

From the Cheesegrater to the Parthenon: A Musical Odyssey

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Abstract

The close relationship that can exist between architecture and music was brought home to me, recently, by one particular building in the City of London. Its architects had not set out to produce architecture with a musical agenda but music can happen anyway when a building generates its own harmony, pattern, discord, repetition and silence. These were the qualities I found in the Leadenhall Building (known colloquially as the 'Cheesegrater') which prompted me to produce a piece of Visual Music linking the two art forms. The result, Citirama, enables me to formulate a considered view on how music and architecture can be found to coexist: how our understanding of the concept of space/time can bring an art form concerned primarily in mapping sound in time closer to a form focused on what we experience in moving through space. For a building to elicit an emotional response a chord needs to be struck inside us that delivers an inner sense of harmony. Such an experience is rare even though the synchronicity that exists between architecture and music, underpinned by mathematics and the laws of physics, was discovered long ago by the Ancient Greeks.

Introduction

As abstract arts, architecture and music share a common aim to create harmony, weave patterns, define spaces, move in time, promote feelings, touch the senses and act as an outward expression of an artist's aspirations. Such a statement must, in itself, provoke discord; surely, these aims cannot be achieved in equal measure by both art forms. Can architecture move in time? Can music define space? Remember that Pythagoras ascertained that the sounds of the anvil he heard in that blacksmith's shop over 2,500 years ago underpinned rules that governed not only the measures of sound but, also, the proportions of spaces and, ever since, the physics of sound has defined the rules by which architects design space. Alberti and Le Corbusier might have devoted much time to honing the proportional systems that underlay their constructions but, always, the rules remained close to those that produce concordant sound. Of course, over time, people's perception of concordant sound changes; each generation of composers will strike new chords to excite, or possibly to aggravate, the ear of the listener. Similarly, architects will produce new forms, influenced by technological advances, that embrace and contain space in unexpected ways. In making a musical odyssey, I've set out to discover when and where architecture can be experienced as music. It's a search that has taken me across Europe and back in time.

The start of my journey was close to home where, unexpectedly, I was struck by the 'musicality' of one particular building in the City of London. Its architects had not set out to produce architecture with a musical agenda but music can happen anyway when a building generates its own harmony, pattern, discord, repetition and silence. Rhythms of ebb and flow can be sensed in a structure without there being any preconceived intention, on the part of its creators, to endow a building with musical meaning. I found these qualities in the Leadenhall Building (known colloquially as the 'Cheesegrater'). It was a realisation that came gradually during a visit to the site, before the building was finished, and during discussion with one of the two project architects involved. No doubt, he was somewhat surprised when, at the conclusion of our meeting, I announced that I saw the Cheesegrater as the basis for producing a piece of Visual Music expressing the relationship between architecture and music. Nevertheless, Rogers + Stirk + Harbour supported my idea from the beginning and have remained enthusiastic ever since. The resulting piece, Citirama, has been shown at the Melbourne International Animation Festival and I've performed it live at the 2016 Brighton Digital Festival and at Intertain held last year in Madeira. Citirama can be viewed at https://youtu.be/OWwgWj_hROE

Citirama: Visual Music Celebrating the Cheesegrater

In producing *Citirama*, my objectives, as ever in my Visual Music, were to explore an idea and communicate it through a process that combined moving visual imagery with musical performance on solo clarinet. Now, enough time has elapsed for me to take a retrospective look at what I produced so as to formulate a considered view on how music and architecture can be found to coexist: how our new understanding of the concept of space/time can bring an art form concerned primarily in mapping sound in time closer to a form focused on what we experience in moving through space.



