

Music and Architecture:

exploring the harmonies
between disciplines
and environments

By Jess McFarlane

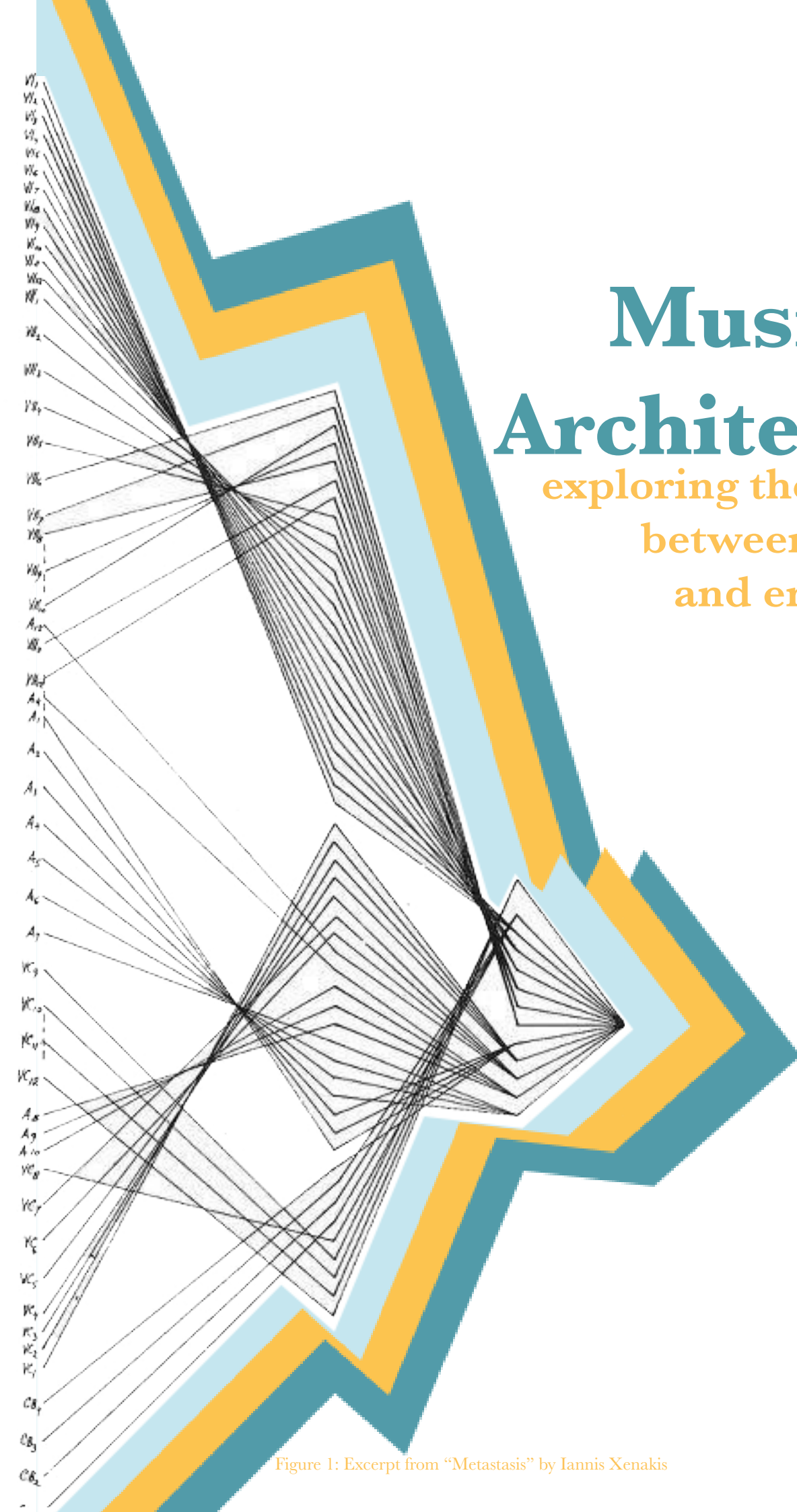


Figure 1: Excerpt from "Metastasis" by Iannis Xenakis

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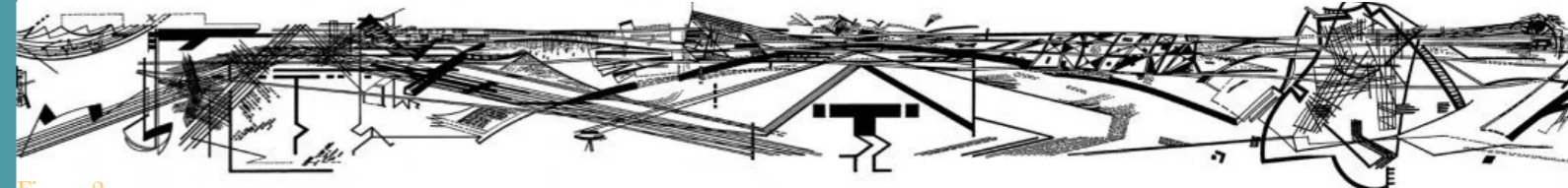


Figure 2

Executive Summary



Figure 3

Music and architecture are linked in many ways and this paper looks to explore these connections as well as research into practice rooms and give designers recommendations on how to better music spaces.

These two disciplines have been intertwined through shared terminologies, composition and building design. Writer and poet Johann Wolfgang von Goethe's most famous quote is: "Music is liquid architecture; architecture is frozen music" meaning that music exists in the current time and space and architecture exists on a more permanent level. Yet these two disciplines have grown together with one impacting the others development and becoming an influence for composition or design.

During the baroque period, music was performed in ornate rooms often in palaces, but as music progressed from baroque to classical and then to the more romantic era of music, ensemble sizes increased impacting the size of performance spaces which had to change and become more adaptable for larger orchestras. This led to research into acoustics for performance spaces and the use of materials through soft and hard furnishings.

From this I concluded that more research must be conducted into the design of the practice room. I interviewed three musicians and sent out a survey to many more and concluded that most practice spaces are unsuitable for musicians as they are often too small, have "bad" acoustics and are not nice environments to be in. I asked participants what they would change about music spaces and aspects such as more colour, less dungeon-like and better acoustics were suggested.

Through this research I hope that designers and architects will begin to understand the complex needs music space demand and be able to create better and more flexible performance and practice rooms.

Introduction



Figure 4

Throughout history many links have been created between music and architecture and it is evident that music has influenced architectural design and vice versa. This paper looks to explore these links and influences further and find out exactly what the needs and wants of a musician are so as to design spaces for them. This research is important as architects and designers need to have a knowledge of music and musicians in order to create the optimum space for the users.

I am conducting this research as I am a musician and have used many music spaces in my life, including practice rooms. I feel as a brass player they are often unsuitable as they can be too small with not enough space to move with unflattering acoustics that can be difficult to work with. Designated practice rooms are often forgotten spaces with too much surrounding noise, unsuitable acoustics and usually a lack of windows or natural light and I feel that many designers and architects lack the knowledge required to create proper facilities for musicians.

Much of the research into architecture and music focuses on shared terminologies, composition and performance acoustics. In order to design music spaces, one must first understand the history of performance spaces, practice rooms and the needs of the musicians who use them. Music has influenced architecture and architecture influenced music since Ancient Greek and Roman times. This influence can be seen through the later development of Baroque music rooms to designated concert halls and performance spaces.

This paper will research how the design of practice rooms can affect a musician's well-being, concentration and their capability to practice. It will also investigate the requirements of the musician so as to create the optimum practice environment from an architectural and acoustic perspective. I will conduct a survey and three interviews in order to better understand the needs of musicians when practicing and to find out how their playing of music affects the design of a space. This research needs to be conducted for designers to be able to create suitable practice spaces for musicians so they can rehearse, teach and play to the best of their ability. Knowledge of a musician's needs in a practice space is important as it is where musicians spend much of their time playing their instruments. It is essentially a musician's office where they work for sometimes hours a day and needs to provide comfort, good acoustics and be a place for concentration. The needs of a musician and the music itself influences the design.

Introduction

Music and architecture have been linked together since the dawn of time (Capanna, 2009): music needs a place to be performed and architecture occurs on an aural scale as well as visual (Sheridan & Lengen, 2003). They share a rich history and culture as well as terminologies and the ability to create an emotional response. Yet on another level they are nothing alike at all: “Architecture acts as a physical, tangible, visible but inaudible symbol, music acts as an abstract, intangible, invisible but audible symbol.” (Imaah, 2004) Though you can feel music through emotion and on a deeper level, it exists only in that time and place: it is intangible, whereas architecture exists in a place and will stand for as long as it is needed “does not float away into space like music” (Wheatley, 2007). Physically they have nothing in common, yet they are forever intertwined through the culture and history that has grown and developed with them (Wheatley, 2007). Benavides says:

“Architecture, like music, is an unavoidable art. Day or night we live or share spaces created by the human hand. It is an art that, especially for those of us who live in a city, surrounds us permanently. Music also operates in the same way, whether we are aware of it or not.” (Benavides, 2024)

We are unable to turn off our hearing and cannot live a life in complete silence. Our way of communicating is through language and music. A blind person is able to perceive a space through the echoes they hear when in a room, therefore “all architectural spaces project sound in one way or another” (Benavides, 2024) An architect must work in visual and sound spaces, as does a musician. For example, a concert hall could not exist without an architect with knowledge of acoustics and would be useless without performers and composers who understand how best to adapt their playing/compositions to different spaces. Both are connected in a tangible and intangible realm and “are two disciplines that directly affect human life” (Jakupi, Haliti, Kajtazi, 2022).

Shared Terminologies

German poet Goethe referred to music as “liquid architecture” and architecture as “frozen music” which gives the idea that though architecture may be immovable and solid, it shares values with the “essentially mobile methods of music” (Waterhouse, 1921). They both share many terminologies with each other and also the other members of the five arts (literature, sculpture and painting) which means we are able to find many comparisons (Imaah, 2004). Waterhouse groups painting, literature and sculpture together as they all focus primarily on “imitation or representation” while music and architecture are less about imitation and more about provoking emotion (music) or beauty and function (architecture). For this reason Waterhouse ranks music and architecture as superior to the other three arts. While music and architecture differ in ways of function: “music is functionless but architecture is possessed of construction as its function” (Waterhouse, 1921), they liken in shared terminologies, creativity and design principals (Felix, Elsamahy, 2016) Some of these are form, rhythm, dynamics, texture, tone, harmony and narrative.

