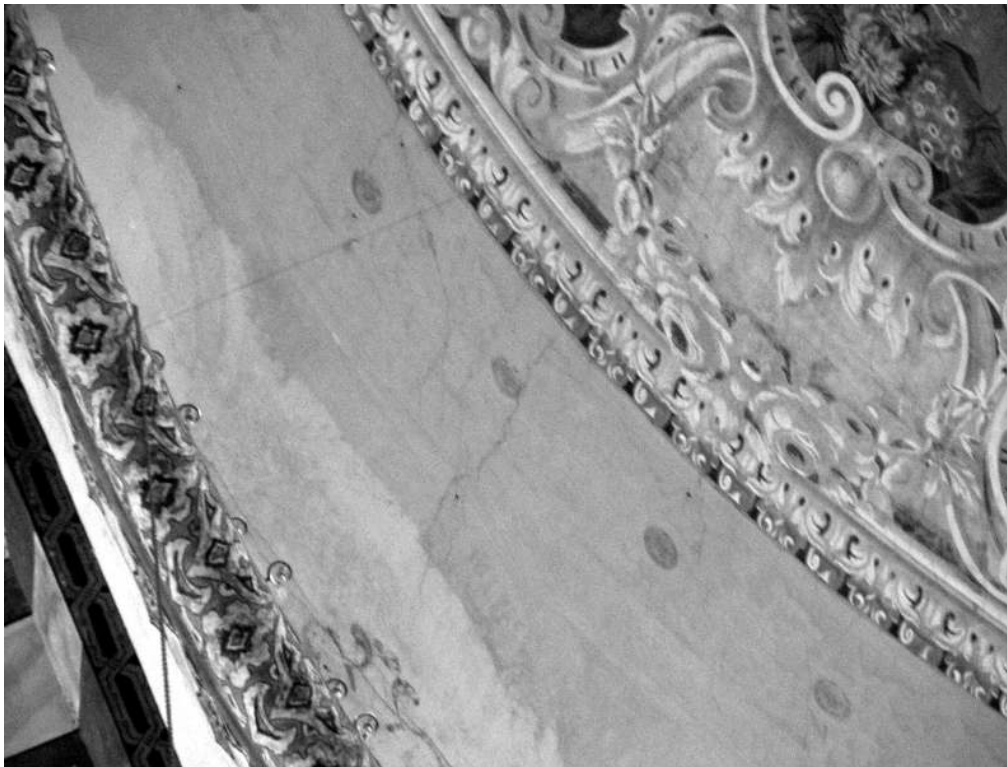


Figure 9 Circular mouths of sounding vessels embedded in the dome of the Süleymaniye Mosque, now plastered over and visible as evenly spaced, dark round spots

200 reciters and salaried worshippers appointed by the endowment deed a majestic quality and encouraged their virtuosity. It would also have drawn an audience searching for an edifying acoustic experience of the Holy Book.

Acoustics and the Building Phases of the Atik Valide Mosque

Nurbanu Sultan's mosque complex in Üsküdar now languishes in a run-down neighborhood called Toptaşı, ignored by tourists, and has not attracted the attention of the CAHRISMA (Conservation of Acoustical Heritage by the Revival and Identification of Sinan's Mosque Acoustics) team. No data are available on its acoustic qualities, and the restricted access as well as the restorations make it impossible to examine the integration of sound vessels in the dome. Yet, much of what has been said about mosques' acoustic design in general also applies to this mosque, and the endowment deed's elaborate specifications concerning the reciters' school indicate that Qur'an recitation played a significant role for Nurbanu Sultan.

In 1584, only six years after the completion of the original mosque building in 1578, lateral wings were added to the central domed unit.⁵¹ The original building was drafted by Sinan but executed by another unknown royal architect

during Sinan's absence for an imperial building project elsewhere. Sinan's plan for the Atik Valide Mosque consisted of an almost square ground plan with a protruding, dome-capped prayer niche and surmounted by a hexagonal baldachin with one central dome and four exedral half-domes (Figure 10). The baldachin rested on two freestanding, slim columns. While the ceiling was certainly articulated enough with its many surfaces (Figure 11), the parallel walls might have created a less than satisfactory acoustic space, possibly suffering from the destructive interference of standing waves. In the second building phase, the architect Davud, a protégé of Sinan's, added domed side wings resting on additional supports and a U-shaped gallery around the interior (Figure 12; see Figure 10).