Figure 1: *The Cheesegrater invites people inside rather than presenting a closed facade to the world.*

As with all Richard Rogers' buildings, the Cheesegrater makes its mark by revealing structure, services and circulation routes on the outside; the workings of the building are not hidden but, instead, they become the means of expressing its nature and function (Figure 1). It invites people inside rather than presenting a closed facade to the world. All in all, the character of the building offers a rich source of pattern making material. But what are these patterns? First and foremost, what I see is a series of *leitmotifs*. (I'm making use of the musical connotations of this term quite deliberately.) Sometimes these are small details. At other times they are whole elevations or complete spaces. But always they serve to capture a design language that produces architecture of exceptional quality. In *Citirama*, I've taken delight in joining these patterns of architecture with the rhythms of music and, conversely, joining the the rhythms of music with patterns of architecture.

Citirama: First Movement

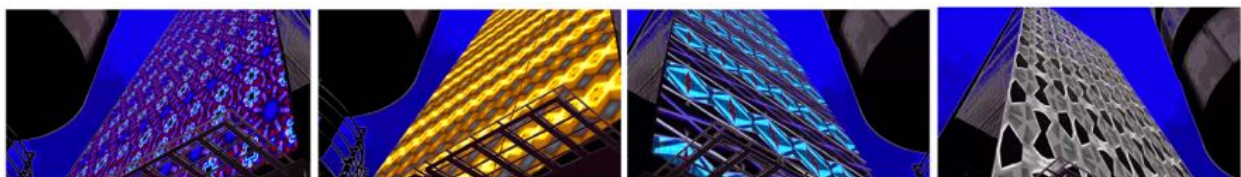


Figure 2: *In the First Movement of Citirama geometric patterns are projected on to the slanting facade of the Cheesegrater.*

In the first movement, I introduce a set of geometric patterns, all derived from the building's *leitmotifs*, which I then project on to the slanting facade of the Cheesegrater (Figure 2). (It's this slanting facade that has given rise to the building's nickname.) Of course, my giant animated display could never happen in reality; the building is 45 floors high (currently, the tallest in the City) so, inevitably, my projections must remain a computer simulation but this doesn't prevent them presenting a continually moving graphic interpretation of the *leitmotifs* where the rhythms of music join with those of architecture to promote a

close interchange between the two art forms. In Citirama, the visual and aural elements of the performance are given equal prominence.

My projections on the Cheesegrater are an outward expression of the building's intrinsic musicality but where such a quality is extrinsic, as in Daniel Libeskind's Jewish Museum, Berlin, it can be allowed to speak (or sing) for itself. The Museum's geometry, based on distortions of the Star of David, produces not just a zig-zag spatial experience internally but, also, a graphic expression of the Museum's musical score on its external elevations. Together they elicit a strong emotional response from visitors which exemplifies Libeskind's belief that the way architecture is produced and received can be very similar to music - a fact that is less surprising when you know that, before becoming an architect, he was a high-calibre performing musician. As Libeskind comments:

I see architecture as musical. When I look at buildings, I don't just see them as planes, two-dimensional or three-dimensional projections. I see them as a musical composition. I hear them acoustically. Architecture is a world of relationships that is very, very close to my experience as a performing musician. My own response is that architecture is very similar to music [5].

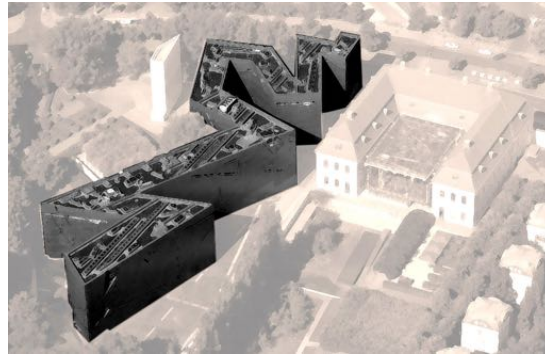


Figure 3: Aerial view of the Jewish Museum, Berlin. The zig-zag geometry of Daniel Libeskind's building is based on distortions of the Star of David.

Conveying the Emotions of Music in Architecture

When Libeskind says that a specific musical work was endemic to the design of the Museum not only do we know this to be true but we feel its effect when we are there, experiencing the full emotional impact of the spaces. We can sense that the Void, which cuts across the whole of the building, was the architect's response to an episode in Arnold Schoenberg's *Moses and Aaron* – an incomplete opera that ends prematurely with 'o Wort, du Wort' no longer sung but spoken to convey Moses, reduced almost to silence, as he laments his inability to lead the people to the promised land. Libeskind's skill in conveying the emotions of melancholy, sadness and desolation, using only the techniques of architecture, is extraordinary and almost unique.

