Spaces That Perform Themselves

Multisensory Kinetic Environment for Sonic-Spatial Composition

ABSTRACT
Building on the understanding of music and architecture as creators of spatial experience, this paper presents a novel way of unfolding music’s spatial qualities in the physical world. Spaces That Perform Themselves arose as an innovative response to the current relationship between sound and space, where we build static spaces to contain dynamic sounds. What if we change the static parameter of spaces and start building dynamic spaces to contain dynamic sounds?

This project combines architectural theories with musical mastery and computation to create an environment as kinetically undulant and emotionally varied as music itself. To achieve this, a multisensory kinetic room is built in order to augment our sonic perception through a cross-modal spatial choreography that combines sound, spatial movement, light, color and vibration. By breaking down boundaries between disciplines, the possibilities of a new type of architectural typology that morphs responsively with a musical piece can be explored. As a result, spatial and musical composition can exist as one synchronous entity.

Spaces That Perform Themselves seeks to contribute a novel perspective to the discourse on leveraging today’s technology to provide a setting to enrich and augment the way we relate with the built environment. This project’s objective is to enhance our perception and challenge models of thinking by presenting a post-humanistic phenomenological encounter of the world.
INTRODUCTION

Spatial experience has many layers of meaning given by motion and guided by time. The distinct character of a space emerges within the interaction between that space and one or more individuals. This interaction immediately transforms four walls into a dynamic container of a narrative that people can engage with. This concept can also be related to established concepts within music. To describe music, both musicians and researchers use architectural and spatial vocabulary; because music unfolds over time it is frequently equated with architecture. Music indeed has kinetic and gestural spatial qualities that are performed in time and are determined by a listener. Furthermore, music’s relationship with one or more individuals is what gives meaning and sense to its innate form and sonic structure; it builds an enveloping experience in time, making music a simultaneous space creator.

The study of the relationship between sound and space, or music and architecture, has been fundamental to the opening of new explorations towards the expansion and merger of both fields. In the second half of the 20th century, many creators explored this in experimental ways. Contributions such as Stockhausen’s sound spatialization, François Bayle’s Acousmonium, IRCAM’s research towards artistic creation with scientific and technological innovation, La Monte Young and Marian Zazeela’s Dream House, and Bernhard Leitner’s sound architectures, to name a few, revealed expressiveness and malleable capacities of spatial sonic experience. Many of these creations—for example Le Corbusier’s Philips Pavilion or Xenakis’ Polytopes—were supported by moving image projections and/or sound-reactive light installations. Despite these additions, the buildings containing the experiences remained static: heavy concrete structures unchanged by sound and unable to move or morph. Today we have the technological means to push this further.

Cedric Price’s Fun Palace proposed a cybernetic architectural system that could adapt to varying necessities of individuals and its context. Today this vision is no longer considered to be a utopia; the work of researchers like Behnaz Farahi et al. (2013), Ruairí Glynn (2014), Skylar Tibbits (2016) and Michael Fox (2016) have opened new possibilities to augment the interaction between humans and dynamic forms of the built environment.

Spaces That Perform Themselves (STPT) continues and extends the discussion from a sonic-spatial perspective. It poses the question: how does a kinetic architectural system change the way we think about and perceive sound? This project’s objective is to create a new relationship between sound and space. Currently, we generally build static spaces to contain dynamic sounds, but what if we start building dynamic spaces to contain dynamic sounds? By integrating kinetic behavior as part of the performance of a space, one is able to give life to a container that morphs along with a musical piece; bringing to life a completely new aesthetic form of expression, creating a new field of exploration combining architecture, art, music, science, technology and philosophy.

This paper seeks to present an architectural typology that re-configures itself and presents a multi-sensory scenario to perceive sound. STPT is a project that will allow music to give shape to a dynamic room that is both alive and in constant flux: it moves, changes its geometry and size, breathes, feels and responds. This room will take the shape of a cube that can host one individual at a time, presenting an intimate and personal experience.

