

**Subsisting Frequencies:**  
The Intersection of Media Arts and Architecture

By

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A thesis submitted in partial fulfillment  
of the requirements for the degree of  
Master of Architecture(M.Arch)

The Faculty of Graduate Studies  
Laurentian University  
Sudbury, Ontario, Canada

Eric Lalonde, 2020

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**THESIS DEFENCE COMMITTEE/COMITÉ DE SOUTENANCE DE THÈSE**  
**Laurentian University/Université Laurentienne**  
Faculty of Graduate Studies/Faculté des études supérieures

Title of Thesis Titre de la thèse	Subsisting Frequencies: The Intersection of Media Arts and Architecture	
Name of Candidate Nom du candidat	Lalonde, Eric	
Degree Diplôme	Master of	
Department/Program Département/Programme	Architecture	Date of Defence Date de la soutenance April 07, 2020

**APPROVED/APPROUVÉ**

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# TABLE OF CONTENTS

<b>Abstract</b>	<b>VI</b>
<b>Acknowledgements</b>	<b>VII</b>
<b>List of figures</b>	<b>VIII</b>
<b>Part 1: Analog-Digital</b>	<b>1</b>
Preface	3
Rhythms	4
Architecture and Media Arts	6
Ryoji Ikeda	8
404.Zero	10
Jeffrey Shaw	12
Iannis Xenakis	14
Experimental Interface	20
<b>Part 2: Community</b>	<b>31</b>
Global Perspective	33
Digital Media in Montreal	38
Mile-end	42
<b>Part 3: Synthesis</b>	<b>53</b>
Architectural Approach	55
Community and the Artists	66
Conclusion	70
<b>Annex</b>	<b>73</b>
<b>Bibliography</b>	<b>91</b>

# ABSTRACT

The facilities currently available for the creation of new media art are exclusively reserved for funded professional artists. This inaccessibility is problematic for young and emerging media artists that do not have the resources to develop their work in physical space. Without the access to a proper facility, these emerging artists use projective equipment to exhibit their work onto large public surfaces hoping to be seen. The proliferation and growing popularity of projective art demonstrates a need to expose this work beyond the limitations of computer monitors, into the potential of an architectural context. This potential relationship between architecture and media arts offers an opportunity to create a building that prioritizes public access to this art form rather than a strict professional use.

The concepts of analog and digital pertaining to light and space are fundamental in developing a methodology while working at the intersection of media art and architecture. The term analog defines a signal represented by a continuously variable physical quantity, such as voltage, spatial position, etc. Analog rhythms are found in waves, usually evidenced by natural phenomena with cyclical behavior. It can be argued that the sun is considered an analog source of light and rhythm. Within an architectural context, for example, an array of window mullions can modulate sunlight into analog rhythms of shadow. Whether they realize it or not, architects create these analog experiences. The work of Iannis Xenakis and Le Corbusier in **La Tourette** is exemplary in demonstrating the ability to create spatial experiences with analog rhythms. Their work designing the **Philips Pavilion** demonstrates how architects can create spaces at the intersect of both analog and digital rhythms.

The term digital describes attributes of computational language represented through binary sequences of ones and zeros. Digital is precise and does not continuously fluctuate. While a flashing light controlled digitally with a microcontroller may appear to continuously change in amplitude, it is doing so by a miniscule and imperceptible stepping pattern. This boundary is known as granularity, a phenomenon that is at the core of differentiating between analog from digital. Unlike architects, new media artists work with a focus on digital experiences. As this architectural thesis is heavily rooted in computational media, the intersection of analog and digital is a vital concept in exploring boundaries of both practices. The core question then is how can rhythms between analog and digital light act as a common foundation for media arts and architecture?

Spatial experimentation with analog and digital rhythms is essential in developing an architectural project alongside media art. The window became a spatial interface between the sun and computer generated projections, conceptually provoking a dialogue between analog and digital light. This experimentation derived principles that could be applied to architectural design. Using a physical architectural model as the interface between analog and digital light is the methodology behind the design. The intention is for the architecture to embody the intersection of analog and digital.

A public media art facility requires a site that suits the cultural mandate of its local community. Montreal is considered to be a leading capital in digital media, it is evident that this type of project would be valuable to this community. The Mile-end district of that city is a culturally unique location that would meet this expectation. Hosting numerous cultural events, the mile end is favorable for a project providing a space for social gathering. Situating this project in this district can take advantage of this neighborhood's unique cultural life while challenging the traditional assumptions of what it means to create a public building.

**Keywords: Architecture, Space, Modulation, Light, Sound, Music**

# ACKNOWLEDGEMENT

I would like to thank my thesis advisor Patrick Harrop for his guidance in maintaining the vision along the way. I would also like to thank my family for their unwavering support.

# List of Figures

## Figure [1]

Guerrilla street projections by Urban Projections

## Figure [2]

Light frames for polytopes de Montreal command film, creating rhythmic patterns

## Figure [3]

Interior photograph of La Tourette, demonstrating rhythmic modulation of light.

## Figure [4]

Ryoji Ikeda's test pattern no.6, temporality between the projection and the participant

## Figure [5]

404.Zero, interfacing with analog equipment creating digital visual projections

## Figure [6]

Ryoji Ikeda's test pattern no.3

## Figure [7]

Ryoji Ikeda's micro | macro, located in the ZKM in Karlsruhe, Germany

## Figure [8]

Photograph of 8.0 by 404.Zero, depicting intentions at an architectural scaled

## Figure [9]

404.Zero using a modular synthesiser to modulate their digital visual performance

## Figure [10]

The Extended virtual environment by Jeffrey Shaw in Karlsruhe, Germany 1993

## Figure [11]

The Cupola installation by Jeffrey Shaw in Lille, France, a hemisphere projection space

**Figure [12]**

Exterior of la tourette monastery light “machine gun”

**Figure [13]**

Interior of la Tourette, rhythms in window panes generating spatial experiences

**Figure [14]**

Metastasis: A musical composition translated into architecture

**Figure [15]**

Photograph of the exterior of the Philips pavillion in Brussuls, Belgium 1958

**Figure [16]**

Drawing representing distribution of muscicians for Terretektorh

**Figure [17]**

Interface for analog and digital rhythmic experimentation located in a south facing window of the McEwen school of Architecture.

**Figure [18]**

Analog and digital rhythmic experimentation

**Figure [19]**

Shifting contrasts according to movement

**Figure [20]**

Observation of similar rhythmic patterns acheived with analog and digital light

**Figure [21]**

Observation of similar rhythmic patterns acheived with analog and digital light

**Figure [22]**

Layered approach to digital rhythm projection

**Figure [23]**

Layered approach to digital rhythm projection

**Figure [24]**

Mylar reflection from the projector

**Figure [25]**

Investigation of spatial rhythms during the day and night

**Figure [26]**

Digital light reflection in space

**Figure [27]**

Spatial interface with digital rhythms

**Figure [28]**

Studio 1 - Goodman, EMPAC

**Figure [29]**

Studio Beta, EMPAC

**Figure [30]**

Studio 2, EMPAC

**Figure [31]**

Exterior photograph of the EMPAC in Troy, NY

**Figure [32]**

ZKM a historical munitions factory

**Figure [33]**

Exterior photograph of the ZKM in Karlsruhe, Germany

**Figure [34]**

ZKM Foyer, spatial intersection of analog and digital light

**Figure [35]**

Modular Media Theater in the ZKM

**Figure [36]**

Photograph from Elektra digital arts biennial in Montreal

**Figure [37]**

Photograph from Mutek festival dedicated to promote electronic music and the digital

**Figure [38]**

La Stratosphere immersive projection theatre, Mutek 2013

**Figure [39]**

Exterior Stratosphere immersive projection theatre

**Figure [40]**

Hexagram Black box theatre in Montreal

**Figure [41]**

Using the black box to create focus on the artwork, void of context

**Figure [42]**

Aire commune

**Figure [43]**

Marché des Possibles

**Figure [44]**

Van Horne Skatepark

**Figure [45]**

The abandoned city garage, home to kabane 77

**Figure [46]**

Mile end train station demolished in 1950

**Figure [47]**

Laurence Grandbois Bernard projecting on the old textile sign

**Figure [48]**

Arial perspective of the site

**Figure [49]**

Photograph of pedestrians crossing the railroad

**Figure [50]**

Site photograph 1

**Figure [51]**

Site photograph 2

**Figure [52]**

Site photograph 3

**Figure [53]**

Site photograph 4

**Figure [54]**

Site photograph 5

**Figure [55]**

High powered RGB LED lights with their driver

**Figure [56]**

Site model experimentation with the LED light

**Figure [57]**

Heliodon

**Figure [58]**

Heliodon connection detail

**Figure [59]**

Shadows exploration of natural sunlight emulation onto the working model

**Figure [60]**

Development of media art alongside the tectonic design

**Figure [61]**

Study of solar rhythms with the working model

**Figure [62]**

Study of solar rhythms with the working model 2

**Figure [63]**

Study of digital rhythms with the working model

**Figure [64]**

Study of digital rhythms with the working model 2

**Figure [65]**

Abstract images of the scale model generated with Touchdesign

**Figure [66]**

Perspective assembly detail of the sun screen

**Figure [67]**

Shadows study generated by the sunscreen, directed onto pedestrian paths

**Figure [68]**

Second floor exterior perspective

**Figure [69]**

Second floor exterior perspective 2

**Figure [70]**

Pedestrian Perspective

**Figure [71]**

Perspective from le Marche des Possibles

**Figure [72]**

West side exterior perspective

**Figure [73]**

East side exterior perspective

**Figure [74]**

Permeation of projected light within the building

**Figure [75]**

Architectural model exploration with digital rhythms 1

**Figure [76]**

Architectural model exploration with digital rhythms 2

**Figure [77]**

Architectural model exploration with digital rhythms 3

**Figure [78]**

Architectural model exploration with digital rhythms 4

**Figure [79]**

Site plan

**Figure [80]**

Longitudinal cross-section

**Figure [81]**

Latitudinal cross-section

**Figure [82]**

Nighttime arial site perspective

**Figure [83]**

Nighttime arial site perspective 2

**Figure [84]**

East elevation

**Figure [85]**

West elevation

**Figure [86]**

North elevation

**Figure [87]**

South elevation

**Figure [88]**

Plan: First floor

**Figure [89]**

Plan: Second floor

**Figure [90]**

Plan: Third floor

**Figure [91]**

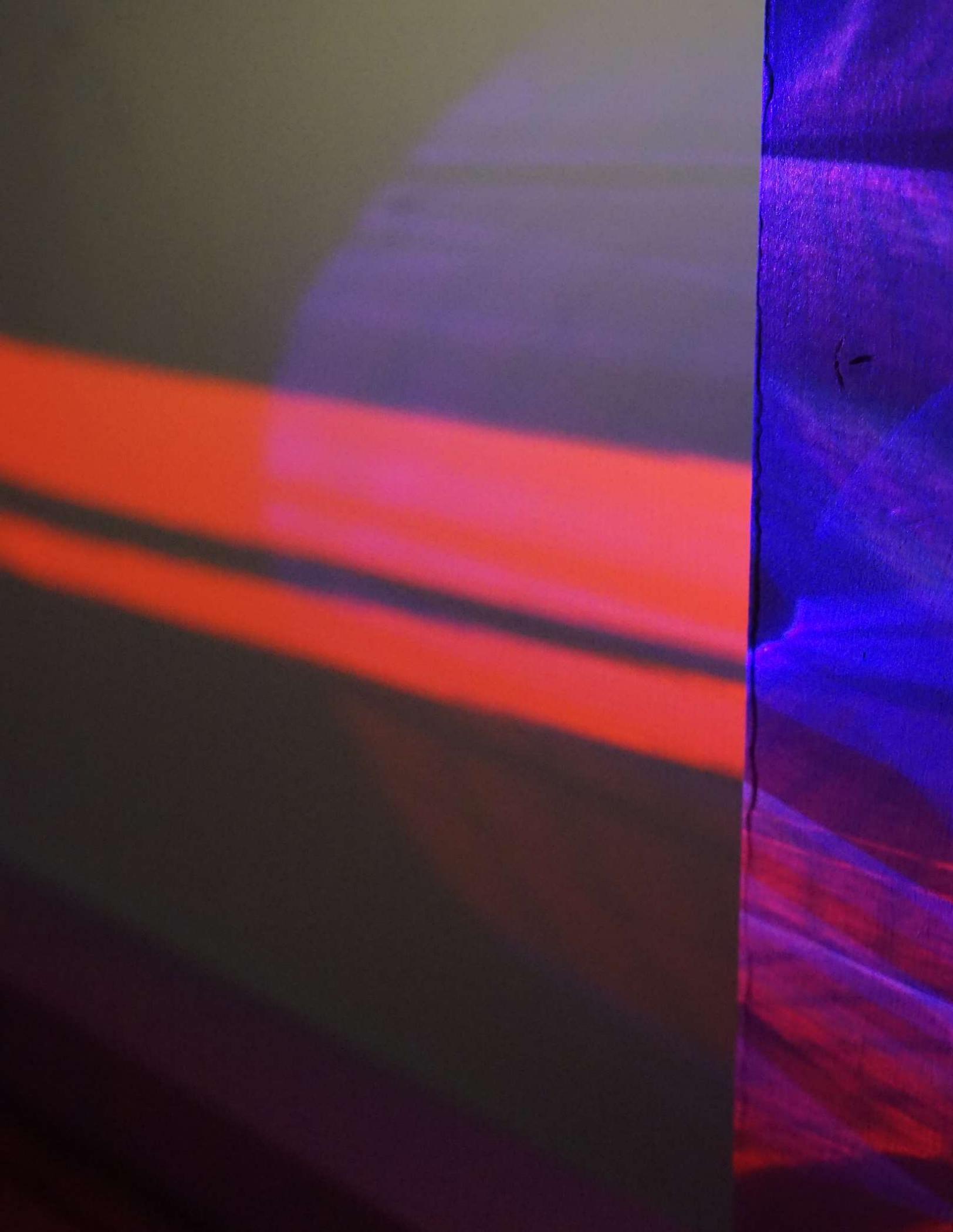
Daytime arial site perspective

**Figure [92]**

Perspective from the Viaduct Van Horne

**Figure [93]**

Perspective from the other side of the railway



**Part 1**

# **ANALOG-DIGITAL**

# Preface

Dedicated media art facilities such as the **ZKM**, **EMPAC**, **La Stratosphere**, and the **Hexagram Black Box** are not devoted to community access. There is a need for discipline-specific infrastructure committed to emerging digital media artists. Without access to a dedicated space for the development or display of their work, young artists are limited to the physical bounds of their computer monitor. A public building for media art can address this problem. The unavailability of media art space for emerging artists is apparent in the works of street projection artists Urban Projections<sup>1</sup> and The Illuminators<sup>2</sup>. These artists project large scale images on built infrastructure using portable projectors. The simple implementation of large planar facade elements can generate a dialog between the media artists and the architecture. The goal is to allow the artist to use the building as a creative tool for their art, while the project serves to alter the professional bias of current media art facilities.

Analog and digital rhythms serve to maintain a dialogue between new media arts and architecture. For the purpose of this thesis, space can be categorised as being analog or digital in accordance's function and attributes. A digital space possesses highly controlled qualities without the presence of external factors leading to variability. The black box theater is a digital space since it is void of natural light and external sound. In contrast, the exterior environment is to be considered an analog space. This is due to the presence of various fluctuating phenomena such as sound generated by the environment, sunlight of varying intensities, seasonal winds, rain and other elements naturally present in space. These attributes can be used to architecturally generate a spatial gradient between analog and digital space.

<sup>1</sup> URBAN PROJECTIONS: "Projection Mapping: 3D Projection Mapping", UP, accessed December 21, 2019, <https://www.urbanprojections.com/projection-mapping/>  
<sup>2</sup> "TROUBLE," The Illuminator, June 14, 2019, <http://theilluminator.org/>



**Fig 1** Guerrilla street projections by Urban Projections

"URBAN PROJECTIONS - Guerrilla & Street Projection: Projection Bombing," Up, accessed December 21, 2019, <https://www.urbanprojections.com/street-projection?lightbox=datattem-imdvau1p>)

# Rhythm

The experimental process of this thesis intends to study the relationship of analog and digital light within physical space. Rhythm is essential to this research as it is common the attribute between solar cycles and the projection of digital media art. The theory of rhythms identifies multiple distinct variations of rhythms that can be used during the experimentation between media art and architecture. According to the Merriam-Webster dictionary, rhythm is “an ordered recurrent alternation of strong and weak elements in the flow of sound and silence in speech.”<sup>3</sup> The principle of **Rhythmanalysis** as described by Henri Lefevbre, demonstrates how various rhythms are present in the everyday life<sup>4</sup>. Lefevbre identifies four types of rhythms: Arrhythmia, Polyrrhythmia, Eurhythmia and Isorhythmia. Each phenomenon can present itself within our collective social environment<sup>5</sup>. Eurhythmia is used to demonstrate a perfect state, which occurs in the various rhythms commonly found in the human body. Polyrrhythmia is a multitude of rhythms that coincide in co-existence<sup>6</sup>. Polyrrhythms add complexity in their utilization in a musical context. Simultaneously, two or more different patterns create a sense of dissonance, which ultimately resolves itself to alter the perception of time<sup>7</sup>. Polyrrhythms are visible in the city through the simultaneous occurrence of pedestrian and automotive movement to that of the sun. Although these elements are unrelated, they operate collectively and independently demonstrating an overall complexity. Arrhythmia defines a conflict among rhythms. Musically represented the implementation of dissonant notes within a harmonious melody. This would be embodied by an individual that is ill in a societal context<sup>8</sup>. Finally, dysrhythmia characterizes an exclusive rhythm that only occurs once<sup>9</sup>. These principles are vital in using a variety of analog and digital rhythms in the experimentation process. The intersection of the two incites the presence of the various rhythms identified by Henri Lefevbre. In a space with fenestration, an artist could build an installation intending to receive digital projections. Since sunlight changes through the day, and even reflects on the surface of the moon at night. The installation is subjected to both analog and digital rhythms. Rhythmanalysis allows a designer the ability to consider the implication of various rhythms within a project. Rhythms present in the analog and digital impact spatial environments and generate rich human experiences.

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3 "Rhythm," Merriam-Webster (Merriam-Webster), accessed December 21, 2019, <https://www.merriam-webster.com/dictionary/rhythm>

4 Lefevbre, Henri. Rhythmanalysis. Continuum, 2004.p.5

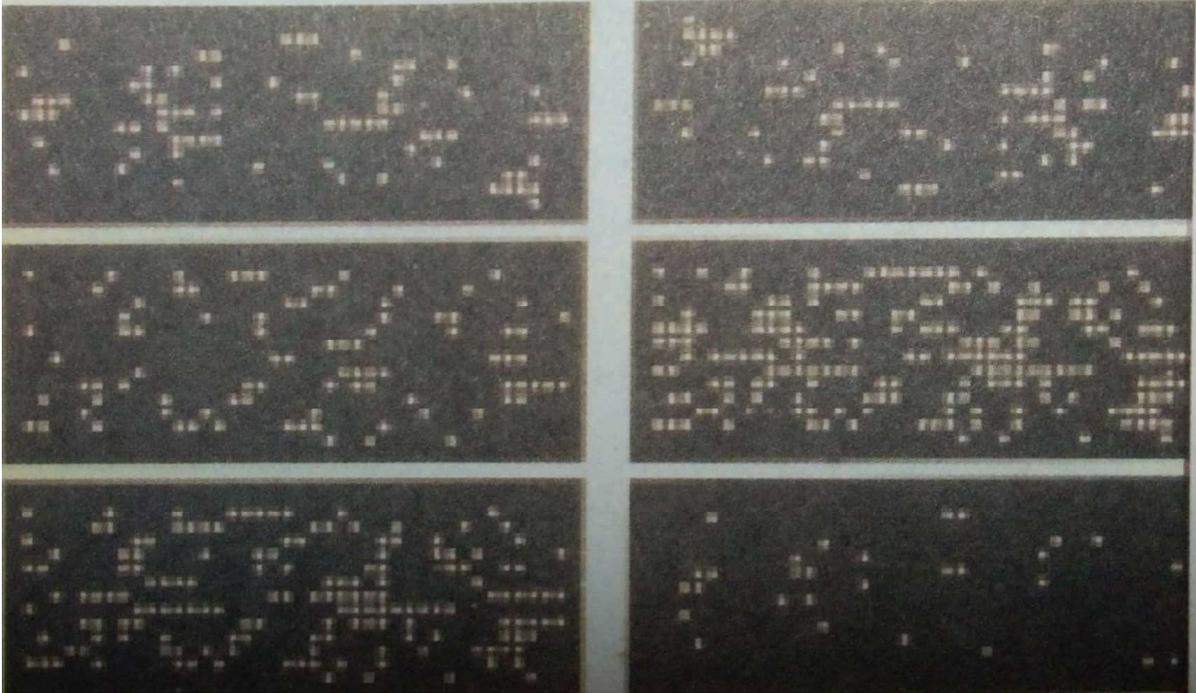
5 Ibid, p.67.

6 Ibid.

7 Dimond, Jonathan. Introduction to Polyrrhythm, accessed December 19, 2019, [http://www.jonathandimond.com/downloadables/Introduction\\_to\\_Polyrrhythm-Dimond\\_2018.pdf](http://www.jonathandimond.com/downloadables/Introduction_to_Polyrrhythm-Dimond_2018.pdf)

8 Lefevbre, Henri. Rhythmanalysis. Continuum, 2004.p.67

9 Ibid.



**Fig 2** Light frames for polytopes de Montreal command film, creating rhythmic patterns  
Xenakis, Iannis. *Music and Architecture: Architectural Projects, Texts, and Realizations*. Edited by Sharon E Kanach, illustrated, annotated ed., Pendragon Press, 2008. p.205



**Fig 3** Interior photograph of La Tourette, demonstrating rhythmic modulation of light  
"Corridor, Couvent Sainte Marie de la Tourette", The Courtauld Institute of Art. <http://www.artandarchitecture.org.uk>

# Architecture and Media Art

The intersection of analog and digital is a vital prospect in the context of media arts and space. The accessibility and availability of projective media technologies and their authoring software have made media art, one of the most prevalent art forms of the day. Moving beyond the use of large screens, artists can exploit the high luminosity of projectors and lasers to create spatial experiences that begin to venture into the architectural scale demonstrating a tangible tectonic sensibility. While most artists are inclined to work within the limits of a computer screen, artists such as the collective 404. Zero, Ryoji Ikeda and Jeffrey Shaw have influenced projective media well beyond the limitation of computer screens. Their work demonstrates an artist's ability to thread the boundaries of analog and digital perception in tectonic space.



**Fig 4** Ryoji Ikeda's test pattern no.6, temporality between the projection and the participant Sasaki, Yasuharu. Photograph. Ryoji Ikeda. Accessed December 19, 2019. <http://www.ryoji Ikeda.com/project/testpattern/>.