Form: the overall structure of a piece or a building. In music we look for patterns in the melody or rhythm and in architecture we look for patterns in structural elements, exterior and interior spaces and in plans and elevations (Felix, Elsamahy, 2016).

Rhythm: “Just as music represents the audible rhythms, the architecture represents visual rhythms” (Mohammed, 2019). This can be felt in music is defined by the silence between the notes. It can be seen in architecture in the repetition of shapes and movement of the space (Jakupi, Haliti, Kajtazi, 2022)

Dynamics: the changing of sound in music from loud to quiet or vice versa. In architecture it is movement of the form or shape in a building (Jakupi, Haliti, Kajtazi, 2022). Without dynamics in a piece of music it would be somewhat boring and monotone. The same can be said for architecture as the dynamics of a building helps to lead your eyes around the space and create visual interest.

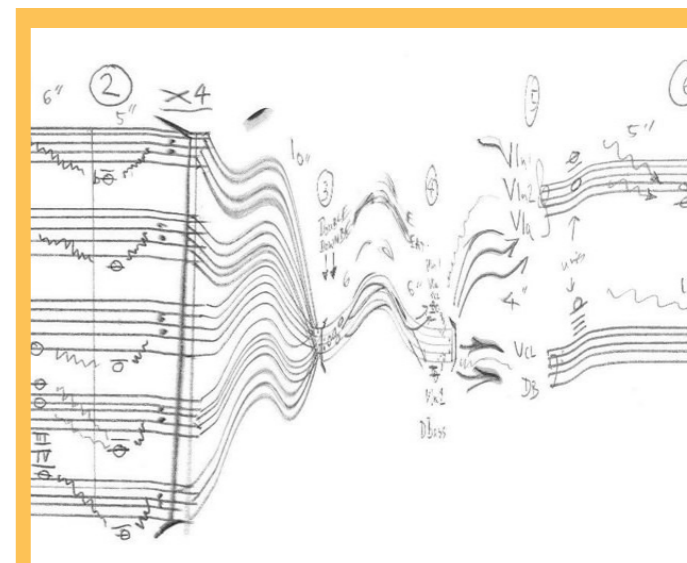


Figure 5: Liquid Architecture by Philip Sheppard

Texture: this is the combination of all aspects of music layered together – rhythm, harmony, instrumentation etc. In architecture this is the combination of materials and how they work together to create visual interest (Jakupi, Haliti, Kajtazi, 2022)

Tone: refers to the intervals played in music: the melody. In architecture it is elements that create a space such as windows, walls, doors, furniture etc. (Felix, Elsamahy, 2016)

Harmony: this is different from tone as it is more than one note played at a time to create a more complex and rich sound and melody. In architecture harmony is the “consistent relationship between the component parts for the whole composition” (Imaah, 2004) It can also be either horizontal or vertical harmony. Horizontal harmony appears in plans or elevations and vertical harmony refers to the combination of layers of architecture such as “structure, function, zoning, landscape, furnishings and others” (Felix, Elsamahy, 2016)

Narrative: In music, a story is told through sounds in a way that cannot be expressed with words. The same can be said with architecture though the stories are shown more visually instead of aurally. There is a sharing of culture through visual and aural cues with one being in an emotional way and another more a story of history and lifestyle (Jakupi, Haliti, Kajtazi, 2022)

Through these shared components we can start to see how architecture and music relate from a design and compositional point of view. When researching the inspiration between music and architecture, Gregory Young, Jerry Bancroft and Mark Sanderson started by identifying shared terminology between music and architecture as well as shared sources of inspiration and influence.

I. TERMINOLOGY	II. SOURCES OF INSPIRATION AND INFLUENCE
ARTICULATION	EMOTION/PERCEPTION
CLUSTER	Aggression
COLOR	Anxiety
COMPOSITION	Awe
CONTOUR	Boredom
CONTRAST	Confidence
DEVELOPMENT	Comedy
FORM	Elegance
IMITATION	Excitement
LINE/LINEAR	Intimidation
ORGANIZATION	Intrigue
PROPORTION	Tension
REPETITION	Tragedy
RHYTHM	Triumph
SHAPE	HISTORY/STYLE
STRUCTURE	STRUCTURE/FORM
TEXTURE	MATERIALS/MEDIUM
THEME	SOCIAL/POLITICAL
TRANSFORMATION	COMMISSION/CLIENT
TRANSITION	CONSTRUCTION/PERFORMANCE
VARIATION	PHYSICAL CONTEXT
	MENTORS/HEROES
	FUNCTION/PURPOSE
	HARMONICS/GEOMETRY
	USER/AUDIENCE
	BEHAVIOR MODIFICATION
	MANIFESTO/STATEMENT
	TEXT
	COST

Figure 6: Table of Shared Terminologies by Young, Bancroft & Sanderson

This table shows at a glance how much music and architecture are linked and inspire each other. This table was used to help in a seminar class where students were to design a building based on a piece of music and vice versa which helped to prove that music can become a “leap vehicle” (source of inspiration) for architectural composition, and vice versa” (Young, Bancroft, Sanderson, 1993).

Music, Architecture and Composition

As music and architecture share so many qualities, one can use the other as a tool for inspiration. “Music translates into a line, a space, a form, a colour, a material, a light” (Mohammed, 2018) and architecture can in turn be translated in to a musical composition. Young, Bancroft and Sanderson describe this inspiration as a “leap-vehicle” and at the end of the seminar they conduct with their students, they concluded that they “believe music can be an excellent leap vehicle for architectural design” and architecture has a potential to do the same for musical composition (Young, Bancroft, Sanderson, 1993).

A way in which music can be a source of inspiration for architecture is graphically: music can be drawn instead of written. An example of this is Daniel Libeskind’s Chamber Works which is a collection of drawings which collates the ideas of “chamber music” and “chamber architecture” and defines the idea of “spatial music” (Capanna, 2009).

