International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 05 | May - 2023 Impact Factor: 8.176 ISSN: 2582-3930

IS ARCHITECTURE FROZEN MUSIC

ARSH JAIN
GUIDED BY: AR. ANUGYA SHARAN
SCHOOL OF ARCHITECTURE, IPS ACADEMY
BACHELOR'S OF ARCHITECTURE

ABSTRACT

Architecture as a whole reflects the cultural history of humanity. Architecture also reflects the thoughts, ideas, culture, and natural elements of a region. Architectural buildings express the sociological and environmental conditions of the people who produced them.

Therefore, for architecture to have significance, it must be structured as much by theory as by the environmental, cultural, and natural conditions, which make up the site on which it will rest, it must be in harmony with its site as well as with the culture. which it is constructed to represent.

As a designer. one must be conscientious while developing the philosophies of human nature as well as the relationship of man to nature and all that makes an area distinct from anywhere else on this earth. A designer must be able to sense the underlying harmony, which makes the site a composition of elements and harmonic sounds. and then in an ever so cautious style integrate his own personal composition and blend it in to the greater to create the connection between all that was, and yet needed to be.

INTRODUCTION

A quote commonly attributed to German poet Johann Wolfgang von Goethe is "Architecture is Frozen Music" (1749–1832). The varied comparisons between music and architecture and how they might be used to complement one another are a result of Goethe's observation. Qualities that define good music also define architectural pieces. Prehistoric, Ancient, Modern, Contemporary, and Neo-Futuristic architectural styles have all evolved over time as a result of the effects of human civilisation. The fundamentals of this topic are some of these likeable traits of the Roman and Greek architectural styles.

Picture 1; Colosseum, Italy (70 -80 AD)

These four principles—harmony and proportion, rhythm, texture, and acoustics—were the foundations of some Greek architectural ideas and theories that have a connection to music. Several of these guidelines might be seen in the Parthenon as well (438 BC). The necessity of Music (Classical Music) for an architect's education was discussed by Roman architect and writer Vitruvius Pollio in book 1 of The Ten Books on Architecture (De Architectura) in approximately 27 BC. While the art of architecture consists of a designer, a user, and an architectural work, the art of music consists of a composer, a listener, and a musical piece. This demonstrates that the parts and elements used in both methods are the same.

Picture 2a; Sagrada Familia Spain by Antoni Gaudi (1882)

In linking architecture psychology with the affects of music, you will see that Humans engage with environments and music in some comparable ways because both can elicit feelings in a person. We can act in a variety of ways in response to the environments and music we encounter. When we explore and interact, how we perceive the surroundings and sound similarly shapes our experiences.

Picture 2b; Taj Mahal, India (1628–1658)

The physical environment is a crucial component of our built world. Hence, Architecture does impact human behaviour in numerous ways. Our human experiences are shaped by it. As a type of art, it is widespread in civilisation because it reflects and transmits the social, political and cultural influences of the times. Also, it is a reflection of the local ideas, nature, and elements.

Picture 3a; Heydar Aliyev Center, Azerbaijan by Zaha Hadid (2012)

The most basic and well-known definition of architecture is "the art and science of planning and constructing structures," yet as architecture uses buildings as a communication tool, we all seem to agree with Goethe that "architecture is frozen music." Excellent architecture embeds symphonic elements which elicit powerful emotional responses in humans and helps them believe they have some control over their environment.

Picture 3b; Jewish Museum Berlin by Daniel Libeskind (1999)

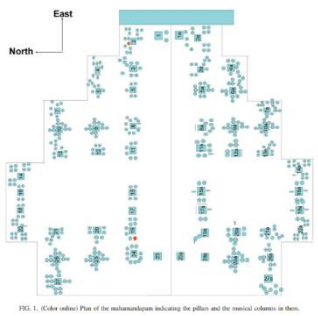
In De Architectura, Vitruvius emphasises the importance of musical theory and philosophy while exposing the profundity of Goethe's idea that classical structures could be thought of as "Frozen Music."