**Fig 5** 404.Zero, interfacing with analog equipment creating digital visual projections Prolific Artist Duo 404.Zero Release Zerror a Control UI for TouchDesigner, Derivative, October 4, 2019,

# Ryoji Ikeda

Internationally renowned artist Ryoji Ikeda pushes the boundaries of digital media art in spatial exhibits that explore the physical limitations of the medium. As a musical composer and visual artist, he has developed a large body of work significant for digital media art<sup>10</sup>. **Micro | macro** and the **Test Pattern Series** alters the observer's perspective of digital space. The audience is permitted to inhabit and immerse themselves in the piece. These works subvert the distinction between the exhibit and the viewer. Furthermore, the physical presence of the audience intercepts light from the projector. This simple strategy establishes a temporal concept that manifests itself within the artwork. Since the audience member casts a shadow from the projection of rhythmic patterns, they create a unique set of conditions that are bound to their physical body in combination with the projection. The participation of the observer at the intersection of the digital projection creates a nuance that is a defining feature of Ryoji Ikeda. The **Test Pattern Series**, beginning in 2008, projected an array of the various binary pattern generated from text files, photos, sounds and movies onto the floor and wall<sup>11</sup>. Ikeda intended to "examine the relationship between the device performance and the threshold of human perception."<sup>12</sup> This rhythmic exhibition is significant to this thesis as it is an example of a digital projection of computerized rhythm in space while incorporating the participant. These principles were once again present in the 2015 **Micro | macro**, performed in the **ZKM** in Karlsruhe, Germany<sup>13</sup>. From 2014-2015 Ikeda was an artist in residence at the CERN nuclear research facility in Switzerland. He produced the **Micro | macro** exhibition, which places the audience in a visual representation of the micro-scale using floor projections with the macro scale projected on the wall. His mathematical depiction beyond what is visible to the human eye demonstrates a new perspective on the world through rhythms, visual patterns, sound and space<sup>14</sup>. In an interview with the MoMA, he states, "to me, sound is a property of physics; vibrations of air. Music is, in essence, a property of mathematics; without mathematical structures, sounds are merely sounds."<sup>15</sup> In demonstrating the macro scale of digitization, Ikeda explores the concept of granularity. It is the distinct feature that separates the analog from what is considered digital. The stepping characteristic of digital frequencies, finely imbedded within digital waves, simulating analog frequencies. At a micro-scale, this limitation of digital frequencies offers an appreciation for the capability of analog signals. The way Ikeda approaches the creation of music through mathematical structure speaks to the nature of architecture as it embodies a frozen music<sup>16</sup>. His work truly is notable for the ability to push the limits of digital media.

10 "Ryoji Ikeda: Biography," ryoji ikeda , accessed December 21, 2019, <http://www.ryojiikeda.com/biography/>)

11 "Ryoji Ikeda: Test Pattern," ryoji ikeda , accessed December 21, 2019, <http://www.ryojiikeda.com/project/testpattern/>)

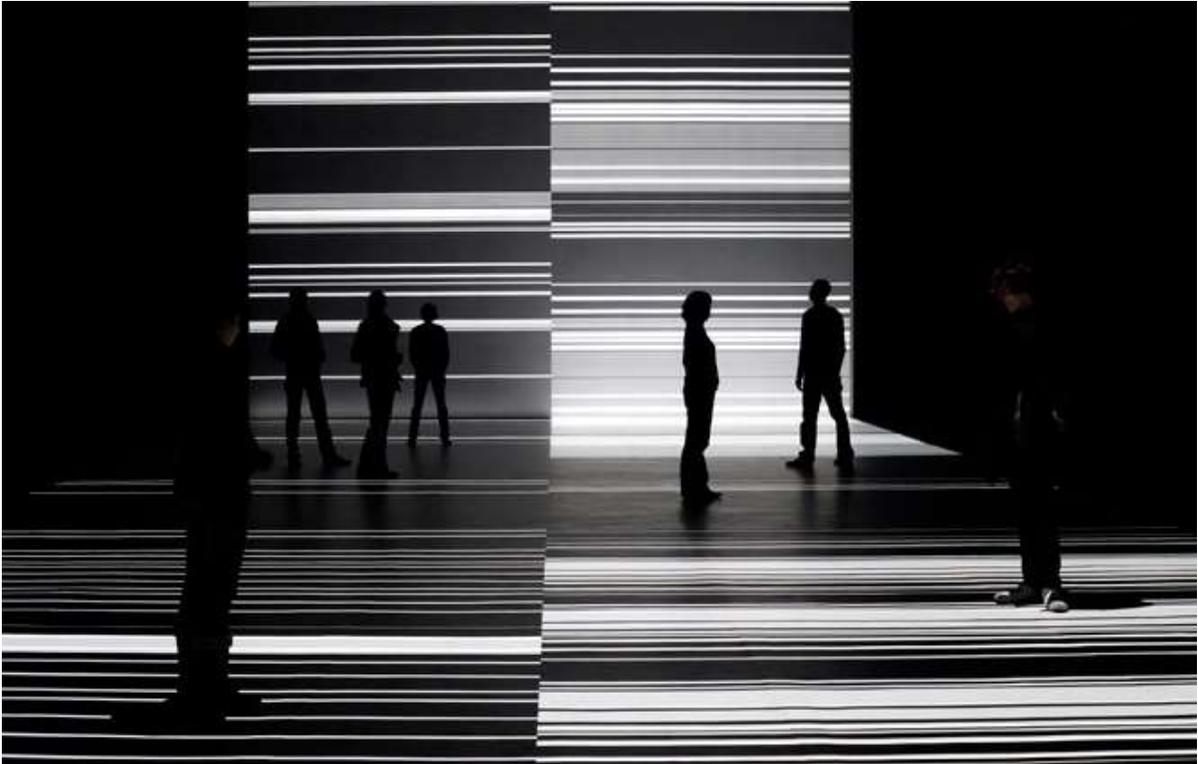
12 Ibid.

13 "Ryoji Ikeda: Micro|Macro," ryoji ikeda , accessed December 21, 2019, <http://www.ryojiikeda.com/project/micro|macro/>)

14 "Ryoji Ikeda: Micro: Macro," Art Guide Australia, July 12, 2018, <https://artguide.com.au/ryoji-ikeda-micro-macro>)

15 Ashley Young and Catherine Hedberg, "MoMA: An Interview with Cyclo. (Ryoji Ikeda and Carsten Nicolai)," InsideOut, accessed December 21, 2019,

16 Johann Wolfgang Von. Goethe, *Conversations with Goethe in the Last Years of His Life* (Place of publication not identified: Theclassics Us, 2013))



**Fig 6** Ryoji Ikeda's Test patern no.3

rc. Photograph. Ryojiikeda. Accessed December 19, 2019. <http://www.ryojiikeda.com/project/testpattern/>.



**Fig 7** Ryoji Ikeda's Micro | macro, located in the ZKM in Karlsruhe, Germany

Wagenhan, Martin. Photograph. Ryojiikeda. Accessed December 19, 2019. [http://www.ryojiikeda.com/project/micro\\_macro/](http://www.ryojiikeda.com/project/micro_macro/).

# 404.Zero

The collective 404.Zero creates new media at the intersection of digital and analog modulation. Taking analog signals and using them to modulate digital outputs, they create unique visualisations and soundscapes. Audiovisual artists, Kristina Karpysheva and Aleksandr Letsius form an artistic collective named 404.Zero. Their media art exhibits are notable as they create spatial experiences with a tectonic sensibility using both analog and digital technologies<sup>17</sup>. Using new media development software as a digital interface, they develop real-time digital visual projections using an analog modular synthesizer. The analog modular synthesizer is a tool that manipulates alternating current through various modulation techniques. It is utilized in various ways, from electronic sound to RCA television graphics using a strictly analog process. As the current modulates, the user turns various knobs and sliders, without being bound to digital precision. This electronic machine is prized for its similarities to traditional musical instruments in its ability to output minute imperfections. The sound generated inherently holds temporal value due to real-time generation and its exact recreation unlikely. The artwork of 404.Zero bridges the gap between the analog and digital worlds, resulting in spatial environments that are fully immersive<sup>18</sup>. **In search of the right place** and **8.0** holds value in incorporating analog and digital methodologies to installations on an architectural scale. **In search of the right place** is an array of still rectangular frames suspended from the ceiling with spinning lasers in the center of each<sup>19</sup>. The corners of each frame hold a bright LED light. This framework allows for the generation of digital light and patterns in space synchronized to an accompanying soundscape, once again produced by their analogue modular synthesizer<sup>20</sup>. This approach to rhythm and light through space is similar in "8.0": "Eight laser projectors are driven by random algorithms and the sound is generated with modular synthesizers in real-time. No samples, no loops. Pure math, code, and electric signals."<sup>21</sup>. 404.Zero's approach clearly defines an aptitude for blurring the lines between the realms of analog and digital technologies. The digital visualization controlled by analog soundscapes is displayed spatially. The line between analog and digital mediums is the defining feature in their work and why they are influential in weaving architecture and media art.

<sup>17</sup> "404.Zero Artistic Collective," Nuts Computer Graphics, accessed December 21, 2019, <https://www.nutscomputergraphics.com/en/inspirational/404-zero-artistic-collective/>

<sup>18</sup> Mutek, "404.Zero," MUTEK (MUTEK, August 3, 2019), <https://www.mutek.org/fr/archives/artists/9829-404-zero>

<sup>19</sup> "In Search Of The Right Place.," Instagram, accessed December 21, 2019, [https://www.instagram.com/p/BIRL\\_U6AGeC/](https://www.instagram.com/p/BIRL_U6AGeC/)

<sup>20</sup> "In Search Of The Right Place - Live," YouTube (YouTube), accessed December 21, 2019, <https://www.youtube.com/watch?v=MfMif1G7DeY>

<sup>21</sup> "8.0 - 404.Zero," YouTube (YouTube), accessed December 21, 2019, <https://www.youtube.com/watch?v=ai2vYGcfzBE>



**Fig 8** Photograph of 8.0 by 404.Zero, depicting intentions at an architectural scaled "8.0 Laser Installation ." Instagram. Accessed December 19, 2019.



**Fig 9** 404.Zero using a modular synthesiser to modulate their digital visual performance Prolific Artist Duo 404.Zero Release Zerror a Control UI for TouchDesigner, Derivative, October 4, 2019,

# Jeffrey Shaw

Jeffrey Shaw's body of work demonstrates the evolution of immersive environments as it pertains to the current facilities available for projective media. His works such as **Corpocinema**(1967), **Diadrama** (1974), **Extended virtual environment** (1993) and **Cupola** (2004) present the evolution of what we consider to be a contemporary understanding of multimedia projective typology<sup>22</sup>. **The Cupola**, created in 2004, is a sizable hemispheric canvas 20m in diameter, suspended above the ground. The installation invites the onlooker to enter and peer upwards at architectural imagery projected onto the screen. Jeffrey Shaw utilizes projection mapping. This process controls the output of a projector in order to display images or videos onto irregular surfaces. The digital nature of the projection allows the creator to modulate the photos and videos. Shaw can deconstruct the photographs into pixels and sort them to become entities of their own. Following the progression of the projection exhibit, Jeffrey Shaw's body of work, shows a clear influence on media art performance space. Built-in 2001, **La Stratosphere**, located within La Société des Arts Technologiques in Montreal, is an immersive modular hemispherical theatre with a canvas that reaches the floor. This ample space can contain up to 350 spectators<sup>23</sup>. This theater is derived from the typology developed by Jeffrey Shaw's work on immersive environments. His various exhibits demonstrate the evolution of digital immersive environments pertaining to new media performance spaces.

<sup>22</sup> "Jeffrey Shaw Compendium," Jeffrey Shaw Compendium, accessed May 1, 2020, <https://www.jeffreyshawcompendium.com/>)

<sup>23</sup> "Satosphere: SAT," Société des arts technologiques, September 3, 2019, <https://sat.qc.ca/en/satosphere>)



**Fig 10** The Extended virtual environment by Jeffrey Shaw in Karlsruhe, Germany 1993  
Bruyère, Jean Michel, and Si Poteris Narrare. "Extended Virtual Environment". Jeffrey Shaw Compendium. Accessed December 19, 2019. <https://www.jeffreyshawcompendium.com/platform/eve/>.



**Fig 11** The Cupola installation by Jeffrey Shaw in Lille, France, a hemisphere projection space  
Shaw, Jeffrey. "Cupola." Jeffrey Shaw Compendium. Accessed December 19, 2019. <https://www.jeffreyshawcompendium.com/>

# Iannis Xennakis

Architect and music composer Iannis Xenakis is significant, as he masters the use of both the analog and digital when creating spatial experiences. A Greek refugee who immigrated to Paris, France, in 1947, he held a degree in engineering from the Athens Polytechnic Institute, which ultimately led to his employment at Le Corbusier's ATBAT (Atelier des Bâtitseurs). Being an engineer and architect, Xenakis took part in the<sup>24</sup> creation of a variety of notable architectural projects such as **La Tourette** and the **Philips Pavilion** during his formative years under Le Corbusier. He would later be more renowned as the creator of musical compositions, which would eventually lead to the realization of multimedia installations such as **Diatopes** and **Polytopes**. Working for Le Corbusier exposed Xenakis to the **Modulor**, a proportional system based on the human body<sup>25</sup>. This system would translate itself into the musical composition **Metastasis** and later in the facade of the **Philips Pavilion**. In 1954, Le Corbusier appointed Xenakis as the chief architect for the construction of the **La Tourette** monastery. He had chosen Xenakis since he possessed a strong sense of geometric and mathematical proportions<sup>26</sup>. Newly promoted, Xenakis proved to be able to translate the elements of the Modulor in an array of different approaches within the Monastery. Among the most influential aspects of the project are the light cannons and, most notably, the proportionality of window mullions. The gestures created by the expression of the proportionality system are identifiable as analog since they are modulated sunlight. Those gestures create "A finely nuanced and symphonic combination of light and darkness..."<sup>27</sup>. The glass panes of 366 centimetres in height are a rigid use of the proportional rhythm system of the **Modulor**. These panes, arrayed throughout the building, create a stochastic distribution acting as "musical glass panes."<sup>28</sup>. Generated by the window's compositional nature, the sun's analog rhythm provides temporal and spatial attributes to the project. As such, La Tourette serves as an exemplary case study regarding the use of spatial rhythms through the lens of an analog typology.

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24 Xenakis, Iannis. Music and Architecture: Architectural Projects, Texts, and Realizations.

Edited by Sharon E Kanach, illustrated, annotated ed., Pendragon Press, 2008.p3

25 Ibid, p.4

26 Ibid, p.49

27 Ibid, p.58

28 Ibid, p.64-64



**Fig 12** Exterior of la tourette monastery light "machine gun"

"LA TOURETTE Monastery, Skylights." Diagonality. Accessed December 19, 2019. <https://centerfordiagonality.org/la-tourette-monastery-skylights/>.



**Fig 13** Interior of la Tourette, Rhythms in window panes generating spatial experiences

Xenakis, Iannis. *Music and Architecture: Architectural Projects, Texts, and Realizations*. Edited by Sharon E Kanach, illustrated, annotated ed., Pendragon Press, 2008.p67

The **Philips Pavilion** is exemplary pertaining to hybrid architecture, as it bridges analog and digital space, a feat far ahead of its time. In 1956, Louis Kalff contacted Le Corbusier to design a pavilion for electronic media displayed at the 1958, Brussels World Fair for the Philips company. The project highlights the work of three key individuals who worked with an interdisciplinary approach. Le Corbusier, who would oversee the design process while crafting a series of projected images for the **Poème électronique**, a 480-second visual poem of light and sound<sup>29</sup>. The second key individual was Edgar Varèse: He would oversee the composition of the electronic music that would accompany the photographs projected within the structure<sup>30</sup>. The electronic poem being the focal point of the project meant that the architectural design needed to consider the interior projective surface, acoustic and limited natural light. As the third influential member of the design team, Xenakis created the hyperbolic form of the structure and composed a piece of electronic music. The piece is heard when the audience would enter and exit the space. Named **Concret PH**(Parabole Hyperbolique), it signifying concrete music<sup>31</sup>. The piece speaks to the design process as the concrete façade is derived from the composition of **Metastasis** by Xenakis. This musical piece is a mathematical extrapolation of the **Modulor** that generates hyperbolic relationships between notes. The rhythms generated by the human proportionality system of the modular, generated music, which was translated architecturally as generating the hyperbolic facade. This design process is genuinely a manifestation of concrete music. Furthermore, the process demonstrates how rhythms can translate into art and, ultimately, an architecture for electronic art. The original concept by Le Corbusier was to create a space that would serve as a stomach in which the audience would enter to “digest” the poem. This space is an anthropomorphic self-reflection stomach<sup>32</sup> that thrives in analog technology. The projection of imagery within the pavilion hints towards an architectural typology for the digital medium. The **Philips Pavilion** lasted eight months before its demolition at the end of the 1958 world fair. Due to its experimental value, some dedicated efforts to preserve the building<sup>33</sup>. Even Le Corbusier attempted to salvage the space as a laboratory of “electronic play.”<sup>34</sup> Nonetheless, this pavilion remains the pinnacle of architecture for electronic media.

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29 Treib, Marc, and Richard Felciano. *Space Calculated in Seconds: The Philips Pavilion*, Le Corbusier, Edgar Varese. illustrated ed., Princeton University Press, 1996. p.86

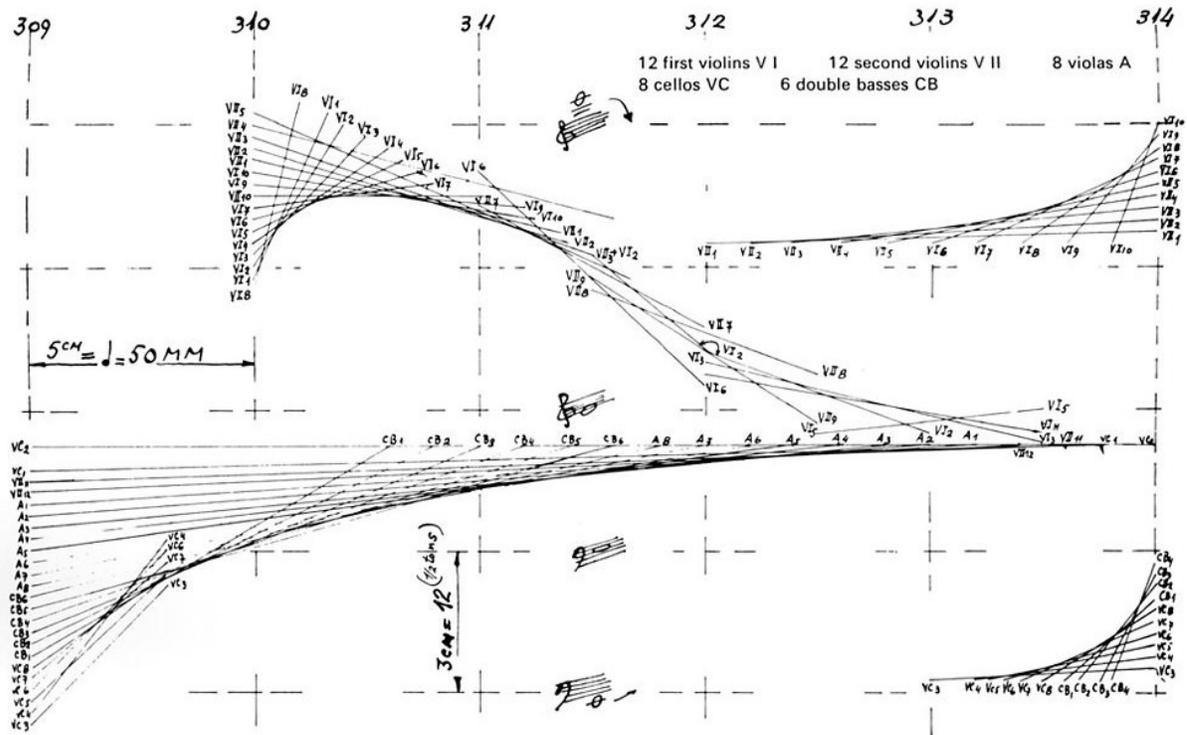
30 Ibid, p.168

31 Ibid, p.15

32 Ibid, p. 26-30

33 Ibid, p.226

34 Ibid, p.227



**Fig 14 Metastasis: A musical composition translated into architecture**  
 Xenakis, Iannis. *Music and Architecture: Architectural Projects, Texts, and Realizations*. Edited by Sharon E Kanach, illustrated, annotated ed., Pendragon Press, 2008.p99



**Fig 15 Photograph of the exterior of the Philips pavilion in Brussels, Belgium 1958**  
 Philips Pavilion by Le Corbusier. World's Fair Community, July 1, 2018. <http://www.worldsfaircommunity.org/topic/16633-philips-pavilion-by-le-corbusier/>.

Beyond his work with le Corbusier, Iannis Xenakis continued to explore how the presence of the audience pertains to sound and later multimedia exhibitions, always creating at the intersect of analog and digital rhythms. Following his exit from the Atelier des Bâisseurs, Xenakis would shift his focus to musical compositions. His pieces remained primarily experimental with a keen interest in mathematical principles and space, **Terretektoth** (1966). Moreover, **Nommos Gamma** (1967-68) are fundamentally questioning the spatial perception of the audience concerning the stability of the performers. **Nommos Gamma** requires a 98-piece orchestra and **Terretektoth** 88, respectively<sup>35</sup>. Both compositions intended to have members of the orchestra embedded within the audience. This detail is essential, as the piece would never be replicable by stereophonic means. Xenakis never truly moved away from his artistic experimentation regarding spatial conditions. His work would later evolve into the **polytopes** with multiple iterations from 1967-1978, located in Montreal, the Iranian desert, France and Greece<sup>36</sup>. These pieces demonstrate complex mathematical rhythms in large light installations made of steel cables with thousands of lights attached<sup>37</sup>. The **polytopes** are an extension of Xenakis's work from **La Tourette** and **The Philips pavilion** as he develops immersive multimedia environments of music and light as digital technologies became prevalent. His mastery of the digital and analog approach to sound and light is evident throughout the various iterations of the polytopes. During the Polytopes de Montreal, Xenakis emphasized the dichotomy between the digital nature of the visible light fixtures and the analog quality of an orchestra<sup>38</sup>. As such, Iannis Xenakis is vital in understanding the rhythmic attributes that perpetuate themselves in space from both analog and digital perspectives.

