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The Acoustics of the Mevlevi Sama'Khana

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Abstract

The Sama'Khana or the Sufi theatre (hall of listening) complex, an 18th century theatre and monastery constructed for the confraternity of the Mevlevi Whirling Dervishes. It is located in Suyufiyyastreet in the medieval Cairo that lies beyond the old Fatimid walls. The complex was developed in the Mamluk period, and located near the pond of the Birket al-Fir and the old KhaligMasri (canal). The Sama'Khana is a wooden structure which features a circular area reserved for performances and constitutes of two levels of circular galleries surmounted by a wooden dome. The hall was used for spiritual listening, in order to listen to the harmony of the cosmos, the dervishes whirled in the circular space, expressing the geometrical and mathematical symbolism involved in the ceremony. According to the Mevlevi confraternity, the complex was devoted to moral and spiritual education. The proportion of its architectural space reveals the symbolism of geometrical and cosmological expressions. This study explores the geometrical parameters of the Sama'Khana, and its impact on the acoustic environment. The modal analysis of the space revealed that the structure was found to resonate at fundamental frequencies, which are further described to belong to the alpha wave patterns found in the human brain. These patterns are associated with meditation, relaxation, and altered states of consciousness. All this adds to the special soundscape patterns associated with the ceremony of listening to the cosmos, and outlines the importance of the sonic properties of the Sama'Khana.

Keywords: Acoustic, Mevlevi, Sama'Khana, Resonance

1. Introduction

Tasawwuf is method by some Muslims to adore god. The believers of Tasawusuf state that it represents the spiritual dimension of god adoration, and the mysterious dimension of Islam. Tasawwuf is seen as a method whose objective is the purification of the heart and mind to take it away from everything except God. The practitioner of the Tasawwuf is known as Sufi.

The Sufis believe that they can embrace the Divine presence in life and they can achieve the perfection of worship by performing their spiritual meeting (called Majeles) ceremonies. According to the approach of performing Tsawwuf (which is known as Turroq) the performance of ceremony is done. Approaches like Khalwaty, Riffai, Aleevi, Chishti, Bektashi, Mevlevi, and Naqshabany are common. The meeting places of Sufis ceremonies are performed in places known as zawiyahs, Khanqqah, or Tekke. From the ceremonies of Sufis (depending on the approach) there are Anasheed which is the use of Duf (a type of drums) to sing Islamic poems, Sama is the pronouncement of names of God while dancing or moving, and Whirling is performing of Sama with customary revolving dance. In Whirling, the dervishes (revolving Sufis) aim to reach the perfection (in relation to God) through individual desires by listing to melody concentrating on God and spinning one's body in repetitive circles, which is seen as a symbolic imitation of planets in space revolving the sun.

2. Mevlevian Approach

The Mevlevi order represents one of the main orders or Turroq of Sufis founded in Konaya by the well-known Persian poet in the 13 th century Galal El-Din Mohamed El Romi. The Mevlevi approach in Tasawwuf, can also be named as Whirling Dirvishes which is based mainly on the whirling. As previously discussed the Whirling is performing Sama while whirling. The Sama represents a mysterious trip for the human spiritual ascent through mind to the perfection.

2.1. Whirling ceremony

Whirling ceremony is dancing by whirling for long hours on the centre of a circle, under supervision of Sheikh (leader of Darvishes). This whirling dance shown in figure1 let them

integrate into the feelings of self-spiritual sublime, where they are freed from their psychological feelings and go far away from the material world to the Divine Presence. These Dervishes ceremony becomes a symbol of immortality and a sign of yearning for God and neutralize the Earth's gravity, to open the eyes of the heart to recognize the infinite immortality, in order to free the dervish 's spirit from the Earth's gravity with the self-liberation of the perception (that represents a constraint), to become a recluse in God(Farraro 2010).



Figure 1. Mavlavian ceremony (Whirling dancing).

The dance of the dervishes, whirling is an expression of the cosmic enjoy that is felt by the impact of the vanishing, coincided with the remembrance of God Almighty, which represents struggling with themselves towards sky.