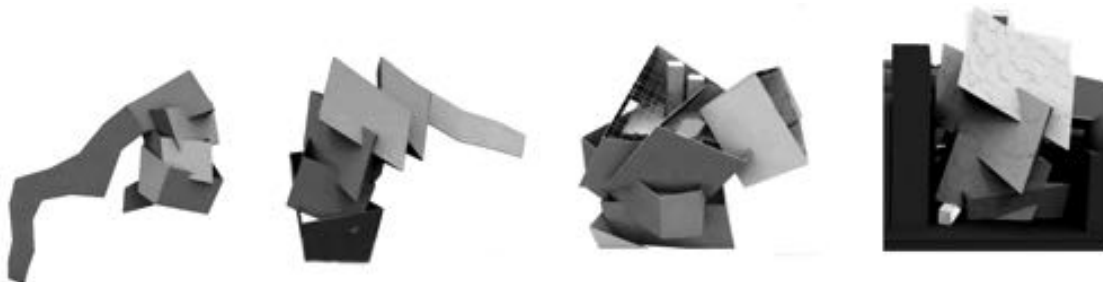


Figure 4: Diagrams of Libeskind's proposed V&A extension showing how Cecil Balmond's analysis of the building's geometry could be unfolded with mathematical precision [4].

The plan of the Jewish Museum, as shown from an aerial view, is extremely complex but it has an underlying mathematical logic that makes it both comprehensible and buildable (Figure 3). Because this is the key contribution of mathematics in architecture; as in any molecular structure, infinite variation and intricacy can be ‘grown’ from a simple geometric device as long as it is measurable – a quality that can be demonstrated by many of Libeskind’s buildings and, in particular, by his proposals for the V&A extension, in London. As it happens, the design received a bad press and was never built but it didn’t deserve this degree of opprobrium; I studied the plans carefully when they were revealed to find that they worked well at a functional level and, also, exhibited a clear logic when viewed as a three-dimensional structure. An analysis of the building’s geometry was undertaken by the engineer, Cecil Balmond, who revealed, in an animated sequence of diagrams, that the design could be unfolded with mathematical precision (Figure 4) [4]. Libeskind sees architecture as being musical and it’s no coincidence that his buildings contain a strong geometric logic that can be unfolded in time like the mapping of sound.

Citirama: Second Movement

Before moving on to the second movement of Citirama and the spatial patterns it weaves, I should explain my choice of music for the work. Sonatina for Solo Clarinet by Richard Rodney Bennett is improvisatory without being an improvisation. Like his saxophone concerto written for Stan Getz, it can be described as combining jazz harmonies with the composer’s own free-flowing serial technique. It’s constantly changing rhythms give the piece a compelling musical momentum which expresses Richard Rodney Bennett’s versatility in a wide range of modes and styles.



Figure 5: *The second movement of Citirama reveals a series of reverse explosions as fragmented components of the building’s ‘leitmotifs’ gradually come together or spin apart.*

In taking a retrospective look at the visual events I create in the second movement (Figure 5), I’m reminded of a comment made by Iannis Xenakis with regard to equivalent explosions in sound:

A complex sound may be imaged as a multi-coloured firework in which each point of light appears and instantaneously disappears against a black sky. But in this firework there would be such a quantity of points of light organised in such a way that their rapid and teeming succession would create forms and spirals, slowly unfolding or, conversely, brief explosions setting the whole sky aflame [8].