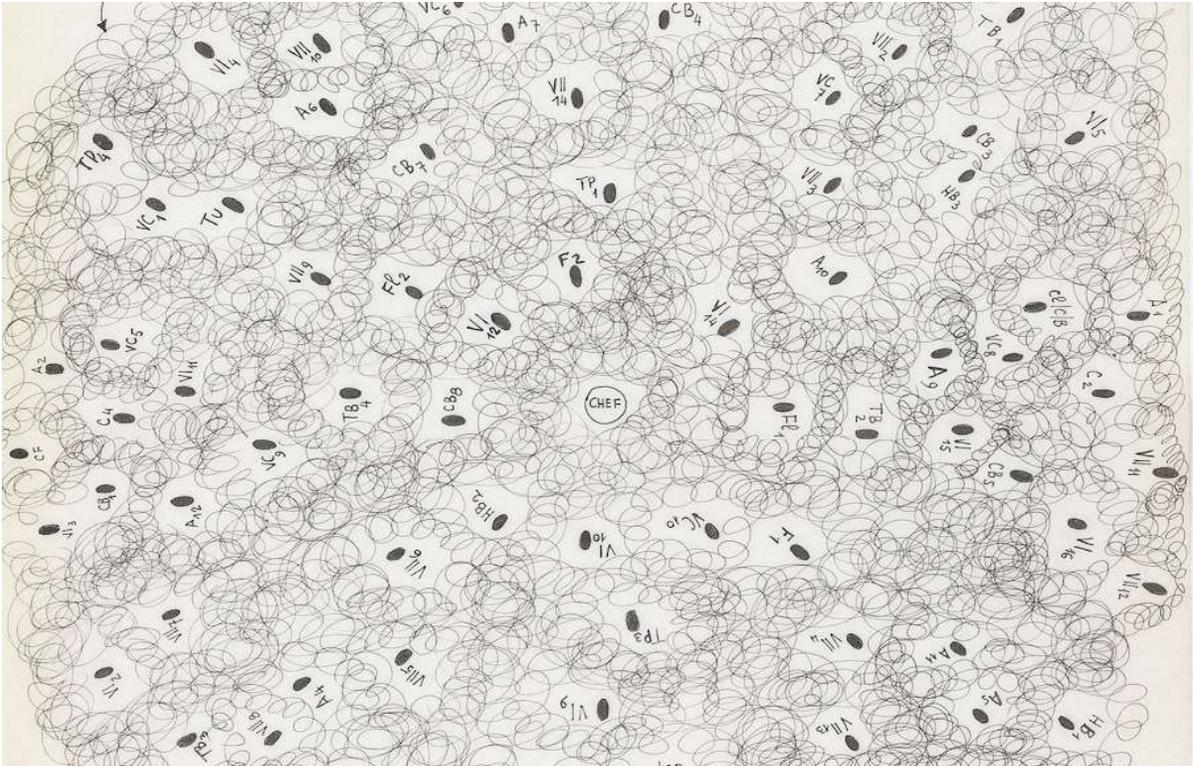
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<sup>35</sup> "Iannis Xenakis - Terretektoth · Nomos Gamma," Discogs, January 1, 1969, <https://www.discogs.com/Iannis-Xenakis-Terretektoth-Nomos-Gamma/release/1403536>

<sup>36</sup> Xenakis, Iannis. *Music and Architecture: Architectural Projects, Texts, and Realizations*. Edited by Sharon E. Kanach, illustrated, annotated ed., Pendragon Press, 2008. p.202

<sup>37</sup> *Ibid.*, p.210

<sup>38</sup> *Ibid.*, p.215



**Fig 16** Drawing representing distribution of musicians for Terretektorh Iannis Xenakis. Study for Terretektorh (distribution of musicians). December 20, 1965. Ink on vellum, 9 x 11 inches. Iannis Xenakis Archives, Bibliotheque nationale de France, Paris.



**Fig 17** Photograph during the performance of Polytopes de Cluny Xenakis, Iannis. Music and Architecture: Architectural Projects, Texts, and Realizations. Edited by Sharon E Kanach, illustrated, annotated ed., Pendragon Press, 2008.p230

# Experimental Interface

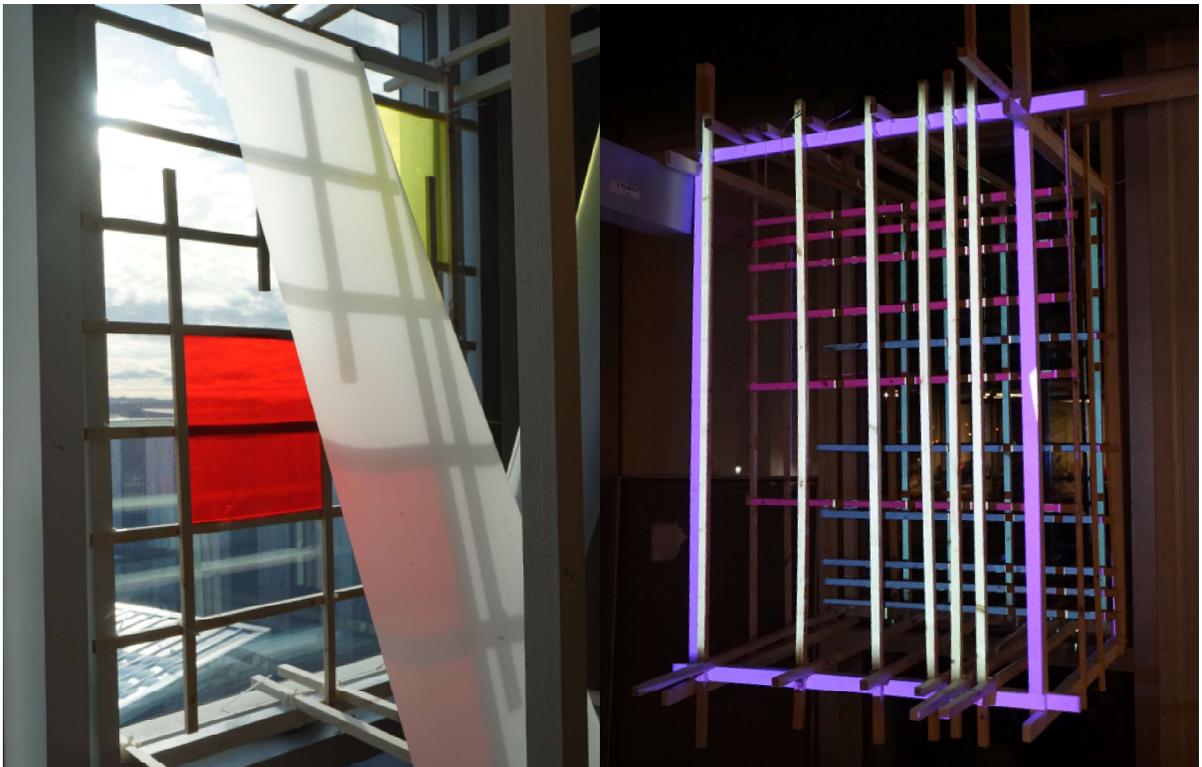
The best way to fully understand digital and analog principles facing media arts and architecture is to work with them physically. This project intended to create a set of exercises that suited a rapid iterative process. The goal was to explore analog and digital rhythms in order to integrate them into the architectural design process.

For this study, an interface was created to acquire an understanding of spatial phenomena at the intersection of analog and digital rhythms. The window was utilized as the location to conduct this experiment as it is where solar rays are modulated by the building. This study observes how rhythms in space function facing both analog and digital light conditions. The architectural modulation of light rays through windows, the absence of wind and altered humidity are all factors that are synthesized by the building. The third floor of the McEwen School of architecture provided an abundance of windows with extruded sill and jambs ideal for the insertion of a box frame. The space serves as an extrusion of the window frame. Experiments within would be subject to the analog nature of the sun since the selected window was located on the south face of the building. At night, the use of a projector would allow for digital experimentation within the same parameters. But facing outside.

The experiments were predetermined to seek results with a degree of predictability. They ranged from the **Modulor**, **La Tourette**, the hyperbolic paraboloid in the **Philips Pavilion**, and an interpretive implementation of **Test Pattern No.5**. This systematic approach to experimentation led to an initial understanding of digital and analog rhythms. Using components from the previous experiments and allowing for freedom and play was vital.



**Fig 18** Interface for analog and digital rhythmic experimentation located in a south facing window of the McEwen school of Architecture



**Fig 19** Analog and digital rhythmic experimentation.

Through the repetition of iteration and the implementation of wood pieces, mylar, coloured film and zip ties, a rapid workflow started to form. The wood members designed as 1.25" x 0.5" x 36" pieces have 0.03" grooves on both sides. These slits were created to allow the insertion of laser cut parts to rapidly generate intricate patterns within the installation.

Furthermore, the use of SPF (Spruce Pine Fir) wood meant that pins inserted themselves easily within the wood members to allow suspension of a variety of materials from mesh screens, reflective sheets and mylar.

The use of a digital projector allowed the projection of light onto the installation at night to experiment with visual representation of digital rhythms. The use of projection mapping meant that light could precisely project within designated areas of its otherwise full frame. Within desired regions, a straightforward two-dimensional grayscale minimalist visualization of rhythms is projected. Following iterations became more intricate by projecting three-dimensional poly-rhythmic patterns within the interface. This experimental approach was influential in developing a series of principles to utilize during the design of an architectural project.

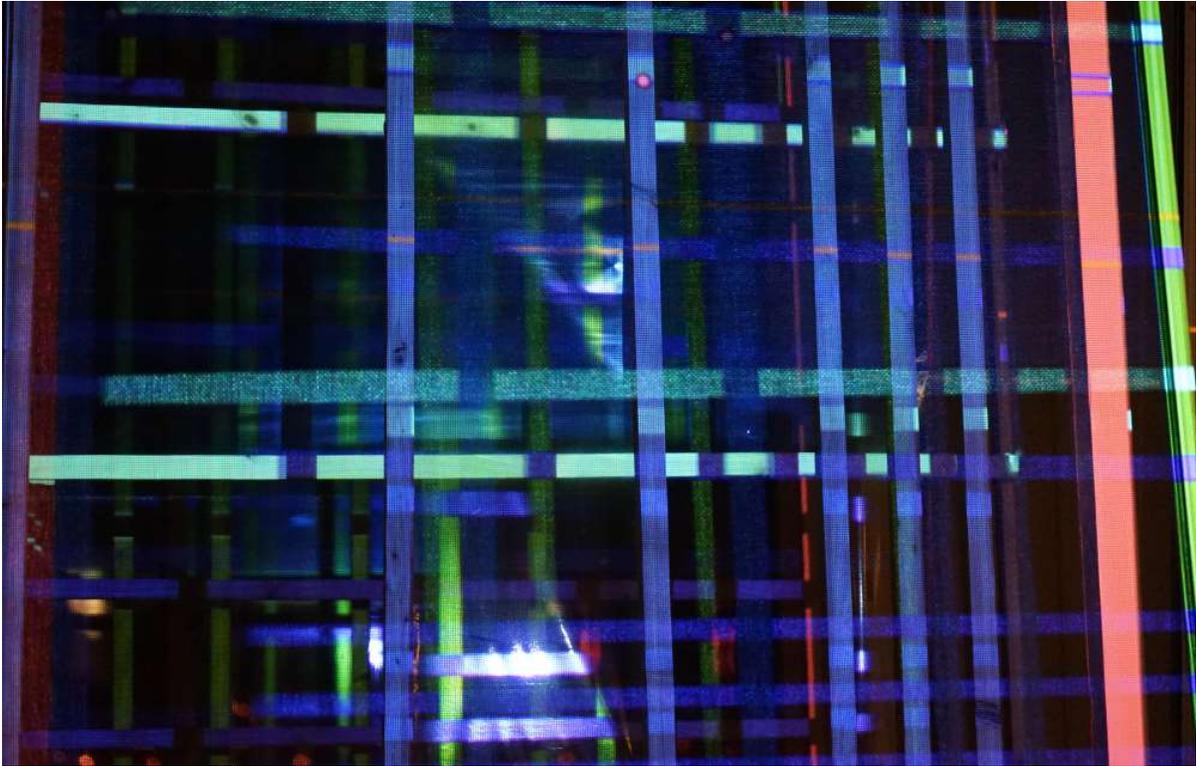


**Fig 20** Shifting contrasts according to solar movement

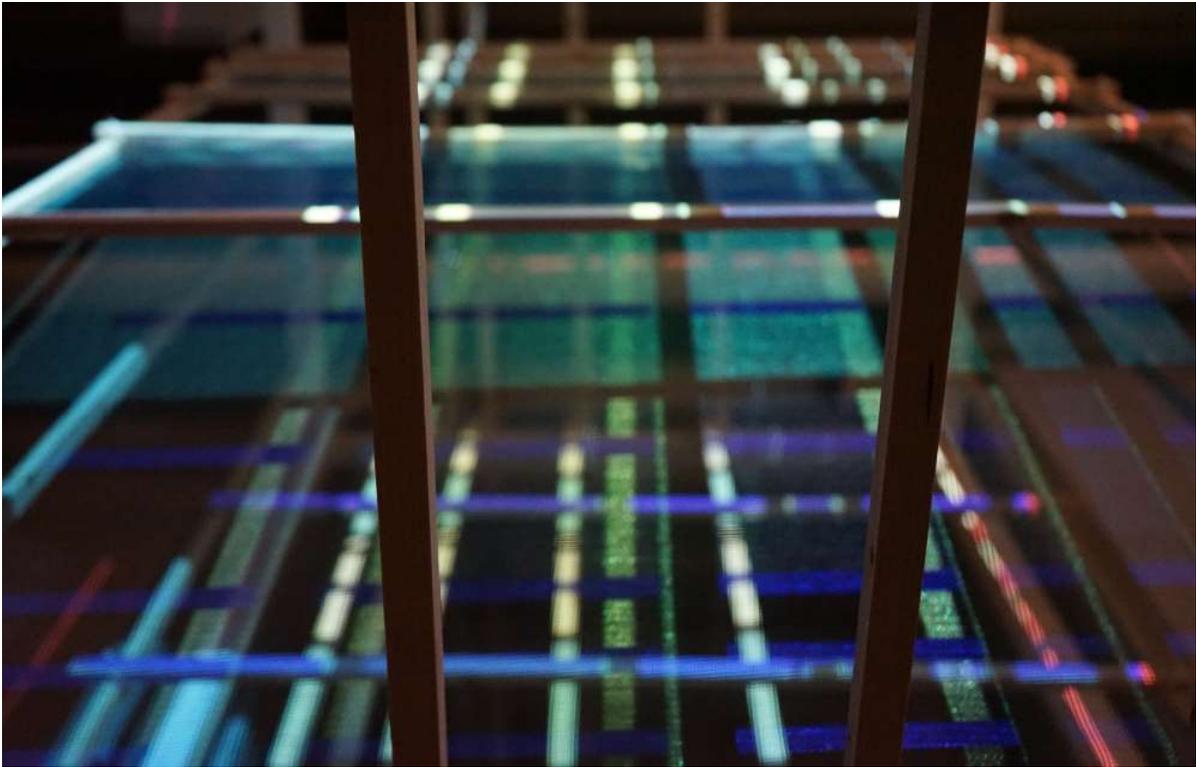


**Fig 21** Observation of similar rhythmic patterns achieved with analog and digital light

Throughout the experimentation process, there emerged identifiable nuances that speak to an architectural process. These are **threshold, contrast, reflection and memory**. The concept of threshold was identified when light permeated through the box onto various surfaces within the building. This phenomenon was visible from shadows cast by the sun and night from the projector. The process demonstrated an extension of the medium that exceeded the limits of the three-dimensional box. In an architectural sense, this could be an abstraction of programmatic elements that permeate beyond their physical limitation. This experimental understanding of analog versus digital light sources serves as a methodology of blurring spatial thresholds using light. Contrast, as a phenomenon, was present through light exposure created by the sun and that of the projector, but from an architectural sense, used as a tool to design architecture regarding spaces that are programmatically different. As the highly exposed wood members within the experimentation box were lit up by the sun rays, they casted shadows that would create rhythmic patterns. The same phenomenon was present during digital experimentation with the projector. The qualities of spaces play a role in designing a gradient from controlled environments to the exterior space. Reflection occurred during the experimentation process on two occasions: The first was in the projection of light, which would permeate through the box onto the window—giving the illusion of space appearing beyond the glass pane. The second was with the use of reflective mylar film, which would cause modification to both digital and analog light regarding its direction and form. This factor incites an implication of programmatic gestures, as reflection can be applied to generate further rhythms to create spaces in a two and three-dimensional way. Lastly, memory, derived through the digital projection process and its use upon the following iteration. Once an iteration was built and the projection mapping aligned, the process of dismantling the iteration to build another would ensue. Once the following experiment was ready to receive projection, the previous mapping would reveal the intersection between the old and the new. This process created a visual polyrhythm that bridged what was previously occupying the space and what was now present.



**Fig 22** Layered approach to digital rhythm projection



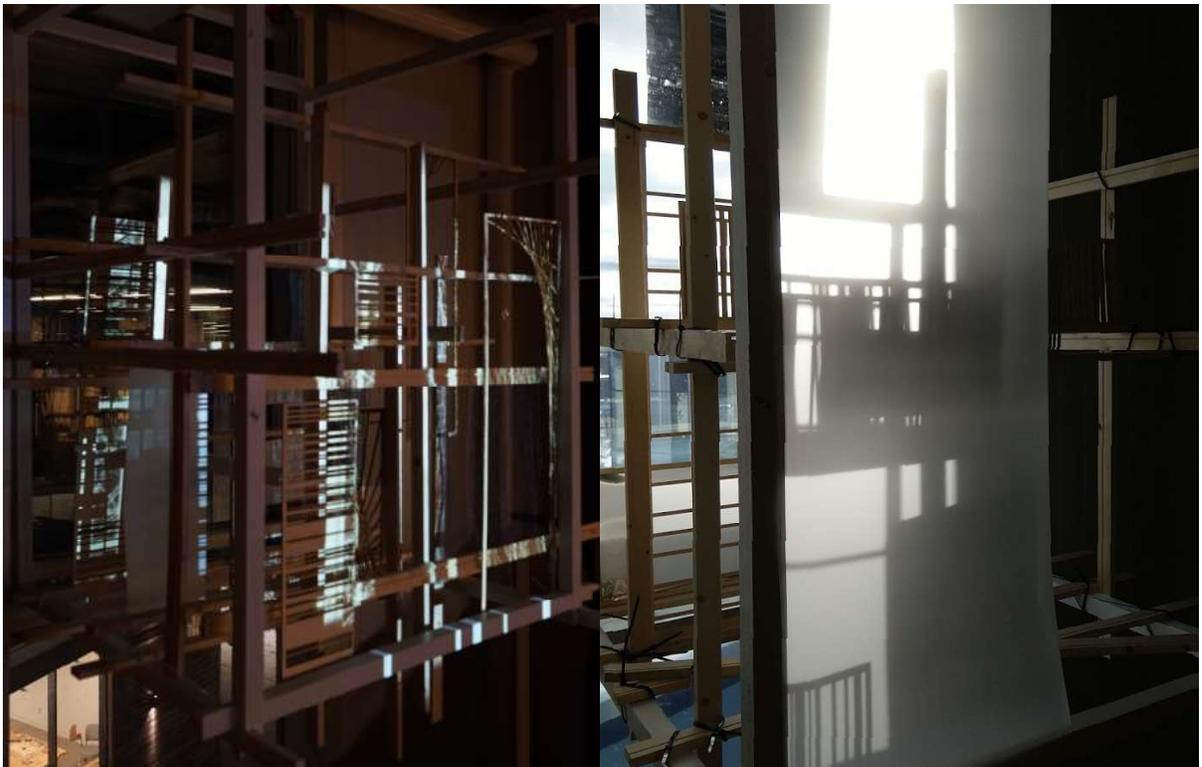
**Fig 23** Layered approach to digital rhythm projection 2

The concept of threshold, contrast, reflection and memory are the resulting themes of this experimental research that can be utilized while designing in section, elevation and generate significant programmatic elements.

This contrast between light and dark is especially relevant to the idea of the black box theatre. As a highly controlled environment, The Black Box Theatre is void of all light and external parameters. As the space transitions onto the exterior space, it is void control as the outdoor conditions are not spaces modulated by architecture in real-time.



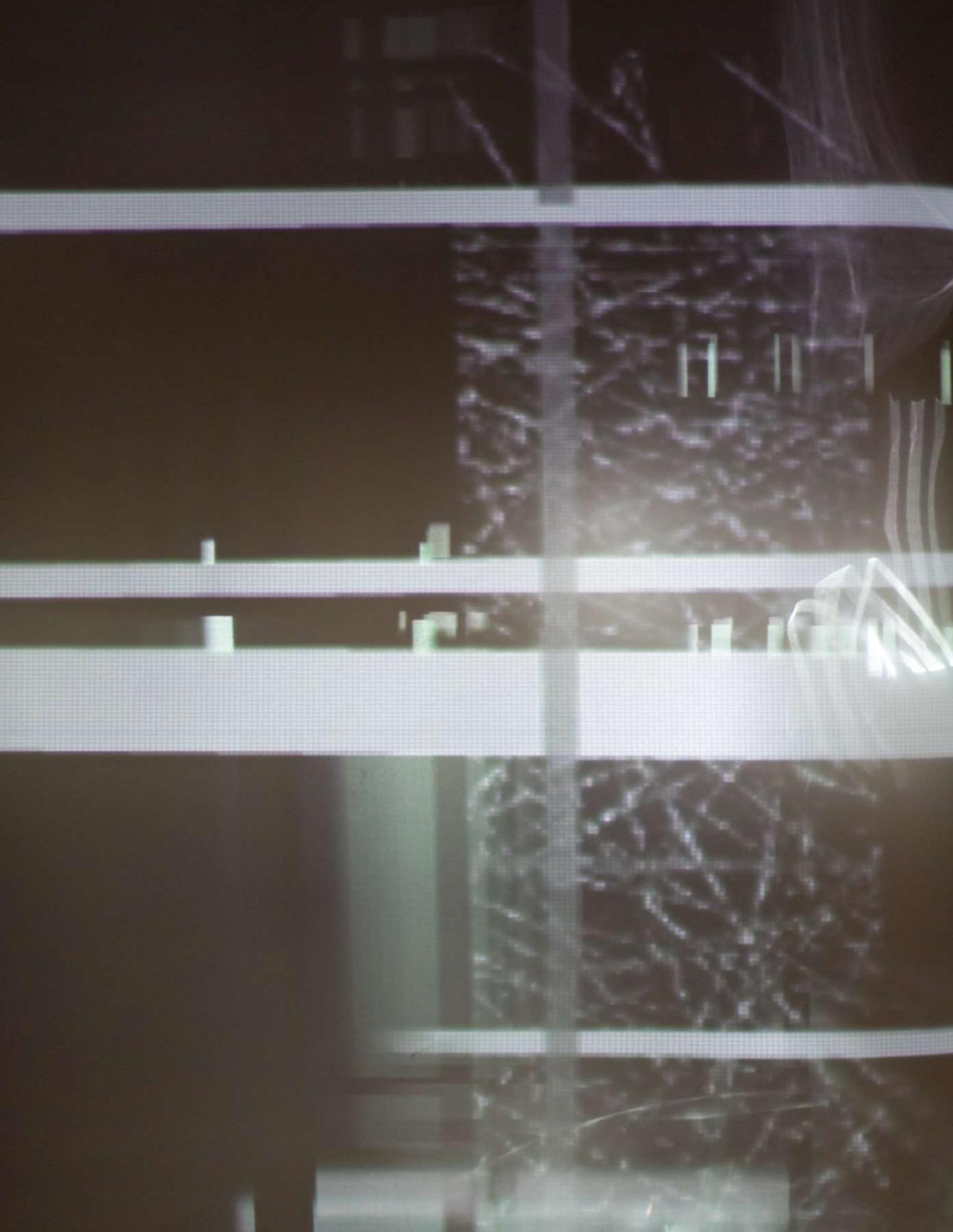
**Fig 24** Mylar reflection from the projector