The process of rotation in the cosmos started with the beginning of the universe, where planets were asked by the God once to rotate, then they revolved around their center (Sun) as an immediate obey to God's order and take the path of the galaxies to rotate in an anti-clock wise in a way which makes the whole universe is worshipping to God. According to Mevlevian Darvishes, if we take a look to the universe we will notice the whole universe is in unstopped revolving. An atom revolve around one or more electrons in orbits , or orbits of their own , and this means that all the atoms of solids , liquid , and gas in the universe are revolving anti clock-wise. Also the electron spins around itself, and then revolves around the nucleus of an atom in an anti-clockwise. Such rotation resembles the revolving of Muslims around the Kaaba (the holy mosque of Muslims in Mecca). The living organisms through each living cell «protoplasm» (is living material cell) is revolving anti-clock wise obeying the same concept like the cosmos, the earth revolves around the sun, the moon revolves around the Earth, solar systems revolve around the center of the galaxy, and the galaxy revolve around the center of the group of galaxies, which all show the unity of the universe and the oneness of the Almighty Creator.

The group of Galaxies revolves around the center of the universe in which no one knows except God Almighty know this center, all of the whole universe is rotating counter-clockwise, everything in the universe is going on this wondrous rotation, the electricity, cells, moons, planets, stars, solar systems, galaxies,... etc.

3. Sama'khana building for Mevlevian ceremonies

The Mavlavi complex containing the Sama'khana is situated at a short distance from the Citadel in Cairo, on as-SiyufiyyaStreet which lies along the ancient north-south axis of medieval Cairo. The cluster of buildings which make up this complex range from the early Mamluk period (the madrasa/mausoleum of the Emir SunqurSa'di/HasanSadaqa built in 1315 and the palace of YazbakAqbardi dating to the 14th century to the late Ottman era (the MevleviSama'khana built in the 18th century)

The Sama'khana is a wooden structure which occupies a 25*25m square and features a central circular area reserved for performances and surmounted by a 10.65m/diameter wooden dome. Two levels of circular galleries line the height of the central performance hall and are supported on slender wooden columns(Giuseppe 1983), as shown in figure2.

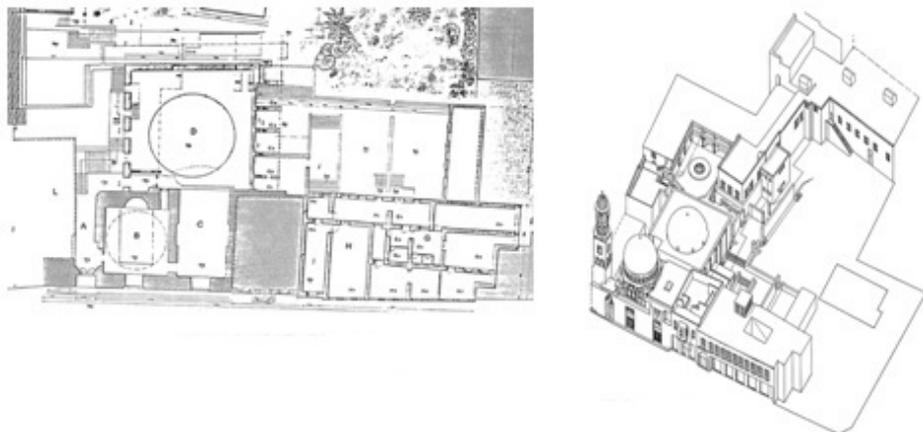


Figure 2. Mavlavi complex with Sama' Khana.

The Sama'khana has a great historical importance not only because it represents the last building of the Mavlavi complex, but also for its unique presence in Egypt as the only building that was designed by Dervishes to perform their ceremonies. On the other hand from the architectural points of view, the Sama'khana (the word means the hall of listening) shows

an interesting architectural design concept that shows the function of the building which is listening to the harmony of the cosmos (names of god and music while performing their ceremony by whirling) by generating the form that fulfills this sonic environment and also embodies the philosophy of MevlevianDarvishes. The main listening hall is shown in figure3.



Figure 3. The hall of listening of the Sama'Khana.

3.1. Concept of Sama'khana design

The Mevlevia's main ceremony is the Sama which is listening, as a refer to the harmony of the cosmos. The Sama ceremony architectural space called Sama'khana is defined by a scheme of geometrical and mathematical symbolisms, the sama'khana represents the greatest expression of this particular architectural function. The central area where the Sama takes place through circular movements as an expression of rotation of the celestial spheres represents the origin of the universe geometrical and cosmological description.