CASE STUDY

Vijaya Vittala Temple

The Vitthala Temple is the most exquisite of the religious structures at Hampi, an Indian World Heritage Site. The Vitthala Temple is located on the southern bank of the Tungabhadra River and represents the pinnacle of Vijayanagara Kingdom style. The temple has been around since at least 1422-1461. The temple is surrounded by a wide rectangular enclosure (164 m*94.5 m). The melodic pillars on the temple's Mahamandapam(greatstage) are one of its distinguishing features.

From where the sound came?



The temple's Mahamandapam is said to have 56 pillars, each 3.6 m high, 40 of which are regularly arranged to form an aisle. In the centre, the remaining 16 form a rectangular court. For years, tourists have travelled to the UNESCO World Heritage Site to hear the captivating melody of the over 500-year-old temple. The

pillars are termed SaReGaMa after the first four notes (svaras) of the standard scale in Indian classical music, which corresponds to the Western Do Re Mi Fa (solfège).

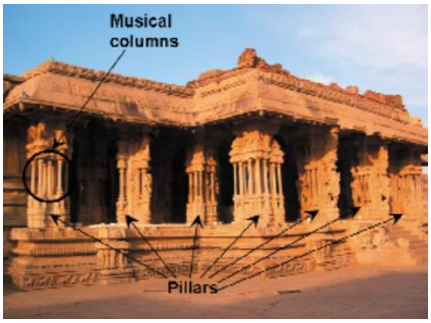
They support the 15th-century 'Ranga Mantapa,' the temple complex's major feature. It was most likely utilised for music and dance, as it resembled an open pavilion. Across the hall, seven tiny pillars surround seven bigger pillars, each of which 'plays' one of the seven notes of the Indian classical music scale. The cluster of musical pillars, made of massive resonant stone, fluctuates in height and width to produce the various tones. Vijaya Vittala isn't the only temple with musical pillars. Throughout the 14th to 16th centuries, these harmonising features signified a dramatic transformation in architecture, particularly in southern India. Experts believe the pillars were formerly tapped or blown into to accompany chants and devotional acts.

About music in Architecture?

Each pillar is a gigantic composite sculptural unit with a group of monolithic sculptures, measuring up to 1.5 m across. The temple's structures, including the melodic pillars, are all built of granite stone. When struck with a finger, the solid stone columns in these pillars emit an audible sound. The musical columns in the pillars vary in size, shape, length, and width, producing sounds from various musical instruments. It is reported that in the 15th century, Bahamani invaders burned down the temple, injuring several of its pillars. Tourists from all over the world have been drawn to and surprised by these musical pillars. Unfortunately, no comprehensive acoustic investigation of these pillars has yet been published.

The current work is the first attempt to scientifically explore and link the acoustic qualities of the musical columns in the pillars of the Vitthala Temple's mahamandapam with dimensional and nondestructive measurements.

The Vittala temple is designed in the Dravidian style. It possesses qualities and features that are typical of south Indian temple architecture. Its intricate and beautiful carvings, as well as its superb architecture, are unparalleled in Hampi.



Vittala, after whom the temple is named, is a manifestation of Lord Vishnu. The cattle herds venerated this aspect of Vishnu as their cult deity in this region of the country (see Gods of Hampi).

The temple was constructed in the 15th century AD. Over their reigns, many succeeding kings improved the temple campus to its current state. There are even remnants of a township called Vittalapura that formerly thrived around this temple complex. The majestic pillared halls and stone chariot are the highlights of Vittala

temple. The hallways are engraved with an amazing array of sculptures on the gigantic granite pillars. The stone chariot inside the campus is almost an iconic Hampi structure.