Xenakis made this comment in connection with his own Stochastic Music, born after he had both denounced polyphony and demonstrated the contradictions of serial music. In their place he proposed a world of sound masses, vast groups of sound-events, clouds, and galaxies governed by new characteristics such as density, degrees of order, and rate of change [8]. In *Metastasis*, his first piece for full orchestra, Xenakis developed his Stochastic ideas in the form of *glissandi*; sonic spaces of continuous evolution derived from long and interlaced sounds produced by dragging the bow across the strings of a violin, cello, viola or double bass (Figure 6). Further, he made a visual representation of *glissandi* by drawing a set of incremental straight lines to produce forms which, eventually, led to designs for the Philips Pavilion at the Brussels World’s Fair, 1958 (Figure 7) [7]. As an architect working in the atelier of Le Corbusier, he was given free rein to experiment with space, time and music – a rare opportunity which, to my knowledge, hasn’t been repeated since.

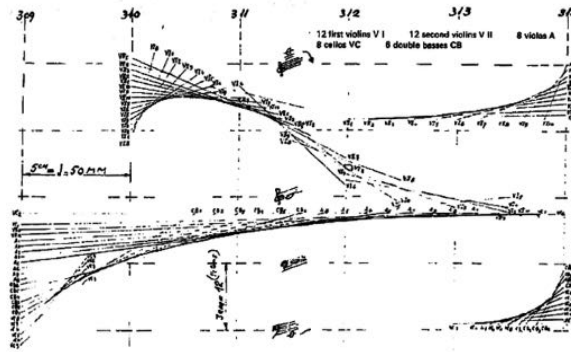


Figure 6: Bars 309 – 314 from *Metastasis* by Iannis Xenakis showing string ‘glissandi’ [6].

The Philips Pavilion

Xenakis has been described as an ‘architect of music’. In designing the Philips Pavilion, he combined the mathematics of Le Corbusier’s proportional scale, Modulor, based on the Fibonacci series, with his own research on hyperbolic conoids to create a causal chain of ideas where ‘*music and architecture could be bound together in intimate connection*’ [8]. With an interior shape which resembled the stomach of a cow, Xenakis’s design involved creating tensile structures of steel cables strung from steel posts at the ends of the ‘tent’ to form his hyperbolic conoids. The Pavilion’s complex shape meant that it couldn’t be built as a conventional poured concrete structure so the final solution was to create a system of precast concrete panels hung in tension from the steel cables. The resulting *Poème Électronique* combined architecture, film, light and music in a total experience made to function in time and space.

The complex calculations required to make the Philips Pavilion buildable were undertaken by Xenakis himself. He had been employed by Le Corbusier, not as an architect but as a trained engineer who was also, as it happened, an iconoclastic composer. These credentials were largely responsible for the extraordinary result; not only had Xenakis conceived the *glissandi* of *Metastasis* but he was also able to calculate the structural implications of converting his incremental straight lines into a three-dimensional reality. It was an engineer’s solution that produced hyperbolic conoids rather than an architect’s idea that required an engineer’s mathematics to make it buildable. Le Corbusier could not have created the Pavilion’s structure without Xenakis although he was reluctant to give his protégé full credit for the design. Musically, Xenakis was responsible for composing a transitional piece heard by audiences before they were enveloped in the main space of light and sound pulsing to a score by Edgar Varese, a composer who Le Corbusier had chosen in preference to Benjamin Britten or Aaron Copland.

