



# SOUND AND SPACE:

## EXPLORING THE RELATIONSHIP BETWEEN MUSIC AND ARCHITECTURE

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### INTRODUCTION

Though invisible, the sound waves that create music often find visual expression in the objects that produce and encompass them. Instinctively, musical notation and instruments are associated with this visual and spatial dimension. Yet, architecture is also intricately tied to music. This relationship presents itself through acoustics, functionality, aesthetic similarities, and proportional links. This project explores such links between music and architecture, examining how individual circumstances and ideologies interact to influence these relationships, and how music and architecture continue to evolve today.

This survey examines key linkages between music and architecture, employing case studies in order to demonstrate relationships that might otherwise go unnoticed. These examples offer a broad exploration of two seemingly disparate fields. While individual qualities may differ, each example provides insight into the link between sound and space, and the ways in which music and architecture have come together regardless of place and circumstance. Through these case studies, this project asks: How are music and architecture linked? How do typological, historical, acoustic and cultural factors influence the structure of buildings created with music as a central focus?

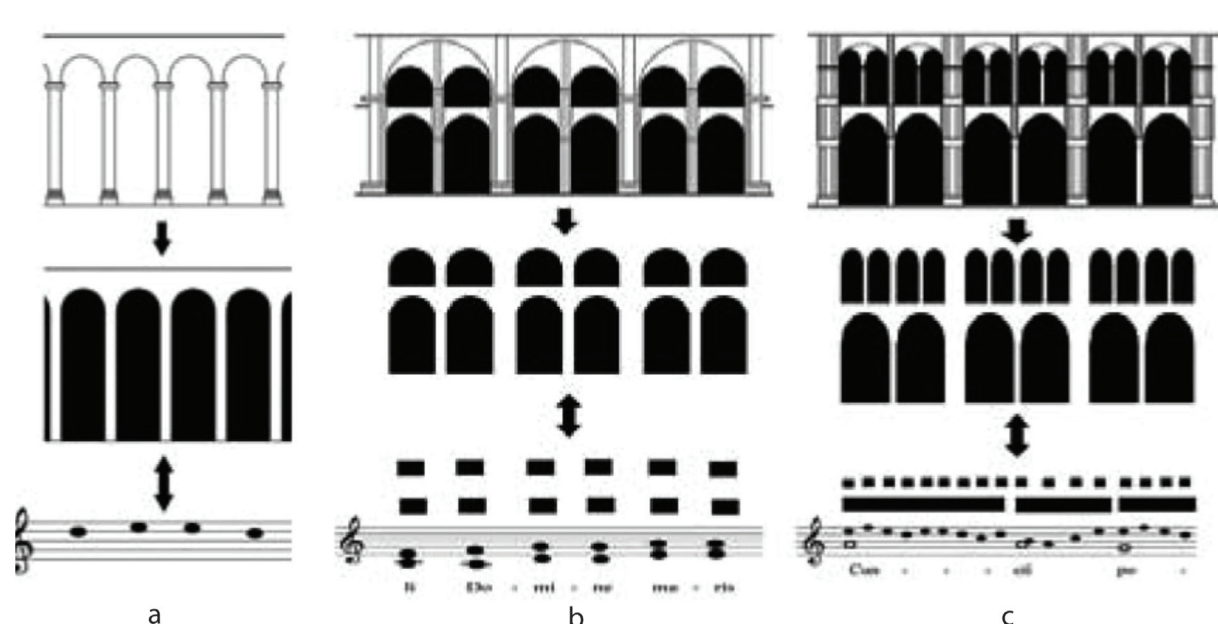
### PROPORTION AND HARMONY IN CLASSICAL TEXTS AND GOTHIC/ RENAISSANCE ARCHITECTURE

Key Findings:

- > Pythagoras' system of musical harmony featured mathematical ratios that formed an important ideological bridge between musical harmony, architecture, and the structure of the natural world.
- > An emphasis on musical knowledge, harmony, and musical numeric relations was present within Ancient Roman architectural thought and education, where it appeared in Vitruvius' *De Architectura*, widely seen as the first preserved architectural text.
- > Architectural development of Gothic and medieval cathedrals has been linked to simultaneous structural developments in music, harmony, and chants.
- > Music was important within Renaissance architectural theory and practice, where architectural treatises described harmonic ratios in detail, providing a set of rules to determine architectural areas and volumes. Musical proportions have been observed in the work of many Renaissance architects.