**Fig 25** Investigation of spatial rhythms during the day and night



**Fig 26** Digital light reflection in space



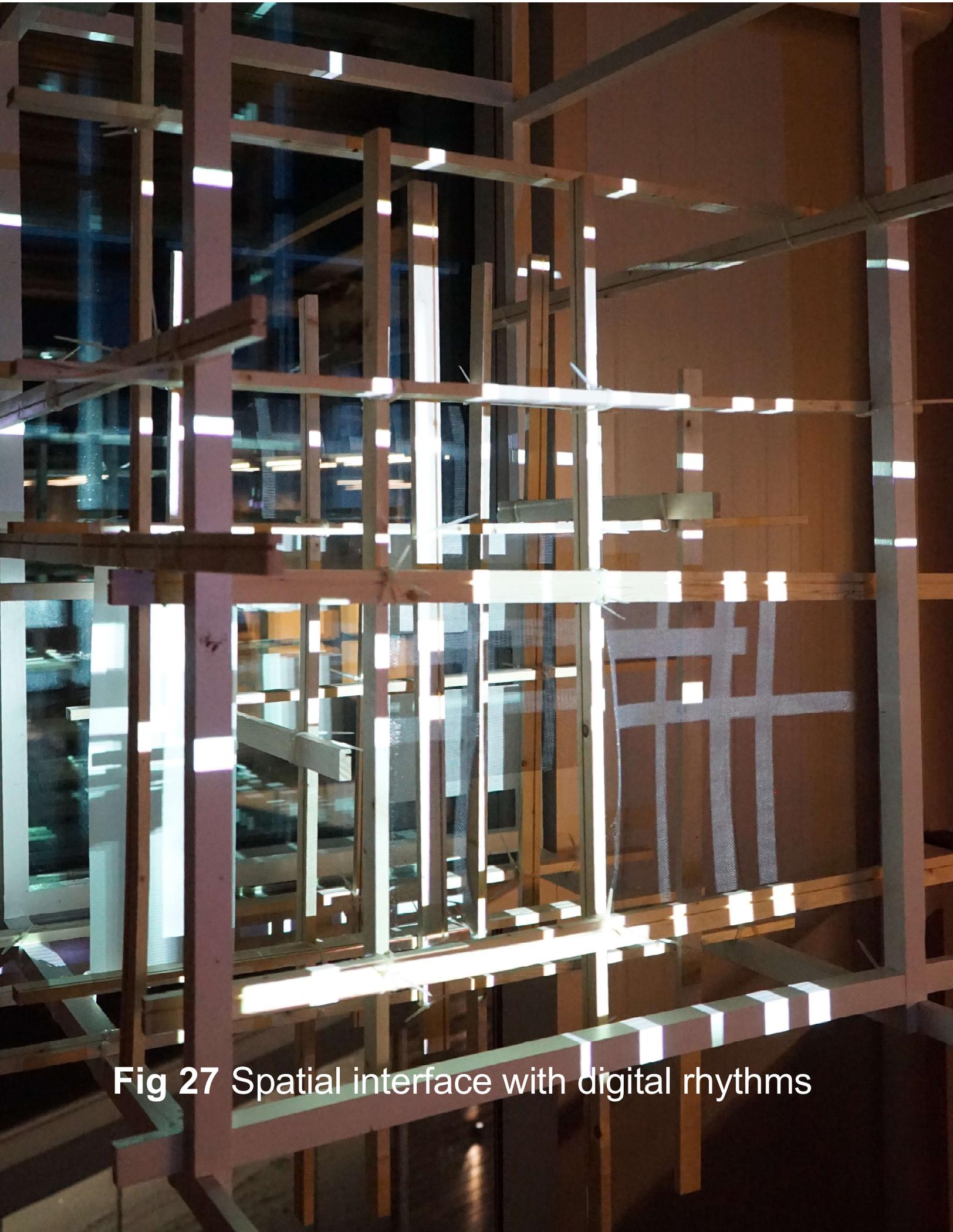


Fig 27 Spatial interface with digital rhythms

**Part 2**

# **COMMUNITY**



# Global Perspective

Digital performance spaces vary greatly as institutions attempt to accommodate a broad range of potential artists. Significant projects examined were the **ZKM** Center for Art and Media in Karlsruhe Germany<sup>39</sup> and the Experimental Media and Performing Arts Center (**EMPAC**) at Rensselaer Polytechnic Institute in Troy, New York<sup>40</sup>. The **ZKM**, founded in 1989 aims to carry the classical arts into the digital age in a sort of digital Bauhaus<sup>41</sup>. The two main spaces in the **ZKM** are the Foyer and the Media Theater. The media theatre is a 345 sqm controlled space with an array of modular lighting and projection screen<sup>42</sup>. The theater would be considered a digital space since it is void of natural light and caters specifically to digital media. The 1000 sqm foyer is an ample three-story open space with the remnant structure of the old industrial building that once served as a munitions factory<sup>43</sup>. This space is significant as it is not completely closed off. The natural light signifies that the space is located at the intersection of digital and analog. The foyer is ideal for the large format installations such as the **Micro | macro** by Ryoji Ikeda in 2015<sup>44</sup>. The space and the exhibit are both located at the intersection of analog and digital.

The **EMPAC** has an array of spaces such as the concert hall, theatre, studio 1, studio two and studio beta<sup>45</sup>. The studios and lobby are of interest here. Studio 1 and 2 are entirely media focused as they are void of external conditions such as sunlight, which signifies they are digital spaces. The studio beta begins to blur this edge of control as it has the functionality similar to a black box, but also allowing an abundance of natural light<sup>46</sup>. The **EMPAC** demonstrates a spectrum of spaces that lie between analog and digital conditions. Access to these spaces is not easily attainable by the public, but rather a specific professional clientele due to funding of their cutting-edge facility. The ZKM and Empac are large buildings that demonstrate an architectural spectrum of spaces that range from analog to digital. By creating a public building with the same diversity of spaces, emerging artists will be able to create to the same capacity as the professionals.

39 "The ZKM," ZKM, accessed December 21, 2019, <https://zkm.de/en/the-zkm>

40 "About." Experimental Media and Performing Arts Center (EMPAC). Accessed December 21, 2019. <https://empac.rpi.edu/about>.

41 "The ZKM," ZKM, accessed December 21, 2019, <https://zkm.de/en/the-zkm>

42 "Media Theater," ZKM, accessed December 21, 2019, <https://zkm.de/en/about-the-zkm/location-renting/media-theater>

43 "Foyer." ZKM. Accessed December 21, 2019. <https://zkm.de/en/about-the-zkm/location-renting/foyer>

44 "Ryoji Ikeda: Micro: Macro: 2015," ZKM, January 1, 1970, <https://zkm.de/en/publication/ryoji-ikeda-micro-macro>

45 "Venues." Experimental Media and Performing Arts Center (EMPAC), accessed December 21, 2019, <https://empac.rpi.edu/about/building/venues>

46 "Studio Beta." Experimental Media and Performing Arts Center (EMPAC), accessed December 21, 2019, <https://empac.rpi.edu/about/building/venues/studio-beta>



**Fig 28** Studio 2, EMPAC

"Studio 2." Experimental Media and Performing Arts Center (EMPAC). Accessed December 21, 2019. <https://empac.rpi.edu/about/building/venues/studio-2>.



**Fig 29** Studio 1 - Goodman, EMPAC

"Studio 1-Goodman." Experimental Media and Performing Arts Center (EMPAC). Accessed December 20, 2019. <https://empac.rpi.edu/about/building/venues/studio-1-goodman>.



**Fig 30** Studio Beta, EMPAC

"Studio Beta." Experimental Media and Performing Arts Center (EMPAC). Accessed December 20, 2019. <https://empac.rpi.edu/about/building/venues/studio-beta>.



**Fig 31** Exterior photograph of the EMPAC in Troy, NY

"Gallery of EMPAC / Grimshaw - 1." ArchDaily. Accessed December 20, 2019. <https://www.archdaily.com/124708/empac-grimshaw/5013e5d128ba0d3b450003ab-empac-grimshaw-photo>.



**Fig 32** ZKM a historical munitions factory.

"Architecture." ZKM. Accessed December 20, 2019. <https://zkm.de/en/about-the-zkm/entstehung-philosophie/architecture>.



**Fig 33** Exterior photograph of the ZKM in Karlsruhe, Germany

"99.9% Shock from the Empty Room: 10.09.2017 - 15:00: ZKM. Startseite. Accessed December 20, 2019. <https://zkm.de/en/event/2017/09/999-shock-from-the-empty-room>.



**Fig 34** ZKM Foyer, spatial intersect of analog and digital light.

Micro | macro: Ryoji Ikeda: ZKM. Startseite. Accessed April 30, 2020. <https://zkm.de/en/event/2015/06/globale-ryoji-ikeda>.



**Fig 35** Modular Media Theater in the ZKM

"Media Theater" ZKM, accessed December 21, 2019, <https://zkm.de/en/about-the-zkm/location-renting/media-theater>

# Digital Media in Montreal

Montreal is a city recognized for a prominent role in the digital media arts. Electronic art festivals are abundant throughout the year from Printemps numérique<sup>47</sup>, Igloofest<sup>48</sup>, Mutek<sup>49</sup> and Elektra<sup>50</sup>. An organization under the name **Culture Montreal** has taken steps in providing infrastructure to promote digital culture on the island. They declare a need to “Stimulate and support the digital art sectors” and, in the process, enable Montreal to become the leading capital of digital creativity by 2020<sup>51</sup>. Since the city demonstrates an abundance of events and participation in the creation of media art, the increase in need for digital media art performance space is evident.

Nicholas Bernier, a professor in the Digital Music program at the Université de Montréal and is also a member of the art collective Perte de signal<sup>52</sup>. Bernier described his creative process as independent of the location in which it would occupy. His artwork is often void of context since it does not directly identify with its surroundings<sup>53</sup>. **Ensemble d’Oscilateur** (2016-Ongoing) and **Transfert**(2017) are projects that have no predisposition in regards to location<sup>54</sup>. These pieces are the focal point for the audience, ultimately able to stand alone. The second interview was with Chris Salter, the Director of the Hexagram, Concordia’s Centre for Research and Creation in Media Arts and Technology<sup>55</sup>. Salter’s work such as **Displace** and **Sensefactory** show a sensibility for the viewer with regards to their environment. The emphasis is on one’s perception within a greater spatial context<sup>56</sup>. Despite having different approaches to their artwork, they had common responses regarding the location where they physically worked. It was either on-site or in a reserved facility. Both of these artists are funded academics. Yet the problem remains for those emergent artists in the same domain. Space required for new media creation is not easily accessible in Montreal as it is for Salter and Bernier. The Hexagram black box theatre at Concordia University and La Stratosphere at La Société des arts technologique located in Montreal, are established facilities for media art. At first sight, they appear to be available to the public. Yet, the Hexagram black box’s availability schedule remains entirely booked for the following year and a half<sup>57</sup>. In Montreal, the accessibility of media art space is problematic. This is an opportunity to alter the focus of media performance spaces from professional to community access.

47 “Home,” Printemps numérique, December 17, 2019, <https://www.printempsnumerique.ca/en/>

48 “Home,” Igloofest, accessed December 21, 2019, <https://igloofest.ca/en/>

49 Mutek, “International Festival of Digital Creativity and Electronic Music,” MUTEK (MUTEK, December 21, 2019), <http://www.mutek.org/en/>

50 “Elektra Montreal: BIENNIAL, Contemporary Art,” Elektramontreal, accessed December 21, 2019, <https://www.elektramontreal.ca/bian2020>

51 Nicolas Bernier, “Nicolas Bernier: About,” nicolas bernier | about, accessed December 21, 2019, <http://www.nicolasbernier.com/page/about.htm>

52 “Home,” Perte de Signal, accessed December 22, 2019, <http://perte-de-signal.org/en/>

53 Lalonde, Eric. Interview with Nicholas Bernier, October 17, 2019.

54 Ibid.

55 “About,” CHRIS SALTER, accessed December 21, 2019, <http://www.chrissalter.com/about/>

56 Lalonde, Eric. Interview with Chris Salter, October 17, 2019

57 “Black Box,” Black Box, accessed December 21, 2019, <https://www.concordia.ca/finearts/facilities/academic-research-support/research-spaces/black-box.html>



**Fig 36** Photograph from Elektra digital arts biennial in Montreal  
"Exhibitions: Elektra Montreal." Elektramontreal. Accessed December 20, 2019. <https://www.elektramontreal.ca/elektra-gallery>.



**Fig 37** Photograph from Mutek festival dedicated to promote electronic music and the digital arts. "MUTEK Montreal." Facebook. Accessed December 20, 2019. <https://www.facebook.com/MUTEK/>.



**Fig 38** La Stratosphere immersive projection theatre, Mutek 2013  
"House." acquiesce to... Accessed April 30, 2020. <https://acquiescetomusic.wordpress.com/tag/house/>.

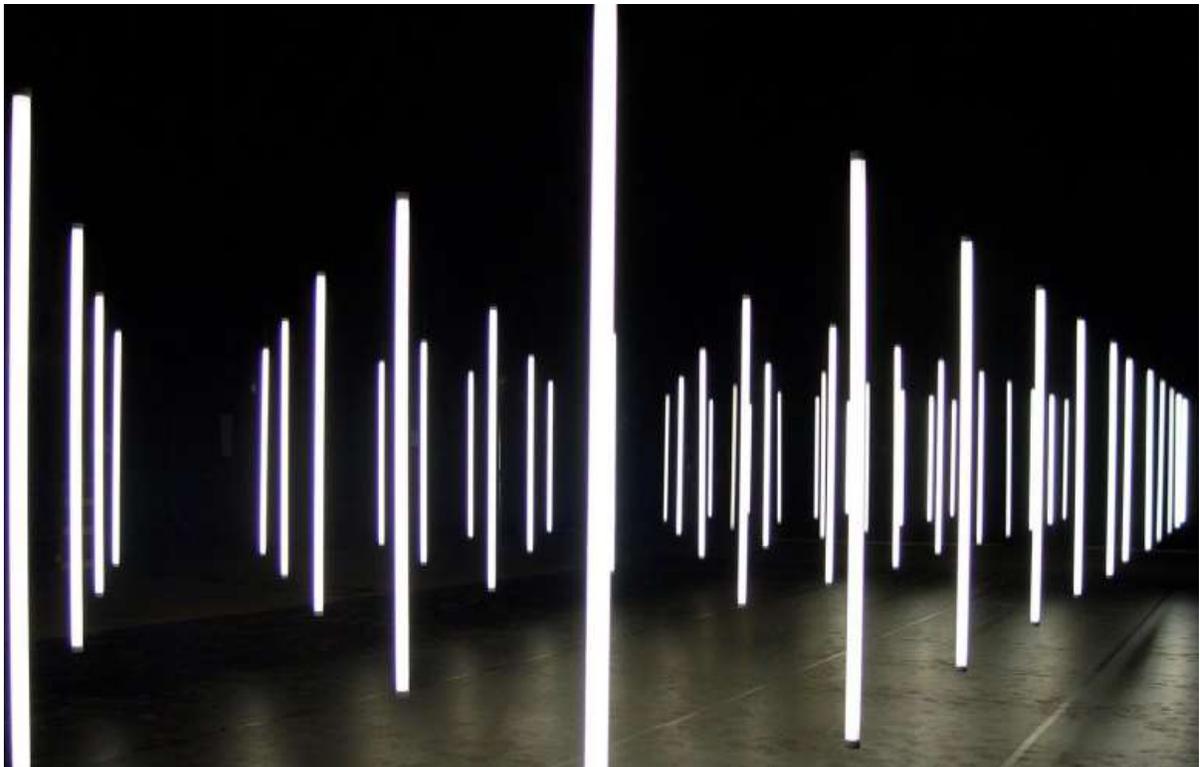


**Fig 39** Exterior of la Stratosphere immersive projection theatre  
Catherine Lalonde, Arts Numeriques - Apres La Renovation, La SAT Version 4.0, Le Devoir (Le Devoir, January 19, 2011), <https://www.ledevoir.com/culture/314833/arts-numeriques-apres-la-renovation-la-sat-version-4-0>



**Fig 40** Hexagram Black box theatre in Montreal

Brito, Ricardo. Montreal Review @ the Hexagram Black Box Studio. Montreal Review @ the Hexagram Black Box Studio, November 13, 2007. <http://ricardo-ed3studio.blogspot.com/2007/11/montreal-review-hexagram-black-box.html>.



**Fig 41** Using the black box to create focus on the artwork, void of context

"Wald-Forest." matralab. Accessed April 30, 2020. <https://matralab.hexagram.ca/projects/wald-forest/>.

# Mile-end

In Montreal, most theatres and performance spaces reside in le Quartier des Spectacles. It is not feasible to build new, community accessible performance spaces in such a developed area. It is simply too dense for a community-focused project. To create a culturally relevant space, it was clear that a location with a strong cultural presence would benefit from this sort of project. The Mile-end offers a set of conditions that complement an approach to an architectural media art project that embodies analog and digital rhythms.

Community initiatives such as le Marché des Possibles<sup>58</sup> and Aires Commune<sup>59</sup> host events that attract people to the area. Le Marché des Possibles is a pop-up event with diversified programming, including live music, film screenings, Biergarten, food and craft vendors<sup>60</sup>. L'Aire Commune is a temporary non-conventional public summer workspace constructed of wood decking and shipping containers. Their focus is to promote alternative work styles offering public boardrooms, workspaces with an emphasis on networking. After the workday, it transforms into space for social gathering. With food trucks, a bar and live DJs, Aire Commune often transforms into a block party. Defining the Mile end, the cultural presence is ideal to support a community-based performance space.

For those who work in the Mile-end, many have jobs relating art and technology that would be able to benefit from a media art performance space. The leading industry in the Mile-end is Ubisoft, a video game development studio with over 3000 employees<sup>61</sup>. Furthermore, there are artificial intelligence firms on the north side of the railway. The presence of art and technology is also prevalent in the vicinity. Not only is there potential for the game developer demographic to participate as an audience for this new performance space, but it can stimulate interest in those already familiar with technology to begin to create media art.

<sup>58</sup> "Marche Des Possibles: New Open-Air Market in Mile End," Montreal Gazette, July 7, 2014, <https://montrealgazette.com/life/urban-expressions/marche-des-possibles-new-open-air-market-in-the-mile-end>

<sup>59</sup> "Aire Commune," Aire Commune, accessed December 21, 2019, <https://www.airecommune.com/>

<sup>60</sup> Ibid.

<sup>61</sup> "Ubisoft at 20: It's Changed Mile End, but for the Better? | CBC News," CBCnews (CBC/Radio Canada, June 2, 2017), <https://www.cbc.ca/news/canada/montreal/ubisoft-20-years-montreal-mile-end-2017-1.4143407>



**Fig 42** Aire commune

"Aire Comune." La Fabrique Crepue, May 20, 2019. <https://www.lafabriquecrepue.com/2019/05/20/aire-commune-revient-pour-une-troisieme-annee-et-ca-donne-envie-de-profiler-de-lete/>.



**Fig 43** Marché des possibles

"CKUT CURATES MARCHÉ DES POSSIBLES FRI. JULY 10TH." CKUT CURATES MARCHÉ DES POSSIBLES FRI. JULY 10TH | CKUT 90.3 FM. Accessed April 30, 2020. <https://ckut.ca/en/node/1553>.

The proposed site is located at 77 Bernard St Est. To access the site using the metro, one needs to disembark at the Rosemont station and walk a fair distance across the Viaduc Van Horne, an overpass crossing the railway north of the site. It is a common occurrence that people create openings within the fence, crossing the train tracks to bypass the extended walk. Although CN strives to enforce security measures on its site, pedestrians continue to cross. If one is to take a bus, the site is a block from the main artery of Le Plateau, boulevard St-Laurent. The site is at the intersection of an urban green path that extends along the Viaduc Van Horne. This path contains various public features such as a children's playground, a dog park and the Van Horne skatepark south west of the proposed site. The path concludes to the north east leading into Le Champs des Possibles. Les Amis du Champ des Possibles is an organization that has stewardship of the green space on the adjacent site to the north-east. Their mandate is to maintain the site in a natural capacity. They strive to maintain the site with minimal human intervention. They promote the use of the site through the formation of pedestrian trails, upkeep of bee colonies and the abundant growth of foreign vegetation from trains, as the tracks are located along their site<sup>62</sup>. Currently, 77 Bernard st est contains the structural remnants of an old building awaiting demolition. It is a storage space for concrete barriers with substantially overgrown vegetation. The state of the site creates an obstacle in the urban path along the railway. This obstacle creates an opportunity to integrate the project within the existing landscape. As well, the extension of the skatepark would enable the project to encourage movement through the site, from skaters to pedestrians. A potential gesture emphasizing the cross interaction between cultural groups that often remain isolated.

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<sup>62</sup> "Secteur Saint-Viateur Est," Mont, accessed December 21, 2019, [https://ville.montreal.qc.ca/portal/page?\\_pageid=7297,112003646&\\_dad=portal&\\_schema=PORTAL](https://ville.montreal.qc.ca/portal/page?_pageid=7297,112003646&_dad=portal&_schema=PORTAL)



**Fig 44** Van Horne Skatepark

Sioui, Marie-Michele. "Montreal Expulse Kabane 77." *Le Devoir*. *Le Devoir*, August 10, 2016. <https://www.ledevoir.com/societe/transports-urbanisme/477385/montreal-expulse-kabane-77>.



**Fig 45** The abandoned city garage, home to kabane 77

Sioui, Marie-Michele. "Montreal Expulse Kabane 77." *Le Devoir*. *Le Devoir*, August 10, 2016. <https://www.ledevoir.com/societe/transports-urbanisme/477385/montreal-expulse-kabane-77>.

Historically, 77 Bernard St Est was the location of the old Mile-end train station. It was demolished in the 1950s, and Canadian Pacific Railway Ltd rented the remaining storehouse to textile companies for the remainder of the century<sup>63</sup>. In 2000, the site was acquired by the city of Montreal with the intention to use it as an industrial garage<sup>64</sup>. The city never made use of the site, and it was abandoned. Unsanctioned by the city, the group Kabane 77 occupied the space with makeshift chairs and hosted various community based events<sup>65</sup>. Although the site is fenced off, this intervention did not deter the members of the community<sup>66</sup>. The intention of Kabane 77 was to convert the space into a venue for independent cinema that would integrate into Le champs des possibles<sup>67</sup>. In the process of accomplishing their goal, Kabane 77 would host various events taking place in the abandoned building. In 2016, a local artist Laurence Grandbois Bernard brought a projector on-site to project on the old textile sign that is still present next to the structure<sup>68</sup>. The photographs of a large gathering of people demonstrate an interest in the integration of media in the area<sup>69</sup>. March 7, 2017, marked the supposed end of Kabane 77 as the old industrial building was to be destroyed<sup>70</sup>. The city bureaucracy left the building untouched until June 27, 2018, when a mysterious fire broke out<sup>71</sup>. Presently, the building is a simple steel structure. The site was rezoned as a cultural space open to the community<sup>72</sup>. Therefore, it is clear that a community institution devoted to digital media performance is right for the future of the 77 Bernard Est.