In the centre, the point was at the beginning as the big bang of the creation, the point geometrically does not have a dimension which is the absolute unity, and its projections are geometric sequence of points that form circular line, as represented in Figure4. The circular line is the path of life and knowledge which continuously has reference to the centre as the origin of everything. The circular perimeter also defines the Sama performance area, since its radius is the diameter of the Sama circular area that represents the first orbit of the Darwishpath. Two lines extending from the post where the sheikh sits and tangent to the orbit forms an equilateral triangle symbolizing the descending of life force from the upper unity to the multiplicity, and its expansion on the earth assumes the shape of the square in the sama'khana plan as shown in Figure5.

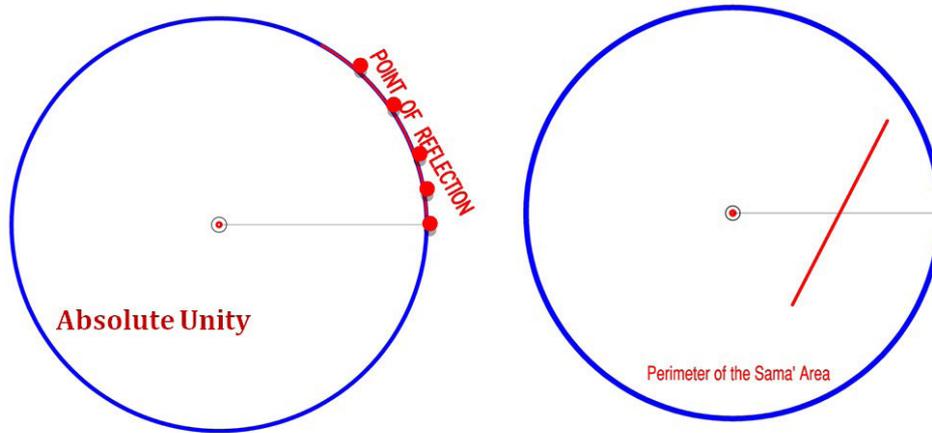


Figure 4. Left: the point as the big bang of creation, Right: is the projection of the point that creates the circular line.

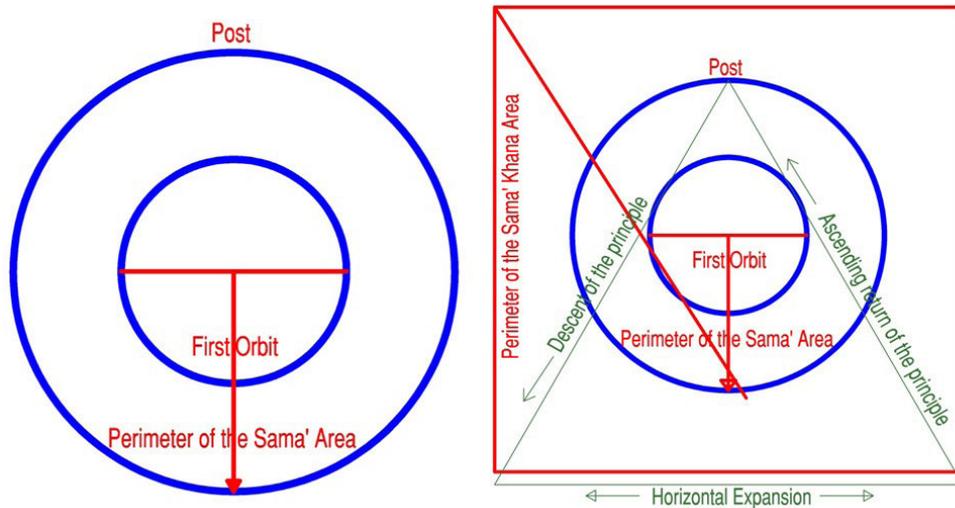


Figure 5. Left: the first orbit of Darvish path, Right: the projection of the point that creates the circular line.

Other circles with their centre along the first orbit are developing and through their intersections the circle of the second orbit of the darvish path is formed as shown in Figure 6. The sequence of the large circles having the Sama area radius and their centres on the first orbit, represent the mystical expansion over the spectators inside the Sama'khana area. Figure 7 shows the intersection of the circles with the perimeter circumference of the Sama area marks the position of twelve pillars supporting the dome of the samakhana itself and symbolically the celestial spheres of the sky and cosmos.

