The *Performity* of Space - Architecture as the Production of Sound and Light

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Music is not a language. Every musical piece is like a complex rock formed with ridges and designs engraved within and without, that can be interpreted in a thousand different ways without a single one being the best or the most true. By virtue of this multiple exegesis, music inspires all sorts of fantastic imaginings, like a crystal catalyst. I, myself, wanted to deal with the abysses that surround us and among which we live. The most formidable are those of our own destiny, of life and death, of visible and invisible universes. The signs that convey these abysses to us are made up of lights and sounds that provoke our two predominate senses. This is why I have conceived the Diatope as a place for the condensation of these signs and signals from our various worlds. Rational knowledge blends with intuitive knowledge, or revelation. It is impossible to dissociate them. These abysses are unknowable; that is to say, knowledge of them is an eternal and desperate search, composed of milestones or hypotheses that have marked our various epochs.¹

- Iannis Xenakis

The limits of architectural space are set by the physical constraints of containment and are, more often than not, defined by the dimensional register of a visually perceived and conventionally accepted system of measurement and representation. The proposition rests in the assertion that aural perception is a more intuitive and natural means by which we both perceive and occupy spatial constructs. In an appreciation of the both conscious and unconscious recognition of distance and dimension, volume and proportion, and material resonance, it is the aural which critically identifies the emotive qualities of architecture in its expanse and in its intimacies. Material resonance, responding to the choreographic movement through space, complete with moments of pause and the frictions of engagement with others, is registered though aural cognition. Sound, or rather acoustics, must be a fundamental principle of design conception and development of an architectural idea. The music of architecture is evident in its articulate resolution.

The position is critical to a larger body of work that considers architecture as a performing art, not a fine art, in that understanding of its composition and intent is a continually evolving and eroding condition as perceived through the tenancy and occupancy of its use. The thesis is not only a pedagogical principle of teaching, but is set as a condition for an inclusive and responsible theory to be incorporated in practice.

The discussion here is situated in the context of the work initiated by Iannis Xenakis as foundational to architectural composition in investigating materiality, visual tactility, and aurality as vital components in the imagining, bounding, and containment of space. Xenakis is the threshold of departure for consideration of spatiality in its resolution and form, but also in its occupation, tenancy, and use. The temporality of experience is permanent in its mimetic register. Large scale—or more appropriately, architectural scale—instruments propose to change the relationship between the musician and the instrument; no longer a prosthetic or an extension of the body, the instrument contains both performer and listener. The insistence on the acuity of perceptions in the compositions and constructions of Xenakis brings to bear a richer set of opportunities to take pleasure in the intelligence and emotions of the spaces in which we dwell. Xenakis sets a model not only for integrated practice, but also a model for an integrated pedagogy within the academy as projective and speculative research seeking to define space through its instrumentality and its performity.
To build anew with unprecedented invention and innovation is the challenge to the performer and to the architect. If the arts are the clearest expression of a culture, the buildings to house and to host them must speak with a strong and articulate voice; yet, they must exercise restraint in the invitation to accommodate the unexpected.

Often lacking the precision, the grace, and the passion of a dancer, we sculpt space as we move through it with energy and with pause. Architecture and music are temporal arts.

Today we share a space, not the space of this room, but a space of ideas … recognizing that the necessity of cities is the necessity of the space in which to exchange ideas …

spaces of intimacy
spaces of gathering and of congregation
spaces of solace and refuge
spaces of confrontation
these, then, are the fragments of our conversation

Xenakis as artist was not limited to media or disciplines but sought with the reasoning of synthesis and the combinatorial practice of an exemplary architect to engage, to explore, and to interrogate the full range of human experience. Xenakis set a challenge to contemporary and future practice and research to demonstrate the innovation, invention, and unprecedented in the evolution of creative expression and in the making of architectures, unfamiliar, but resonant with the understandings of myth and of history and made possible through the rigorous use of technologies and the craft of making.