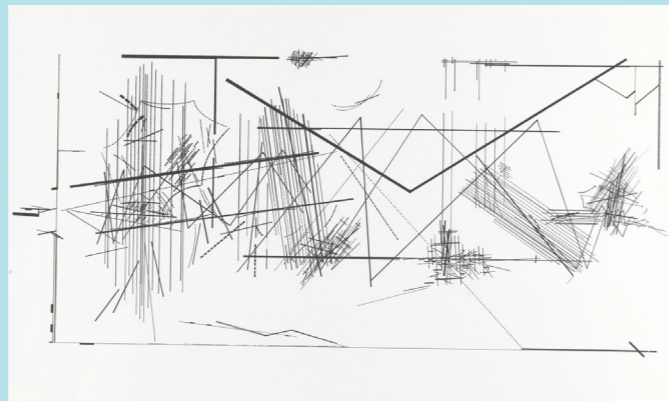


Figure 7: Chamber Works by Daniel Libeskind

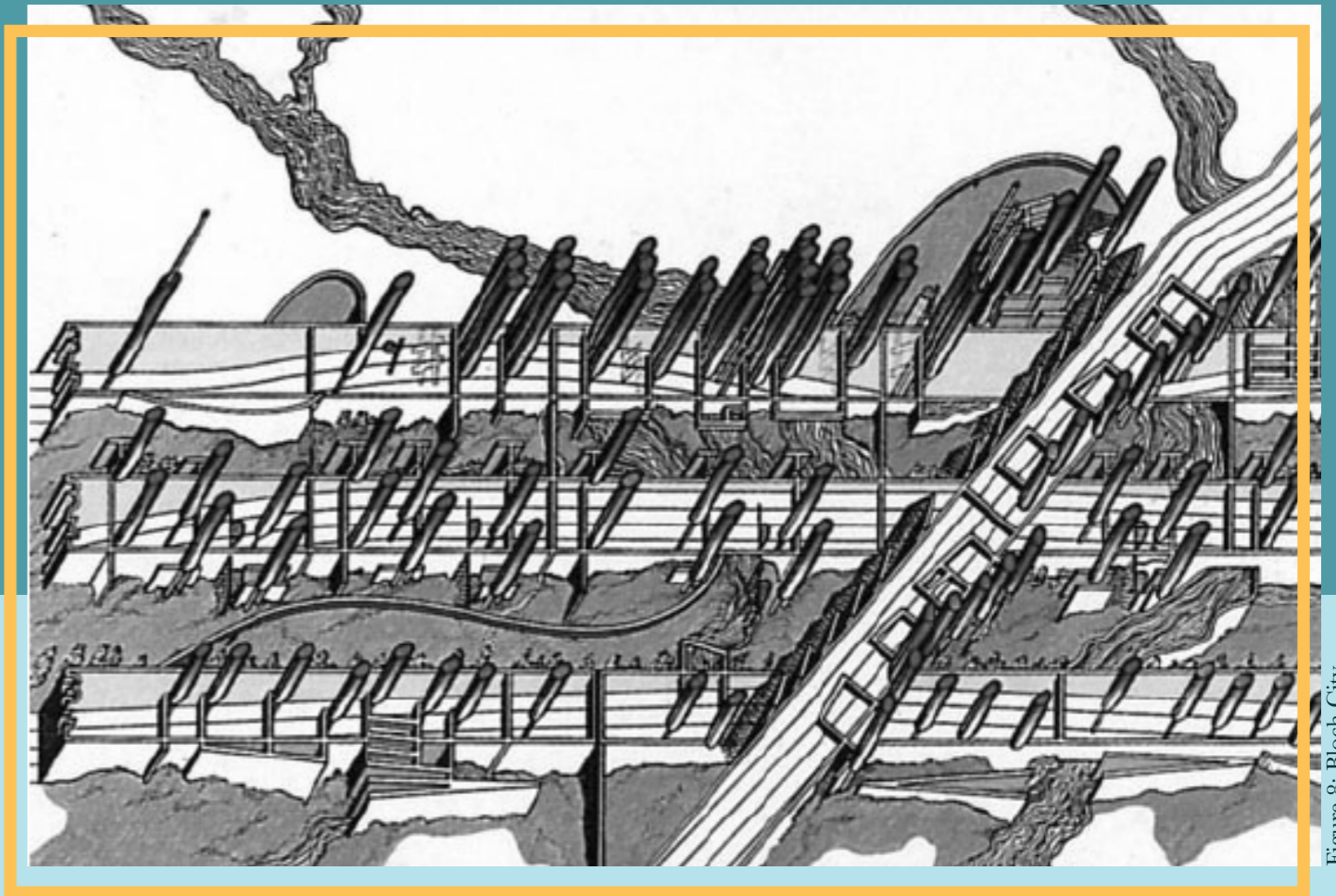


Figure 8: Bloch City

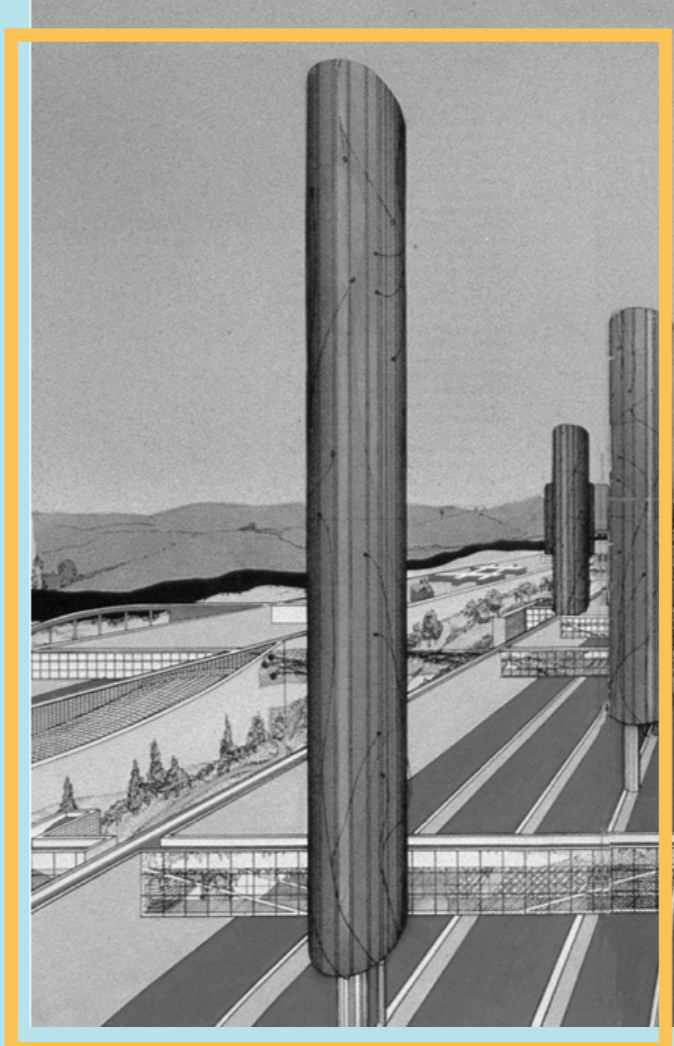


Figure 9: Bloch City

Peter Cook did a similar thing but in a slightly different direction. He took Ernest Bloch’s violin concerto and interpreted it into “the plan of an ideal city” titled Bloch City (Capanna, 2009). Cook spoke of his work: “The notes become towers, the staff becomes a street, the supporting markings become walls” (Capanna, 2009) showing that a musical score can invoke designerly ideas.

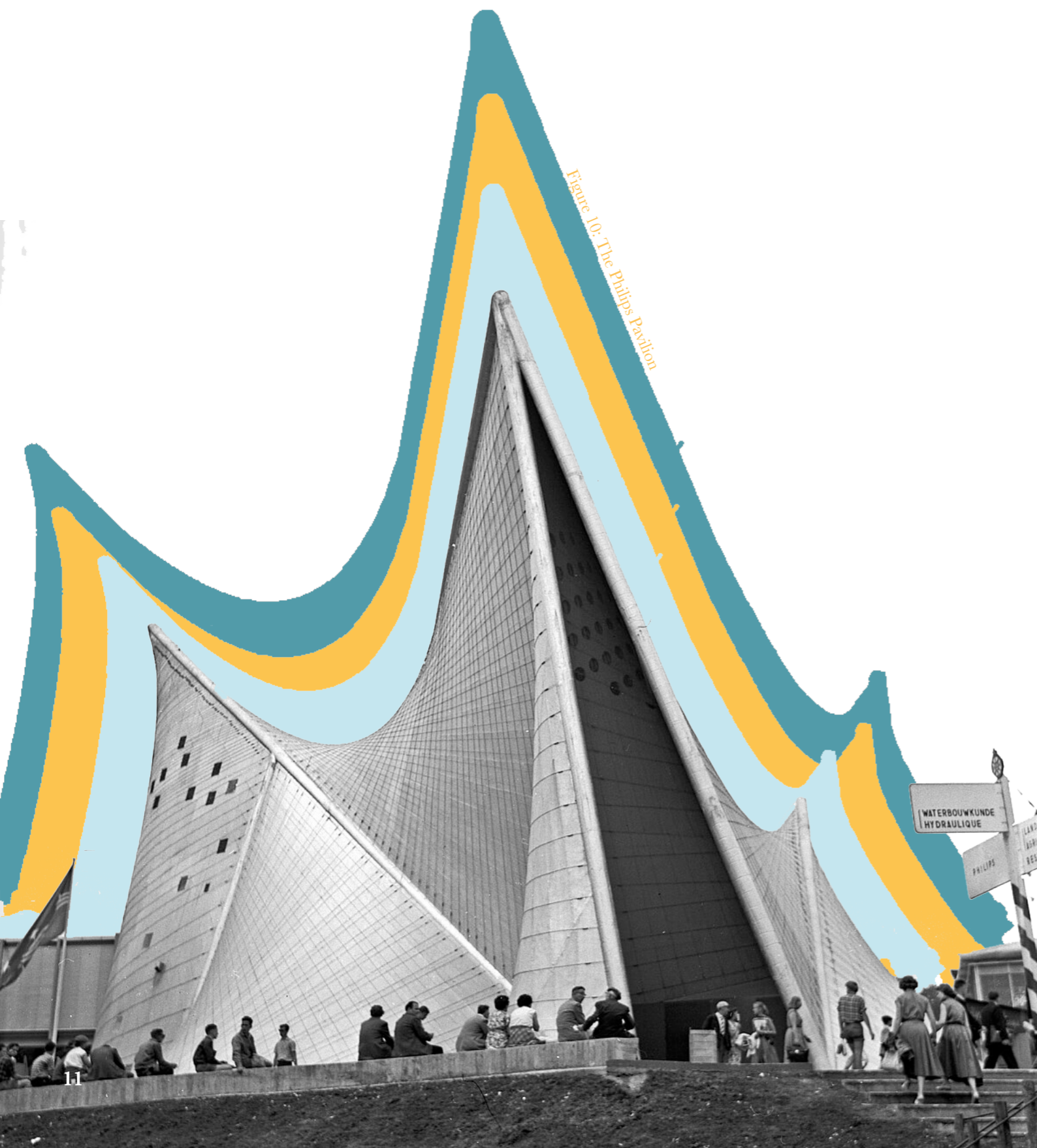


Figure 10: The Philips Pavilion

Graphical scores are visual representations of music and a great example of one is *Inside Out* (Situation 3) performed by Franziska Schroeder where each drawing “represent the performance space, the position of the pipes and their resonant pitches. It does not tell the performer what to play, but only informs which pipe resonates which pitch.” (Alvim, 2018)

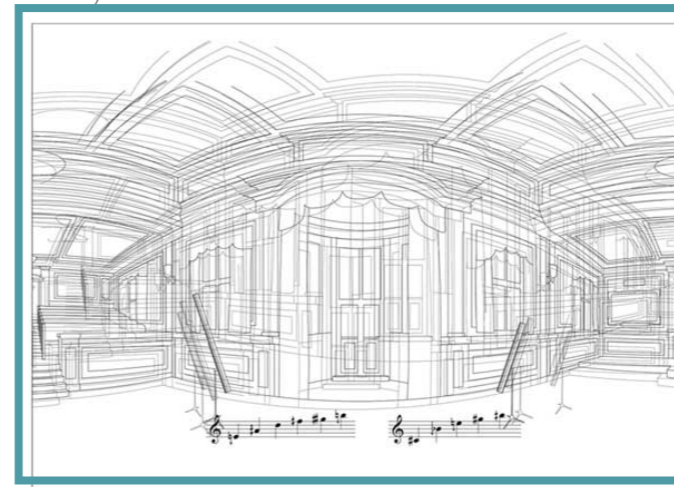


Figure 11: *Inside Out* (Situation 3) by Franziska Schroeder

You can see here that the score is practically just a drawing of the performance space with some notes with which to improvise upon, but it is directions for the performer to “wonder, explore, dwell” (Alvim, 2018).

Iannis Xenakis was an architect and composer who lived from 1922-2001 and was best known for his mathematical approach to music. One of his first major compositions titled *Metastasis*, had aspects of its composition based on the Fibonacci series as well as large glissandi at the beginning and end of the piece (Sterken, 2007). He used the graphical method of composing but more as a way to “enable(ing) constant feedback between the hand and the ear” (Sterken, 2007). This can be seen in the glissandi in *Metastasis*.