It may appear to be a monolithic building. In truth, this stone temple was constructed from numerous massive granite pieces. The joints are cleverly concealed among the carvings and other ornamental elements that embellish the Stone Chariot. The chariot is constructed on a rectangular platform about a foot high. Mythical war scenes are engraved all around this base platform. Despite the chariot is not sitting on it, the four massive wheels attached to it are exact replicas of real-life ones, replete with axis shafts and brakes. The wheels are decorated with a sequence of concentric flower motifs. The marks on the platform where the wheels rest indicate that the wheels were free to travel around the axis. The remnants of the painting may still be seen on the chariot's carvings.

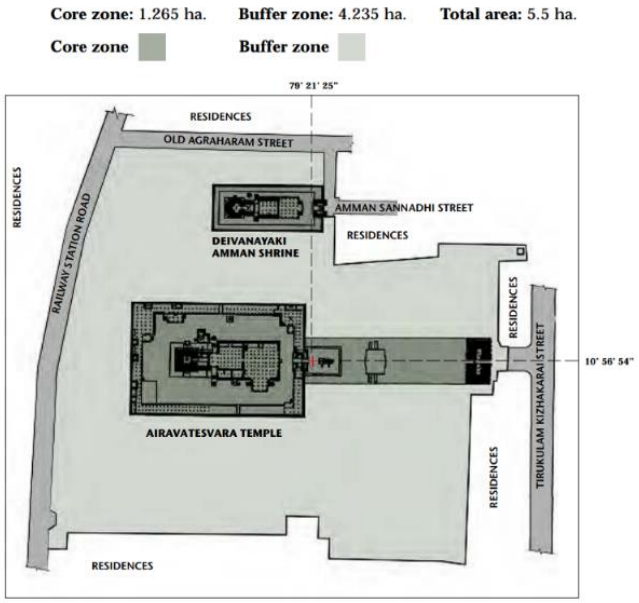
The Der carriage of the chariot is one of the best-preserved specimens of this type of painting, most likely because it was somewhat shielded from the natural wearing factors. It is thought that the entire Vittala Temple's statues were previously wonderfully painted in a similar style utilising minerals as a medium. At Tirunelveli, South India, the Nellaiappar Temple has a series of melodic pillars that are positioned so that when one is tapped, a neighbouring one reverberates, producing a bell-like sound. Temples have been known to have additional musical architecture, such as staircases, in addition to singing pillars.

Darasuram Airavatesvara Temple

Airavatesvara Temple is a Hindu temple of Dravidian design found in Kumbakonam, Thanjavur District, Tamil Nadu, South India. This temple, erected in the 12th century CE by Chola monarch Rajaraja II, is a UNESCO World Heritage Site, along with the Brihadeeswara Temple in Thanjavur and the Gangaikondacholisvaram Temple in Gangaikonda Cholapuram, which are referred to as the Great Living Chola Temples.

The Airavatesvarar temple is one of eighteen large medieval-era Hindu temples in the Kumbakonam district of Thanjavur District. Shiva is honoured at the temple. It also reverently portrays Hinduism's Vaishnavism and Shaktism traditions, as well as narratives related with Nayanmars - the Bhakti movement saints of Shaivism.

From where the sound came?



Before proceeding to the great Airavatesvara Temple, you should pay attention to a modest edifice directly behind the Nandi mandapam. The Balipeetham is a structure with a tiny flight of stairs. This is the Airavatesvara temple's sacrificial altar. The stairs, which are now contained in a cage, are notable. These stairs are known as the Airavatesvara Temple's Singing Stairs or the Musical Staircase.

A metal screen surrounds a staircase going inside the Airavateshwara temple at Darasuram, north-east of Tirunelveli. This is to safeguard the ten stairs, as walking on them 'plays' the first seven notes of the Indian classical music scale.

When you step over them, you will hear seven different notes. Nonetheless, there are a total of ten steps. What are the three more steps? This temple's speciality is the three extra steps that form the sound AUM. When you roll a stone down the steps, it makes the sound Aah. The extra three stages will result in Ooh and MM. As a result, when you combine the sounds, it will sound like AUM.

