

Resonant Form: The Convergence of Sound and Space

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"Listen! Interiors are like large instruments, collecting sound, amplifying it, trasmitting it elsewhere." – Peter Zumthor

Human spatial perception is a sensual experience of the world we inhabit. While we experience architecture through all of our senses by varying degrees, the process of design has long preferenced the visual at the expense of other modes of perception. This body of research and proposed design methodology aims to focus on acoustic aesthetics to create spaces which manifest sonic phenomenon that not only elicit psychological responses for inhabitants but also induce shifts in brain states toward meditative and/or mystical experience. As humans are sonic instruments themselves through use of our hearing and vocal range, the engagement of our sonic qualities within a sensitively designed aural architecture creates the potential for a truly transcendent and immaterial experience. It is in this way that this design proposal strives to enlist the resonant natures of architectural forms to deeply engage and expand the sensory awareness of human spatial perception.

I. EXTENDED ABSTRACT

I.1. BACKGROUND

Inspired by powerful sonic phenomenon manifest in architecture found around the world and specifically at the Hypogeum Hal Saflieni in Malta, this design proposal acts as a speculative exploration into the creation of aural architecture. The findings of neuroscientific research show that sonic phenomenon created by the resonant chamber of the Oracle Room in the aforementioned Hypogeum act to induce shifts in the human brain through sensory expansion (Cook, 2008). Such shifts toward meditative or trance states are a powerful effect of the influence of sound on the brain and body. Just as the captives in Plato's cave, our sensory perception defines the limits of how we understand ultimate reality. If architecture can act as a tool to extend such limits of perception, so to may it enable an extension of our understandings of the world around us. Architects have a critical role in the creation of future spaces which leverage this sonic ability to expand human sensory perception, and by proxy create spaces fine-tuned for contemporary enlightenment.

I.2. METHODOLOGY / PROCEDURE

Just as Plato sought to discover the generative forces of the universe through mathematical rationalism (Platonic Solids), this project searches for generative processes hidden within the mathematical formulae which define nature. Rather than seeking purely geometric ideals though, this work mines the blueprints of creation through physics, specifically cymatics – a subset of modal vibration phenomenon. Through the creation of an algorithm which maps the motion of sonic frequencies, the designer is able to use sound as a generative force within the design process. The resulting 3 dimensional formal arrangements, or Nodal Structures, each represent a particular frequency mapped in space. Through this design process, the designer is enabled to use sound as inspiration not only in the poetic sense, but also through literal means as form-giver.

By applying the lessons behind various sonic precedents including the Hypogeum Hal Saflieni, the designer seeks to create spaces which are hyper resonant to particular frequencies. Through a choreographed series of sonic experiences composed of disruptive sonic input along with patterning forces such as entrainment, the designer could formulate spaces intended to shift brain states to specifically predetermined patterns. (Crowe, 2004) Such a tunable space would open the doors to potentially powerful sonic effects on human cognition and sensory perception.

I.3. CONTINUED TESTING

Since exploring such a generative design process, the designer continues working toward methods of acoustic testing and verification by which to drive further innovation and development. Through advanced 3D modeling processes and algorithmic design, the designer continues to probe the potential effectiveness of various spatial arrangements to manipulate resonance and reverberation. Examples of ray tracing processes explore the movement of sound within the generated forms while mathematical measurements of scale and dimension inform the potential resonant frequencies based on wavelength calculations. All of these are checked against frequencies which exhibit manipulative effects in the realms of sensation, perception, emotion, and affect; all toward the aim of creating formal arrangements which act as instruments for altered mental states.

2. IMPLICATIONS FOR FUTURE WORK

While this body of research and design currently remains in the realm of proposition and experimentation, the exploration acts to exhibit how lessons learned through cross-disciplinary research might be applied into the built environment. Potential programmatic uses for such architectural spaces would include sensory laboratories, sonic therapy chambers, sonic exploratoria, use in theater design, church/sacred spaces, and even urban follies offering a sonic oasis from a disastrous urban soundscape. The built results of such research may someday offer the opportunity for further acoustic testing. Such a focus on the power of sound to effect brain states could offer exciting new insight into the role of architecture in creating healthy spaces; or taken to its furthest extents, create tools for meditative experience and instruments for expanded sonic perception.

3. REFERENCES

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4. AUTHOR BIO

Shea Trahan holds degrees in architecture from both the University of Louisiana at Lafayette and Tulane University. His graduate research combined interests in sensory neuroscience, architectural acoustics, and algorithmic design. Shea's architectural process focuses heavily on the experiential interaction between architecture and the senses, most notably hearing. His award-winning explorations into algorithmic design and 3D printing have been featured at the New Orleans Museum of Art. He has spoken on the topic of sonic architecture as part of the ULL Art/Tech Fusion Conference as well as a 2015 TEDx talk.

Shea is a project manager at the New Orleans based firm of TrapolinPeer Architects where he focuses on the design of theater projects along with cultural/museum designs. Most of his projects also incorporate adaptive reuse of historic buildings allowing for a fusion of contemporary design within historic contexts. In addition to architecture, Shea maintains a modestly respectable vinyl record collection and has a lifelong passion for both analogue and digital photography.