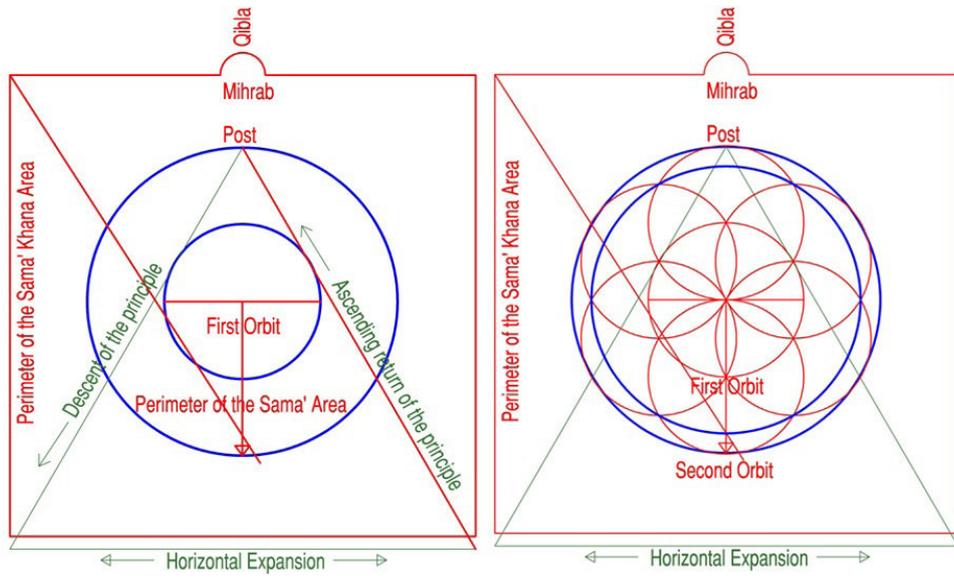


Figure 6. The second orbit circle.

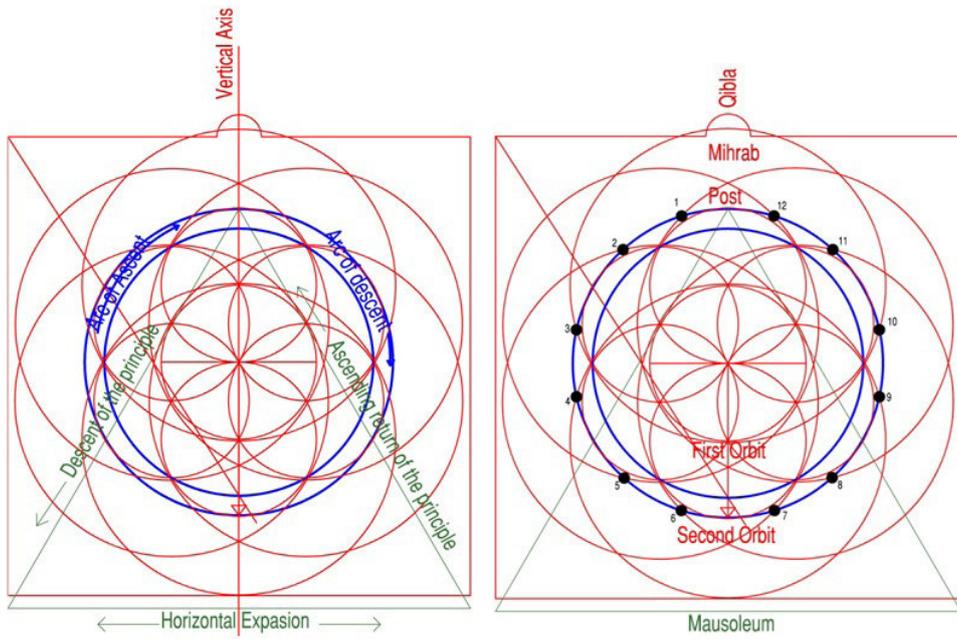


Figure 7. Left: circles represent the mystical expansion over the spectaculars, Right: The twelve wooden pillars.