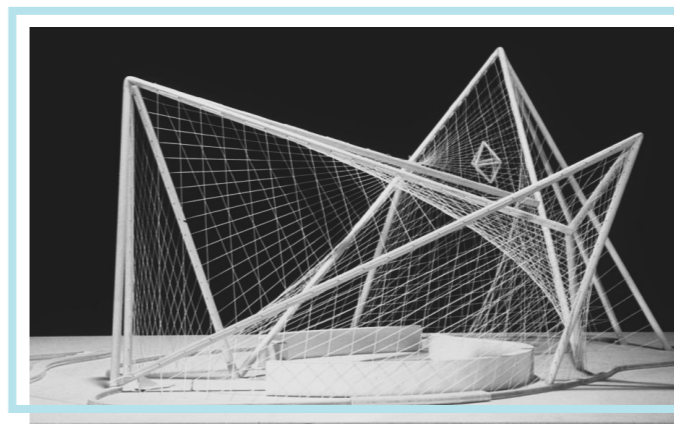


Figure 12: Philips Pavilion Model

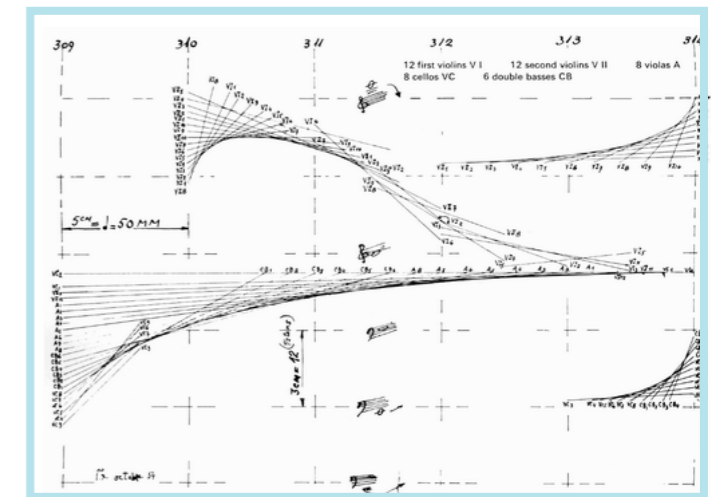


Figure 13: *Metastasis* Glissandi Inspiration for the Philips Pavilion

This graphical score become somewhat of an influence for the Phillips Pavilion created for the 1958 World Fair in Brussels. The Phillips project also played some of Xenakis’ compositions through loudspeakers. Xenakis stated that “we are capable of speaking two languages at the same time. One is addressed to the eyes, the other to the ears” (Sterken, 2018 (London: Faber and Faber, 1996, more research needed)) and this is very apparent from the way he designed and composed music. This takes us right back to the idea we started with: “all architectural spaces project sound in one way or another” (Benavides, 2024). We cannot design any space, whether for music or not, without also designing for the ears. Same as we cannot have music without a space in which to play and preform. Music and architecture will always be intertwined for as long as we continue to both see and hear our surroundings.



Figure 14: Philips Pavilion Construction

History and Development

There has always been a connection between architecture and sound. Yes, our visual sense takes precedent when designing, but you cannot separate a space from sound and “aural interpretations provide additional layers of meaning to the architectural experience” (Sheridan & Lengen, 2003).

In oral societies, such as pre-alphabetic Greece, exchange of culture came from sound and rhythm which created stories then passed down from generation to generation. As a result, built spaces took on the more organic forms as opposed to the organised man-made forms seen in post-literate architecture. They didn't stand out from the surrounding natural or man-made context but rather reflected “the sounds of life and living” (Sheridan & Lengen, 2003).

When the Greek phonetic alphabet was created, buildings changed from being created for aural purposes and more for visual: “Greek oral/aural consciousness (was) displaced into literate space” (Sheridan & Lengen, 2003). This can be seen in the Athenian Acropolis where instead of inviting in the sounds of life as previous sacred spaces, the building was designed in a way to lessen the sounds emerging from the surrounding city. This style of design was carried into the design for Gothic Cathedrals where the primary concern was hearing the reading of written word. There was a mix of creating a space for visual stimulation but also for an aural experience as music and spoken word were still a central part of churches and cathedrals (Sheridan & Lengen, 2003).

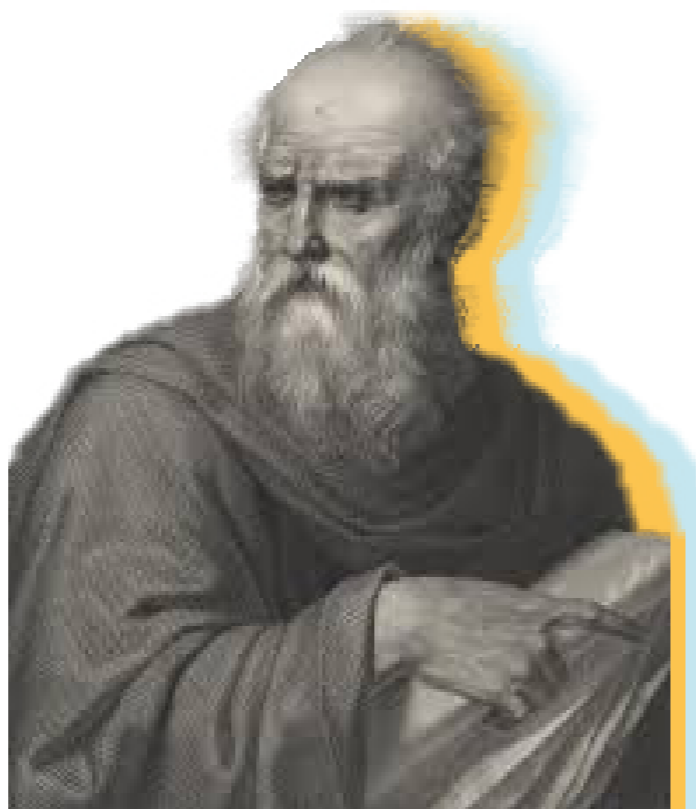


Figure 15: Marcus Vitruvius Pollio

Vitruvius, a Roman Imperial architect, used Greek music-theory as taught by his predecessors, Aristoxenus and Pythagoras, in his architectural and mechanical design. He thought that in order for an architect to fully understand design and spatial reasoning, they must receive a full musical training (Walden, 2020). Since then, architecture and music can be seen to be linked through performance spaces like the first auditoriums from Ancient Greece, to plainchant performed in gothic, “Romanesque” churches, to opera (Benavides, 2024), baroque music, classical music and romantic music, all performed in different styles of space.



Figure 16: Acropolis of Athens



Figure 17: Acoustic Vase at Chartreuse Notre Dame du Val de Bénédiction

Vitruvius' influence can be seen today in over 200 churches in France. These Roman Gothic Churches and cathedrals house what are known as acoustic vases. One example of such a church is in the Cathedral of Noyon. The vases are clay pots embedded into the walls of an underground room of the cathedral and this idea can be linked back to Vitruvius, the Roman architect. Vitruvius had the idea that “bronze vessels” could be added to a room and when someone sang, the sound waves would hit them and a harmonic tone reverberate to harmonise with the singer. Vitruvius thought that this reverberation would enhance the acoustics and even create more volume to project the sound of the voice. (Tallon, 2016) The vases found in French churches were typically located in the upper walls and vaults yet there was a question as to whether these vases resonated sound or not. Some “thought that it was done to please the foolish” (Tallon, 2016) and was more for show and exhibition. It was thought that if the vases were made of clay or wood, like in the Noyon Cathedral, they would not work and only bronze would reflect the sounds. (Tallon, 2016)

Andrew Tallon, a Belgian-American historian, conducted research into whether these vases worked and came to the conclusion that they in fact “cannot amplify sound according to the law of conservation of energy” and “if anything, it diminished whatever little sound energy managed to enter from the choir space above” (Tallon, 2016). But these vases are proof that sound production and acoustics affected the way that architects thought even back in the 12th century.

“Architecture is a cultural variable and a fashion target representing styles depending on numerous cultural factors” (Sütterlin & others, 2014). This can be seen throughout the progression and changes of musical style throughout human history. “Two ages of architecture differ in style for exactly the same reason as do two ages of music.” (Higgins, 1925) Baroque music emerged in the 17th century where music changed from unaccompanied choral music to instrumental music with occasional vocal contribution. This music was much more complex or in a contrapuntal style than previous choral music and was often performed in palace music rooms which were hard surfaced, ornate and usually rectangular (Beranek, 1992)

Later on in the Baroque period, some concerts started to be performed in smaller theatres but when the classical period started, larger halls were required as orchestras grew substantially in size. The first concert halls were built in 1820 and by the middle of the 19th century, halls were designed specifically for orchestral music. At this point in time, reverberation times started to affect performances as spaces were much larger. The romantic period gave way to more emotional and expressive music which again influenced concert hall design and at this point acoustic science of concert halls started to become a focus for a Harvard professor called Wallace Clement Sabine (Beranek, 1992).