This temple has thousands of carvings, and until now, no one has studied this one, yet what we have here is a visual representation of the sound AUM. These are AUM-representing sound bursts. And this is the world's oldest carving that visually depicts sound; you can see sound pictures on your computer today, but this was produced at least 800 years ago. Is this simply a theory? Absolutely not! Lord Shiva, according to ancient Tamil traditions, learns the mystery of AUM through his son Murugan. In the same sculpture, we see Shiva in a reverent position, acquiring the sound AUM from his son, who is shown as a small kid.

And this sculpture demonstrates something crucial: ancient architects were capable of advanced sound technology that we do not understand. They could see sound, and all of the circular designs in Hindu temples are visual representations of various sounds. Even now, such melodic steps cannot be created from stones.

Yet, ancient builders constructed a plethora of unusual stone items that produce a variety of noises.

It is thought that stone sculptors had their own stone science. They learned how to combine various stones to make pleasant melodies. Shilpa refers to the entire science.

Shastra is an old knowledge that has been lost to the globe over time. It's little surprise that, despite their efforts to analyse Hampi's musical pillars, the British were unable to discover the answer to this stone attribute.

The Agra mandapa has an adjoining square porch of 7metres (23ft) side it has ornately carved steps that go from east to west. The ballipithamn is located to the east, outside the main podium. It is unique in that it is made in the form of beautifully carved balustrade steps. They emit a musical note when walked or stepped on. As a result, they are known as the "singing steps."

present scenario

The steps in this 12th-century temple have been sectioned off after years of major damage caused by the large number of tourists who come to stroll on the stairs and listen to their music. All of the temples listed above are dedicated to Lord Shiva, one of Hinduism's most important deities who is associated with dance and music. This most likely explains the temples' strong presence of musical architecture.

It is worth noting that the temples mentioned are dedicated to Lord Shiva, one of Hinduism's most important deities, who is associated with dance and music, which could explain the strong presence of musical architecture in these temples.

Airavatesvara Temple is a Dravidian-style Hindu temple in the town of Darasuram, near Kumbakonam, in the South Indian state of Tamil Nadu. This temple, erected in the 12th century CE by Rajaraje Chislain, is a UNESCO World Heritage Site.

The temple's entrance contains musical stairs constructed of stones that generate seven different sounds when tapped. Each step emits a different tone of the musical scale when tapped. At some points, the full oven Swaras may be heard.

Modern example of Music X Architecture

Coca-Cola's Beatbox Pavilion

Cargo Guitar

Dithyrambalina's Music Box

Star Wars Barrle Organ

Court of Water Wall

The Singing Ringing Tree

Sea Organ

The Music Box Village

Underwater ORB Lights

Frozen Music: Music and Architecture in Vitruvius' De Architectura

Vitruvius examines how musical genres can be used to construct temple columns, how stone theatres can be made resonate like musical instruments, and how a catapult's cords can be set to a precise musical pitch. then examine how music is incorporated into theatres, machines, and architectural designs.

Similar to this, the bronze vessels—what the Greeks refer to as echea—that are contained beneath the seats in theatres are positioned using a mathematical theory based on their pitch. Another illustration would be that without using musical principles, it would be impossible to make water organs (hydraulics) and other similar devices.

According to Vitruvius, an architect can only fully comprehend design, spatiality, and proportionate measurement if they have had the right musical and mathematical instruction. He is sure to underline that each of these applications "recurs" on the rationes of musical theory.

In any case, Vitruvius was making the point that an understanding of music is essential to comprehending the processes that result in building and technology that is more in tune with nature and, thus, more attractive, practical, and helpful.