63 Images Montreal, "Mile End Old Train Station," Mile End old train station - Montreal, accessed December 21, 2019, [https://imtl.org/montreal/building/Gare\\_Saint\\_Louis\\_du\\_Mile\\_End.php](https://imtl.org/montreal/building/Gare_Saint_Louis_du_Mile_End.php)

64 Marie-Michèle Sioui, "Montréal Expulse Kabane 77," Le Devoir (Le Devoir, August 10, 2016), <https://www.ledevoir.com/societe/transports-urbanisme/477385/montreal-expulse-kabane-77>

65 "Kabane 77," Heritage Montreal, accessed December 21, 2019, <https://www.heritagemontreal.org/site/kabane-77/>

66 Marie-Michele Sioui, "Montreal Expulse Kabane 77," Le Devoir (Le Devoir, August 10, 2016), <https://www.ledevoir.com/societe/transports-urbanisme/477385/montreal-expulse-kabane-77>

67 Marie-Michele Sioui, "Montreal Expulse Kabane 77," Le Devoir (Le Devoir, August 10, 2016), <https://www.ledevoir.com/societe/transports-urbanisme/477385/montreal-expulse-kabane-77>

68 "Laurence Grandbois Bernard Textiles Inc.," Laurence Grandbois Bernard | Textiles Inc., accessed December 21, 2019, <http://laurencegbernard.com/textiles-inc/?slug=projection-architecturale>

69 Ibid.

70 Marie-Michele Sioui, "Montreal Expulse Kabane 77," Le Devoir (Le Devoir, August 10, 2016), <https://www.ledevoir.com/societe/transports-urbanisme/477385/montreal-expulse-kabane-77>

71 "Arson Squad to Investigate Fire at Former Industrial Storehouse in Mile End," Montreal, June 28, 2018, <https://montreal.ctvnews.ca/arson-squad-to-investigate-fire-at-former-industrial-storehouse-in-mile-end-1.3992043>

72 "Requalification du 77, rue Bernard Est Rapport de la demarche demobilisation et de consultation des parties prenantes", [http://ville.montreal.qc.ca/pls/portal/docs/PAGE/AR-ROND\\_PMR\\_FR/MEDIA/DOCUMENTS/77BE\\_RAPPORT%20FINAL\\_WEB.PDF](http://ville.montreal.qc.ca/pls/portal/docs/PAGE/AR-ROND_PMR_FR/MEDIA/DOCUMENTS/77BE_RAPPORT%20FINAL_WEB.PDF)



**Fig 46** Mile end train station demolished in 1950

Images Montreal, "Mile End Old Train Station," Mile End old train station - Montreal, accessed December 21, 2019, [https://imtl.org/montreal/building/Gare\\_Saint\\_Louis\\_du\\_Mile\\_End.php?id=2705](https://imtl.org/montreal/building/Gare_Saint_Louis_du_Mile_End.php?id=2705)



**Fig 47** Laurence Grandbois Bernard projecting on the old textile sign

Bernard, Laurence Grandbois. Laurence Grandbois Bernard | Textiles Inc. Accessed December 20, 2019. <http://laurencegbernard.com/textiles-inc/?slug=paysage-urbain>.



Fig 48 Arial perspective of the site





**Fig 49** Photograph of pedestrians crossing the railroad



**Fig 50** Site photograph 1



Fig 51 Site photograph 2



Fig 52 Site photograph 3



Fig 53 Site photograph 4

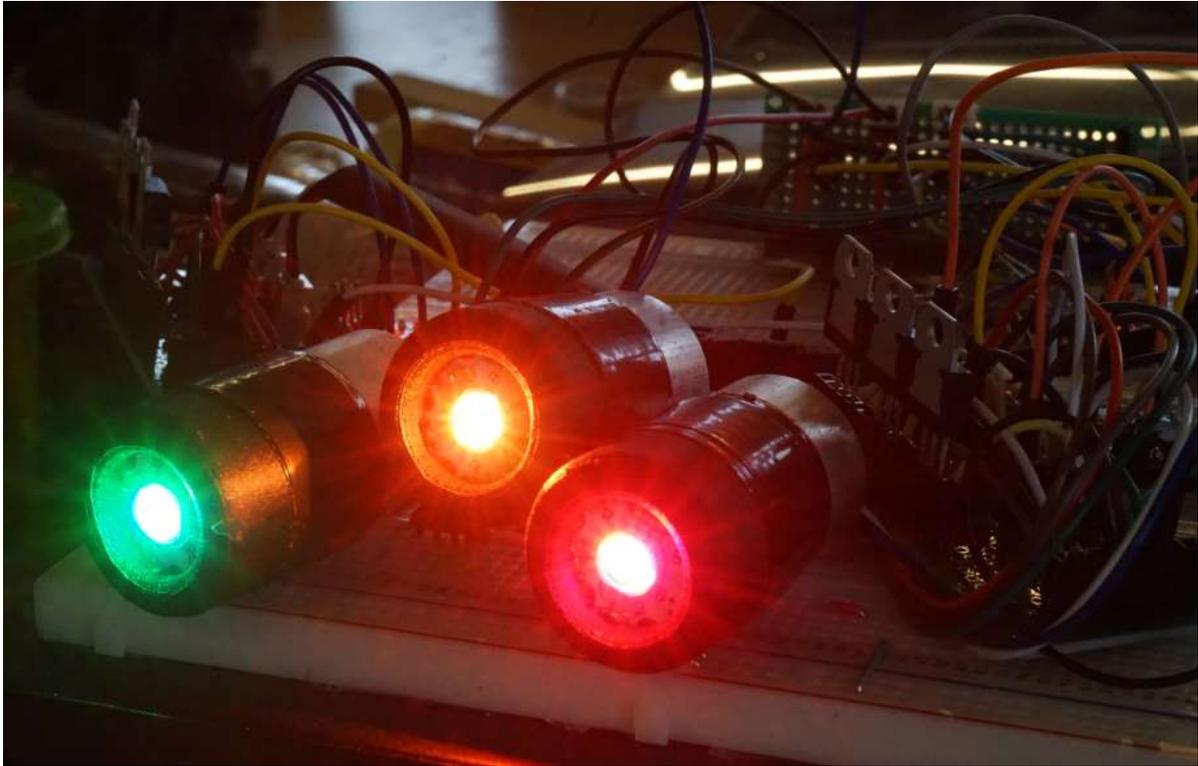


Fig 54 Site photograph 5

# Architectural Approach

The purpose of designing a building with light is not only to integrate media arts, but to maintain a close relationship between the project's tectonic articulation and the intended principles of analog and digital rhythms. The physical model is a tool for the exploration of digital and analog rhythms at an architectural scale. The principles from the interface experimentation integrated themselves into the design process for the new media cultural theatre. From an architectural standpoint, the black box theatre is the center mass of the project. The spatial qualities of the black box theatre act as the focal point and structural anchor in this design. This space has stringent parameters from its modular characteristics, the acoustic control, black interior finish and no natural light. It completely contrasts the exterior environment in almost every aspect. Using a physical site model at a scale of 1:100 was the foundation for the exploration of multiple massing and working models. The wood pieces used during the interface experiments served as modelling components to work iteratively. By emphasizing the integration of light, the building form began using the principles of **threshold, contrast, reflection and memory**.

When working iteratively with the physical model, I instinctively started with the black box theater and developed the project outwards into the adjacent park. The contrast between the exterior site conditions and that of the black box was important to emphasize that contrast. It became clear that the addition of spaces in between the black box and the exterior formed a layered gradient. The core mass is the black box which is enveloped by subsequent layered spaces that eventually lead to the exterior space being conceptual identified as a **nesting** strategy. In creating an architecture that serves as an interface between the black box and the exterior conditions, the project spatially bridges the two. The use of the nesting was key in articulating the form. For example, storage space and control booths are located closer to the black box as they have similar sound and light qualities. Other spaces such as washrooms and storage, follow suit and are located in the denser parts of the building. Conversely, the lobby and accessible community rooms are located in the architectural layers closer to the park than that of the black box. Having similar qualities to the exterior spaces, they have less stringent acoustic requirements and can tolerate an abundance of natural light. As such, this acts as the first architectural step or part diagram for this nested gradient approach. The nested gradient approach is a development method taking into consideration the spatial conditions of contrasting spaces rooted in the relationship between analog and digital spaces.



**Fig 55** High powered RGB LED lights with their driver



**Fig 56** Site model experimentation with the LED light



**Fig 57** Heliodon



**Fig 58** Heliodon connection detail

By suspending a point light source, it was easy to simulate the sun conditions and allow it to inform design decisions. Typically, this is accomplished with a Heliodon, a developed tool used to test the sunlight effect on physical building models, aiming at reproducing the actual direction of sunlight concerning a building<sup>73</sup>. It is an invaluable tool for architects, and it was clear that the school needed such a device. As part of the Fabrication 2 class, the creation of an artifact was an opportunity to build a heliodon. This tool would greatly aid the design process in facilitating the control of light cast on the scaled model. Within a larger context, pertaining to the exploration of analog and digital light, the heliodon methodology is key for understanding analog conditions of light.

The physical model in combination with high powered LEDs are vital to developing an architectural form consistent with the intentions of the nesting strategy. As discussed earlier, the intersecting principles of analog and digital rhythms are essential in maintaining a close relationship between the architecture and the media arts.

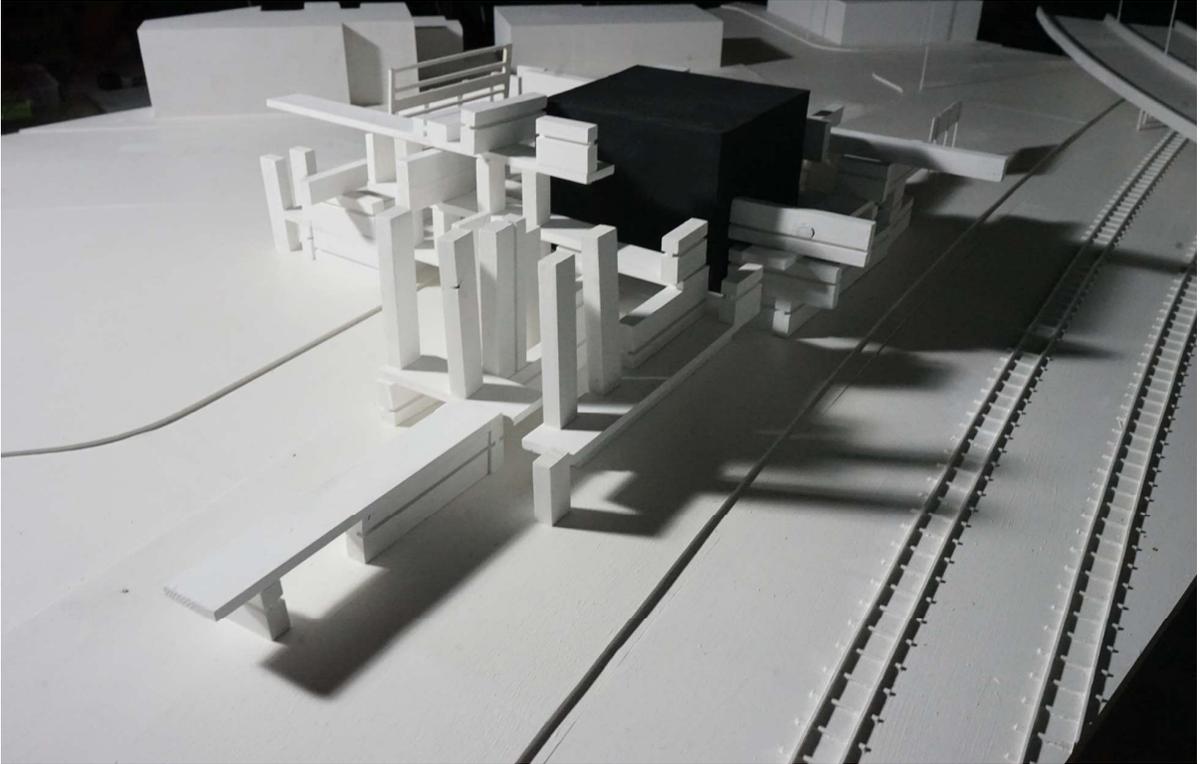
Digital design tools were developed to experiment with the architectural model. Touchdesigner is a node base computer language software that is ideal for the creation of real time interactive multimedia content. Using this digital media development tool is essential to control digital hardware such as RGB LED lights. With the sophistication of Touchdesigner, it is easy to create complex algorithms to control the lights. For the purpose of generating a fluent dialog between the lights and the tectonic model, it was imperative that the rhythmic functions remained simple. Although visually appealing, the heightened complexity of lighting rhythms made it hard to alter the architectural model accordingly.

Digital design tools were developed to experiment with the architectural model. Touchdesigner is a node base computer language software that is ideal for the creation of real time interactive multimedia content<sup>74</sup>. Using this digital media development tool is essential to control digital hardware such as RGB LED lights. With the sophistication of Touchdesigner, it is easy to create complex algorithms to control the lights. For the purpose of generating a fluent dialog between the lights and the tectonic model, it was imperative that the rhythmic functions remained simple. Although visually appealing, the heightened complexity of lighting rhythms made it hard to alter the architectural model accordingly.

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73 "A TABLE TOP HELIODON DEVELOPED FOR USE IN AN ARCHITECT'S ...," accessed March 28, 2020, [https://www.bse.polyu.edu.hk/researchCentre/Fire\\_Engineering/summary\\_of\\_output/journal/IJAS/V2/p.118-128.pdf](https://www.bse.polyu.edu.hk/researchCentre/Fire_Engineering/summary_of_output/journal/IJAS/V2/p.118-128.pdf)

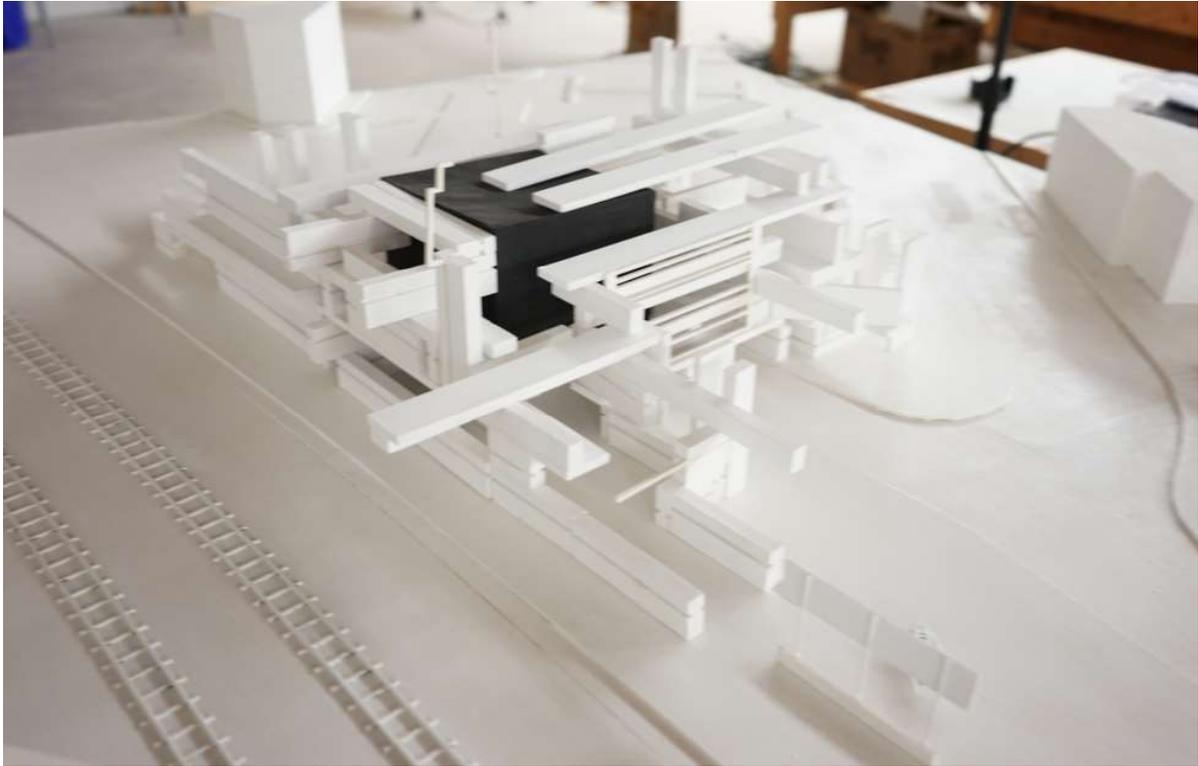
74 "About Derivative," Derivative, October 2, 2019, <https://derivative.ca/about-derivative>)



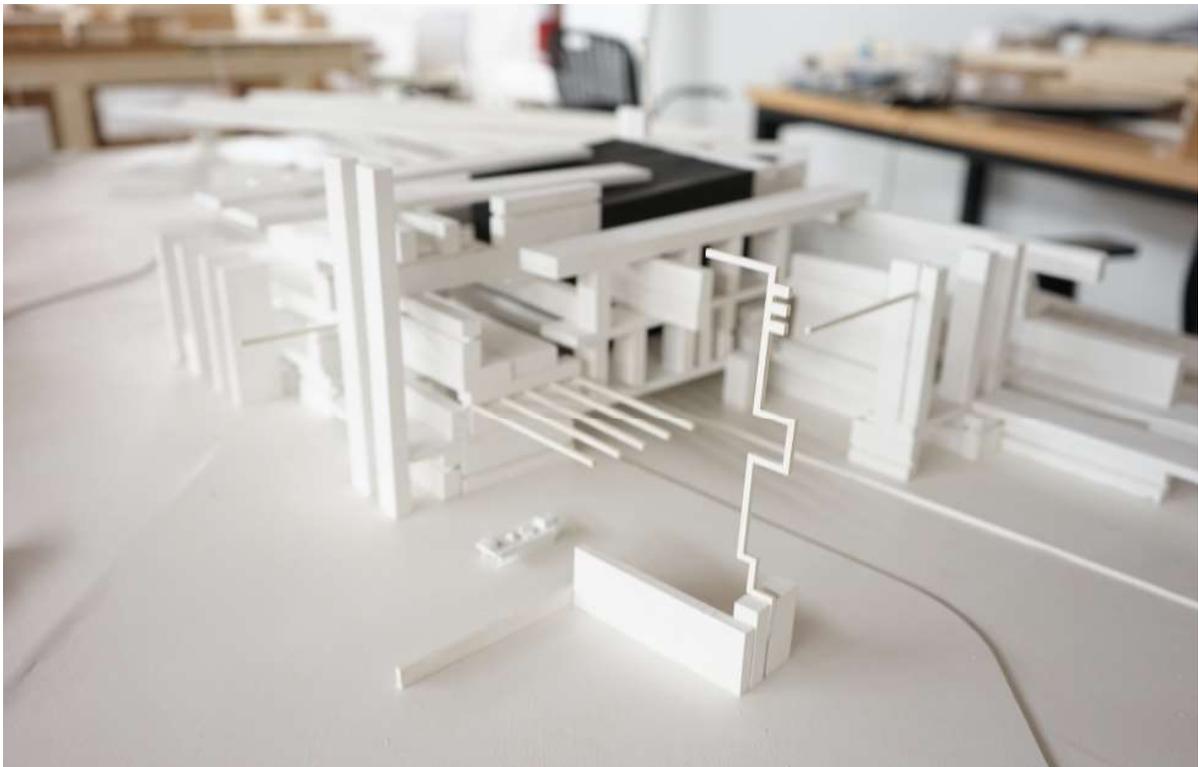
**Fig 59** Shadows exploration of natural sunlight emulation onto the working model



**Fig 60** Development of media art alongside the tectonic design



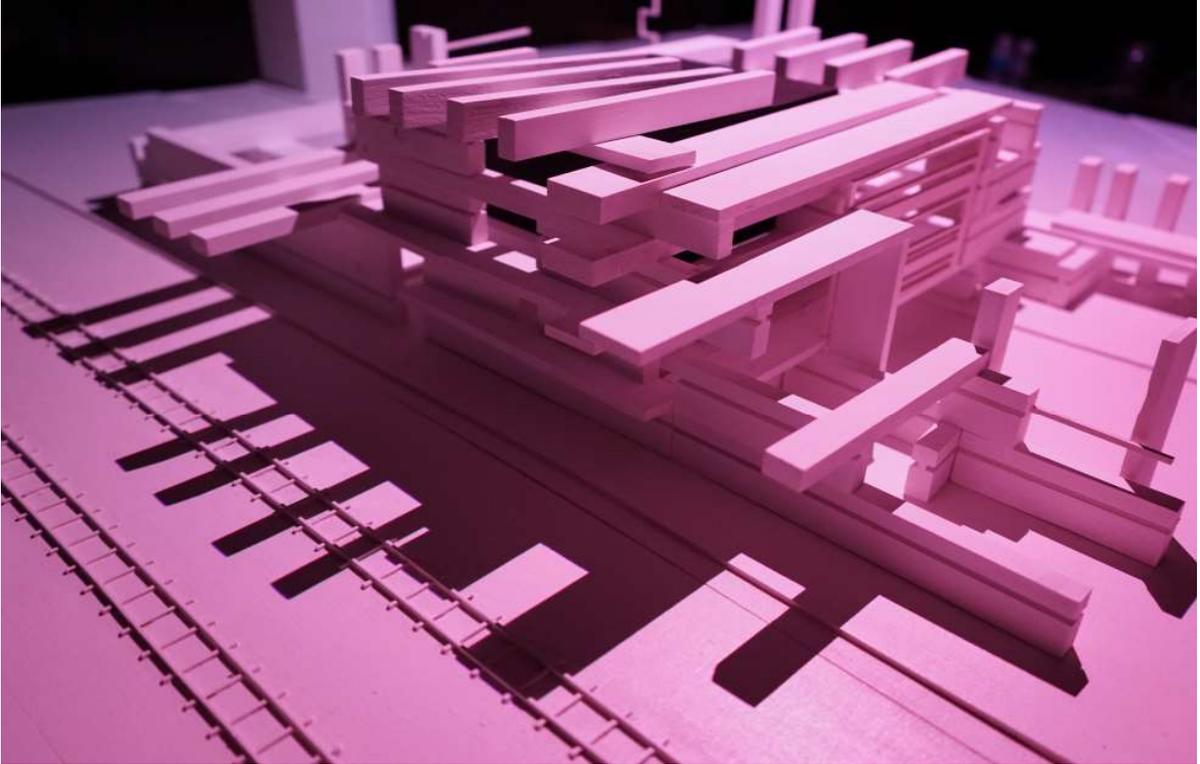
**Fig 61** Study of solar rhythms with the working model



**Fig 62** Study of solar rhythms with the working model 2



**Fig 63** Study of digital rhythms with the working model



**Fig 64** Study of digital rhythms with the working model 2

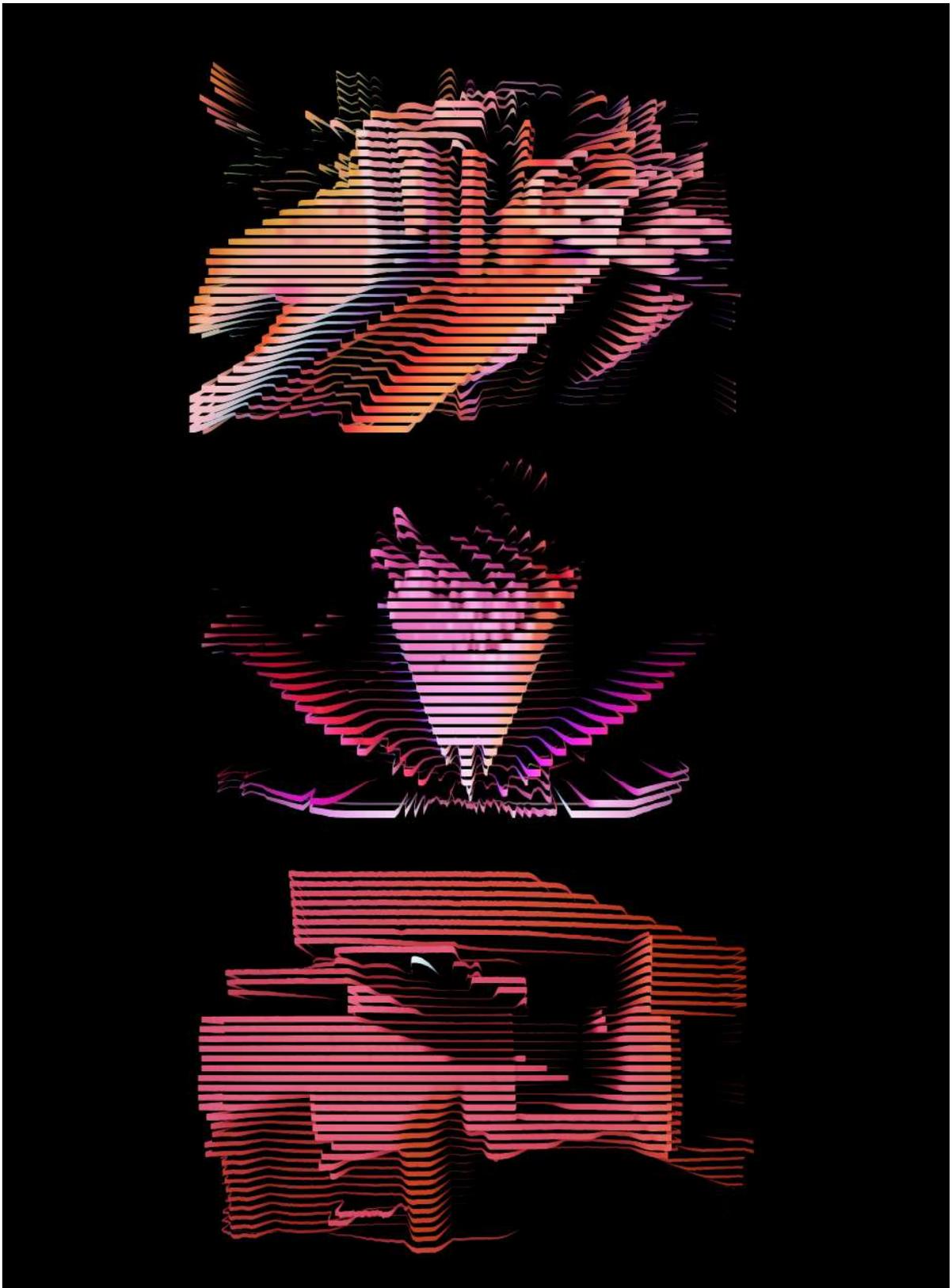
The lights and subsequent drivers were handmade. An understanding of their control protocol was essential in enabling their control with Touchdesigner. These lights would serve as a light source for digital design exploration using the scale model. Both their colour and light intensity were controlled by the analysis of RGB values of photographs. Images of the experimental modeled interface were initially used and would change as the design development generated more. Incorporating the real-time control of light color and intensity was achieved using a live video feed of the model. This action demonstrates a time base cyclical feedback process in which the architectural form would alter the lighting conditions as an input for the media art. This feedback process is demonstrated as the architecture influences the media art which in turn lights the model in a different way creating a cyclical design process.