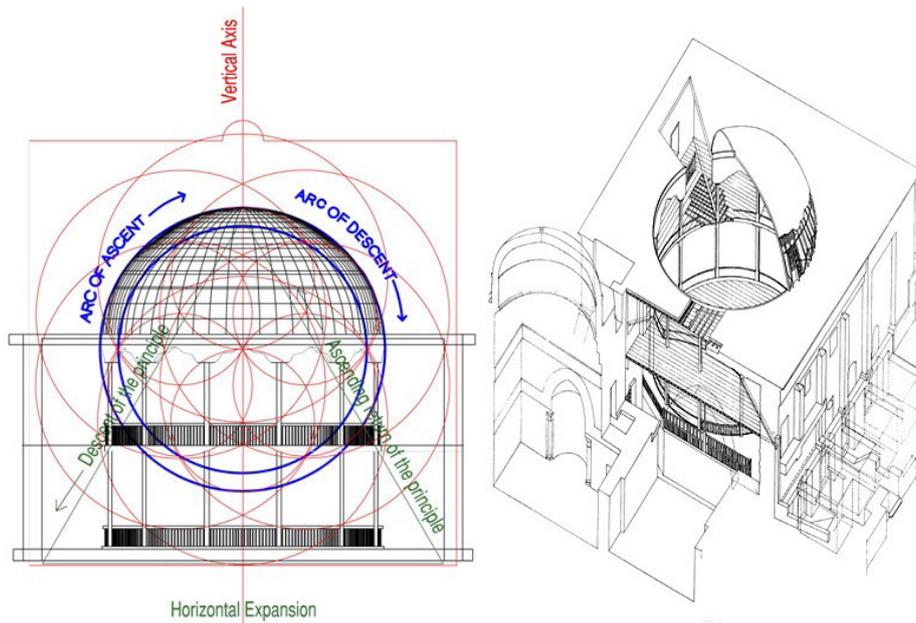


Figure 8. Architecture section of Samakhana shows the same proportions like the plan.

The square has symbolical reference to the earth, the circles and the geometrical design of the Sama'khana plan was linked on propose again with the same proportions in the vertical dimensions in the architectural section. The cube is an earthly world, and the overhanging dome is the support of the cosmos spheres, the resulting geometry is shown in figure 8.

4. Perception of Sound

4.1. Circular buildings

The most intriguing design feature of the Sama'khana from the acoustic perspective is its circular plan. Thus it is not surprising that a numerous of well known religious buildings, have circular plan design, and consequently outstanding acoustic phenomena. St. Pauls cathedral in London(Raman n.d.)has a circular raised dome that allows clearly a whispering gallery effect to be heard at remote distances. Even 5000 years old stone structures such as the Stonehenge were found to resonate at certain frequencies. Till (Till 2010) showed that in Stonehenge the sarsen stone ring, called the slaughter and heel stones are placed in a middle zone so as to interact with the acoustics of the space reinforcing the sonic environment. Modern Soundscape sculptures as well incorporated a circular shaped cylinder. Bernhard

Leitner (Leitner 1990) introduced a space for seeing and hearing. The Cylindre Sonore at the Parc de la Villette in France is representing a new approach in architecture design, bringing together the architect experience and the composer imagination and the will of the sculptor. This soundscape feature lies sunken inside the bamboo garden. The upper edge of the double cylinder is at the level as the pedestrian alleys.

This outlines clearly the importance a circular shaped space plays in the resultant acoustic environment and soundscape experiences for attendees. Generally if one stands in the middle of vertical walls erected on a circular pattern the sound will propagate away hitting all the circumference hard surfaces simultaneously and all energy packets will return back at almost the same time, due to the equal path length. Depending on the space size a prominent echo and reverberation will be produced by the late energy packets.

If the location of the listener is away from the centre near the edge of the circle then the reflections will arrive according to the following sequence: The first reflection would be sound packages reflected back from the nearest wall portion, the second when sound hits the side parts of the walls reflects twice and propagates back forming a triangle. Higher order of reflection will form a polygon shape path with n sides where $n-1$ is the order of reflection. Thus in circular shapes form a reverberant field is created and additional echoes are experienced as well.

4.2. The Acoustics of the Sama'khana

It is not surprising that the circular wooden building of the samakhana would have strong acoustic effects. The effect is produced by circular modes of vibration that produce a number of harmonics. It is not surprising that the samakhana building resonates and produces sound in time with the regular echoes produces inside the space. The samakhana is therefore a complex monument involving number of geometric shapes, despite this theoretically it should have a strong fundamental resonance at a certain frequency.