Architecture consists of ordering [ordinatione], which in Greek is called taxis [τάξις], and of design [dispositione]—the Greeks call this diathesis [διάθεσιν]—and shapeliness [eurythmia] and symmetry [symmetria] and correctness [decore] and allocation [distributione] which is called oikonomia [οἰκονομία] in Greek. Vitruvius has not invented these key terms; once again, he borrows from both Pythagoras and Aristoxenus. Five out of six of the terms are Greek, indicating that he has taken them from earlier Greek sources; Latin translations of these terms appear often in Roman philosophical discourses from other disciplines, such as rhetoric

Many of their proportions [symmetriai/συμμετρίαι] and organisations [taxeis/ τάξεις] are perceived as being foreign to perception, while only a small number are seen as conformable to it and able to be organised into the nature of rhythm. Because the rhythmizomenon is by definition capable of absorbing both types of structure, rhythmic [eurythmon/εὔρυθμον] and arrhythmic, it shares some characteristics with both rhythm and unrhythmicness.

Taxeis denotes the numerous potential arrangements and arrangements of rhythmic durations for Aristoxenus; Symmetria demonstrates the various potential combinations of various rhythmic and durational lengths, while Eurythmia depicts a rhythmic structure that has been aesthetically well-constructed.

Symmetria is the correspondence of well-proportioned individual modules to one another and to the whole; Eurythmia is the graceful assembly of well-proportioned pieces; and Diathesis is the variety of possible arrangements of individual components in a beautiful way. This comparison highlights the underlying parallels between music and architecture: Architecture involves a comparable division of volume and physical space to the way that composers arrange and split rhythmic impulses in temporal'space' to make music.

WORK AND PHILOSOPHY BY LANNIS-XENAKIS IN MUSIC AND ARCHITECTURE

INTRODUCTION

- Theorizations about the relationship between music and architecture are very certainly as old as the disciplines themselves. In general, they occur on two levels: intellectual and phenomenological. The first interpretation dates back to ancient Greek thinking and is associated with form and structure issues. The theory of "harmonic proportions" is the most complex paradigm here. This synthesis of rationalism and metaphysics reached a climax during the Renaissance, when several architects and composers attempted to sculpt architectural and musical form using the same numerical concepts. The expressive aspect of art is crucial in the second perspective, which derives from 18th century aesthetic relativism. Beauty is derived from the aesthetic effect of the work of art rather than its complicated structure.
- In both readings, the connection between music and architecture is based on the presence of a third element that serves as an intermediary between the two fields. Both facets of the music-architecture link can be found in the work of lannis Xenakis today (1922 2001). Xenakis has worked as both an architect and a composer, amassing a significant body of work in both professions. With his book

"MUSIQUEntricate structure of the work of art, but from its aesthetic effect," he also presents dealing with architectural ARCHITECTURE", forms, and music.

- Xenakis studied music and architecture from a scientific and quantitative standpoint in his early work. As a result, his musical compositions and physical work from this time period share formal notions and processes. Xenakis' approach has become more pragmatic in his later work, utilizing space to communicate the intricacy of the musical language and enhance the sensory sensation of sound. His grandiose concept for a "City of Music" in Paris represents the pinnacle of this growth. As a result, a transition from an abstract, intellectual relationship between music and architecture to a more sensual and practical approach to sound and space will be exposed.

USE OF NUMERICAL PROPORTION and new methods IN DESIGN

- Xenakis studied musical composition with the French composer Olivier Messiaen (1908-1992), as well as architecture with Le Corbusier. Rather of teaching his student traditional skills, Xenakis was urged to find musical inspiration in his Greek ancestry, engineering background, and work as an architect.
- He employed the first tool to rationally organize time, and the second to shape pitch envelopes and musical form. The Modular is a metric system developed by Le Corbusier in Western European culture in 1950 that is based on the Fibonacci series (1,2,3,5,8,13...) and the Golden Section. It was acclaimed as a way to solve any form challenge, not just in building, but in art in general.
- The iconic undulating glass panes' that cover the façade of the Monastery of La Tourette were designed using Xenakis' study into rhythmic patterns discovered by the Fibonacci sequence. Surprisingly, this well-known feature began as a cost-effective solution to a practical problem. Le Corbusier envisioned the convent's Western façade as a "windowed outer skin" to take advantage of the wonderful view of the valley. But the limited budget did not allow for costly huge glass panes.
- Le Corbusier and Xenakis also experiment with the distances between the concrete casings to give the façade an asymmetrical appearance in order to solve the problem of endless repetition of similar glass panes. To produce specific rhythmical motifs, Xenakis first experimented with permutations of a set of window panes of varying diameters. However, he soon discovered the limitations of the permutation strategy.