The location of the RGB LEDs would be positioned on the site model in locations where users would presumably be able to use a projector to project their art on the building. It became apparent that surfaces on the north and south of the building were optimal locations due to the linearity of the side east to west. This allowed for the implementation of façade elements such as flat surfaces to promote digital projection on the north and south façade. Analog interventions such as screens would be predominantly oriented on the east to cast shadows in accordance to the sun cycle. The digitally-driven RGB lights and sun simulation were essential in generating tectonic gestures at the intersect of analog and digital rhythms.

The creation of a visualization program in touchdesigner, inspired by Bruno Imbrizi would create tectonic moments through the processing of photographs and live video<sup>75</sup>. This method is an extension of the early projection interface experiment. The program, developed through the analysis of contrast of images or videos, is a series of horizontal lines that extrude outwards in correlation to the brightness of an image. The program generates abstracted images serving to create architectural form. Using Grasshopper, a parametric design tool, the physical geometry of the horizontal stripes could be imported as a 3d model. Having the ability to manipulate the linear strips in 3d space offers an opportunity to imbed media art directly within the project. These strips become façade elements that modulate the analog sunlight during the day or digital projectors at night.

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<sup>75</sup> Bruno Imbrizi, accessed March 28, 2020, <http://brunoimbrizi.com/>)



**Fig 65** Abstract images of the scale model generated with Touchdesign.

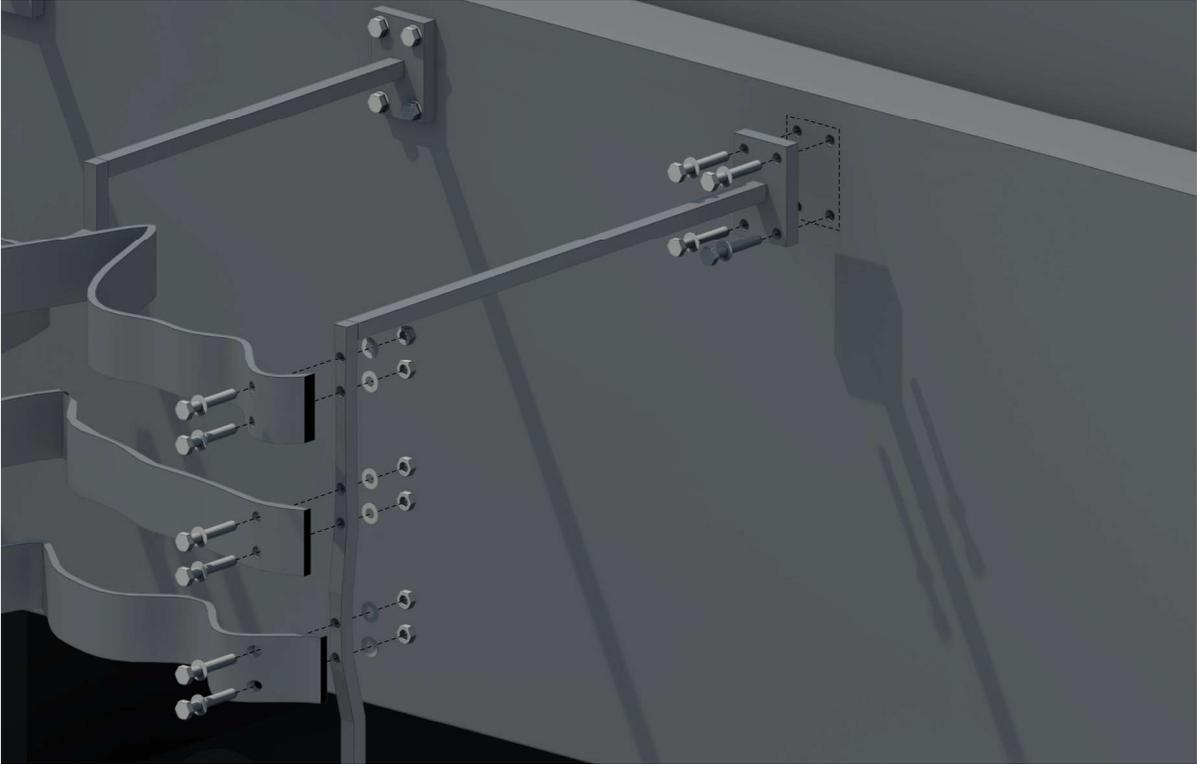
Furthermore, the abstraction of images generated by the visual program inspired design gestures. These images hinted to possible spatial gestures that were formalised by drawing over them. In the cross-sections and the elevations of the building, these gestures demonstrate another approach in integrating the media art within the architectural design process. This is important as there are both direct and nuanced instances of media art embedded throughout the project.

The site conditions are significant in the articulation of large-scale site gestures. It is essential to keep in mind that the site on 77 Bernard borders on Le Champs des Possibles. The outer space of this park completely lacks immediate control from human activity. Environmental factors such as the wind and the noise from the train tracks, the overpass or the Yeshiva Toras Moshe Academy are variable site conditions that will affect the site programming. These considerations were imperative in breaking up the north façade. The building functions as a diffuser for the sound of passing trains. The longitudinal articulation of pedestrian flow is developed in contrast to the latitudinal directionality of projection locations. The light study using the high powered RGB LEDs revealed that the main points of interest for projection align themselves to the north or south of the site. Conversely, pedestrians and cyclists generally move longitudinally east to west through the site. The intersection of artists projection and someone walking through the site is an element that is emphasised in this project.

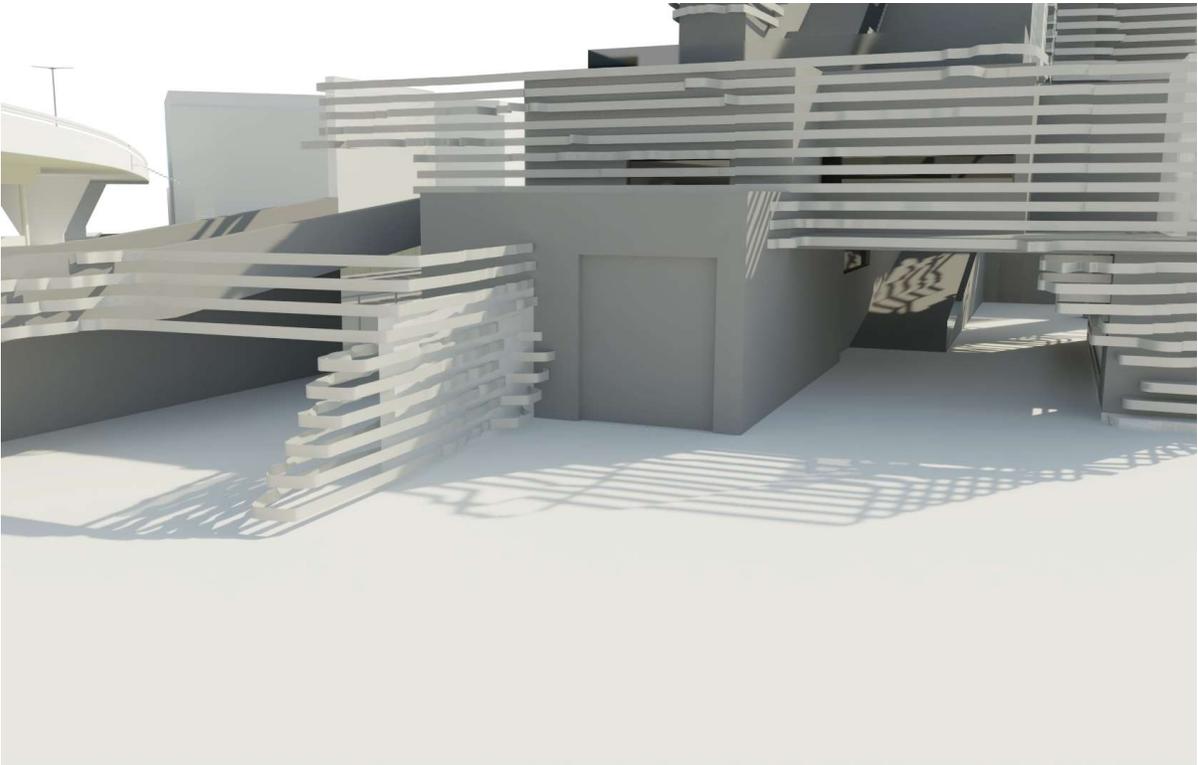
Closing the road allows for the project to extend from east to west and prioritizes the pedestrians and cyclists who remain the highest volume of traffic. The vehicles that use this road are only subject to a block of deviation, which is not a significant detour. In turn, this gesture promotes site accessibility and limits the development into Le Marché des Possible to the south. The ground floor is dedicated to spectators who access the black box and contains supporting spaces for theatre operation including offices, storage, shop and a loading bay. The spectators enter from the west to meet a front desk and coat check. As they come to the spaces, there is a substantial room with a bar and tables to socialize pre and post shows. The second floor consists of control rooms and rentable space, which is accessible from the inside and outside. This design decision solidifies the idea that these spaces are available to the general public. The third story contains artist residences, a mechanical room, ample storage, two sound studios and access to the black box grid at approximately 20' 6 the ground floor level<sup>76</sup>. Public access is incorporated throughout each floor as the building tapers in height from its center mass. Offering the ability for artists and community members to access the entire building is important to ensure that the project is a public building.

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<sup>76</sup> "General Information And Black Box Theater Technical Information." Medical City Lewisville Grand Theater. Accessed April 30, 2020. <https://www.mclgrand.com/home/showdocument?id=9460>.



**Fig 66** Perspective assembly detail of the sun screen

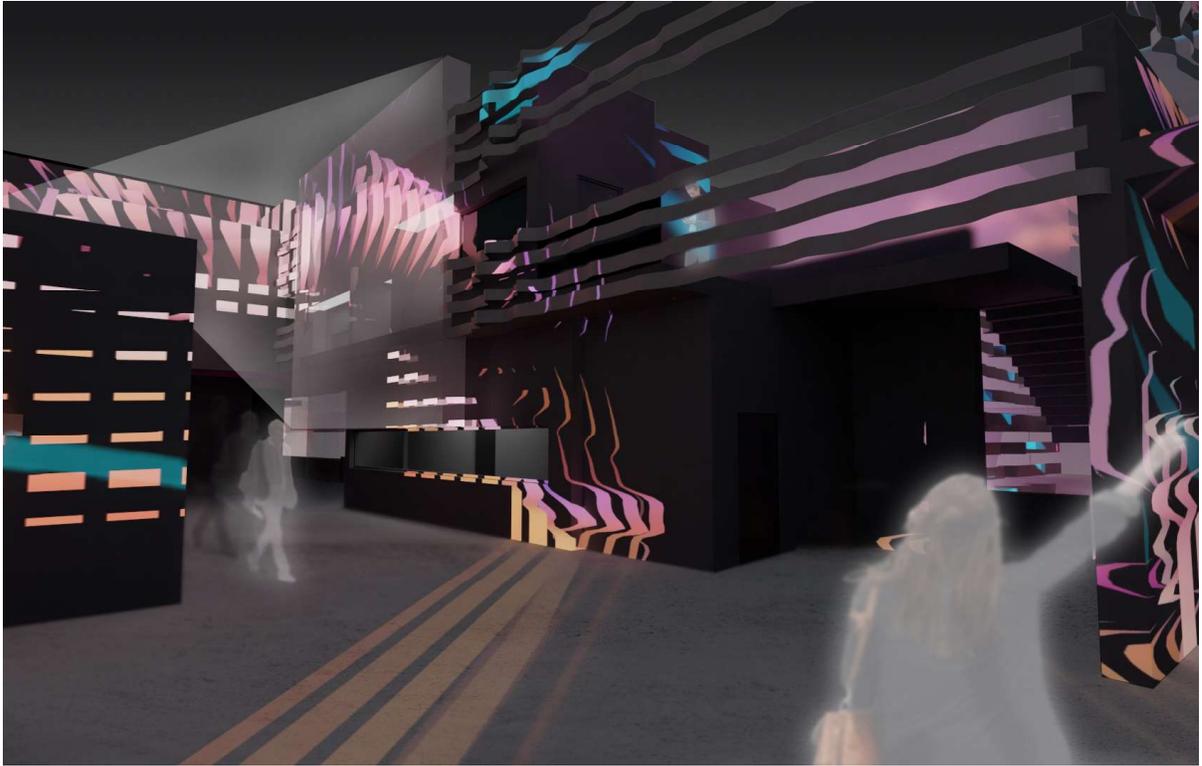


**Fig 67** Shadows study generated by the sunscreen, directed onto pedestrian paths.

# Community and the Artists

Community integration within the design is essential to alter the paradigm regarding professional focus in media art performance space. By emphasising the importance of community interaction with the building, it will become rooted in the very culture of the neighborhood.

Consideration for active and passive users during the design process allows for the building to interact with different community members that come to the site. Active users are those who have direct interactions with the building. For example, the artist who brings their projector to the site has many options in order to display their work. From the various planar surfaces to the multitude of sun screens, the building was designed for artistic freedom. Promoting flexibility, an artist can project on any surface including the ground from one the terrace. During the model exploration, projection points of interest were located both to the north and south of the building. These locations can be equipped with hardware that offers the ability for artists to obtain output data from a variety of sensors embedded within the project. Using an array of contact mics, humidity and sun sensors, artists can use the real-time information to modulate their own media art. This allows the building to play a role in the creation of media art as an extension of their artistic practice.



**Fig 68** Second floor exterior perspective



**Fig 69** Second floor exterior perspective 2

Passive users are the people who simply walk past the building. They may never have an interest in creating media, but this project can expose them to the analog and digital rhythms of electronic art. The various paths a pedestrian could take while passing through the building are located in areas where sun screens display a rhythmic shadow play throughout the day. As the bystander steps through shadows cast on the ground, their movement plays a temporal role in the modulation of analog light. This is similar to the spatial phenomenon used by Ryoji Ikeda in **Test Pattern [no.5]** between the participant and the digital projector. By exposing passive users to temporal experiences, the intention is to pique their curiosity. They may possibly seek to further explore the site which is feasible due to the various unrestricted routes throughout the project. To design a facility offering diverse experiences for all, is to create a public building.

While developing the design approach using the cyclical feedback between the media art and the working model, it was difficult to identify the moment of conclusion. Yet, there is an opportunity for the design process to continue beyond the work of the architect. Using the sun and digital projections, the community members can play a role in the next iteration of the building. Whether they implement a series of makeshift furniture like Kabane 77 or begin to suspend reflective material within the sun screens, the community members act as an extension of the design process. As the architect my intention was not to dictate the physical outcome of community creations, but to highlight the fact that they would be created at the intersection of analog and digital rhythms. Between the projector and the sun lies the potential for great architecture and media art.