The following is a description of a current graduate studio offering at the University of Toronto, a studio cross-listed by the Faculty of Architecture, Landscape and Design and the Faculty of Applied Science and Engineering. It is my hope that Iannis Xenakis would have endorsed the venture as an exemplar of integrated disciplines – not inter-disciplinary, cross-disciplinary, trans-disciplinary or multi-disciplinary, but integrated. Music is the common ground in which the all-too-often separated disciplines of architecture and engineering engage; no, common is not ap-
propriate, rather it is the foreign ground, the territory of unfamiliarity which permits both the palpability and ephemerality of sound and of light to be the substances of discourse. It is the vibration and oscillation of our constructed and occupied world that allows us to both build and to appreciate the results of our efforts. For the engineer, structure has become the dynamics of form in understanding the physics of construction and of making and its vibration determines material performance; for the architect, it is the dynamics of the occupation of the spaces we create—we test the limits of their containment and are immersed in the emotive qualities of optical perception and of aurality.

The inspiration for the studio comes from the conviction that a unique expression in built form emerges from the fully collaborative relationship between an architect and an engineer. The resultant work arises from a convergence of concerns beyond style, from the spatial to the perceptual, and the material to the structural. The collaborative nature of the studio reflects a model of practice, which has produced some of the most grounded and most speculative work in the last decade. Notable projects include the Glass Pavilion at the Toledo Museum of Art/SANAA (Sejima/Nishizawa, Guy Nordensen, and Front Inc.) and China Central Television Headquarts (CCTV), Beijing (OMA/Rem Koolhaus, Arup/Cecil Balmond, and Front Inc.). The critical link in both cases being Front Inc., a firm of architects and engineers whose current work is focused on integrated disciplines in the design of building facades and envelopes with an expertise in glass and fabrication. The future of the practice will, I trust, include sound, acoustics, and aurality in dialogue with current developmental research in optics and light.

The project for this term is a new venue for the Music Gallery in Toronto as a renovation to the Church of St George the Martyr encompassing an insertion into the existing sanctuary, considering the space of performance as an instrument unto itself, and development of a structure to facilitate expanded use of the exterior courtyard. Materials are to be selected for their visual, aural, and tactile acuity with the precision and clarity of an instrument maker seeking to find the “voice” within a piece of wood, carefully selected for its weight, its color, and its feel. The work will include full-scale investigations and testing of materials.

2 http://www.musicgallery.org/
Renzo Piano, in describing his stage setting for *Prometeo*, an opera by Luigi Nono, presented in Venice in 1983 and Milan in 1984, a set which journeyed like the Ark from one city to the other, not on the waves of the sea but on the waves of its sound, stopping to rest in the space of performance, stated:

"The music in *Il Prometeo* is not projected into perspective, over the heads of the audience, but instead inundates the audience, which becomes truly immersed in the performance."

As a means of facilitating initiating work, the studio examines the range of possibilities in developing a new facility for the Music Gallery in Toronto and includes attending a range of music workshops and performances, supplemented by seminars with guests from the New Music community. The studio will not necessarily produce a series of proposals for complete buildings, but will use the thematic of “sound” to research and investigate capacities of space to accommodate the certainties, uncertainties, and the indeterminacies of program. Spaces of rehearsal, spaces of performance, spaces of recording, spaces of conversation, spaces of intimacy, and spaces of congregation … all can be found within the scope of the studio. Natural acoustics and electroacoustics are to be considered as essential to the architectural vocabulary of making and enclosure. The visual remains a paramount concern and the manipulation of light, both natural and artificial—as it projects, absorbs, refracts, reflects, and filters—in search of emotive qualities. Recording the traces of movement and moments of pause and stasis is critical to speculation and to the formation of ideas. The sanctuary is to be site of an instrument/venue to accommodate up to 120 people, the church courtyard is to be modified for outdoor performance; the opportunity exists to expand to adjacent vacant properties: a parking lot to the north, another to the east and the Grange Park. Base drawings are provided of the existing building; photographs and models are the responsibility of the studio.