METHODS

Body

STPT is the creation and study of the expressive and relational capacities of a multisensory environment. Through digital mapping, musical input will power the reconfiguration and spatial organization of a small room. By creating the perception of a single space that morphs along a progression of situations, this room will have the ability to become many rooms within the same structure. A synchronous choreography of sound, motion, vibration, light and color will shape this perceptual experience, confounding the senses and giving the possibility of inducing different mental states. Furthermore, finely tuned reactions will be possible by embedding sensors within the environment.
The body of the room takes shape in a cube, one of the most essential expressions of an enclosed architectural space. This gives a pure and clean geometry as the initial state. In order to have a controlled environment, the cube is meant to host a personal and intimate experience; this is why it was decided to have a very small room, confining it into a 6’ x 6’ footprint. The cube is hung from the ceiling, avoiding doors and other interstitial elements. This action also highlights the cube in its context.

The suspended cube features 5 distinct faces, with an opening beneath to allow a person to enter within the suspended space. The five faces of the cube feature a mechanical system of rack and pinion, which engages acrylic rods to actuate flexible fabric walls. These walls will adopt different shapes and positions, creating a malleable room. Every wall contains 9 stepper motors to actuate the system. To achieve a fully functional and stable system, the motors are conceived and designed as individual modules. Each control board has an ATtiny84 microcontroller and receives information via I2C bus communication.

Expression
In order to deliver a compelling experience, the cube requires the capability of being expressive to communicate, connect and engage. The musical parameters are carefully mapped to the electronic elements of the system. This opens an extensive exploration of cross-modal perception, ranging from sound and color perception, light awareness to vibrations, acoustics and space modulation.

In the exploration of spatial experience and its relationship to the phenomenon of sound, it is imperative to understand how sound and space are linked; as we generally experience on earth, there is no space without sound and there is no sound without space. The main effect of the composition is to create a unified understanding of sound and space. The sound will change when the structure of the cube changes, and also the other way around, as the space will change along with the sounds. For example, if the space is small and intimate, the sound will be small and intimate: the walls will only “whisper.” However, if the space grows to its maximum size, the size of the room will change sonically, unfolding into resounding reverberations relaying the feeling of being transported to the inside of a cathedral. Through these mappings and distinct undulations, STPT reveals an electroacoustic interaction that takes one through different sonic scenarios.

The choreographic abilities of this environment are key to creating a cohesive composition capable of building a personality.
This is a tool to empower the sonic-spatial composer to create a piece of unified sensory modalities. Thus, it is in the composer’s hand to designate a balance between every single element. This tool will likely expand the thought process surrounding musical composition, expanding concepts to light, movement, and vibratory and electroacoustic composition. Through this methodology, a new compositional experimental model emerges, one where no element comes first, and everything is created together in a synchronous way. By doing this, it is possible to create different effects, emotions and as in the Dream Machines, achieve varying mental states through calibrating particular frequencies of light and sound.

How can an expressive environment like this effect and change the way we compose music, spaces, and aesthetic experiences? How can the personality of this environment change the way we interact with and understand spaces?

RESULTS
Relationship
Every experience is the result of a cumulative phenomenological encounter with the world, in which perception plays a key role. Through perception, human beings are able to understand and represent our environment. In other words, our bodies mediate the experience of being in the world. This characteristic of perception allows us to simultaneously interact with objects in space and individuals within them. This is supported by Merleau-Ponty’s and Bergson’s theories of how the world makes sense through experience and our embodied existence in time.