#### CASE STUDIES

- > Notre Dame de Paris, Paris (1345)
- > Santa Maria del Fiore, Florence (1436)



Cathedral elevations, translated by Lee and Park into musical harmony and rhythm. Shows a single-story elevation (a), a parallel elevation (b), and a melismatic elevation (c).  
Diagrams: Hong, Kyu Lee and Kin-Ho Park, "Structuring Vertical Space: Relationship between Chants and Cathedral Naves in the Medieval Period," *Journal of Asian Architecture and Building Engineering* 8, no.1 (May 2009): 27-28, fig. 6, 11, <https://doi.org/10.1310/jaabe.8.25>.

### CONCERT HALLS, 19<sup>TH</sup> CENTURY – PRESENT

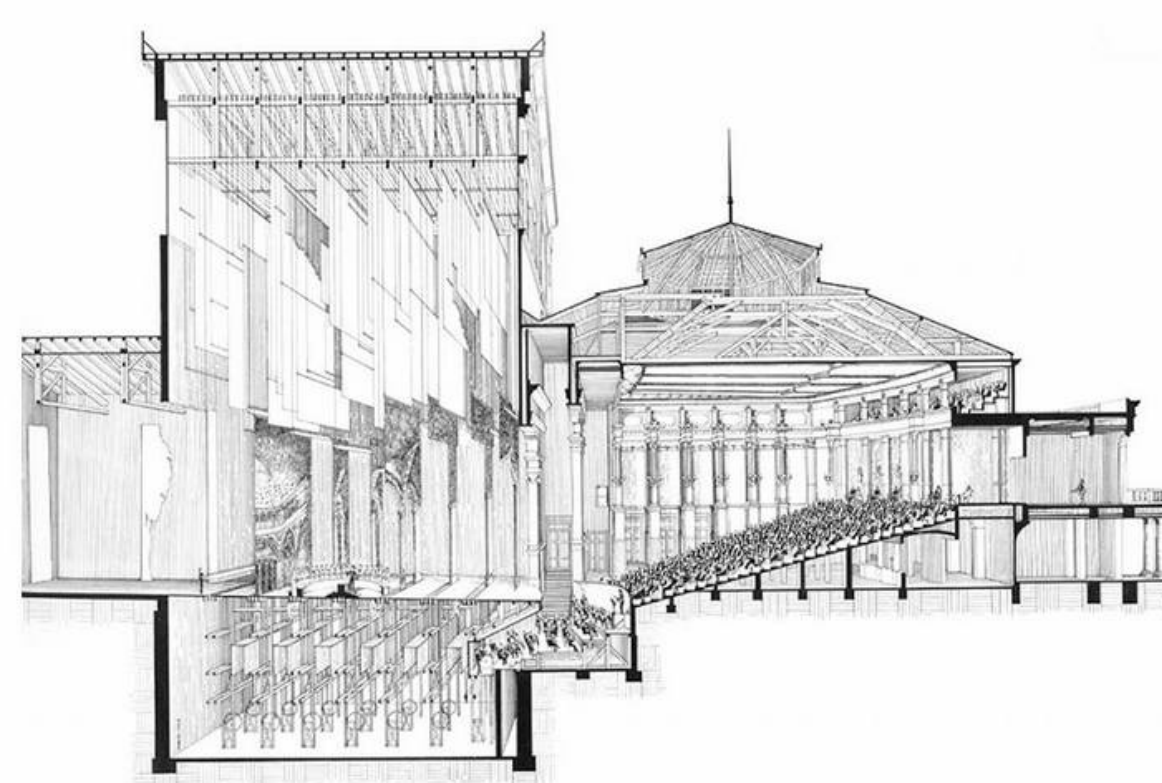
Key Findings:

- > Within the concert hall, music and architecture have a bi-directional influence. Musical style influences architectural form through the acoustic and structural qualities necessary to optimize a musical performance, as well as the seating and other accommodations necessary for a live audience.

- > Composers have often created music with a specific architecture in mind, and in such cases have created a musical style that will feature favourably in the specific acoustics of the venue.
- > In certain instances, architecture itself can be played as a musical instrument.
- > Music and architecture can also interact to produce spatial musical performances, for example where choirs encircle an audience to produce a "surround-sound" effect.
- > Musical halls can additionally be designed with specific ideological goals, for example the democratic structure of the Berliner Philharmonie

#### CASE STUDIES

- > Bayreuth Festspielhaus (1876)
- > Berliner Philharmonie, Berlin (1963)
- > Norwegian National Opera and Ballet, Oslo (2008)



Perspectival Section of the Bayreuth Festspielhaus, a hall designed specifically to showcase Richard Wagner's operas  
Diagram: Perspectival Section, digital image, Wagner & Heavy Metal, accessed September 5, 2020, <https://www.wagner-heavymetal.com/ein-hollauminder-in-bayreuth-2017---meistersinger.html>.