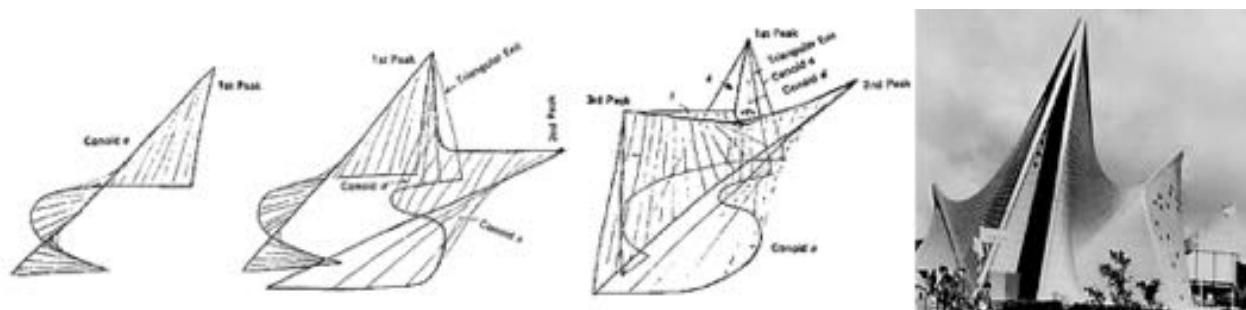


Figure 7: A visual representation of ‘glissandi’, made by drawing a set of incremental straight lines, produced forms that led eventually to the design of the Philips Pavilion at the Brussels World’s Fair [8].

The young Xenakis must have been less than pleased with his secondary musical role at the Philips Pavilion but, still, he had succeeded in creating a genuinely musical building which was capable of resonating in space and time. As an ‘instrument of music’ the Philips Pavilion bears little relationship to

any other Le Corbusier building but, uncannily, its hyperbolic conoid form does bring to mind the work of that other architect of music, Daniel Libeskind .

A Journey Back in Time

It was as an architectural student that I visited the Brussels World's Fair, in 1958, to experience, at first hand, the all enveloping sights and sounds of the Poème Électronique. It's only through a process of full immersion in a work of architecture or a piece of music that its impact can be seen, felt and heard; there's no way that an adequate evaluation can be made from plans, photographs or hearsay. My memory of some events may have faded but I still have an awareness of what it was like to be inside Xenakis's hyperbolic conoids; it's an experience that can never be repeated but it did provide, for me, some sort of measure by which the musicality, or otherwise, of a building could be assessed. Remember that those responsible for creating 'architecture which sings' may not have set out with any such intention but, nevertheless, the result can still succeed in touching the auditory senses of the building's visitors or inhabitants; the visual harmony that results from an exceptional piece of architecture can, to quote Le Corbusier, *make people serene or gay (sic), as can music* [3].

My journey to the Brussels World's exhibition, in 1958, didn't end there but continued, via discursions and vicissitudes, to the steps of the Parthenon. For many architects this building, and the Acropolis on which it's sited, is a place of pilgrimage. For me, the allure of its architecture was prefaced by visits to the Elgin Marbles, in the British Museum, where the sense of movement and rhythm conveyed by these relief sculptures from the frieze of the Parthenon is a cause of wonder. They sent out a strong signal that I must find out for myself whether or not their birthplace, on the hill of the Acropolis, would exert a similar impact.

The Pull of the Parthenon

Many before me have felt the pull of the Parthenon. Almost more than any other observer, Le Corbusier, in his *Towards a New Architecture*, regarded it as an exemplar of almost every quality he admired in architecture; he devoted far more words (and illustrations) to the Parthenon's features than to any of his other references. He found in the Parthenon *a work that rings within us in time with a universe whose laws we obey, recognise and respect* [3]. He described a site, which is surprisingly uneven and *out of square*, as a place where visitors experience vistas stretching from the mountains to the sea (Figure 8). The buildings themselves, the Parthenon, the Erechtheum, the Propylea and the temple Athena Nike, are arranged asymmetrically with the relative distances between buildings creating a variety of rhythms: *rhythms apparent to the eye and clear in their relationship to one another. And these rhythms are at the very root of human activities. They resound in man by an organic inevitability, the same fine inevitability which causes the tracing out of the Golden Section by children, old men, savages and the learned* [3].



Figure 8: Aerial view of the Acropolis. In his visit of 1911 Le Corbusier saw at the Parthenon a system which appeared to satisfy a spiritual order through the pursuit of ingenious and harmonious relations.