This room allows us to compose a mind-expanding and field-augmenting choreography of music and architecture. As a result, new possibilities are triggered, challenging systems of thinking, making us aware of our bodies in an emotional relationship with space, sound and time. Juhani Pallasmaa (2012) suggests the concept of Architecture of the Senses, and writes about the importance of cross-modal experience exploration in order to engage new sensorial and emotional possibilities of human-spatial perception, communication and interaction. This idea promotes the creation of further unusual, unconventional and awe-inspiring environments with the capacity to bring life to spaces through which we can establish a dialectic relationship. The cube is an Actant as Bruno Latour (2004) would say, or an enhanced body of Vibrant Matter, referencing Jane Bennett’s (2010) vital materialistic theories.

Although earlier prototypes were smaller than the cube (e.g., a small 1’ x 2’ cube for head only or one 4’ x 4’ wall), over 50 people tried the immersive experience and gave feedback that was incorporated in the current design. Statements from participants included quotes such as: “although I haven’t gone anywhere, I feel transported” and “the space makes the music feel extremely tangible.” Once the cube is completed, a more intensive study will be conducted to evaluate the impact of the design with participants ranging from various backgrounds and interests, architects and composers among them. The evaluation will consist of having people experiencing the multisensory composition and then giving feedback through a questionnaire.
CONCLUSION

STPT provides a creative modality to explore cross-modal perception in the context of sound perception augmentation by manipulating sound, movement, light, color and vibrations; essentially creating an inclusive and diversified language of music.

The most recent prototype will further research an understanding of individual experiences within a multisensory kinetic environment, as well as design aspects imperative to the project. Analysis gained from this phase will provide insight to later editions of the project, elevating the scale to a size capable of hosting larger groups of people.

Technology and computer-aided design are changing the landscape and creating new ways to relate to the built environment. In this case, they instate the foundation of a new experimental compositional model that expands aesthetic expression in the field of music and architecture. This level of sensory unification changes how we think about sound, its relationship to space, new aesthetic forms, and the expansion of knowledge and its production towards an anti-disciplinary perspective.

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NOTES

1. “Creating spaces with the vocabulary of sound introduces new forms of expression - the potential for a fundamentally new experience. It is above all the intensity, the rhythm, the speed of the moving sound and their interrelated variations that determine the shape of a space. As an event in time, a sound-shaped space has such psycho-physiological dimensions as pulling, stretching, guiding, bouncing, etc., depending on how sound is organized between the loudspeakers” (Leitner 1978, 15).

2. In this case, a static space is considered to be any architectural space that is perceived as passive and immutable, one that does not have a programmable body, organic components or computer-aided structures with the capacity of physically changing over a short period of time. In contrast, dynamic spaces are considered to be kinetic architectural systems that can reconfigure the organization, geometry, or dimensions of a room or a building.

3. “ACTOR, ACTANT: Actant is a term from semiotics covering both humans and nonhumans; an actor is any entity that modifies another entity in a trial; of actors it can only be said that they act; their competence is deduced from their performances; the action, in turn, is always recorded in the course of a trial and by an experimental protocol, elementary or not” (Latour 2004, 237).

REFERENCES


**IMAGE CREDITS**

All drawings and images by the authors.

**Nicole L’Huillier** Interdisciplinary artist, musician and architect from Santiago, Chile. Currently based in Boston as a PhD researcher at the MIT Media Lab, Opera of the Future group. She works at the intersection of art, music, architecture, science and technology in order to create multi-sensory immersive environments, to open questions about possible futures, redefine how we perceive our world, and most importantly: trigger connection and empathy between human and non-human agents. She is also a drummer, experimental musician and one half of the space pop duo Breaking Forms.

**Tod Machover** Composer and Inventor, and Muriel R. Cooper Professor of Music and Media at the MIT Media Lab, where he also directs the Opera of the Future Group. He is known for numerous innovations in music and technology, including Hyperinstruments and Hyperscore. His compositions have been celebrated worldwide and have received numerous prizes and awards such as the Chevalier des Arts et Lettres from the French Culture Ministry, the Composer of the Year 2016 citation from Musical America, and a 2017 Emmy for the TV documentary on his Symphony in D, the latest in a series of worldwide collaborative City Symphonies.