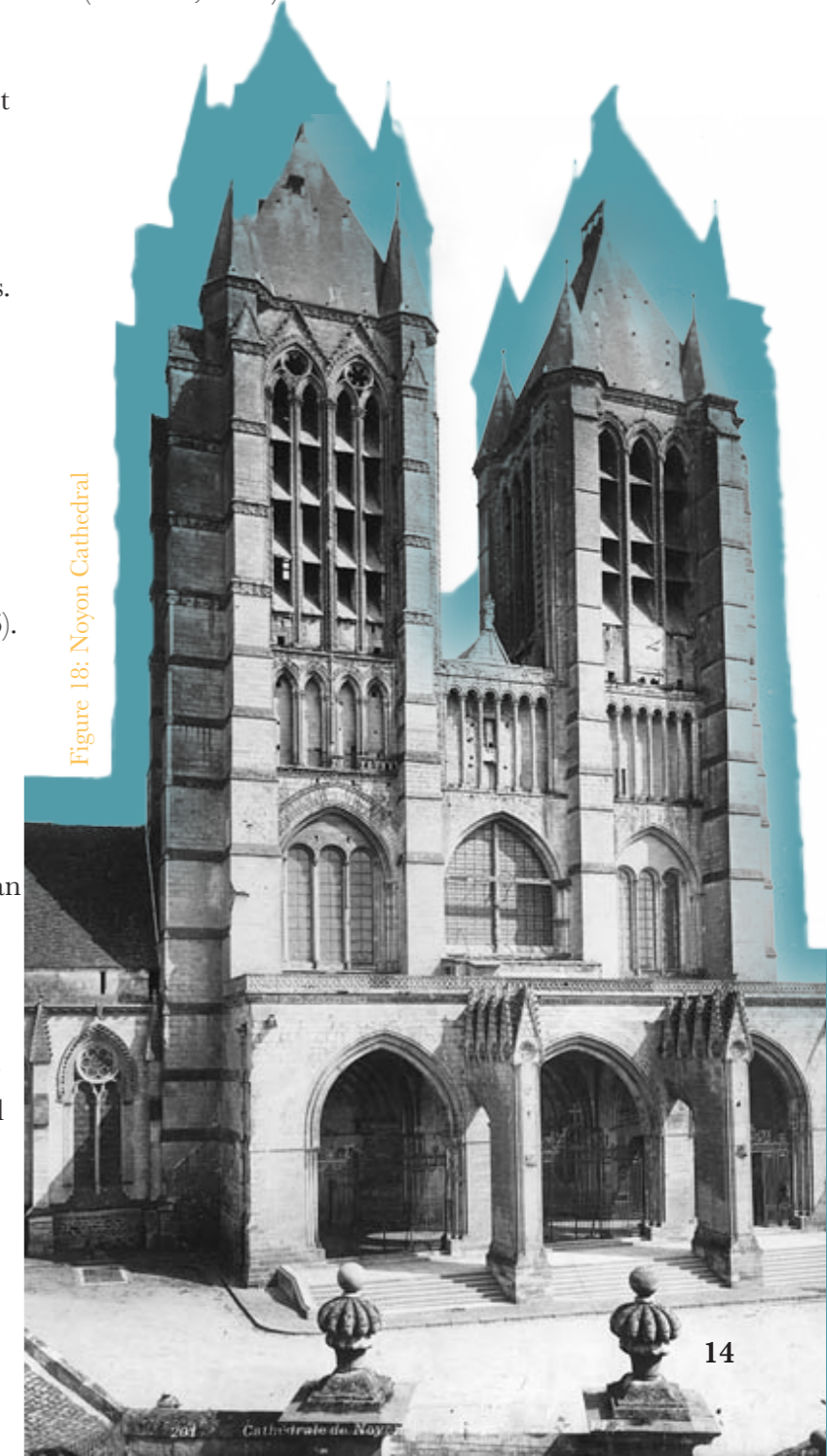


Figure 18: Noyon Cathedral

Sabine's Experiment

Sabine was interested in “what constitutes good and what constitutes poor acoustics” (Sabine, 1906) and found that reverberation was the answer to this question. In order to learn more about what reverberation and type of room is optimum for playing music, he created an experiment. A variety of rooms were chosen where some rooms were different sizes and had different amounts of furniture and soft furnishings. A committee were chosen to decide which room sounded best acoustically and this was “judged solely by listening to piano music” (Sabine, 1906). Each room's acoustic conditions were varied and the same pianist played the same short excerpts of a variety of music genres. The rooms varied from barely furnished to fully furnished:

“In room 1 there was a bare floor, and no furniture except the piano and piano stool.

Room 2 had rugs on the floor, chairs, a sofa with pillows, table, music racks, and a lamp.

Room 3 had a carpet, chairs, bookcases, and a large number of books, which, overflowing the bookcases, were stacked along the walls.

Room 4 had no carpet, but there were chairs and a small table.

Room 5 had a carpet, chairs and shelia curtains.” (Sabine, 1906)

It was found that the reverberation in all rooms was too much so cushions were brought in and a process of trial and error helped to see what worked best. In the end it was decided that reverberation in a music room with a piano should be 1.08 seconds. (Sabine, 1906)

This experiment proved that sound production is affected by “the volume of the room, and the absorbing character if the walls and of the materials with which the room is filled” (Sabine, 1906) and shows that the design of music spaces is directly linked to the sound itself: you must have knowledge about one to understand the other.

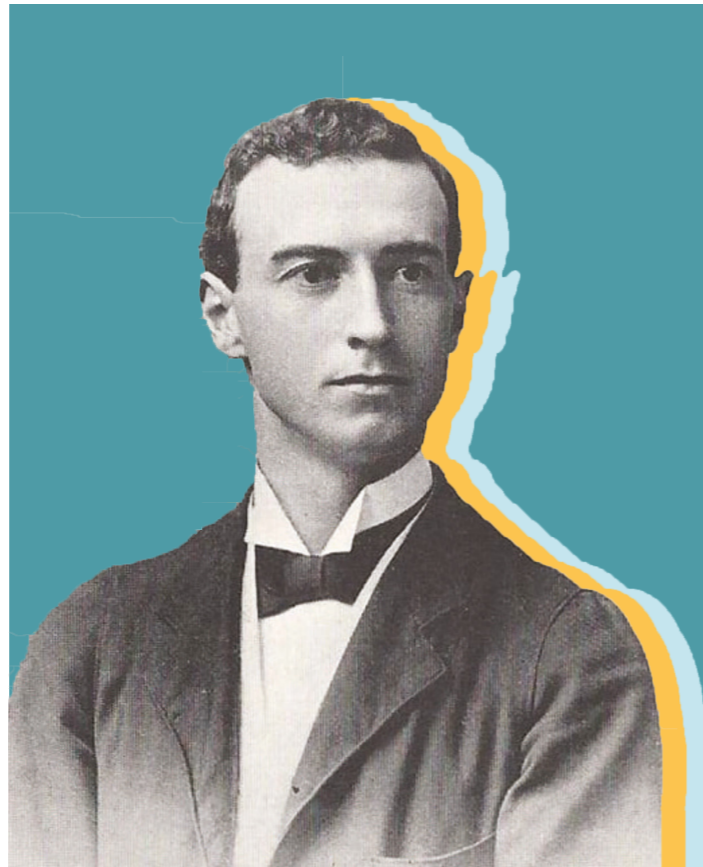


Figure 19: Wallace Clement Sabine



Figure 20: Reverberation Experiment

Conclusion

Music and architecture are linked through many aspects such as shared terminologies and composition and have been throughout history. The Ancient Greeks and Romans thought that in order to fully understand spatial reasoning, one had to have music knowledge and since then this way of architectural thinking can be seen throughout auditorium and music halls. Later, Sabine started research into acoustics for music and later this affected the concert hall design. Much of the research into acoustic design and architecture has been for smaller performance spaces or concert halls, but it seems that practice spaces have been overlooked from a research perspective. In order to fully understand music spaces, practice areas must be studied and user/instrumental needs expanded on and understood.

Methodology

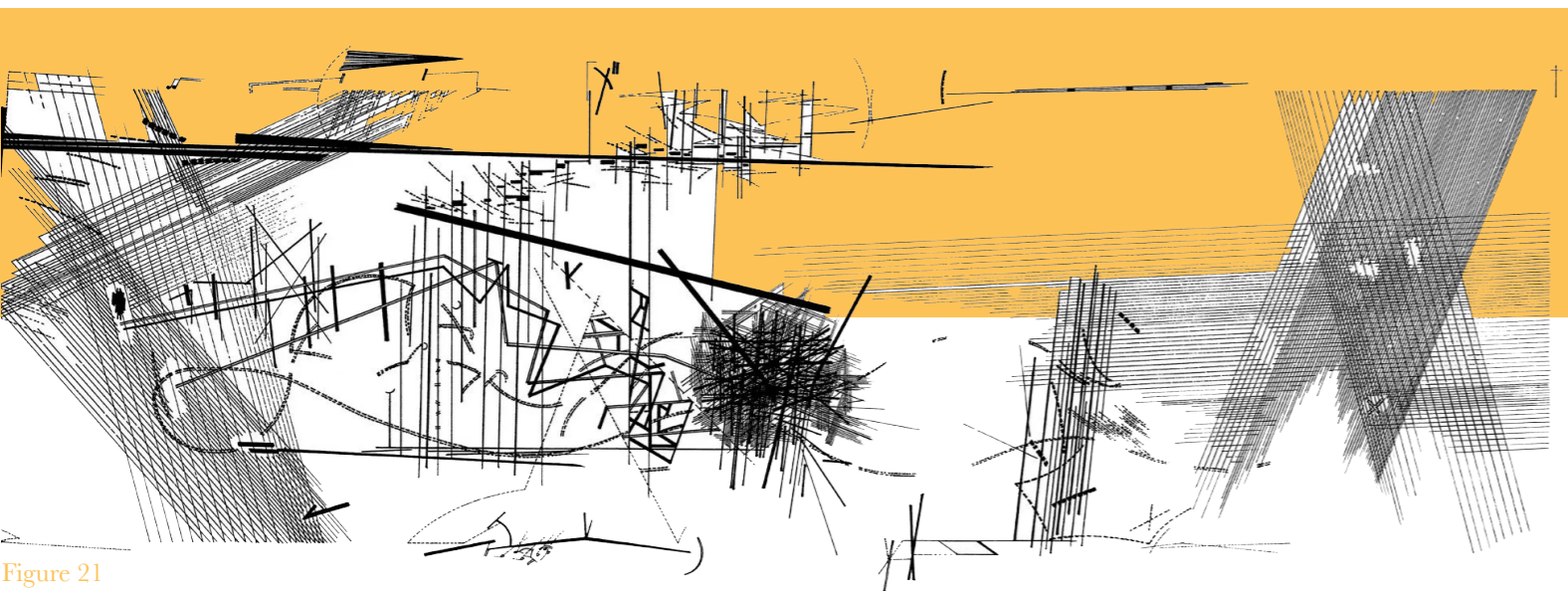


Figure 21

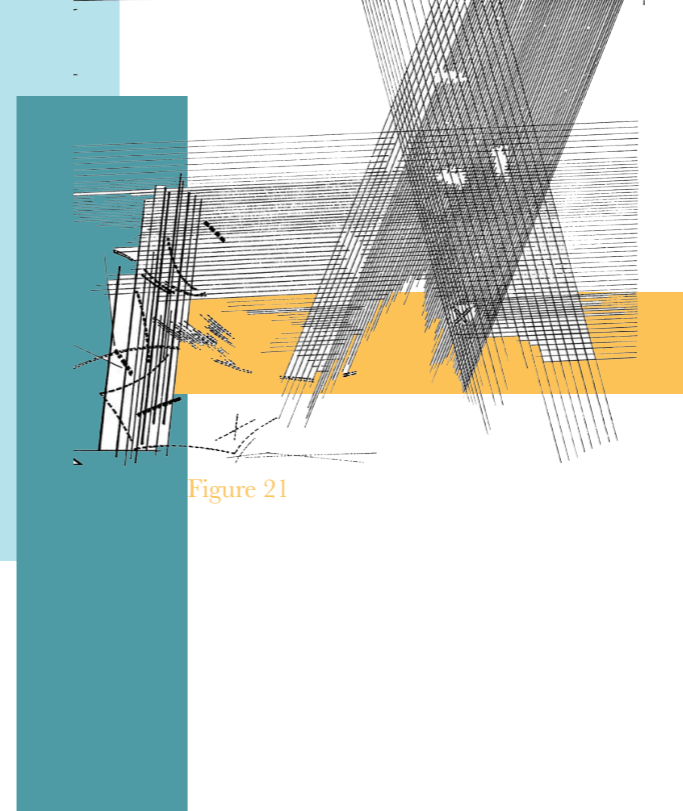


Figure 21

Introduction

It is apparent from my initial research that while much of the research into music and architecture focuses on the similarities between disciplines, the links throughout history and the architecture of performance spaces, but practice spaces also need to be thought about. Their design is of the utmost importance as this is where a musician spends the majority of their time. As a result of this insight, I decided to research how the design of practice rooms affect a musician and what musicians require in order to create the optimum practice environment. To research this I conducted three interviews and an online survey.