Given that growth of the congregation in the previously uninhabited area was unlikely to have necessitated a larger mosque, the reason for the expansion must lie elsewhere. Necipoğlu suggests that the expansion was meant to reflect the patron's increased status, as the original, smaller plan had been conceived at a time when she was only wife to, rather than mother of, the incumbent sultan.⁵² That might well be true, but why would the expansion then have happened posthumously? Changing a ground plan in 1574, when Nurbanu became queen mother and before the mosque was completed, would have been an easier and

more cost-effective undertaking. Maybe the unknown royal architect's treatment of the interior space, executed in Sinan's absence, proved unsatisfactory in terms of acoustic design and Sinan suggested the addition of side wings to refract and diffuse sound. Also, the addition of the visually unpleasing gallery points toward acoustic considerations, since the gallery gave the reciters a location from which their chanting might have gained a better sound distribution. Further research is necessary to test the validity of these claims about the role of acoustic considerations.

Conclusion

In either of these two cases, the mosque, in its original context, can be considered a finely tuned acoustic instrument, meant to sound the word of God in the form of melodic Qur'an recitation to the believers, sometimes so effectively that listeners wept, fainted, or experienced an ecstatic union with God through the auditory process. That Sinan's mosques had a direct sensuous appeal and gave great pleasure to the users can be deduced from contemporary descriptions that use expressions such as glittering with light, joy-giving, and heart-captivating.⁵³ Unfortunately, these instruments are no longer "played" today. Most of them have undergone misguided restorations, during which the sound vessels' mouths were plugged or plastered over. Furthermore, since the endowments related to Ottoman mosques were dissolved in the wake of nineteenth-century modernizing reforms and the Turkish Republic's establishment, the voices that made these instruments resound have been silenced.

Analysis of Qur'anic sound in general and in the Ottoman context and of acoustic characteristics of mosques point to new ways of writing architectural as well as Ottoman history. First, considering sound challenges the practice of reducing the lived experience of space to two-dimensional ground plans and photographs, and allows a reconsideration of the architectural canon according to alternative paradigms. In the case of Islamic architecture, where sound was an integral part of many buildings, such an alternative paradigm might well prove itself to be more sensitive to the original cultural context. If the architectural historian's task is to uncover the totality of the original use and perception of monuments in the past, an exclusive focus on the visual and the textual will not allow reaching this goal. No sixteenth-century visitor to the Süleymaniye mosque would have seen or thought of the building in the form of a black-and-white ground plan (except maybe the members of the imperial workshop of architects). Granted that scholarly conventions demand printable articles