architecture is not frozen music
at its best, it is not unlike a score
spare and precise

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an invitation to improvise
for with each rendition, the piece is altered
in annunciation and its inflection
in the space between notes

In referencing cinema in “The Work of Art in the Age of Mechanical Reproduction,” Walter Benjamin speaks of new modes of perception based on spatial expansion and contraction as well as temporal compression and extension; music and sound have engaged these issues. Architecture must embrace its experiential qualities, not through derivative compositional analogies, but through transformative speculation and experimentation to discover the performity of space.

I am an engineer. Often people will call me an ‘architect engineer’ as a compliment. It is meant to signify a quality of engineer who is more imaginative and design-oriented than a normal engineer. This is because in the minds of the public and other professionals, the engineer is associated with unimaginative dull solutions. If people find an engineer making original designs, designs which only an engineer can make, they feel the need to grant him or her a higher accolade, hence ‘architect engineer’. It is not that I object to being called an architect engineer. Occasionally it may even be appropriate, but mostly it is not because there is a fundamental difference between the work and the way of working of an engineer and that of an architect or designer.

I would distinguish the difference between the engineer and the architect by saying the architect’s response is primarily creative, whereas the engineer’s is essentially inventive.

If architectural composition is the creative synthesis of programmatic logic, it requires the craftsman’s sensibility of materials and details. The poetic concerns for color, light, and texture choreographed in spatial sensibilities of sensual delight reside in the eloquence of built form. To imagine necessitates the aspiration to build. Architects must build with the understanding of the body of the project … the skeleton, the musculature,

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the tendons and ligaments, the flesh and the skin, let alone the veils of revealing and concealing in the garments that clothe.

Building is an act of argument and debate, not resignation and compromise. The critical exchange between architect and structural engineer is the first of these discussions.

The essential elements and forms of classical architecture were derived from the capacity of a material to perform, and in turn, from the manner in which humanity could shape and fabricate. Joseph Rykwert suggests that the flutes of a column originate in the shaping of a log with an adz, but is then its resolution in stone mimetic reference or aesthetic conceit?

In setting the early direction for the Bauhaus, Walter Gropius turned from Peter Behren’s use of industrial design and modern materials to craft methods and traditional materials. Both Mies van der Rohe and Le Corbusier used structure to accentuate aloofness in the lifting and separation of the building from its surroundings; the space of architecture was no longer the space of the earth, striving for a purity of both form and idea. Le Corbusier and Xenakis at Le Couvent de La Tourette gave a concrete material appearance to abstract religious ideas. There are many ways to think and many ways to build.

What promise is then held by not only the aspiration and the invention, but in the act of making … to build … is indeed the question.

The space of performance is to be considered as another instrument in the orchestra; an instrument that can accommodate its colleagues—to amplify, quantify, and to modify their voices.

Whether sited in a verdant landscape, an urban square, a floating barge, or a “host” building, it shares the stage with the other instruments for the duration of the performance. It must, of necessity, sit above the ground plane to allow for a space of entry and detachment beneath and for the possibility of the installation of acoustic and electronic devices.

The space is to be played by musician and audience, performer and listener, for both visual and aural response. The instrument of the venue is reflector, absorber, refractor, and projector of light and of sound.

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The space of containment is determined by issues of *performity*, not by conventional wisdom of building science and structure or modes of enclosure and climatic control.

The venue, if only by virtue of size, is the ark and the vessel. The amphora, lost long ago on the ocean floor, has been lifted from its archaeological past and has been opened; like a shofar, it calls for our attention and seeks to engage the audience in moments of reflection and contemplation. This, then, is the place and the space of music.

Yes, this, then, is the place and the space of music.

The piece will be driven by acoustic considerations and have the flexibility to be tuned for different performances. It must also provide accommodation for the integration of electronic amplification, generation, and modulation of sound when required and have provision for the integration of light, including “cinematic” projection and/or composition for specific use.