Survey

The requirements of practice spaces vary for different instrument types, ages, capabilities and personality types, so I created a survey that was sent to musicians of various abilities, ages and instrumentation. I curated the survey with carefully selected questions that varied from likert scale questions, to multiple choice to more open-ended questions. I focused on how different instruments have varied requirements from a practice room as I want to understand how to create a flexible space for different people. To ensure the most responses the survey took no more than 10 minutes to complete and was anonymous. I distributed the survey through email, Whatsapp groups and my Instagram story. I also asked people to pass on the survey to other musicians to complete.

Interviews

I conducted 3 interviews: one with a music student at university who plays percussion, one with a fiddle player who played in the Edinburgh Military Tattoo and finally with a music teacher who was Head of Music at Morrison's Academy and now teaches brass instruments and piano. The primary focus of these interviews was to understand the effect that acoustics have on different instruments, to learn what they all require from a practice room and how they use various practice spaces. Percussionists play a variety of instruments from tuned percussion to untuned and each have a different timbre. Playing fiddle in the Edinburgh Military Tattoo is unique to most performances as sound travels very differently outside in an open space compared to in a practice room and therefore when rehearsing for such events, practice must be conducted in a different way. Finally, brass instruments are much louder than string instruments and pianos are static instruments so the requirements from a practice room are different from both violin and percussion. When teaching such instruments, some venues such as tiny practice rooms, can affect teaching methods so I want to learn what are the optimum conditions for teaching music.

Why?

I chose these methods of research as I felt a survey was the best way to reach a wide variety of people from different musical backgrounds and the three interviews helped me to then focus on specific aspects of musical practice and teaching. I have spent time studying music in London and I grew up playing music back home in Perthshire, in Glasgow with the Tommy Smith Youth Jazz Orchestra and with the National Youth Orchestra of Great Britain. Through these contacts I feel I was able to have a very varied response to my survey and collate information that reflects many different walks in life.

I chose to interview three people with very different musical backgrounds in order to expand knowledge I already had about music practice. Interviews are great to answer more open-ended questions and through semi-structured interviews I was able to gain information and perspectives I had not previously thought about.

Primary Research

Introduction

From my findings, I discovered that while people have a variety of insights into practice spaces, over 90% of people said that their surrounding environment does affect how practice and their practice morale. When I interviewed a percussion student at university, he showed me his designated practice room on campus and said

“what this room screams to me is that they didn’t ask someone who was going to be playing percussion or has played percussion what would you like? This is a generic space. And that never works because it’s not a one-size fits all”.

I feel that this quote perfectly summarises the need to carry out this research and find out from musicians what they require from a space.



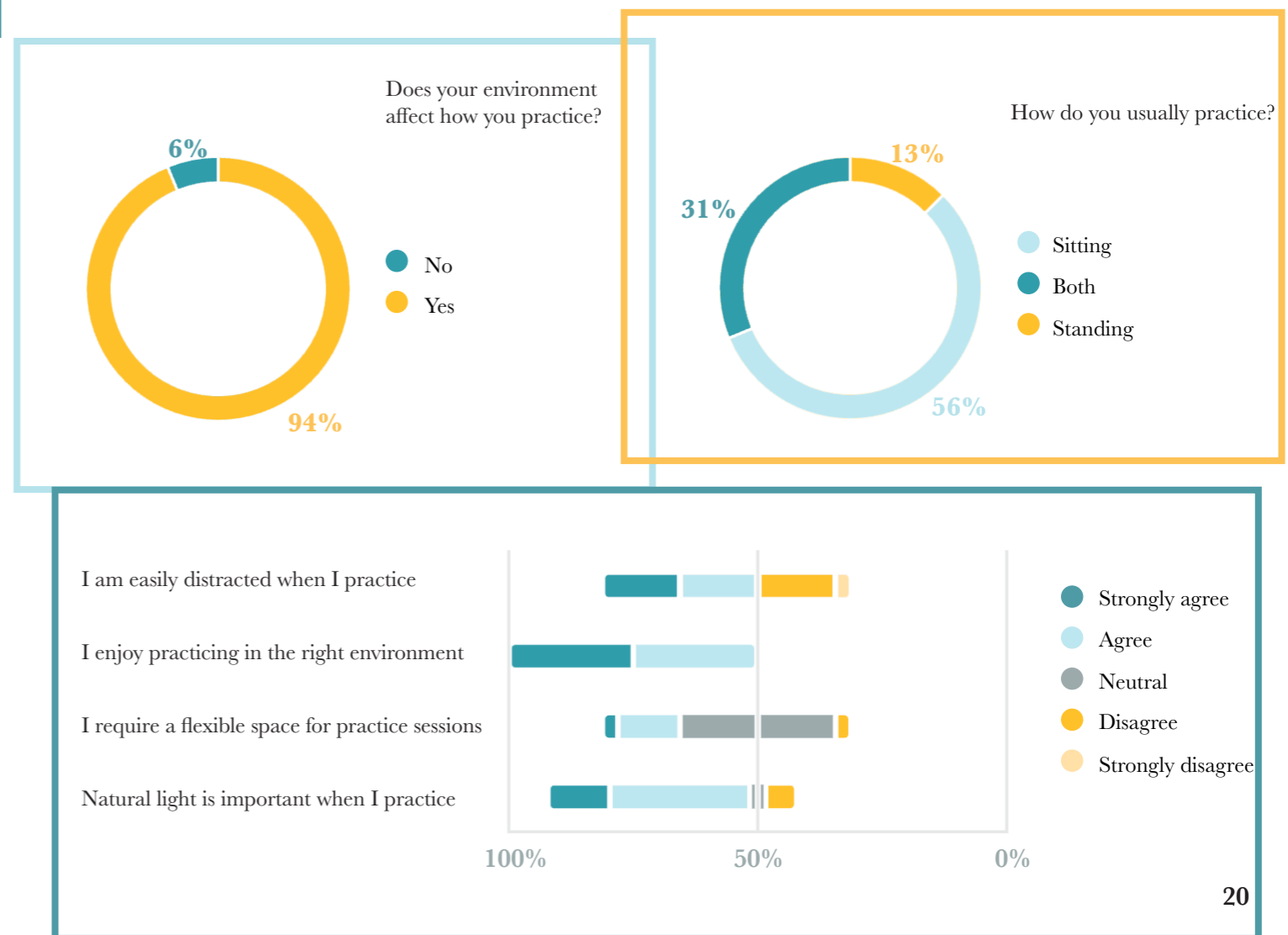
Figure 22

Current Practice Habits

My first step in understanding the requirements practice rooms was to find out more about the musicians who are using them and their current practice habits. From my survey I found out that the majority of musicians practice at home or in designated practice rooms and most practice sitting down, although the three people I interviewed all practice standing up. When asked if participants required a flexible space for practicing, the answer was mostly neutral with people using the space for practice and nothing else. During my interview with a brass teacher, I asked her if she found she used her practice room in her house differently when she was teaching compared to practicing. She mentioned that if she is trying to teach projection, she will get the pupil to play towards the window to visualise playing into the street, but other than that all the equipment and space needed is the same and the room used in the same way.

In both the survey and interviews I asked participants if they are easily distracted when they practice and there was an overwhelming “yes”. All three interviewees said they can be distracted by their phones and the student went on to say that he also gets distracted by the piano in his practice room especially when he is practicing something he doesn’t enjoy as much. The teacher also said that sometimes if she sees pupils walking past her house she can be distracted and the fiddle player in the Edinburgh Military Tattoo commented that she finds practicing in Edinburgh more difficult than practicing back home in Shetland because there are so many distractions around.

One of the musicians I interviewed described her past practice room in school as “awful” and another said that she actively avoided the designated practice rooms in at university and opted to practice in her student accommodation with a practice mute so as not to disturb her flatmates with loud trumpet sounds. These initial responses to practice rooms were a great insight into how there is a lack of thought for the mental well-being of musicians and their comfort in current practice rooms.



Aesthetics

When asked if participants enjoyed practicing in the right environment, all agreed or strongly agreed and said that their environment affects how they practice. Natural light was said to be one of the most important aspects of practice spaces and many said that one of the main things they'd change about practice rooms would be to ensure that all rooms had windows for fresh air and natural light. I asked survey participants what they like and don't like about practice rooms and a participant said they disliked how damp and dingy some practice rooms are, especially ones where you are in the basement of buildings. Another said that they disliked how some practice rooms look like they have been created in what looks like a cheap, low-budget way with thin nylon carpets and a lack of comfort. One participant said that carpets are needed in practice rooms as cellists need to be able to have their spikes out and not slip as they do on polished floors. Soft furnishings such as carpets and curtains can help to diffuse the sound but make the space a nicer environment to be in. One participant commented that minimal furnishings in a practice room can mean less distraction so there is a fine line between creating a nice environment for people to practice in and an environment of concentration, productivity and good acoustics. When asked for any more statements or suggestions at the end of the survey, one participant commented that "funky colours" would make practice rooms more exciting and visually pleasing.

Acoustics and Size

Acoustics affect musicians in many ways from how they play their instruments to the sound an audience hears. The majority of participants agreed that acoustics in a practice space affect how they practice and practice morale. I asked survey participants to rate in order where they would prefer to practice from an acoustic perspective and the majority rated a church first, small practice room second, a town hall with a lack of soft furnishing third and a living room with many soft furnishings fourth. This showed me that most musicians prefer an acoustic with more reverberation to practice in, but size of a space matters too. Participants dislike how claustrophobic practice rooms are and would make them slightly bigger but still feel self-contained. All interviewees agreed that practice rooms need to be slightly bigger than tiny box rooms for reasons such as teaching, moving when practicing and using percussion instruments. The acoustics of a room also changes with the size so this has an impact on how musicians practice.