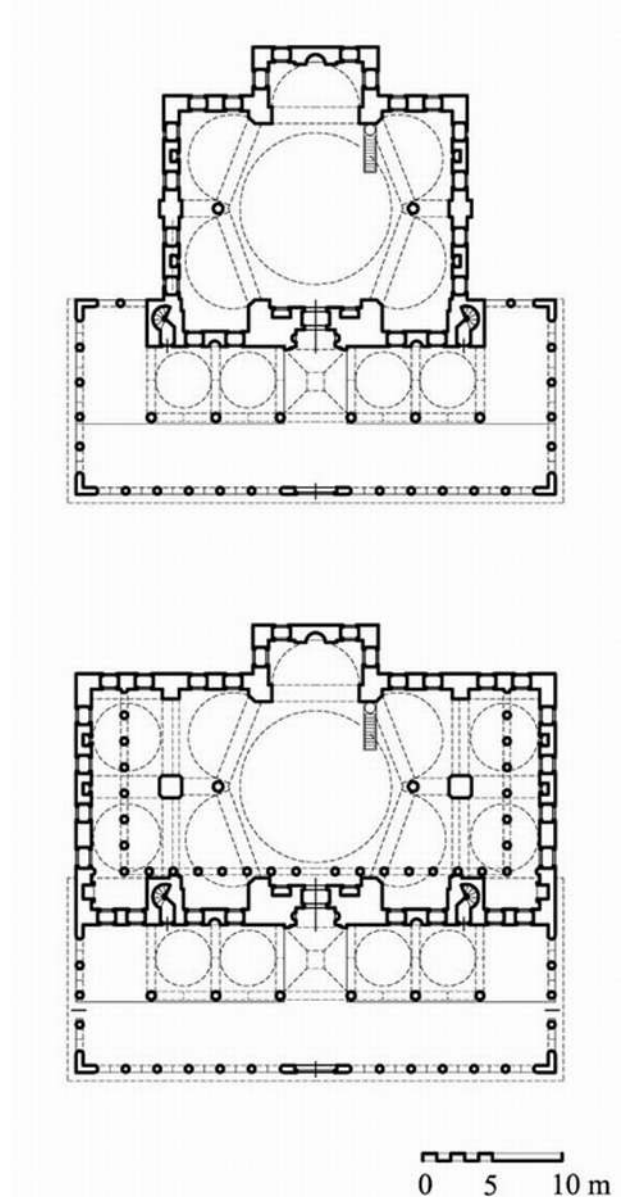


Figure 10 Atik Valide Mosque, ground plan of the first (above) and the second (below) building phases



Figure 11 Atik Valide Mosque, view of the ceiling

exhibiting academic rigor rather than experimental, impressionistic essays with appended CDs, there are nevertheless ways to consider the idea of a holistic bodily experience in writing. The same goal of moving beyond texts can be brought to the field of Ottoman studies, which, by necessity, is centered on archival documents recorded by the empire's bureaucrats, often at the expense of a history oriented to everyday human experience. Studying sound, even if through archival documents, draws the focus away from paper to the lived experiences of flesh-and-blood Ottomans.

Secondly, in some instances the physical appearance of monuments might only be fully explained by combining visual with sonic considerations, as I have suggested in my discussion of Nurbanu Sultan's mosque. The extant mosques are ample evidence that Ottoman architects were cognizant of acoustic technology and design principles and applied them with great virtuosity; there is no reason why Islamic architectural historians cannot be equally cognizant, even if the endeavor of studying sonic phenomena falls outside the field's visual comfort zone.

Notes

This paper has greatly benefited from the comments of Murat Ergin and, in particular, of Hilary Ballon and the two anonymous reviewers of *JSAH*. Of course, any errors that remain are my own. A portion of the research and the writing of this paper coincided with my tenure as a postdoctoral fellow at the Research Center for Anatolian Civilizations, Koç University, Istanbul, in 2005–6, whose generous support I wish to acknowledge. A version of the paper was presented at the architecture/music/acoustics conference at Ryerson University, Toronto, in June 2006, where I received many valuable comments from the audience.

1. The document is published in transcription in Kemal Kürkçüoğlu, *Süleymaniye Vakfiyesi* (Ankara, 1962).
2. Ankara Vakıflar Genel Müdürlüğü Arşivi (Archive of the General Directorate of Endowments), D. 1766. For a translation of the complete endowment deed, see Nina Cichocki [Ergin], "The Life Story of the Çemberlitaş Hamam, Istanbul: From Bath to Tourist Attraction" (PhD diss., University of Minnesota, 2005), 356.
3. The acoustics of Italian church architecture have begun to receive attention with the international, interdisciplinary research project based at the Centre for Acoustic and Musical Research in Renaissance Architecture (CAMERA) in the Department of Art History, University of Cambridge,



Figure 12 Atik Valide Mosque, view of the gallery

with an edited volume of conference proceedings: Deborah Howard and Laura Moretti, eds., *Architettura e Musica nella Venezia del Rinascimento* (Milan, 2005). In contrast, I am aware of only two publications by Islamic art historians that address acoustic aspects of mosque architecture, even if only in passing. Howayda al-Harithy briefly mentions niches built for Qur'an reciters in a Mamluk mosque complex in Cairo, and how these niches facilitate the passersby's hearing of the Qur'an. Howaydah al-Harithy, "The Concept of Space in Mamluk Architecture," *Muqarnas* 18 (2001), 73–89. In her recent magisterial book on the architect Sinan, Gülru Necipoğlu refers to Qur'an recitation and aspects such as the call to prayer throughout; however, the wide scope and the line of argument of her work precludes any detailed forays into acoustics. Gülru Necipoğlu, *The Age of Sinan: Architectural Culture in the Ottoman Empire* (Princeton, 2005).