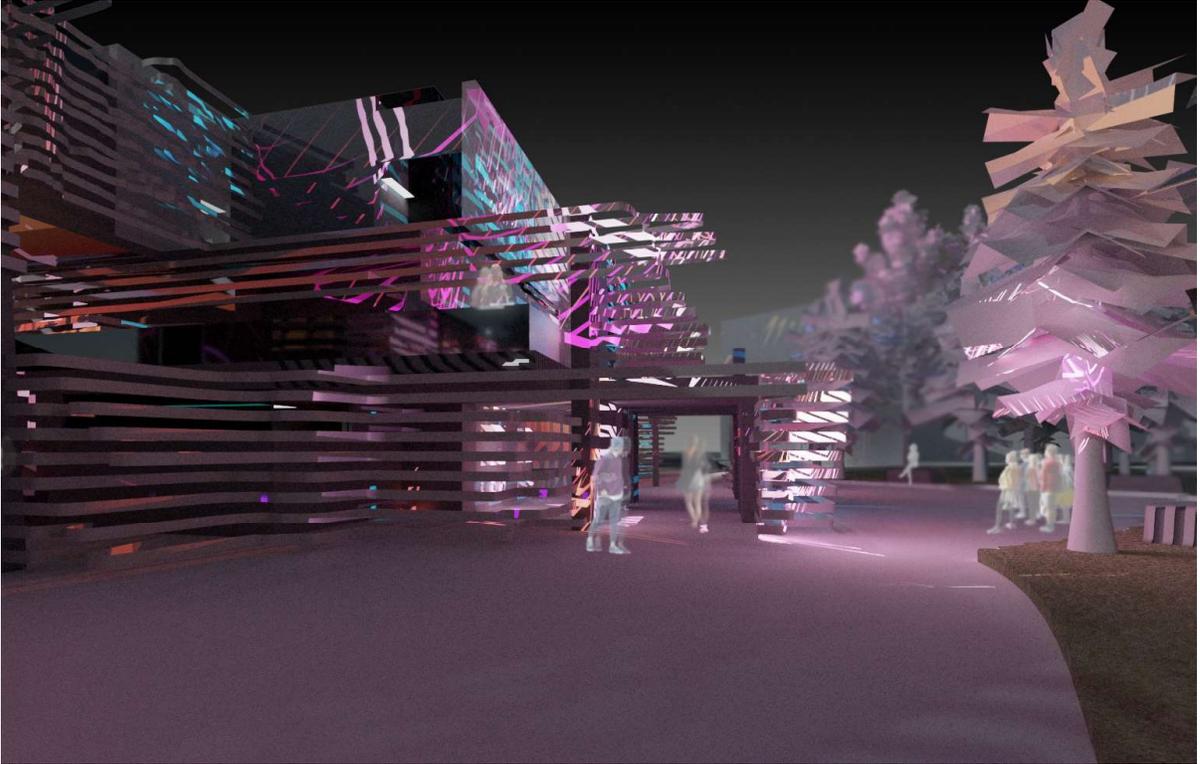


Fig 70 Pedestrian perspective

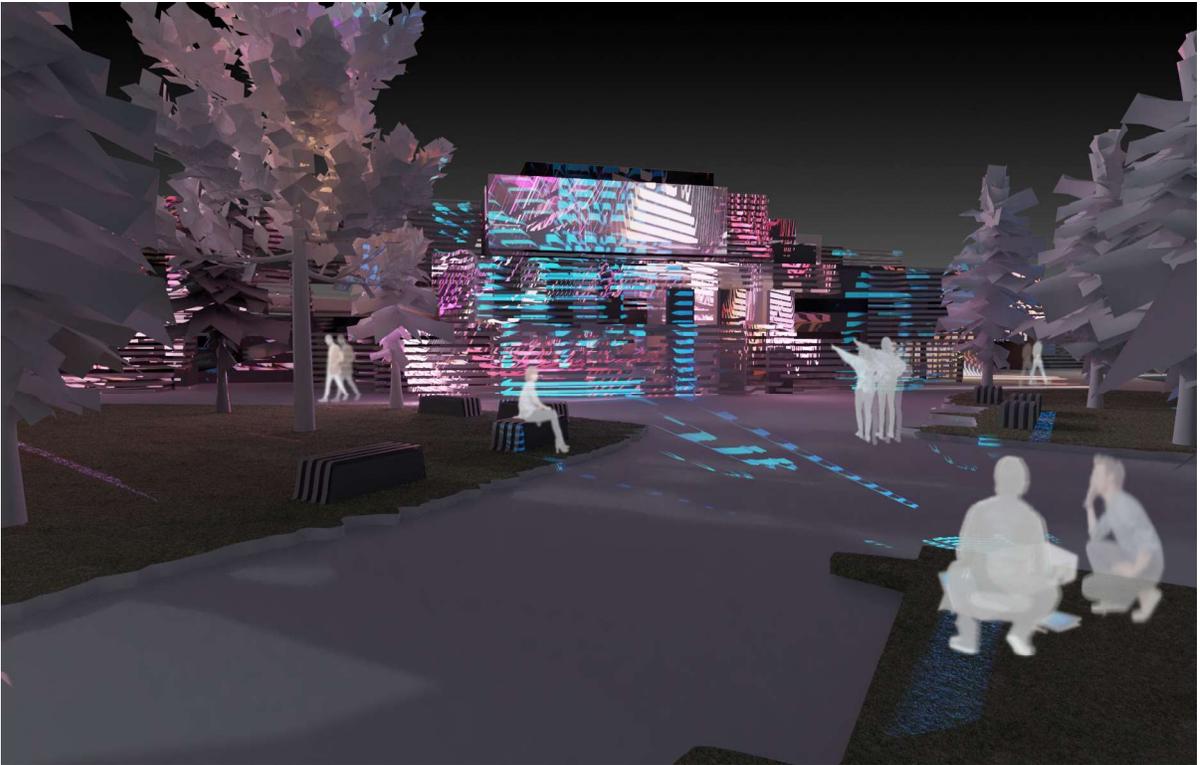


Fig 71 Perspective from le Marche des Possibles

# Conclusion

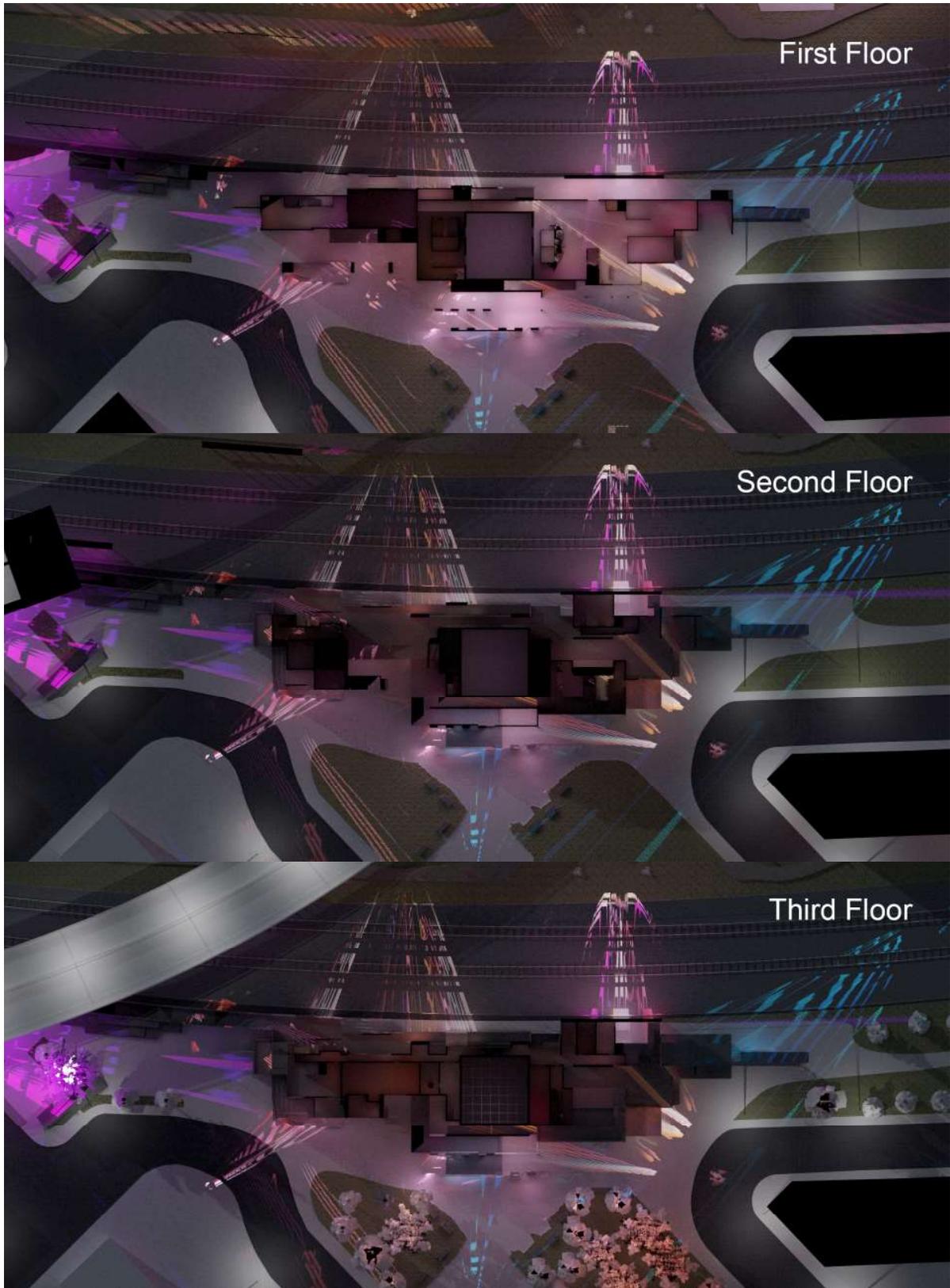
Intending on providing emerging media artists with a place to create and display their work, it is important that an interdisciplinary approach be integrated into a design process. Focusing on hybridity between the built and virtualized, the building proposal is intended to develop at the intersection of a physical and digital design process. The simultaneous approach in creating media art and tectonic space exploring shared analog and digital rhythms, embeds key elements of both practices within the other. As an alternative to relying heavily on background research and documentation, an iterative mode of synthetic working combined with observational acuity is a valid approach in the creation of an architectural project. By interfacing between the site conditions and media art, the building is integrated within its context through the entirety of the design process. The implementation of new media within physical infrastructure generates a dialog between media art and architecture, extending practice beyond the architect's traditional mandate. As a building project, there are many opportunities for the community, along with artists to play a role in the future development of the space. By modifying the sun screens or further developing spaces around the building, the project encourages community interaction as a reflection of their collective ownership. The evolution of the facility should go beyond the limitation of the officially funded project and into the communal. This thesis underlines the importance of creation for an alternative architectural approach to design and programming while staying true to the cultural implications of a public building.



**Fig 72** West side exterior perspective

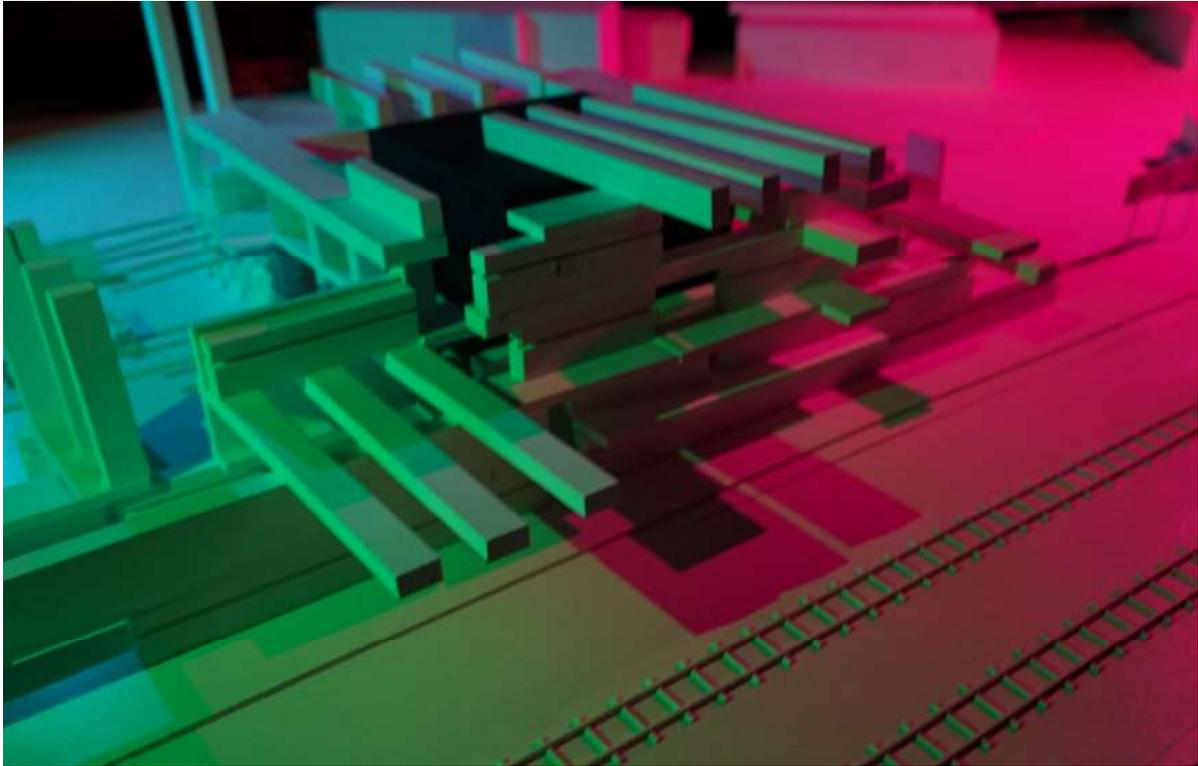


**Fig 73** East side exterior perspective

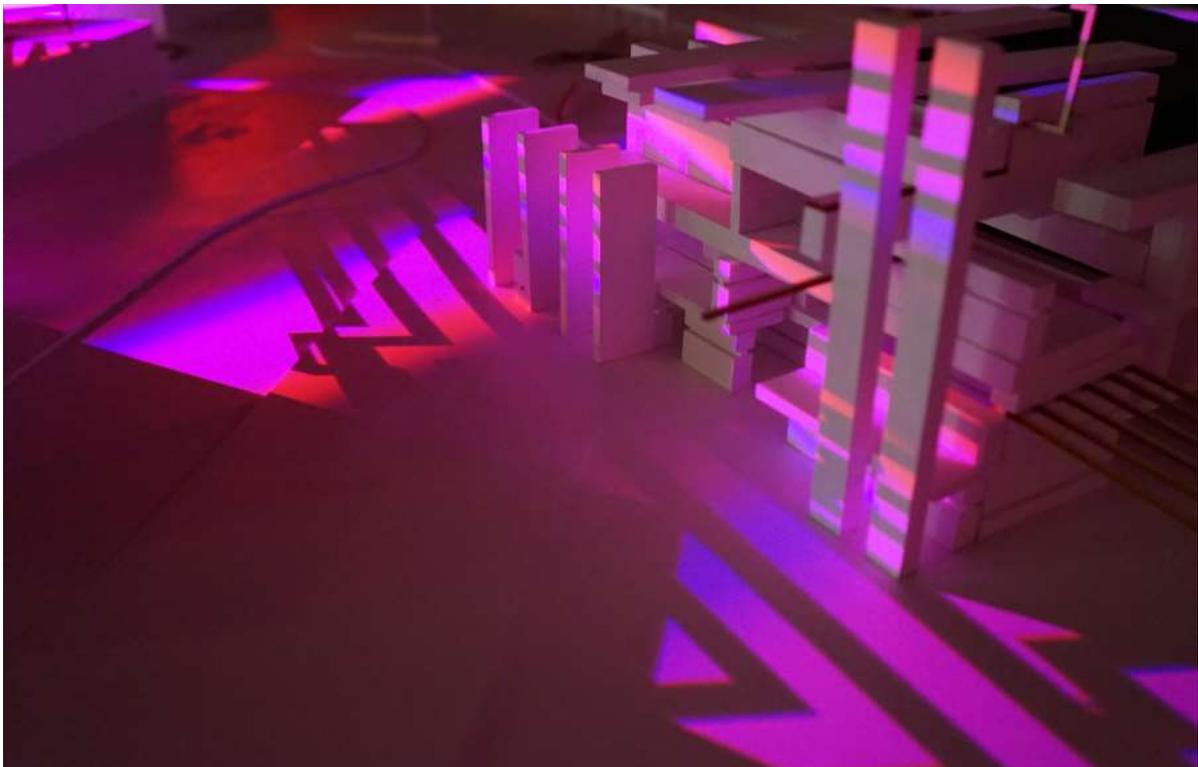


**Fig 74** Permeation of projected light within the building

**ANNEX**



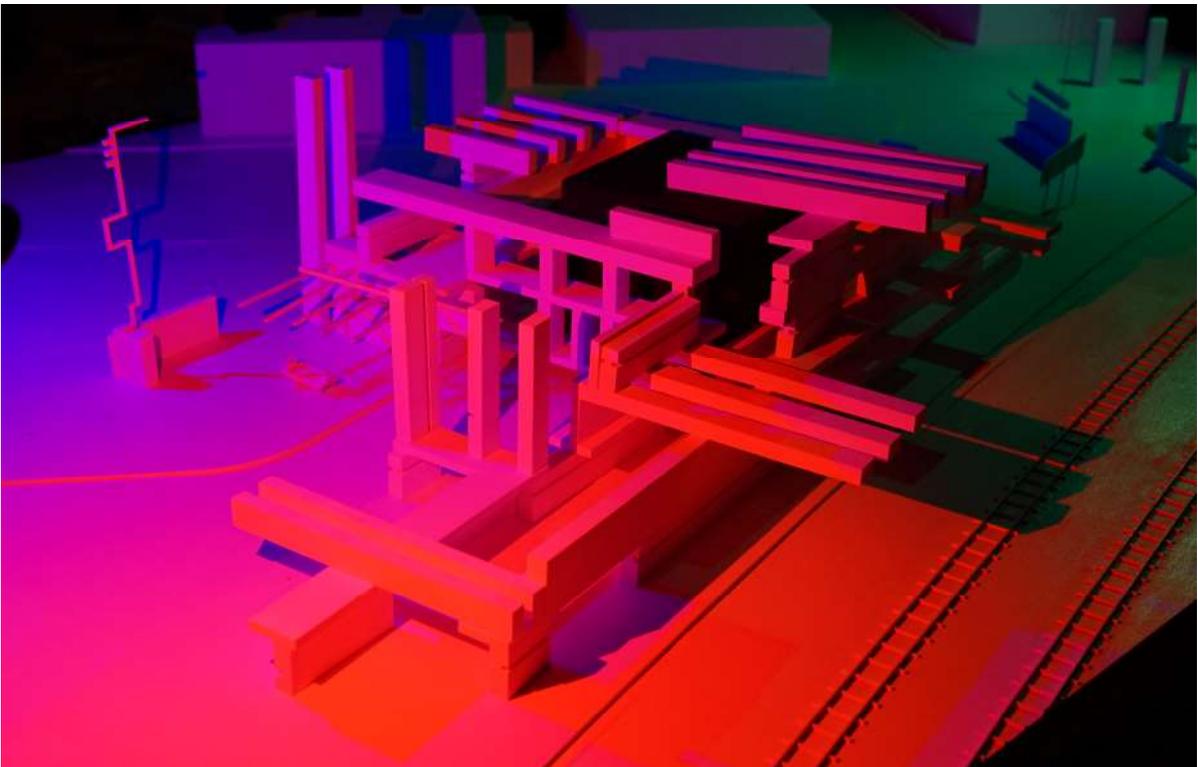
**Fig 75** Architectural model exploration with digital rhythms 1



**Fig 76** Architectural model exploration with digital rhythms 2



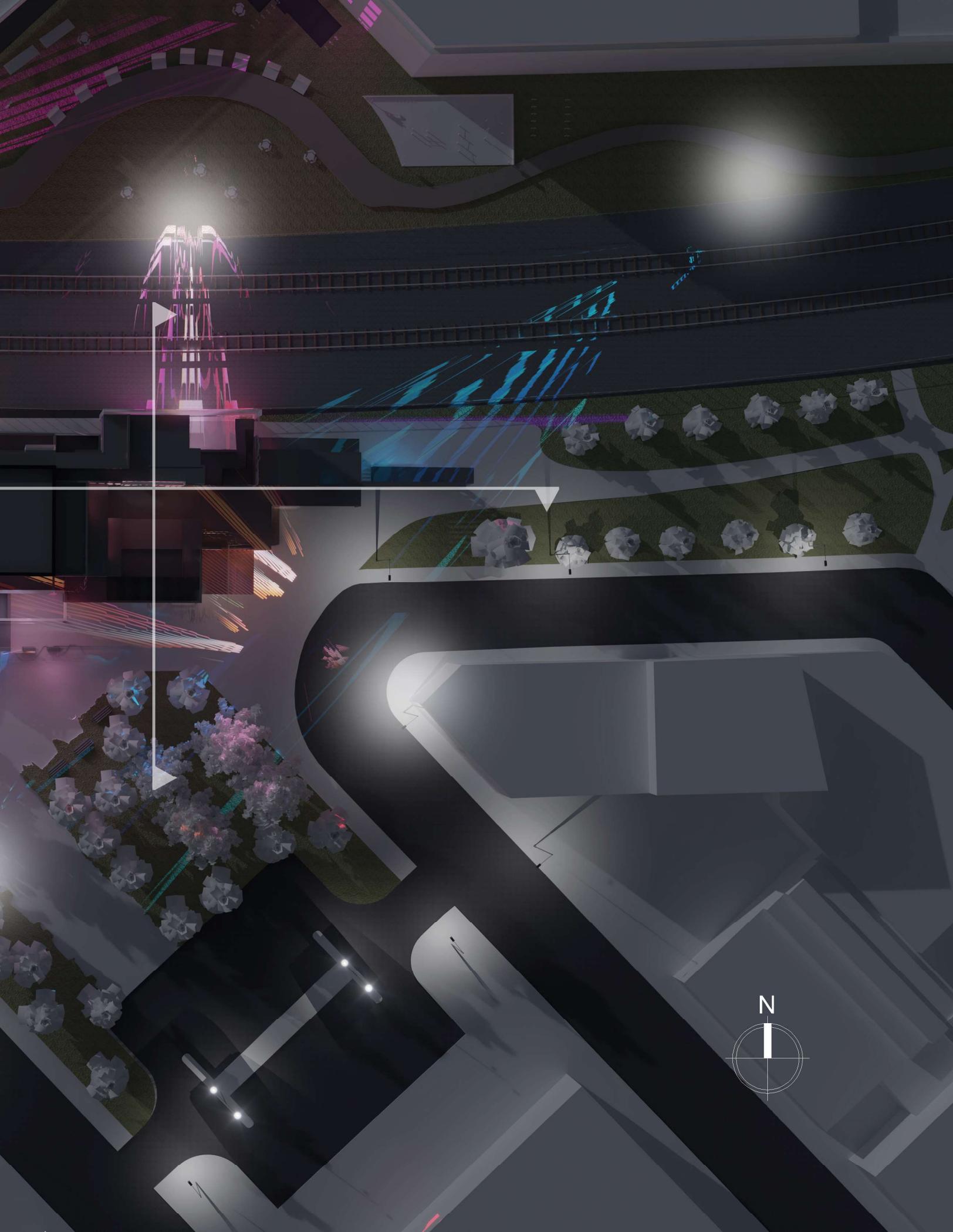
**Fig 77** Architectural model exploration with digital rhythms 3



**Fig 78** Architectural model exploration with digital rhythms 4

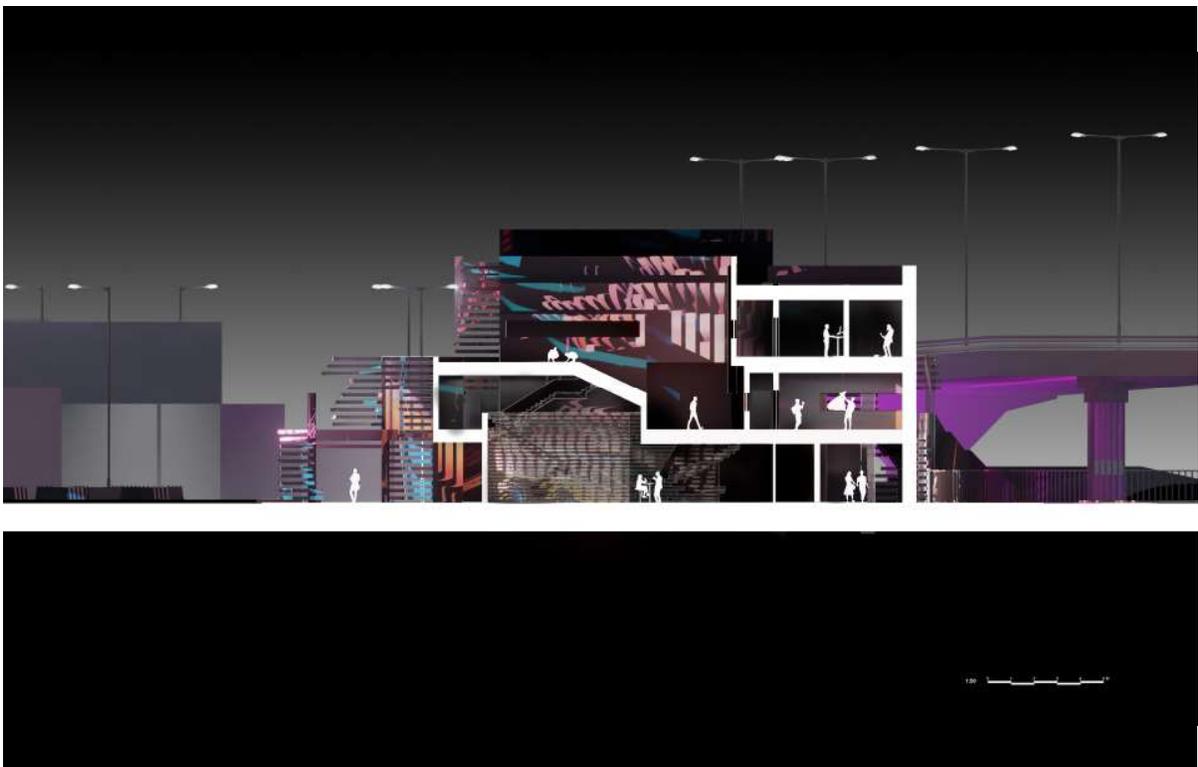


**Fig 79** Site plan





**Fig 80** Longitudinal cross-section



**Fig 81** Latitudinal cross-section



**Fig 82** Nighttime arial site perspective



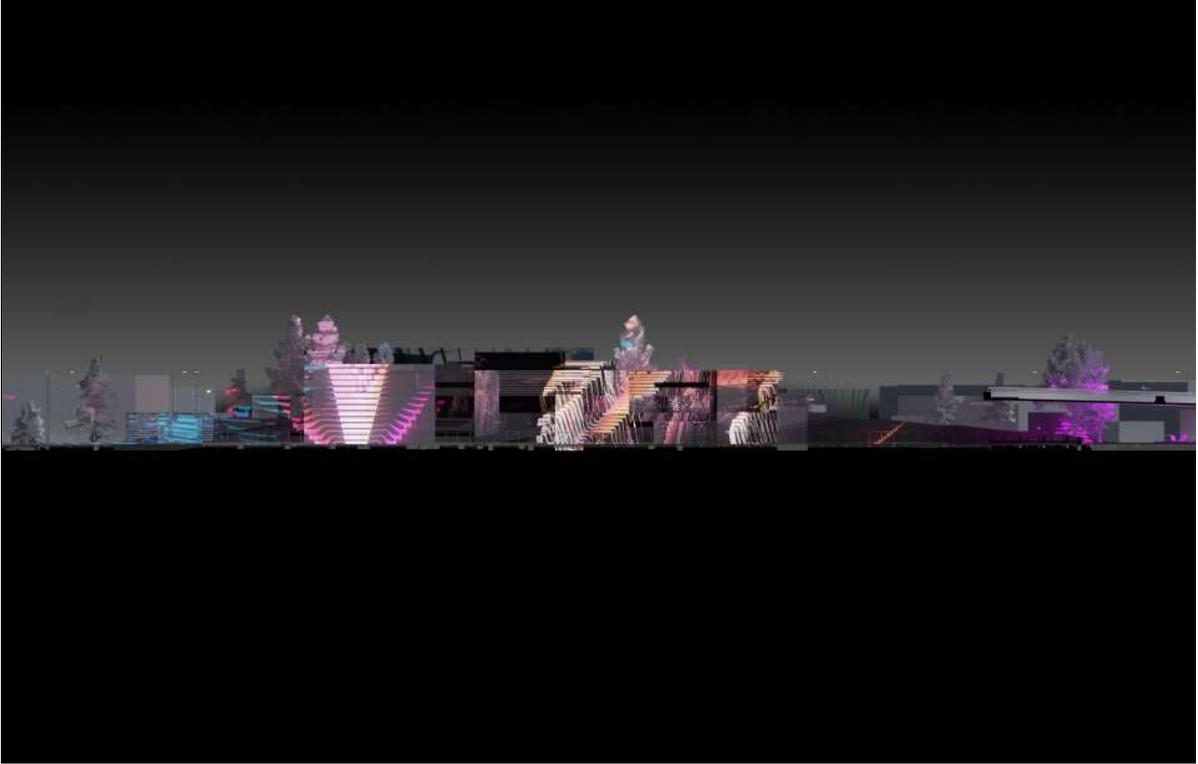
**Fig 83** Nighttime site perspective 2



**Fig 84** East elevation



**Fig 85** West elevation



**Fig 86** North elevation



**Fig 87** South elevation

**Fig 88 Plan: First floor**



**Legend:**

- 12. Creation Space A
- 13. Creation Space B
- 14. Control Booth A
- 15. Control Booth B
- 16. Creation Space C