One possible response is an opportunity to further develop large scale architectural instruments furthering the work commenced with the development of the *Stredici*, a long stringed instrument challenging the relationship of the musician to the tradition of an instrument as prosthetic or a device which can be embraced by the musician. Now, the instrument is of a size and scope to engage the musician on an architectural scale in that the vessel can accommodate and contain the player(s). It is the first in a series of proposed innovations in the design and construction of instruments and spaces of aurality and the production of sound. The *Stredici* was commissioned by *tranSpectra*, a collective of artists using an alternative tuning system, the Bohlen-Pierce Scale. Bohlen Pierce is a harmonic, non-octave scale; its thirteenth-tone steps fill the framework of the twelfth (3:1). It is meant to permit the creation and performance of harmonic music in tonal relationships that are different from traditional scales. The scale can be derived from a purely mathematical approach in keeping with the work of Pythagoras. The instrument, as currently constructed, is a first phase prototype. The *Stredici* premiered at the Open Ears Festival in Kitchener Waterloo in April of 2009; it was short-listed for the Guthman Musical Instrument Competition at Georgia Tech in Atlanta in late February 2010 and was the only acoustic instrument in the competition, and
has been in concert performances in Boston at the Bohlen-Pierce Festival of Boston Microtonal Society in March 2010. The current version is a first phase prototype and is tuned to three “tritives” or thirteenth-note ranges of the Bohlen-Pierce scale. Other tunings are being investigated, materials are being selected for improved performance, custom strings are being made, and consideration is being given to the inclusion of interior drone strings, and to the percussive potential of the vessel. A beta version, again between four and five meters in length, is in development with more traditional tuning and should be completed in June 2012.

Figure 1 Interior of the Stredici (Photo: author)

A second instrument under consideration is a five meter diameter drum with complex differential tonalities achieved through the irregular polygonal tiling of the skin to be played by a percussion ensemble, with the fine tuning of the stretched skin to be facilitated by the choreographed movement of dancer(s) across its surface. Drawings and modeling are complete, construction awaits funding…
Dancing is specifically an assault upon space, an assault of love, a similar assault to that of the carver upon his stone … ballet [dance] is the most spectacular mode of assaulting space.

It is noticeable that not only were these fantasies provoked by sound but contain in them the projection of a great deal of noise. Even the scenes of my early childhood sustained their life through music, the circulation of traffic. Where there is movement there is noise, and from the noise we fashion images of movement.

In our urban life, sound qualifies visually scenes which otherwise are confusing and meaningless to the eye. What the eye alone might perceive is inhuman to a degree. The arts today concerned with interrelationship of sound and movement, particularly ballet, are able to draw upon a wealth of life-giving fantasy which in one form or another is common to millions.

An electro-acoustic installation, the *Space of Sound*, proposed as a gallery installation, is conceived as a fifteen foot (five meter) nine-square grid as a “microphone” of piezoelectric fabric laminated to plywood panels to create a “floating” floor and a corresponding “floating” ceiling as speaker of piezoelectric fabric on aircraft plywood; both surfaces’ independence from the gallery is enhanced by concealed lighting. The “microphone” picks up audible and sub-audible frequencies of vibration and sound and project them back into the space of generative origin. Feedback control and an audio loop create an envelopment in the aural texture and palpability of spatial containment. Initial experiments are underway and are promising. The ambition is a truly interactive and enhanced experience, not one mediated by actuators of a pre-determined or programmed set of sounds.