4. Several papers on the acoustics of contemporary mosques have been published in the *Journal of the Acoustical Society of America (JASA)*: Mohamed Abdel Azeez, et al., "Acoustics of King Abdullah Mosque," *JASA* 90 (1991), 1441; Sami Khaiyat and Abdallah Elbashir, "Acoustics of Mosques: An Overview of Current Design Practices in Saudi Arabia," *JASA* 100 (1996), 2706; Anders Gade, "Acoustic Concerns Related to Multi Cultural Societies," *JASA* 110 (2001), 2664; Sheikh Muhammad Najmul Imam, "Speech Intelligibility in the Community Mosques of Dhaka City," *JASA* 112 (2002), 2332; and Adel Abdou, "Measurement of Acoustical Characteristics of Mosques in Saudi Arabia," *JASA* 113 (2003), 1505–17. On Ottoman mosque architecture, see Mutbul Kayılı, "Mimar Sinan'ın Camilerinde Akustik Verilerin Değerlendirilmesi," in *Mimarbaşı Koca Sinan Yaşadığı Çağ ve Eserleri*, ed. Sadi Bayram (Ankara, Turkey, 1988), 545–55. More recent important contributions to the study of acoustic properties of Ottoman mosques are the publications by the researchers involved in the CAHRISMA (Conservation of Acoustical Heritage by the Revival and Identification of Sinan's Mosque Acoustics) project, most notably Zerhan Karabiber. Many of their papers are available from <http://www.dat.dtu.dk/cahrisma.htm>. Furthermore, there exists an unpublished dissertation on the subject: Levent Topaktaş, "Acoustical Properties of Classical Ottoman Mosques: Simulation and Measurement" (PhD diss., Middle East Technical University, Ankara, Turkey, 2003).

5. To give an idea of how long it takes to complete the recitation of a sura of 83 verses, Ya Sin can be recited in approximately twenty minutes.

6. Readers familiar with the Latin transcription of the Arabic language will find the transcription system used here somewhat peculiar. Since my primary documents are in Ottoman Turkish (written in Arabic letters), I am keeping in convention with a transcription system of Ottoman Studies that approximates modern Turkish spelling and ignores the diacritical marks that indicate long vowels and consonants not existing in English. My reason for this choice is that it is easier for the nonspecialist to read.

7. Kürkçüoğlu, *Süleymaniye Vakfıyesi*, 35.

8. Sura 6:1. All quotations from the Qur'an are taken from the following translation: *The Meaning of the Holy Qur'an*, trans. 'Abdullah Yusuf 'Ali (Beltsville, Md., 1997).

9. Sura 6:165.

10. On higher religious education and its prerequisites in the Ottoman Empire, see Hüseyin Atay, *Osmanlılarda Yüksek Din Eğitimi. Medrese Programları, İcazetnameler, İslabat Hareketleri* (Istanbul, 1983). For an introduction to the cognitive style of Islamic learning and to institutions of higher learning, albeit in a non-Ottoman context, see Dale Eickelman, "The Art of Memory: Islamic Education and Its Social Reproduction," *Comparative Studies in Society and History* 20 (1978), 485–516.

11. On the inscriptions, see Gülru Necipoğlu, "The Süleymaniye Complex in Istanbul: An Interpretation," *Muqarnas* 3 (1985), 107–11; and Cevdet Çulpan, "İstanbul Süleymaniye Cami Kitabesi," in *Kanuni Armağanı*

(Ankara, 1970). The only inscription not from the Qur'an is the foundation inscription over the mosque's main entrance, composed by Süleyman's grand mufti Ebussuud Efendi, a staunch defender of orthodoxy and orthopraxy. According to his foundation inscription, this mosque is a place "for people who dedicate themselves to prayer and to devotional services, for those who despair at night and ask forgiveness at dawn, for those who recite God's verses all night and mornings and evenings." Necipoğlu, *The Age of Sinan*, 109; Ergin's emphasis. Although outside the scope of this paper, a survey of Qur'anic inscriptions together with suras and verses selected for recitation, as stipulated by mosques' endowment deeds, should reveal much interesting information about the different founders' agendas and spiritual predilections, the standard practices of Qur'an recital in mosques, and the relation between aural and visual cues in ritual performance.