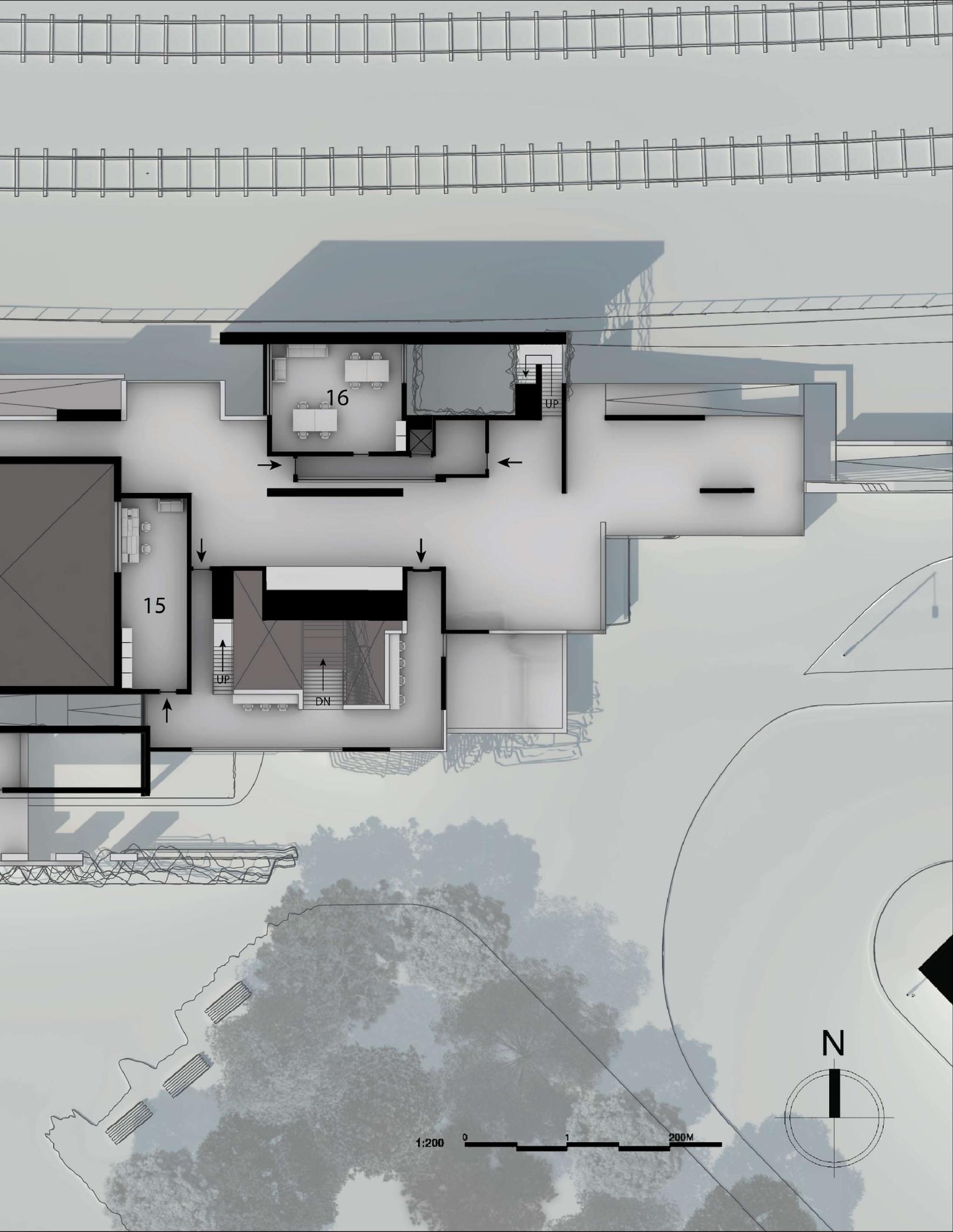


**Fig 89 Plan: Second floor**



**Legend:**

- 1. Loading Bay
- 2. Workshop
- 3. Fabrication
- 4. Storage
- 5. Dressing Room
- 6. Black Box
- 7. Bar and Lounge
- 8. Storage
- 9. Entrance
- 10. Offices
- 11. Conference Room



16

15

UP

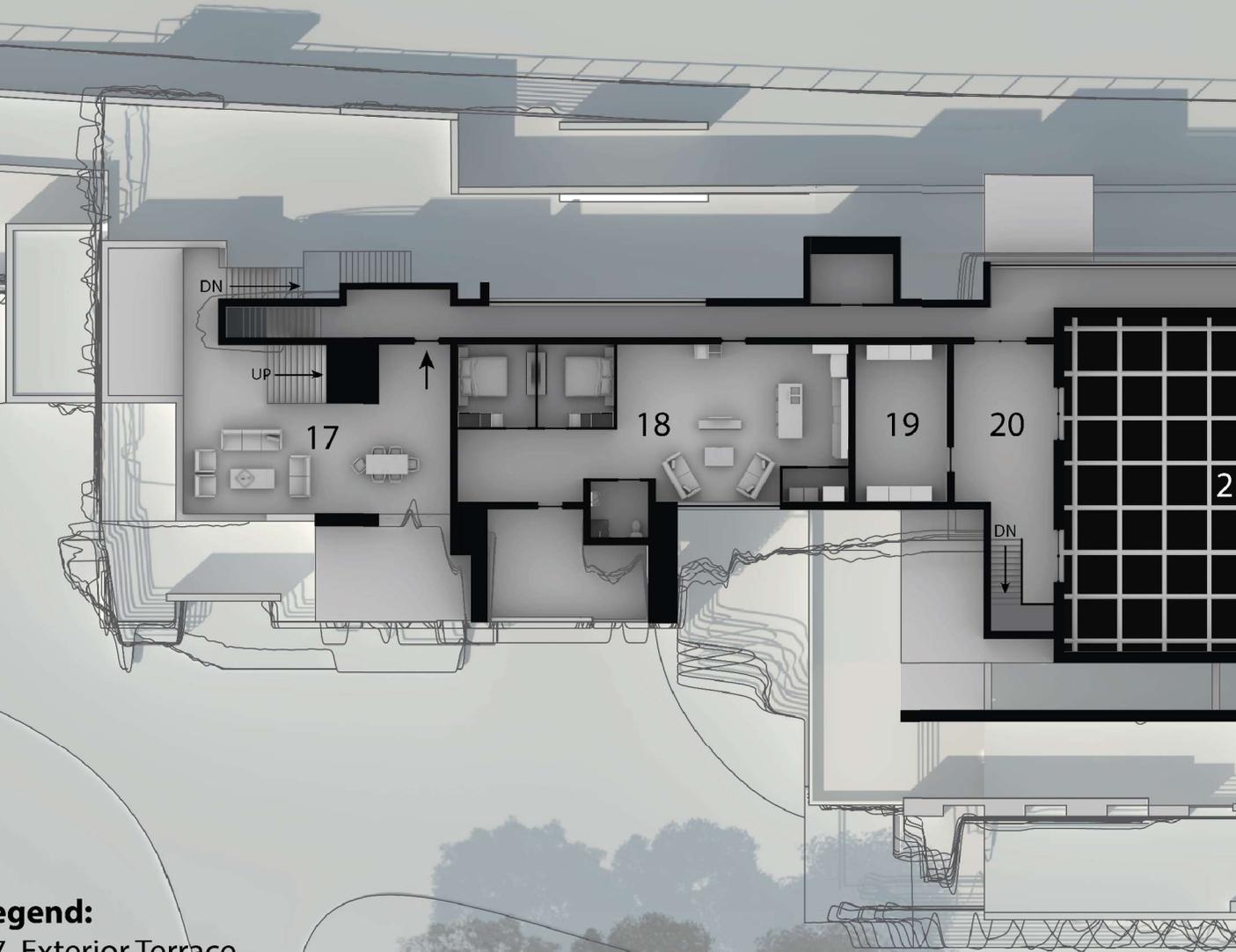
UP

DN

N

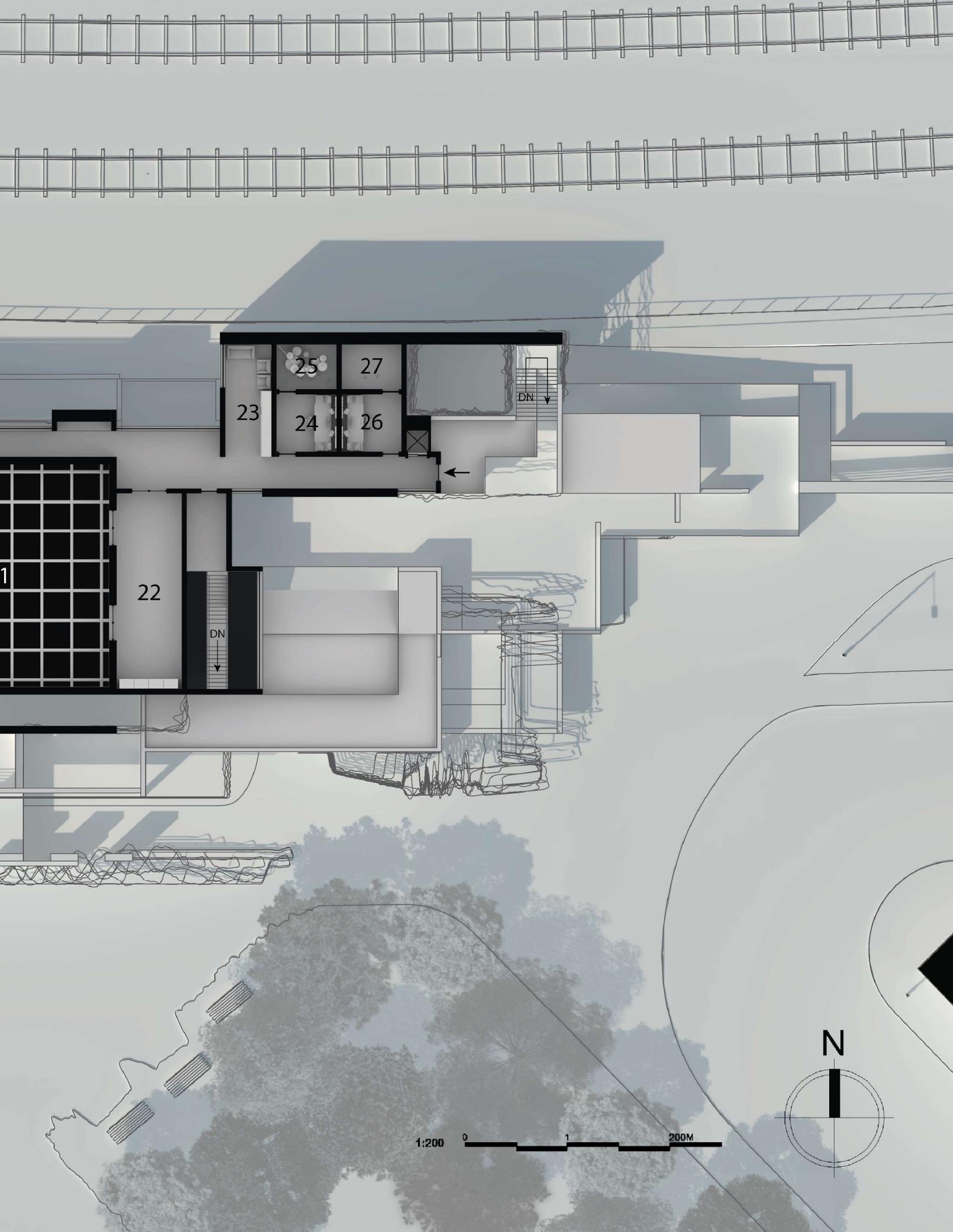
1:200 0 1 200M

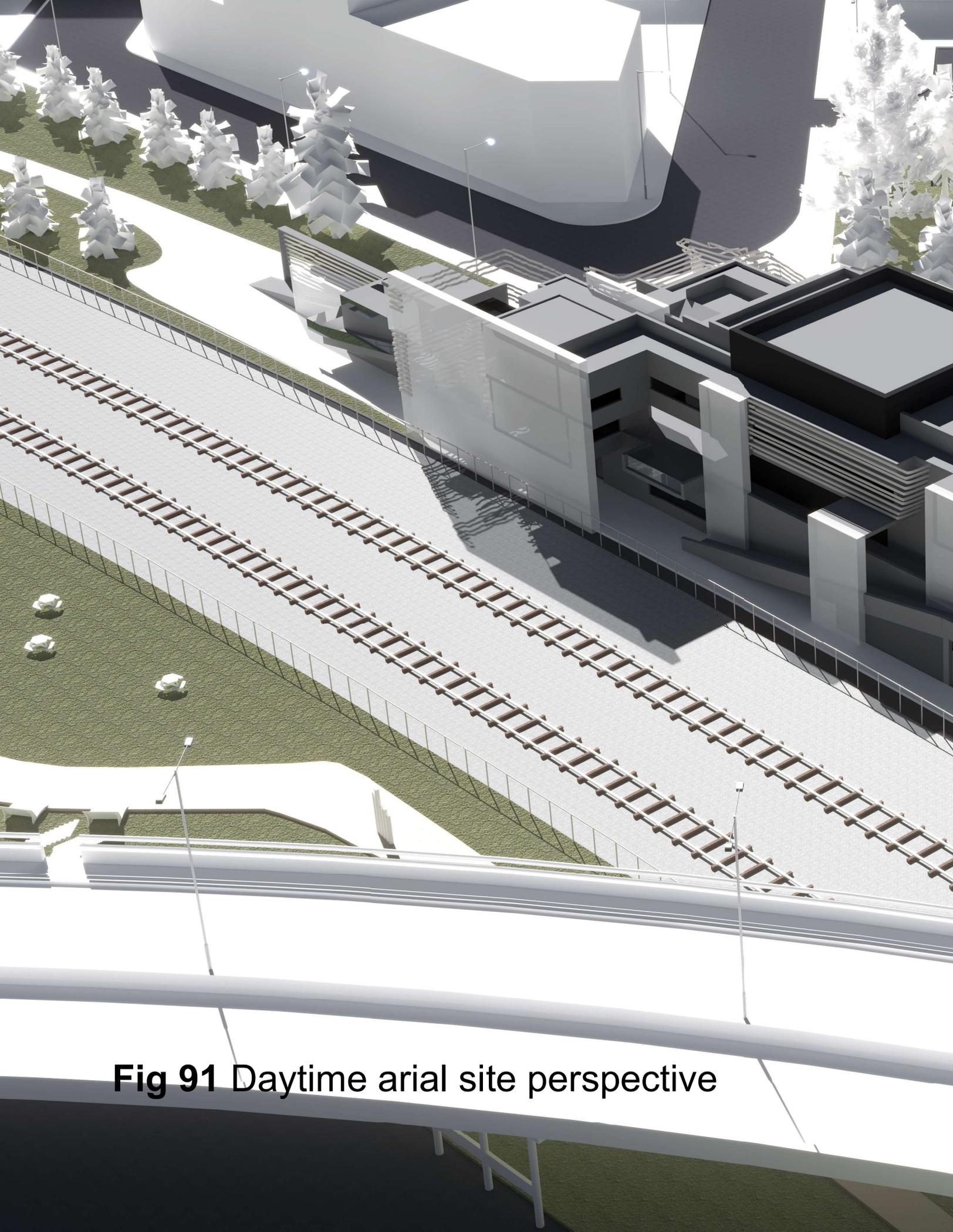
**Fig 90 Plan: Third floor**



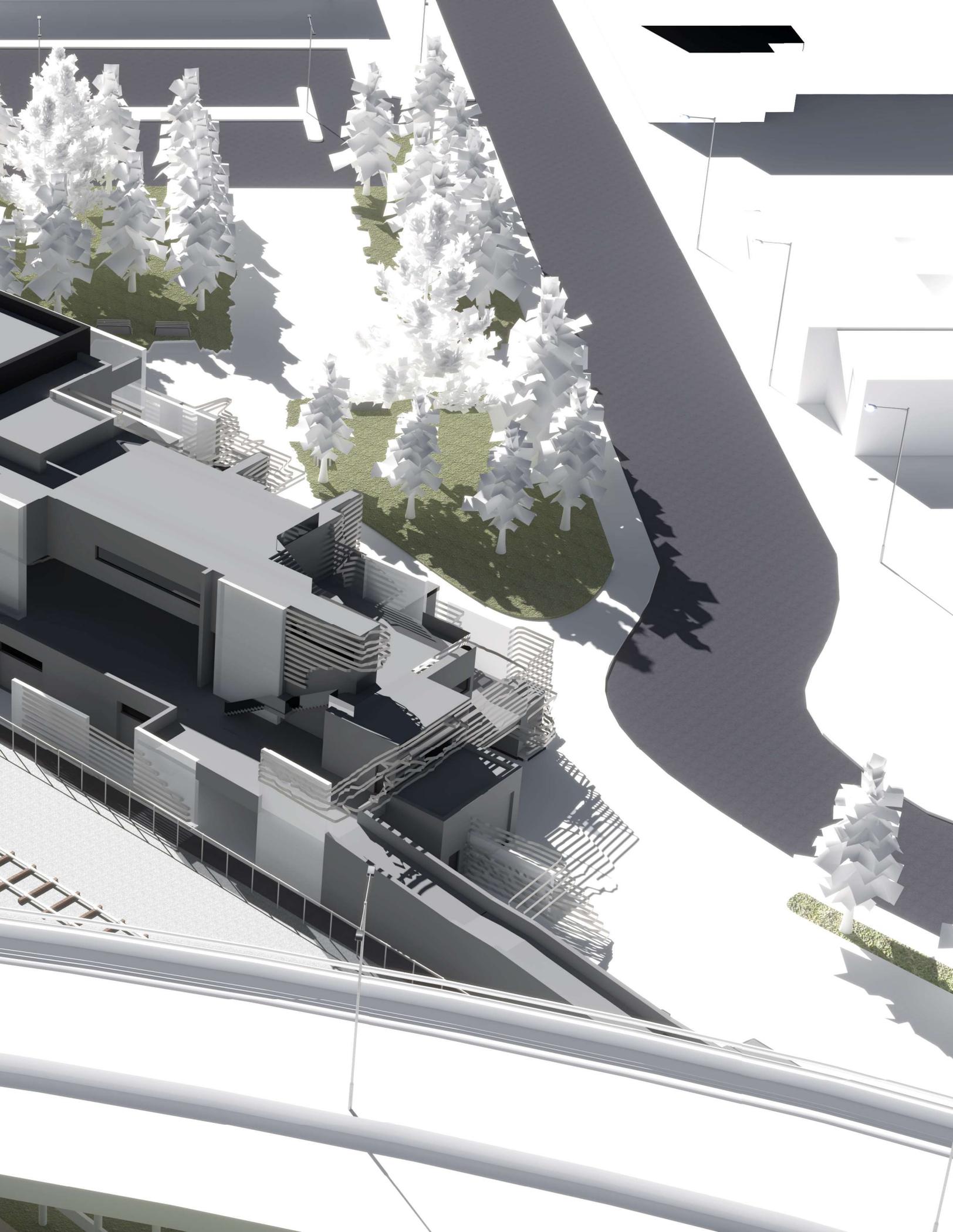
**Legend:**

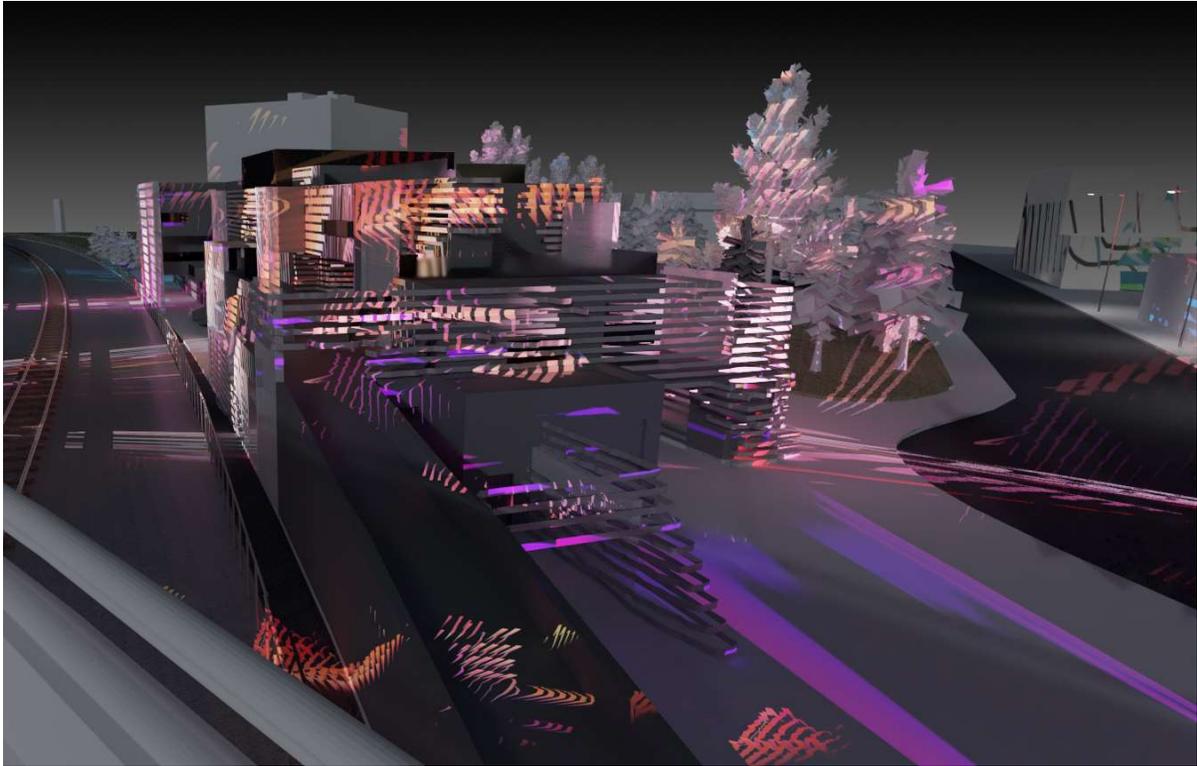
- 17. Exterior Terrace
- 18. Artist Residence
- 19. Storage
- 20. Grid Access
- 21. Black Box Grid
- 22. Grid Storage
- 23. Studio Lounge
- 24. Sound Studio A
- 25. Recording Booth A
- 26. Sound Studio B
- 27. Recording Booth B





**Fig 91** Daytime arial site perspective





**Fig 92** Perspective from the Viaduct Van Horne



**Fig 93** Perspective from the other side of the railway

"404.Zero." 404.zero. Accessed November 25, 2019. <http://www.404zero.com/>.

"A TABLE TOP HELIODON DEVELOPED FOR USE IN AN ARCHITECT'S ..." Accessed March 28, 2020. [https://www.bse.polyu.edu.hk/researchCentre/Fire\\_Engineering/summary\\_of\\_output/journal/IJAS/V2/p.118-128.pdf](https://www.bse.polyu.edu.hk/researchCentre/Fire_Engineering/summary_of_output/journal/IJAS/V2/p.118-128.pdf).

"About Derivative." Derivative, October 2, 2019. <https://derivative.ca/about-derivative>.

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