Many participants agreed that mimicking performance space acoustics is useful but also is difficult to do. One participant wrote

"Dry acoustic rooms are great for preserving hearing, being able to hear and pinpoint mistakes and are often great for recordings but can be less fun/realistic compared to performance spaces which are often slightly more reverberative."

When interviewing the student, he commented that his practice room has no reverberation and when practicing marimba he said "it's just very obvious that you're hitting the same note over and over. Whereas if you were in a concert space or a church, it sort of blends into one note." He would like to remove the soft soundproofing material that is on the walls and replace it with a solid material to change the sound and make the room more of a wet acoustic rather than dry. He also said that it is very difficult going from playing in a small practice room to a larger performance space:

"because every space is different, you don't know what to expect. I guess there's no way of mimicking that. It's like when I used to play piano more; every piano is different and every piano feels different and that is something that's really hard to get used to when you when you first play a piano that you've never played before. Just the action of the keys is different."

This showed me that practice rooms may not be able to fully mimic larger performance spaces, but it is key to have a flexible room that can be used in a variety of ways for a variety of instruments.

One of my main questions was how acoustics affect different ages and if younger students are affected by bad or unflattering acoustic. The brass teacher commented "I have an amazing amount of faith in everyone. And I think most music teachers do really, I think just some get quite lazy, but I mean even some of the five year olds that I'm teaching, they really care what it sounds like. Like if they play a note or on the piano or whatever instrument, and there's a ring and there's an acoustic, and they're getting all that good feedback from five years old, then they know that music is a beautiful thing... So I think even little ones are aware of when something sounds good." This really opened my eyes to the fact that acoustics really do affect everyone, and everyone can tell if they are playing in a "good" or "bad" space. Students especially want to impress their teachers with their sound and if the room does compliment their playing, this can be somewhat demoralising.

The teacher mentioned that her teaching/practice room in her house is mostly natural wood with a few soft furnishings to diffuse the sound such as curtains and an armchair. The room is designed to be a comfortable space and multi-functional: "If you play the violin on an open string in here, all the natural wood and even the piano strings resonate with the natural string a little bit, and it's all lovely and you feel wrapped up with sound." She commented that if she were to teach or play in her living room with so many soft furnishings the sound would not be anywhere near as flattering or fun to play in.

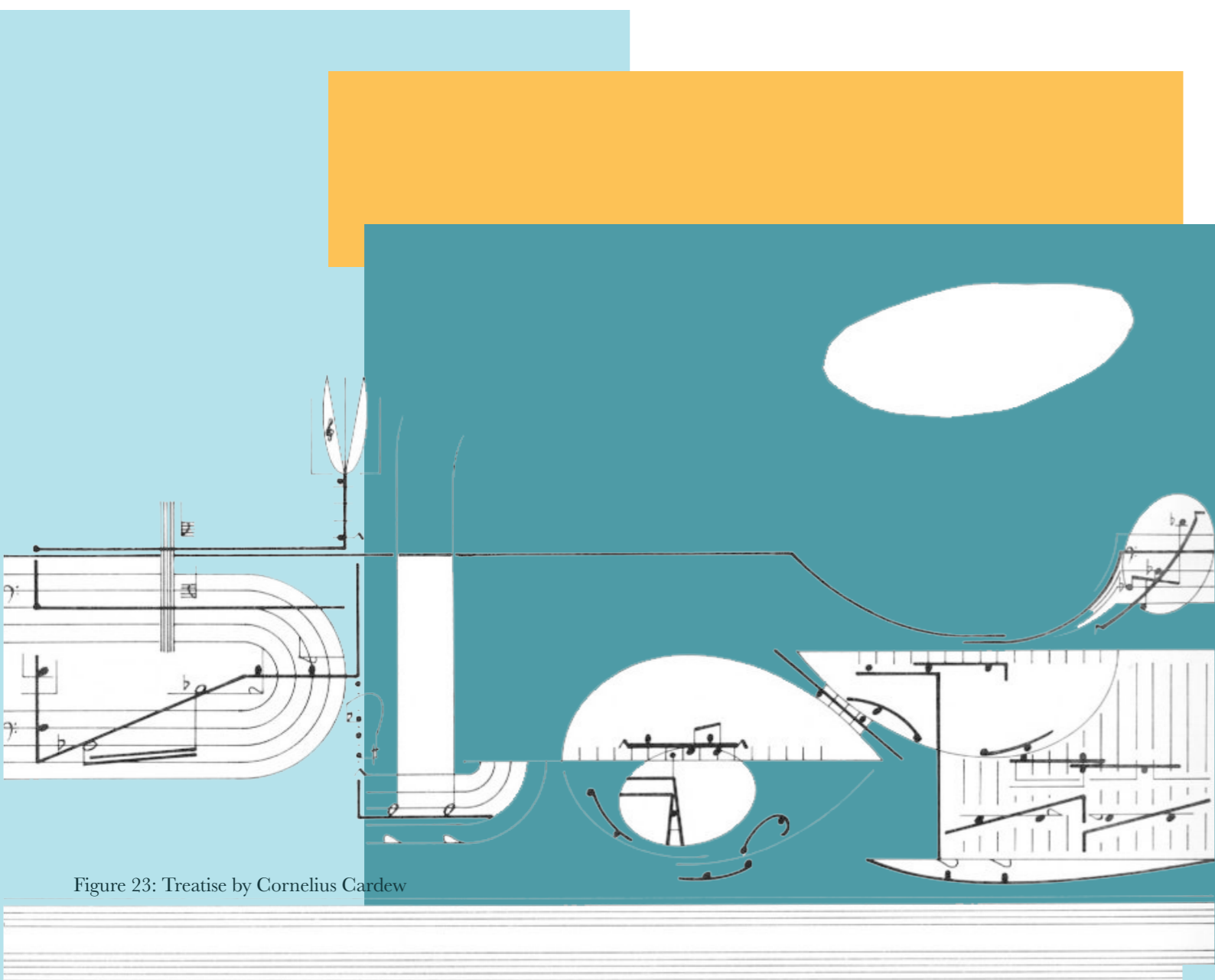


Figure 23: Treatise by Cornelius Cardew



Figure 24

Soundproofing and Privacy

It became apparent through my research that one of the biggest issues with practice rooms is the lack of privacy and sound proofing. The fiddle player commented that she enjoyed practicing in school practice rooms because she felt able to freely practice and didn't mind if anyone heard a mistake, but the teacher said that "I think there's a rule that nearly everyone practices worse when people can hear them. You need privacy to really focus and not always be aware of what someone else is doing and not be disturbed by other people's noise." The participants in the survey predominantly agreed they feel pressure when others can hear them practice and would prefer if practice rooms were more private and soundproof. A survey participant mentioned that double doors seem to help with room soundproofing and this can also make access into a room easier for bigger instruments. It is also an issue when sound bleeds in from rooms nearby and participants said it can be very distracting having lots of external noises around you. It is inevitable that without soundproofing sound will carry from others practice spaces. One participant said when asked for any further comments that they "quite liked when I was in college being able to hear other people playing, however, I don't know if they felt the same about my practice!" This shows that not everyone struggles with outside noise, but as a general rule most people prefer a soundproof room.

Room Components

There is a final aspect of practice rooms that was brought up in interviews and the survey: temperature, seating, windows and mirrors. As previously discussed, natural light seems to be very important for a musicians well-being so this means windows are essential and also allow airflow. The need for mirrors was mentioned by both the teacher and university student as it can help with posture and technique, despite occasionally being distracting especially for younger students. The teacher also mentioned that mirrors need to be full length and at a height for both short and tall people to see. Temperature is very important to maintain good and true tuning in instruments, especially pianos and string instruments. The teacher mentioned that this can be a colder or warmer temperature but must be kept within the same few degrees. Pianos also must not be kept beside radiators as this can affect their tuning. Finally, adjustable seating is essential for all ages and heights to be able to use a space. It was mentioned by a cellist in the survey that adjustable seating was a must, and the teacher mentioned the need for adjustable piano stools to ensure proper posture for students and pianists.

Figure 24



Discussion & Conclusion



Figure 25

Introduction

Through the research into the links between music and architecture, I found that while they have been linked throughout history, a lack of research has been conducted into the needs and requirements of practice spaces. From the research I conducted I have discovered that there are 3 main aspects to practice room design in order to meet the needs of the musician.

Main Components

Acoustics, size, soundproofing and privacy are the main architectural components to designing practice rooms and all need to be considered when designing for musicians. Practice rooms must be designed so they are bigger and not just a “one-size fits all” type of space. Musicians need to be able to sit, stand, move around, practice performing and teach in these spaces so they cannot all be small box rooms as they so often are. Privacy and soundproofing seem to go hand in hand: to achieve privacy when practicing, sound must not travel from room to room. This is an architectural problem and can be achieved using different materials such as acoustic caulk or acoustic panels and double doors which create a seal and can block sound traveling. Soundproofing also influences the music practice as musicians tend to practice differently when they know no one can hear them and they will not be distracted by other practice sounds in a building. Finally, acoustics are one of the biggest factors in the design of music spaces. From my contextual research, I found that there needs to be a balance between soft furnishings to diffuse sound and hard surfaces which reflect sound. Each space will be different depending on the size and volume of the instrument being played, but as a rule acoustics need to be better considered in practice spaces and musicians consulted in their design as they know what will best suit many instruments.

Aesthetics and Specialist Equipment

From an aesthetics perspective, natural light and colour seem to be essential for musicians to feel happy in their space. The addition of windows into practice spaces is of the utmost importance for the mental well-being of a musician and it allows for fresh air to pass through the space, which is vital for a musician who is playing in a room for hours on end. The design of performance spaces has always had aesthetics at the centre of design as well as function, so the same should be applied to practice rooms. Musicians deserve a space that is comfortable and visually pleasing as well as practical.

Finally, specialist equipment is required throughout practice spaces from adjustable seating to piano pedal extenders to mirrors on the walls. Each musician has a variety of needs, but mirrors and adjustable seating is non-negotiable for most musicians and also ensures that the practice rooms will be more flexible for their users.