The smakhana was built to have strict geometrical circular concepts in its horizontal plan, the same proportions adopted in the plan are proposed again in its architectural vertical section. Measuring these dimensions that equalizes the space vertically and horizontally, tells us that the fundamental resonant frequency would start at 7-14Hz, this raised a number of interesting issues. Alpha brain waves of deep relaxation start at 8Hz and end up at 15 Hz. Alpha brain waves are present in deep relaxation and usually when the human eyes are partially or totally closed, when you're slipping into a lovely daydream or during light contemplation. It is an opportunity and optimal time to program the mind for success and it also increases the human memory, imagination, visualization, learning and concentration.

It is the gateway to the human subconscious mind and lies at the base of the conscious awareness. Alpha activity has also been connected to the ability to recall memories, lessened discomfort and pain, and reductions in stress and anxiety(Williams 2006)(Nomura T 2006) (HC. 2000)(Hall 1865). The 14Hz is described as infrasound; it is possible for humans to hear notes below 20Hz they only have to be adequately loud(Till 2010), in addition periodic rhythmic vibrations. One feels sound waves between 15Hz and 20Hz as much as one hears it; the sounds between these ranges are felt as rattles or vibrations.

According to Till (Till 2010), from 1-14Hz one perceives sound as rhythms, often described as number of crotches or beats per minute, table 1 outlines the human perception of sounds at various frequencies.

Table 1. Perception of sound at different frequencies(Till 2010)

Frequency	Perception
Above 20Hz	Pitch or musical note
14Hz-20Hz	Vibration
1Hz-12Hz	Rhythm
1-3Hz	crotched pulse
2-6Hz	quaver pulse
4-12Hz	semi quaver pulse
0-1Hz	
1Hz	1 second
0.5Hz	2 seconds 60 seconds or 1 minute
0.0167Hz	

This outlines clearly the intended geometric proportions of the Samakhana design that respond acoustically to functional aspects of being a place of spiritual religious ceremonies. Table 2 and Figure X summarize the axial modes of the samakhana space.

Table 2. Axial modes inside the Samakhana.

	1st	2nd	3rd	4th
Length	7Hz	14Hz	22Hz	29Hz
Width	7Hz	14Hz	22Hz	29Hz
Height	7Hz	14Hz	22Hz	29Hz

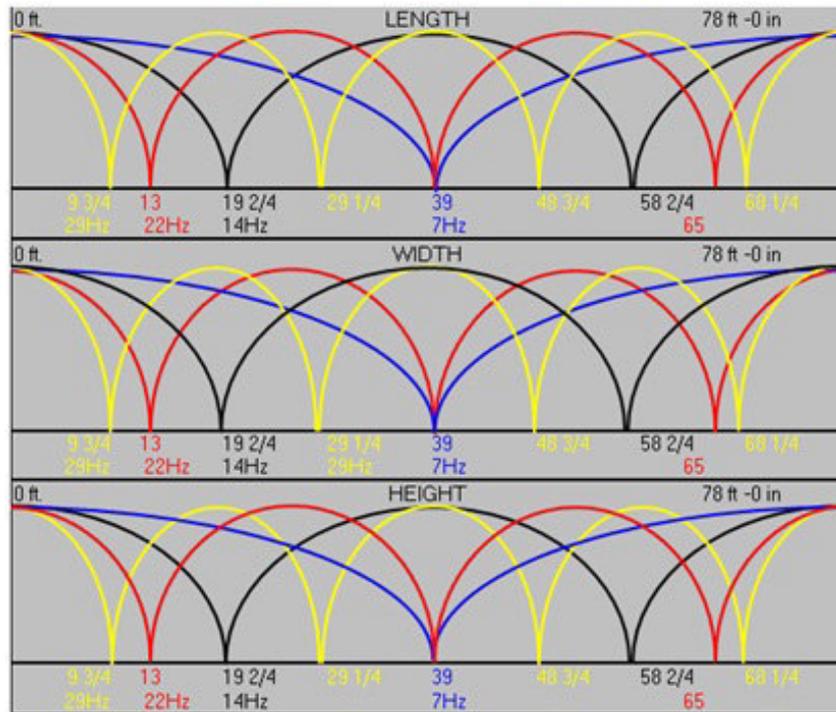


Figure 9. Arepresentations of modes inside the Samakhana space.