### MUSIC AND ARCHITECTURE, 20<sup>TH</sup> CENTURY – PRESENT

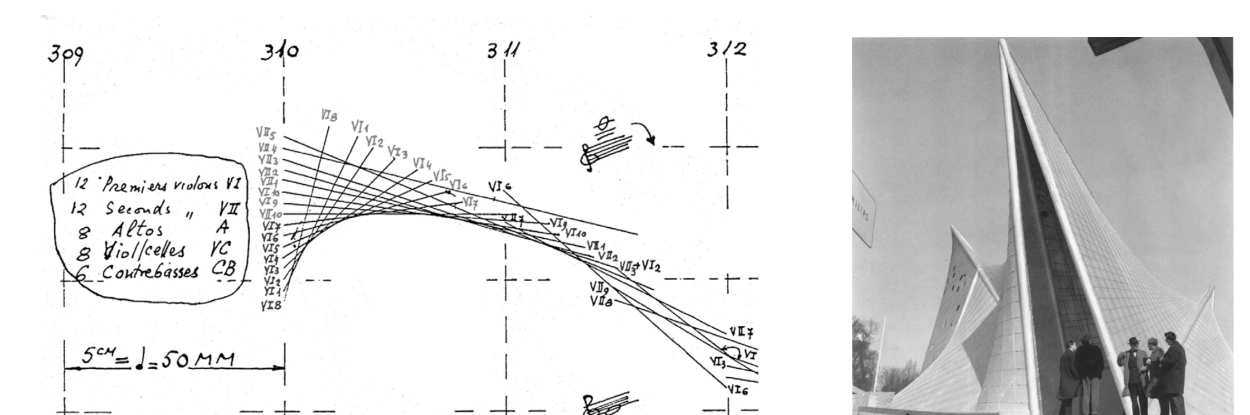
Key Findings:

- > Architectural facades can be read musically like a visual score, where different elements weave together to create architectural polyphony.
- > The collaboration between composer Iannis Xenakis and architect Le Corbusier offers a unique situation where proportional systems (The Modulor), musical scores, and architecture continually influenced one another. This relationship is exhibited in both architectural and musical works.
- > Musical rhythm can be translated into architectural facades, for example at the Monastery of La Tourette. Here, the facade can be read as a musical score, but is also comparable to the compression and rarefaction patterns of a sound wave.

- > Architecture can be formally inspired by music, for example in the Toronto Music Garden, where aesthetic and formal aspects are informed by both metaphorical and concrete interpretations of J.S. Bach's Cello Suite No. 1.

#### CASE STUDIES

- > Philips Pavilion, Brussels (1958)
- > Monastery of La Tourette, Éveux (1961)
- > Toronto Music Garden, Toronto (1999)



Left: Portion of the preliminary visual score for Xenakis' *Metastasis*, showing a glissando represented using ruled surfaces.  
Right: Exterior view of the Philips Pavilion, constructed using ruled surfaces in a similar way to Xenakis's musical glissandi.  
Diagram: Anne-Sylvie Barthel-Calvet, "De l'ubiquité poétique dans l'œuvre de Iannis Xenakis – espace, temps, musique, architecture," *Intersections* 29, no. 2 (2009): 46, fig. 15a, <http://myaccess.library.utoronto.ca/login?url=https://www.proquest.com/2f40c0e0e27855341213%3Faccountid%3D14771>.  
Image: Iannis Xenakis and Le Corbusier, "Philips Pavilion," *ANY: Architecture New York*, no. 5 (1994): 34, <http://www.jstor.org/stable/41845639>.

### CONCLUSION

- > Music and architecture have developed in parallel throughout history; some of the most innovative buildings both today and in the past contain explicit and even structural links between the two.
- > Proportional harmonic relationships have influenced architecture since antiquity, and continue to feature in architectural texts and thought. Aesthetic interpretations of music continue to shape architecture, whether in landscape or concert hall design. The interchangeable use of terms such as counterpoint, texture, harmony, rhythm, tempo, proportion, and articulation to describe music and architecture is revealing, and demonstrates a fundamental link between the two fields.
- > Music and architecture's continued relationship highlights the versatility and experiential nature of both mediums. Together, each expresses and communicates in reference to the other, transforming and adapting to an ever-shifting cultural space.

### ACKNOWLEDGEMENTS

I would like to thank the Laidlaw Foundation for their support in completing this research. I wish to express my sincere appreciation to Professor Peter Sealy for his supervision, support and advice during the research process. I would additionally like to thank Shradha Prasad for her support and coordination throughout the Laidlaw research summer.