- Xenakis' composition technique tackled the problem on a more general level, above the individual pieces, by substituting the concept of rhythm with that of density (in the sense of number of events per time or length unit"). He now delineated zones in the façade rather than addressing the individual distance between the upright casings. As seen in the picture, Xenakis created a table containing progressions or rectangles with increasing widths taken from the Modular.
- Xenakis composed a triple-layered vertical polyphony, resulting in a comprehensive polyrhythmic exploration of light and shade (show in fig). Although each layer of the façade corresponding to a storey has a pretty simple construction in and of itself, the total visual composition is of significant intricacy here. While attempting to follow the development of the façade, the eye quickly begins to wander from story to story and becomes disoriented.

SPACE AND COMPOSITION PARAMETERS

- As stated in the introduction, architecture and music are not simply linked by mathematical principles; both arts are also concerned with space. Xenakis addresses this concept as both a composer and an architect. Given the importance of his musical activities, we shall focus on the role he assigns to the concept of space in musical composition and sound diffusion.
- Xenakis segmented spatial awareness and auditory attention via the dispersal of sound sources. As a result, space no longer serves as a passive link between music and architecture, but rather as an active element that creates new aural experiences and boosts musical expression. The idea of enveloping the listener in music introduces us to a key concept in Xenakis' approach to sound, notably the concept of immersion.
- Xenakis once said that concert hall designers should look to the great art of instrument making for inspiration. The shape of an acoustical instrument not only influences the quality of the sound, but it also affects its timbre and hence its identity. Xenakis feels that architectural form has a comparable effect on the feeling of a space. As a result, a concert hall is concerned with more than just acoustics and practicality; it can also serve as a catalyst or impediment to the development of novel aural experiences.

  Xenakis experiments with music in the open air, yet he understands that sound can only exist in enclosed space. Rather than material enclosures, his solutions should be viewed as'spatial envelopes' shaped according to the governed surfaces paradigm. Besides from structural properties and

aesthetic/symbolic appeal, such surfaces have good acoustic properties. Their continually changing curvature causes non-polarized reflection of sound waves, resulting in homogeneous sound diffusion. The music hall's asymmetrical form and parts are imagined as a bucket with a 'potatoid' plan, placed as an autonomous piece beneath the enormous concrete shell. While the floor of the hall is built of one-meter-wide cubes to provide for a variety of seating topographies, a spiral gangway encircles the space many times. Both architectural elements allow for a completely three-dimensional distribution of the audience, musicians, and technical equipment.

CONCLUSION

Architecture is a combination of many different art form, senses and things, so as sound and so good and proper arrangement of sound i.e music is also part of Architecture and one of the major part of architecture. Music and sound play an important role in our life belongingness and our mental and physical health we so much dependent on our hearing abilities more for a disable person hence an important part of barrier free architecture as well.

Any piece of architecture cannot be a good and human sufficient in every manner is it is not responsive to sound and acoustics. Music and architecture both belongs to the world of art.

However, art on its own can be classified into three categories.

1. Spatial arts, which consist of painting, sculpture and architecture.
2. Temporal art, which consist of music and narrative literature.
3. Spatial and temporal arts, which consist of dance and drama

Hence while music is perceived in time, architecture is perceived in space. While music structure time, architecture space. It is also obvious that the essential purposes of both are different. While architecture is an outcome of satisfying man's basic need for shelter, music came above as a communication medium, which stirs all the human feelings.