Thus the acoustic of the samakhana seemed to suit sound making, participative, amplified, and rhythmic activity where the gathering of people take part in the Mevlevis ritual ceremonies. These Mevlevis ritual resemble trance-like rituals. The body and mind were entertained by specific frequencies produced by the acoustics that helped the brain to produce alpha wave patterns; this consequently helped to achieve the desired state of consciousness.

5. Conclusion

This study revealed that the sama'khana design demarcated visual relations as well as sensuous aspects. The building was proposed to house the rituals of the Mevlevis confraternity, dedicated to spiritual dimensions. The conceptual analysis of the sma'khana design revealed that its plan and section are carefully laid out to correspond to the cosmos relations. The circle where the whirling dervishes performed was designed so as to mimic planet movements in an orbital accurate tactic motion. Even structural elements represent connections with

spectaculars platforms. Thus being inside the circular ring would produce a powerful sense of inclusion and involvement, with the surrounding set of configuration.

Having the sama'khana designed for performances to achieve a coherent body and soul connection, in conjunction with the exhaustion provoked by the whirling, during which the “dancers” could reach the mystic ecstasy. Music was a powerful vehicle for the diffusion of those new movements; often, remixing Oriental rhythms in order to meet the religious expectation. Having these parameters indicating a strong potential that the building could have outstanding acoustic features, the paper examined the sonic impact of the building and its effect on the resultant soundscape, and the additional semantics that could be added to the space.

The investigation of modal patterns of the space revealed evidence of resonance starting at low as 7Hz, which helped to induce alpha wave brainwave patterns. Alpha brainwaves are associated with relaxation, altered state of consciousness, meditation, and consequently a spiritual level of acoustic practice. Previous research revealed that the brain can synchronize and entrain to such frequencies, this means that if the dervishes whirl at such tempo their brain tend also to exhibit such frequency. Thus the sama'khana acoustic atmosphere was found to be prominent, specific and well specified, that it seems that the acoustic effect was understood and designed to act in harmony with the ritual performances. Further investigation is needed to support such findings in terms of acoustic measurements, and analysis to predict important modal patterns, to justify the findings.

REFERENCES

- Farraro, Valeria.** “From Literary Texts to Musical Sounds: Mawlânâ’s Message in Italy.” *Dünyada Mevlâna İzleri – Bildiriler*, 2010: 147–187.
- Giuseppe, Fanfoni.** “Il Complesso Architettonico dei Dervisci Mavlavi in Cairo”, in *Rivista degli Studi Orientali*. Università di Roma ‘La Sapienza’, LVII, 1983: 77–92.
- Hall, Charles Francis.** *Arctic Researches and Life Among the Esquimaux: Being the Narrative of an Expedition in Search of Sir John Franklin in the Years 1860, 1861, and 1862*. New York: Harper and Brothers, 1865.
- HC., Ossebaard.** “Stress reduction by technology? An experimental study into the effects of brainmachines on burnout and state anxiety.” *Appl Psychophysiol Biofeedback* 25, no. 2 (2000): 93–101.
- JH., Williams.** “Frequency specific effects of flicker on recognition memory.” *Neuroscience*. 104, no. 2 (2001): 283–286.

- Leitner, Bernhard.** *Le Cylindre Sonore*. AEDES
Galerie für Architektur und Raum, 1990.
- Nomura T, Higuchi K, Yu H, et al.** "Slow-wave
photic stimulation relieves patient discomfort
during esophagogastroduodenoscopy." *J. Gas-
troenterol Hepatol.* 21(1 Pt 1) (2006): 54-58 .
- Raman, C. V.** "On whispering galleries." *Proc.
Indian Ass. Cult. Sci* 159, no. 7: 1921-1922.
- Till, Robert.** "Songs of the Stones: An investiga-
tion into the Acoustic Culture of Stonehenge."
*Journal of the internationa association of the
study of popular music* 1, no. 2 (2010).
- Williams, J., Ramaswamy, D. and Oulhaj, A.** "10
Hz flicker improves recognition memory in
older people." *BMC Neurosci.* 21, no. 7 (2006).