12. Cichocki, "Life Story of the Çemberlitaş Hamam," 362–64.

13. Sura 96:1.

14. Michael Sells, *Approaching the Qur'an: The Early Revelations* (Ashland, Oregon, 1999).

15. Sells identifies these moments as the prophecy, the creation, and Judgment Day. *Ibid.*, 185.

16. *Ibid.*, 186.

17. Navid Kermani, *Gott ist schön. Das ästhetische Erleben des Koran* (Munich, 1999).

18. Kristina Nelson, *The Art of Reciting the Qur'an* (Cairo, 2001), xiv.

19. Labib Al-Said, *The Recited Koran* (Princeton, 1975), 73; and Kermani, *Gott ist schön*, 173. See also Charles Hirschkind, "Hearing Modernity: Egypt, Islam, and the Pious Ear," in *Hearing Cultures: Essays on Sound, Listening, and Modernity*, ed. Veit Erlmann (New York, 2004), 134.

20. On the preference to read and recite at the same time, see Nelson, *The Art of Reciting*, 60. On the multisensoriality of ritual communication in different cultures, see David Howes, *Sensual Relations: Engaging the Senses in Culture and Social Theory* (Ann Arbor, 2003), 64.

21. Nelson, *The Art of Reciting*, xvii.

22. "And when they listen to the revelation received by the Messenger, thou wilt see their eyes overflowing with tears, for they recognize the truth." Sura 5:83.

23. Kermani, *Gott ist schön*, 377.

24. *Ibid.*, 419.

25. Necipoğlu, *The Age of Sinan*, 57 (see n. 3).

26. On village bells, see Alain Corbin, *Village Bells: Sound and Meaning in the Nineteenth-Century French Countryside* (New York, 1988).

27. Ottoman Islamic jurists of the Hanefi rite defined the boundaries of cities and towns as the outskirts from which the call to prayer could still be heard. Necipoğlu, *The Age of Sinan*, 55.

28. Oleg Grabar, "Symbols and Signs in Islamic Architecture," in *Architecture and Community: Building in the Islamic World Today*, ed. Renata Holod (Millerton, N.Y., 1983), 29, 31; Ergin's emphases.

29. See n. 4.

30. Howard Crane, "The Ottoman Sultan's Mosques: Icons of Imperial Legitimacy," in *The Ottoman City and Its Parts: Urban Structure and Social Order*, ed. Irene Bierman, Rifat Abou el-Haj, and Donald Preziosi (New Rochelle, 1991), 185–86.

31. Necipoğlu, *The Age of Sinan*.

32. Lucienne Thys-Şenocak, "The Yeni Valide Mosque Complex of Eminönü, Istanbul (1597–1665): Gender and Vision in Ottoman Architecture," in *Women, Patronage and Self-Representation in Islamic Societies*, ed. D. Fairchild Ruggles (Albany, 2000), 69–89.

33. Jale Erzen, "Aesthetics and Aisthesis in Ottoman Art and Architecture," *Journal of Islamic Studies* 2 (1992), 1–24.

34. Jale Erzen, "Space and Staging: Ottoman Architecture and Painting in

the Sixteenth Century,” in *Seven Centuries of Ottoman Architecture: A Supra-National Heritage*, ed. Nur Akın, Afife Batur, and Selçuk Batur (Istanbul, n.d.), 51.

35. Necipoğlu has used this term in reference to the relation between mosque architecture and the decorative arts employed to enhance mosque space, but not in relation to sound. Gülru Necipoğlu, “A Kanun for the State, A Canon for the Arts: Conceptualizing the Classical Synthesis of Ottoman Art and Architecture,” in *Süleyman the Magnificent and His Time*, ed. Gilles Veinstein (Paris, 1992), 195.

36. Both Süleyman’s and Nurbanu’s mosques had their own employee who made “beautiful-smelling smoke and [perfumed] this mosque on Fridays and other holy times, as is tradition.” Cichocki, “Life Story of the Çemberlitaş Hamam,” 358 (see n. 2); and Kürkçüoğlu, *Süleymaniye Vakfiyesi*, 36 (see n. 1).