MUSIC'S DIRECT INPUT TO ARCHITECTURE.

The crystalline sound of pure and clear water running above rill stones, pierced by the bright rays of forest-filtered sun, could very well have been in Frank Lloyd Wright's mind when he constructed Kaufmann House. "A forest from the air is complicated and fascinating." A single tree is just as complicated. "A single leaf, or even a single atom, is eternally interesting." That is the way music should be." This statement by Brain Eno sounds eerily close to Le Corbusier's architectural ideas, who felt that the design of a whole town.

Iannis Xenakis was an architect and musician who, while working in Le Corbusier's office and being entirely responsible for several Le Corbusier projects, gave his expertise of music and his particular notation system in the service of the development of twentieth-century architecture. During his year with LE Corbusier, he demonstrated his aptitude with numbers, geometry, and proportions, and he contributed to the introduction of a high degree of rhythmic regularity to various Le Corbusier projects.

lannis Xenakis was primarily responsible for developing the mathematics for Le Corbusier's Modular series of proportions. At first glance, it appears to contradict Xenakis' pursuit of an immersive experience as well as his focus on the visual and architectural aspects of the listening space. His goal was to separate the auditory experience from the physical presence of the architecture, audience, instruments, and musicians.

Architects have used sound as a part of building since very ancient times and in many different forms and types of architecture, such as in Mughal architecture. Sound is a communicating source, but Mughals used it to communicate through buildings, such as echo, which is the most commonly used branch of sound. Not only in Mughal but also in Hindu architecture, two examples are the Vijaya Vithalla temple in Hampi and the Airateshwar temple in Tamilnadu.

The first scientific analysis into the acoustic qualities of the musical columns in the pillars of the mahamandapam of the Vitthala Temple in Hampi, India, The research focused on the 11 most prominent pillars, which are widely known to produce the sounds of various Indian musical instruments. And the Airateshwar temple, which has 10 steps of sounding like auh hu mm and 7 musical notes.

On the musical columns of the pillars, nondestructive procedures such as low frequency ultrasonic testing, impact echo testing, and in situ metallography were used. The microstructure of the pillars was shown by in-situ metallography to be identical to that of a typical granite microstructure. The testing of low frequency ultrasonic and impact echo confirmed that all of the musical columns are solid shafts. Furthermore, ultrasonic velocity was discovered to be nearly uniform in all of the good pillars. The velocity in the damaged pillars is found to be significantly lower than in the good pillars. The frequency of the sound produced by the musical columns could be well associated with the calculated flexural resonance frequencies based on the height and diameter of the columns, as well as the velocity of the sound waves in the columns.

We don't have enough knowledge to recreate these sound producing members, and the knowledge that was left behind was burned in libraries centuries ago, so we can't recreate it. However, we do have technology and the knowledge to use it, so the use of technology is essential for sound control and production. In conclusion, music is liquid architecture if architecture is frozen music. When comparing music and architecture, one should

not consider how one will affect the other, but rather what can be learned from one and how to apply it to thinking about the other. My experience as an Architecture student has taught me to understand, appreciate and pay attention to intricacies in every design that some people might not see.

Reference

- Frozen Music: Music and Architecture in Vitruvius' De Architectura by Vitruvius
- I call Architecture Frozen by Johann Wolfgang Von Goethe
- ARCHITECTUR E AS FROZEN MUSIC, Mescalero Apache Cultural Arts Center by Abelardo Natividad
- https://medium.com/@theodoraiboi/architecture-as-frozen-music-352d5307bc94
- https://en.wikipedia.org/wiki/Airavatesvara_Temple
- https://pubs.aip.org/asa/jasa/article/124/2/911/841865/Nondestructive-characterization-of-musical-pillars
- https://earthlymission.com/mysterious-musical-pillars-vittala-temple-hampi-india-music/