Final Thoughts

My research had limits as I did not have time to ask musicians to play in different acoustics and rooms to see for myself the difference in sound, but I was able to be informed through expert opinions from anonymous survey participants and three interviewees. Research into practice rooms is important as these spaces are where a musician spend much of their time playing and their environment contributes massively to their mental well-being. If a musician is not comfortable and at ease in their practice space, then this will affect their quality of practice and concentration. From my research I have found that current practice spaces have been designed without thought for the needs of the musician and have been created without consulting the users of the space. For practice and teaching spaces to be fit for musicians, we must spend more time in conversation with them and design with their needs at the heart of the space.



Figure 4

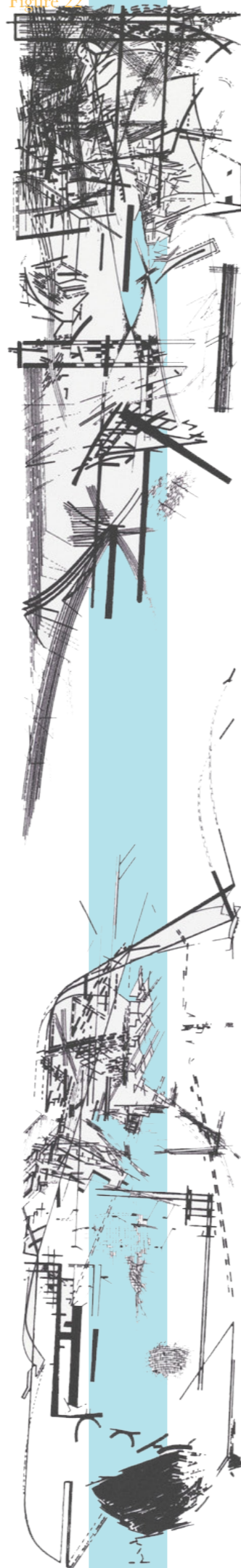
Brief

Based on the findings from my research, I can now give recommendations to designers for the creation of music spaces. First, I recommend creating performance spaces that are flexible, aesthetically pleasing and with good acoustics for a variety of ensembles (mix of hard and soft furnishings). Second, designers should ensure that the creation of practice rooms will be a main focus in the building and not overlooked. Good and correct acoustics should be prioritised, soundproofing for all rooms is essential and they should be of a good size for both teaching and practice. Finally, music spaces should be created with thought to the use of natural light, colour and natural materials in order to make them visually pleasing, ergonomic and enjoyable to present in.

Music spaces must be created to prioritise the needs and comfort of musicians throughout the building. It is vitally important that the mental wellbeing of musicians is at the forefront of any music space design and through this research I better understand how to create the spaces musicians require.

References

Figure 22



Alvim, Diogo. "As the World Leaks into the Work: Composition and Architecture." *Organised Sound : An International Journal of Music Technology* 23, no. 1 (2018): 51–60. doi:10.1017/S1355771817000279.

Basha Jakupi, A., Haliti, F., & Jashari Kajtazi, T. (2022). Hip-Hop Music Decoded in Architecture. *Urbanism. Arhitektură. Construcții*, 13(1), 61–70.

Benavides, Ana. "Sound Architectures: The Relationship between Music and Architecture." *Diagonal (Riverside, Calif.)* 9, no. 1 (2024). doi:10.5070/D89163365.

Beranek, Leo L. "Music, Acoustics, and Architecture." *Bulletin of the American Academy of Arts and Sciences* 45, no. 8 (1992): 25–46. <https://doi.org/10.2307/3824233>.

Capanna, Alessandra. "Music and Architecture: A Cross between Inspiration and Method." *Nexus Network Journal* 11, no. 2 (2009): 257–71. doi:10.1007/s00004-008-0092-z.

Felix, Mary, and Eslam Elsamahy. "Visualizing Music Compositions in Architectural Conceptual Design." *Architecture and Planning Journal (APJ)* 23, no. 2 (2016): 9

Higgins, L. N. "Music and Architecture." *The Musical Times* 66, no. 988 (1925): 509–10. <http://www.jstor.org/stable/912830>.

Imaah, Napoleon Ono. "Music: A Source of Inspiration and Harmony in Architecture: An African View." *International Review of the Aesthetics and Sociology of Music* 35, no. 2 (2004): 169–82. <http://www.jstor.org/stable/30032149>.

Mohamed, Essam Metwally. "The Relationship Between Interior Architecture and Music." *Modern Applied Science* 12, no. 10 (2018): 86. doi:10.5539/mas.v12n10p86.

Sabine, Wallace C. "Architectural Acoustics." *Proceedings of the American Academy of Arts and Sciences* 42, no. 2 (1906): 51–84. <https://doi.org/10.2307/20022177>.

Sheridan, Ted, and Karen Van Lengen. "Hearing Architecture: Exploring and Designing the Aural Environment." *Journal of Architectural Education (1984-)* 57, no. 2 (2003): 37–44. <http://www.jstor.org/stable/1425798>.

Sterken, Sven. "Music as an art of space: interactions between music and architecture in the work of Iannis Xenakis." *Resonance: Essays on the intersection of music and architecture (2007)*: 21–51.

Sütterlin, Christa, Wulf Schiefenhövel, Christian Lehmann, Johanna Forster, and Gerhard Apfelauer. "Art as Behaviour — an Ethological Approach to Visual and Verbal Art, Music and Architecture." *Anthropologischer Anzeiger* 71, no. 1/2 (2014): 3–13. <http://www.jstor.org/stable/24252951>.

Tallon, Andrew. "Acoustics at the Intersection of Architecture and Music: The Caveau Phonocamptique of Noyon Cathedral." *Journal of the Society of Architectural Historians* 75, no. 3 (2016): 263–80. <https://www.jstor.org/stable/26418914>.

Walden, Daniel K.S. "Frozen Music: Music and Architecture in Vitruvius' De Architectura." *Greek and Roman Musical Studies* 2, no. 1 (2020): 124–45. doi:10.1163/22129758-12341255.

Waterhouse, Paul. "Music and Architecture." *Music & Letters* 2, no. 4 (1921): 323–31. <http://www.jstor.org/stable/726588>.

Wheatley, John. "The Sound of Architecture." *Tempo* 61, no. 242 (2007): 11–19. <http://www.jstor.org/stable/4500554>.

Young, Gregory, Jerry Bancroft, and Mark Sanderson. "Musi-Tecture: Seeking Useful Correlations between Music and Architecture." *Leonardo Music Journal* 3 (1993): 39–43. <https://doi.org/10.2307/1513268>.

- Figure 1** Xenakis, Iannis, Excerpt from “Metastasis”, (1954)
- Figure 2** Liebskind, Daniel, Chamberworks, (1983), <https://libeskind.com/work/chamber-works/>
- Figure 3** Liebskind, Daniel, Chamberworks, (1983), <https://libeskind.com/work/chamber-works/>
- Figure 4** Liebskind, Daniel, Chamberworks, (1983), <https://libeskind.com/work/chamber-works/>
- Figure 5** Sheppard, Philip, Liquid Architecture, (2012), <https://philipsheppard.com/2012/04/04/liquid-architecture/>
- Figure 6** Young, Gregory, Jerry Bancroft, and Mark Sanderson, “Musi-Tecture: Seeking Useful Correlations between Music and Architecture.” *Leonardo Music Journal* 3 (1993): p40, <https://doi.org/10.2307/1513268>.
- Figure 7** Liebskind, Daniel, Chamberworks, (1983), <https://libeskind.com/work/chamber-works/>
- Figure 8** Cook, Peter, Bloch City, (1983)
- Figure 9** Cook, Peter, Bloch City, (1983)
- Figure 10** Xenakis, Iannis, The Philips Pavilion, (1958), <https://blog.iaac.net/philips-pavilion/>
- Figure 11** Schroeder, Franziska, Inside Out (Situation 3), (2013), <https://diogoalvim.com/inside-out-situation-3/>
- Figure 12** Xenakis, Iannis, The Philips Pavilion Model, (1958), <https://blog.iaac.net/philips-pavilion/>
- Figure 13** Xenakis, Iannis, Graphical Compositional Sketch for Metastaseis (1954), https://www.researchgate.net/figure/enakis-graphical-compositional-sketch-for-Metastaseis-1954-showing-string-glissandi_fig1_317790128
- Figure 14** Xenakis, Iannis, The Philips Pavilion Construction, (1958), <https://blog.iaac.net/philips-pavilion/>
- Figure 15** Unknown, Portrait of Marcus Vitruvius Pollio, Engraving, (Undated)
- Figure 16** Photograph of Athens Acropolis, <https://www.acropolis-tickets.com/acropolis-of-athens/>
- Figure 17** Borvan53, Resonance amphora embedded in the wall of the church of the Chartreuse Notre Dame du Val de Bénédiction, (2015), https://commons.wikimedia.org/wiki/File:Chartreuse_du_Val_de_B%C3%A9n%C3%A9diction_Vase_acoustique.JPG#metadata
- Figure 18** Unknown, France, Noyon, Cathedral of Notre-Dame, West facade (BP1.86), https://projects.mcah.columbia.edu/medieval-architecture/htm/related/ma_noyon_01.htm
- Figure 29** Sabine Memorial, Wallace Clement Sabine, Physicist, Harvard Professor, and the Father of Architectural Acoustics, <https://hearingreview.com/practice-building/practice-management/continuing-education/back-basics-wallace-sabine-music-halls-reverberation-time>
- Figure 20** Unknown, Sabine Reverberation Experiment, <https://www.prosoundtraining.com/2010/03/16/room-reverberation-time/>
- Figure 22** Liebskind, Daniel, Chamberworks, (1983), <https://libeskind.com/work/chamber-works/>
- Figure 23** Cardew, Cornelius, Treatise (1963-67), <https://blogthehum.com/2016/02/29/cornelius-cardews-treatise-1963-67/>
- Figure 24** Liebskind, Daniel, Chamberworks, (1983), <https://libeskind.com/work/chamber-works/>
- Figure 25** Liebskind, Daniel, Chamberworks, (1983), <https://libeskind.com/work/chamber-works/>

Figure 22



Figures