37. Necipoğlu, *The Age of Sinan*, 341, speaks of a “visionary experience of the divine” in regard to mosque space. I propose to add the term “auditory” to denote a sacred experience, since in Islamic culture hearing rather than seeing is thought to constitute the most accessible way to experience the divine, as I have outlined above.

38. In this sense, architecture merges with the phenomenology of the sacred. The visual aesthetic of the sacred in Islamic architecture has been the subject of Valerie Gonzalez, “The Comares Hall in the Alhambra and James Turrell’s *Space That Sees: A Comparison of Aesthetic Phenomenology*,” *Muqarnas* 20 (2003), 253–78. Gonzalez’s work is thought-provoking and commendable for the fact that she introduces sensual experience—even if only in terms of vision—as a factor in medieval Islamic architectural design. However, her arguments could benefit from acknowledging the cultural conditioning of sensory perception. After all, Muslims living in fourteenth-century Spain perceived the world around them differently from an art historian visiting an architectural sculpture made in 1992.

39. Necipoğlu, *The Age of Sinan*, 103.

40. Sinan’s familiarity with Qur’an recitation is documented in the endowment deed accompanying the small neighborhood mosque built in his own name. The deed stipulates that more than forty reciters dedicate different suras and Qur’an portions to his benefit. For a summary of these stipulations, see Necipoğlu, *The Age of Sinan*, 148–52.

41. For a brief introduction to the requirements of good building acoustics, see Leland Roth, *Understanding Architecture: Its Elements, History and Meaning* (Boulder, 1993), 91–103 (bibliography on p. 103). A comprehensive introduction to all aspects of acoustics is F. Alton Everest, *Master Handbook*

of Acoustics, 4th ed. (New York, 2001).

42. On the acoustic properties of concave surfaces and domes, see Roth, *Understanding Architecture*, 93; and Everest, *Master Handbook*, 237, 286.

43. On standing waves in general, see Roth, *Understanding Architecture*, 93 (he uses the term “flutter echo”); and Everest, *Master Handbook*, 240. On standing waves in Sinan’s mosques, see Mutbul Kayılı, “Sinan Eserlerinde Akustik,” *Vakıf Hattası* 6 (1989), 274.

44. Measurements available from <http://www.dat.dtu.dk/cahrisma.htm>.

45. Kayılı, “Mimar Sinan’ın Camilerinde Akustik Verilerin Değerlendirilmesi,” 274–75 (see n. 4).

46. Nicola Prodi and Matteo Marsilio, “On the Effect of Domed Ceiling in Worship Spaces: A Scale Model Study of a Mosque,” *Building Acoustics* 10 (2003), 117–34.

47. Ömer Lütfi Barkan, *Süleymaniye Cami ve İmarat İnşaatı (1550–1557)* (Ankara, 1972–79), 2:171.

48. Kayılı, “Mimar Sinan’ın Camilerinde Akustik Verilerin Değerlendirilmesi,” 553; and Kayılı, “Sinan Eserlerinde Akustik,” 276.

49. These measurements have been conducted by the team members of the CAHRISMA project and are available from <http://www.dat.dtu.dk/cahrisma.htm> and http://www.odeon.dk/nam_p.htm.

50. Patrizio Fausti, Roberto Pompoli, and Nicola Prodi, “Comparing the Acoustics of Mosques and Byzantine Churches,” <http://cipa.icomos.org/fileadmin/papers/antalya/65.pdf>, p. 3.

51. The expansion was probably financed by the mosque complex’s endowment, which by that time was up and running. It was customary for these pious endowments to finance initial building, maintenance, repair, and expansions to the original structure serving religious and charitable purposes.

52. Necipoğlu, *The Age of Sinan*, 286 (see n. 3).

53. *Ibid.*, 146.

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Figures 1, 4. Photographs by Reha Günay

Figures 2, 3, 5, 10, 11. Gülru Necipoğlu, *The Age of Sinan: Architectural Culture in the Ottoman Empire* (Princeton, 2005), figs. 167, 179, 261, 265, 273
Figures 6, 7, 12. Creswell Archive, Ashmolean Museum, Oxford, neg. EA.CA.7175, EA.CA.7154, EA.CA.7173

Figure 8. Mutbul Kayılı, “Sinan Eserlerinde Akustik,” *Vakıf Hattası* 6 (1989), fig. 9

Figure 9. Photograph by Nina Ergin