The Parthenon was the apogee of a long process of development and constant refinement. Sophisticated techniques were used to combat the optical illusion that a large scale building appears to be curved. To create the illusion of straightness, the columns lean over slightly inwards, a device which makes the Parthenon appear lighter than its heavy marble construction would suggest. Also, the *stylobate*, or floor of the temple, is not exactly flat but rises slightly in the centre. The columns have an *entasis* (ie. a slight widening towards the half way point in their height) and the four corner columns are almost imperceptibly wider than other columns. The combination of these refinements makes the Parthenon seem perfectly straight, symmetrically in harmony and gives the building a sense of vibrancy. As Le Corbusier comments:

If we are brought up short by the Parthenon, it is because a chord inside us is struck when we see it. It's an impact that can't be felt in other Doric temples which, by comparison, seem static and fail to raise the emotions [3].

Le Modulor

Le Corbusier was one of the foremost advocates for applying the Golden Section to art and architecture. His appreciation of the Pythagorean definition of harmony achieved by numbers led, eventually, to his own Modulor which aimed to provide a harmonic set of human scale measures, universally applicable to architecture. It was a project, developed during the 1930s and 40s so that, by the time Le Corbusier started to receive post-war commissions, he was ready to test the tenets of the Modulor on a real building - the Unité d'Habitation in Marseille (Figure 9). Here, the architect was able to put into practice his ideas for a 'vertical garden city' by supporting the structure on massive 'pilotis' to allow for circulation and gathering space flowing through at ground level. Designed like a huge liner, Unité d'Habitation *disposed of arbitrary metric measurements in construction and replaced them with the remarkable resources of numbers and, in particular, the fruitful and inexhaustible Golden Section* [2]. Its proportions and *leitmotifs* reveal musical meaning just as Le Corbusier intended because, always, in giving presentations of his Modulor, he described it as '*a tool of linear or optical measures similar to a musical script*' [1].



Figure 9: *At Unité d'Habitation, in Marseille, Le Corbusier disposed of arbitrary metric measurements and replaced them with the 'remarkable resources of numbers' derived from his Modulor man.*

In bringing to the process of design the means of fixing the fundamental geometry of the work, Le Corbusier aimed to provide an 'assurance against capriciousness'. But for Michael J. Ostwald the two books of the Modulor represent a maddening and enthralling description of the trials and tribulations of an architect trying to find a universal solution to the problems of human proportion. Nevertheless, they remain landmark works on the relationship between architecture and mathematics which emanated directly from Le Corbusier's visit, in 1911, to the Acropolis. He had seen, at the Parthenon, a system which appeared to satisfy a spiritual order; *it confers on the work the quality of rhythm* [3].

From the Parthenon to the Cheesegrater

Rhythm is the focus of Citirama's third movement; a series of quick change *collage* confound the eye as each image, showing a different arrangement of the Cheesegrater's *leitmotifs*, appears and disappears in time with the constantly changing rhythms of Richard Rodney Bennett's music (Figure 10). As ever, the Greeks have a word for it – *rhythmos* – movement, fluctuation or variation marked by the regular recurrence or natural flow of related elements.



Figure 10: *The third movement of Citirama is the most rhythmic of the three movements with each 'collage' revealing a different arrangement of the Cheesegrater's 'leitmotifs'.*

Returning to 1958, my odyssey ended at the Parthenon. Sitting on the steps watching the sun go down in the company of Richard Rogers and Paul Koralek was a life changing experience; for all three of us, at various stages of becoming architects, the Pentelic marble cast its magic spell. It seems both apt and inevitable, therefore, that Richard Rogers' Cheesegrater was the cause of setting me off on a search for when and where architecture becomes musical. In my journey through space and time, and prompted by my production and performances of Citirama, I've found the answer lies in mathematics. It's a discovery made long ago by the Ancient Greeks but, over the centuries, developments in the two art forms have tended to obscure their common roots. For a building to elicit an emotional response a chord needs to be struck inside us that delivers an inner sense of harmony. It's a relatively rare experience, which requires that the complexity of a building's geometry produces rhythmic tension as it unfolds in space. Le Corbusier could produce such magic in his own works but, in attempting to produce a universal prescription for proportional logic, he revealed that rules, by themselves, cannot achieve musicality. As I've shown, it takes a rare talent and creative skill to produce a building that generates its own individual Modulus of success.

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