A third proposed instrument is a for a large scale landscape installation, the *Aeolian Forest*, a “planting” of 156 five-meter tall flutes to be played by the winds: a constructed landscape to be navigated. The release holes of the flutes are located at ear level and will create a layer or variable datum, a “sea of sound”. Detailed drawings and scale mockups are

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proceeding, investigating several different materials with the intention of producing a scale prototype of several flutes. There are multiple references to landscape traditions in Japanese garden design and the development of pipe organs particularly in the German Baroque. The *Aeolian Forest* is a critical link to a speculative landscape project entitled, the *Alchemist’s Garden*, an extensive collection of drawings, models, and cinematic compositions exploring mythical, historical, and projective relationships to landscape through sixteen sculptural installations of alchemical instruments as enabling mechanisms to measure and to reference and to transform the experience of a constantly changing and evolving world.

**Figure 2** Aeolian Forest, with dancers Helen Cox and Daniel Lieberman  
(Photo: Jesse Colin Jackson)

Forests beckon and seduce with promises of verdant pleasures. They are also dark and foreboding, and yet we are continually drawn to an imagined, if not real, sense of nature. To listen, listen carefully, and listen intently. How is it that we understand dimension and appreciate the limits and containment of space as we choreograph movement through the city. The garden shares in the whispers of the winds in the Aeolian Forest of flutes and saplings. The incorporation of the aural in furthering the experiential manifests itself in current projects from small-scale building to large-scale urban design and landscapes in seeking to understand space not as public or private but in its nuanced tenancy as the spaces of the City. To walk in the garden of sounds, to share the stories and experiences of those who have gone before us is the provocation and the challenge.
Further work is underway on a new digital and physical modeling of an operable acoustic ceiling in which the containment and configuration of the space participates as an instrument in the orchestra or performance and is a contributing factor in the nature of occupancy and use of the space. The work includes digital fabrications, responsive systems and controls interface, and materials research.

The work in my studio at the University is work in its infancy of the explorations inspired by Xenakis. His text, co-authored with Sharon Kanach, Music and Architecture, is required reading, and listening to the music and watching performances of Xenakis are the thresholds of departure for the studio—this is Xenakis: Past, Present, and—most importantly—an extraordinary Future.

Contemporary practice and compositional form no longer are of necessity evolved in relationship to site and are often situated in what is perhaps more appropriately described as virtual landscape. As form evolves in the shifting territories of an ephemeral ether, architecture becomes an experiment in identifying parameters in terms of spatial dimension and quality through drawing and through digital scripting in order to understand both aural and visual performity. Space and an understanding of one’s perception of place within it need not be defined by the boundaries of physical containment.

Issues of perceptual acuity and relational perceptions set the limits of territory and have begun to suggest possible occupations. Arguably, the intensity of visual and aural information destabilizes and defamiliarizes the observer, the listener and the viewer, setting forth the need for a new set of conditions to establish a sense of location and questioning the need for grounding. The fluidity or variability of context becomes apparent in the “sea of sound.”

Architecture needs to define or set the limits of its capacity for accommodation of tenancy and program. An architecture based on the clarity of observation and the specificity of perception may, in fact, permit the development of a new and unpredicted manifestation as the containment of space and of desire.

8 Xenakis. Music and Architecture, op.cit.
Architecture that arises from consideration of the aural in its initial conception will produce not only a clearer understanding of space, but will allow for an exploration of the materiality and tectonic invention by which the space is bound.

Musical expression invites improvisation; the score is never played the same way twice in its constant variations on a theme and in its juxtapositions, be they harmonic or discordant. Again, it is the space between notes. The experience of that music is not unlike the difference of perceptions and the variations on a theme of architecture in that each time we move through a space, we move at a different pace and our perceptions of space are understood in the moments of reflective pause.

Essential to an understanding of space and architectural composition are the elements or the details of assemblage. The metaphorical conditions of painted and constructed landscape afford a series of opportunities for access, intervention, and punctuation. Spaces are perceived as we move through them, views are framed, and transitions are mediated.

The temporal narrative is anecdotal to the “topography of chance” in attempt to facilitate the permeability of containment and enclosure through the employment of architectural devices as alchemical instruments of transformative experience.

listen, listen intently
to substance and materiality
listen, listen intently
for in listening, we discover and we find meaning

in the space
and in the place

of architecture