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Danke!
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Einleitung


Während meiner Studienzeit wurden mir die vielen Gemeinsamkeiten zwischen diesen beiden Disziplinen bewusst. Die Grundideen für musikalische oder architektonische Projekte können sehr ähnlich sein, auch wenn sich die Endprodukte sehr unterscheiden.


Abstract

Before I started studying Architecture my biggest passion was music. Playing instruments, listening to music and going to concerts were the first experiences of creative processes and performances I made.

During my studies I realized the similarities in the creative process of developing a concept between the disciplines of Architecture and Music. Though the output is varying a lot according to the different constraints a concept is going through when it is transformed into a final project, the concept can be very similar at a basic level.

Music is based on single notes relating to one another and to the composition as a whole. Most Music is written in a specific key, giving order to a musical piece and controlling the relations of single notes to one another. The notes are varying in sound, length and always are influenced by individual performances of musicians. Architecture on the other hand is consisting of spaces, varying in size and atmosphere, related to each other and the creation of an entity that affects or is affected by it’s surroundings. So, the city or the landscape surrounding a building is similar to the key a musical piece is written in.

The Location for this project came to mind when I was living in Copenhagen for an internship. The creative scene in Copenhagen is very inspiring and the performance of music takes place in a lot of public places. So, the goal of this project is for one the creation of a new concert venue for Copenhagen and also the creation of a platform for musicians to promote emerging artists and host spontaneous live events.
ever since the invention of the mp3-file format and the rapid growth of file sharing via the internet in 2002 the music industry is going through a significant change. As of the 1980’s live shows were mainly used for promoting bands in order to increase the selling of their records, as this was the main source of profit in music. This situation seems to have shifted since then. Platforms like “Spotify”, “Youtube” or the semi-legal usage of torrents to download music for free took the spot of physical sound carriers and reduced the amount of sold cd’s from 210 million copies in 1997 to just 146 million copies as of 2007. With the possibilities of the internet, music now is available instantly, at any time via computer or even smart phones.

With this development the perception of music has changed dramatically. The physical form of cd’s, records or cassettes has dissapeared and also the package design, that used to come with it, is no longer of importance. This development also changed the possibilities for emerging artists, since it’s harder now to make profit out of music, if the musician is not famous yet.

Many bands and artist now are being staged by casting shows or via the internet. As such, the canadian RnB singer songwriter Abel Tesfaye, also known by his stage name The Weeknd can be mentioned.

Tesfaye posted several songs on Youtube and drew the attention of Toronto based hip hop artist Drake, who helped then to generate interest in The Weeknd. Tesfaye posted mixtapes called „House of Balloons“, „Thursday“ and “Echoes of Silence” in 2011 on his website for free. Due to very acclaiming critics the albums received, a fanbase emerged and the singer was signed to a record labe and the three mixtapes were released in physical form as a compilation called “Trilogy”.

The albums were produced by the singer himself on a macbook in his flat in Toronto. So, the usual process of signing to a record label and producing records professionally before distribution has vanished in this case due to the possibilities of distributing music via “Youtube” and generating interest this way. Generally the possibilities of producing music in semi professional studios has improved due to the development of recording software. So, the internet is not only a disvantage for emerging artists but also a great platform for distributing homemade productions and gaining popularity all over the world. The term “Youtube wonder” was introduced for artists emerging with such a background. Mainly in the area of pop music many artists emerged this way last years. Teenage singer Justin Bieber also was introduced to the world via YouTube.

Taking these developments into account, the design of concert venues can be challenged in order to achieve similar kinds of possibilities for musicians and audiences. So, the creation of a feeling of instant availability in order to connect the artists intentions with the audience. Therefore the program of a concert venue in this case was extended with rehearsal rooms for local musician that also work for spontaneous events. The border between public and artists spaces, usually totally seperated, in this case is meant to vanish and spaces shell be surprising and challenging.
The provided spaces for rehearsal and recording of local bands will inspire a lively public scene in the area and contribute to the formation of bands. For this matter the design of the groundfloor area is split into several boxes functioning as rehearsal rooms and spaces in between them working as spontaneous event spaces and meeting points.

A public space capable for the lauch of spontanous live events is a goal of the concept for this building. As there is a lively jazz, metal or pop music scene in Copenhagen, several festivals are taking place all over the year. As such an event the “vinterjazz festival” can be mentionend. Taking place in various venues the festival brings together a variety of famous musicians as well as it is eager to promote local musicians. Providing a venue for such a festival is also a goal for this project.

As the location is very central at the Kvaesthusbroen pier in Copenhagen, a lot of different visitors can be expected. The recent development at the area saw a new national opera and a new royal playhouse being erected just close to the site. So, the space between the completed projects and those that are to come in the future can be seen as an access point to a performing arts center, taking all these buildings into account.

Contradictory to the cultural institutions of the neighbouring theatre buildings, which are mainly built for creating profit, this project seeks to create spaces for the development of music and the formation of new musical relationships and challenges the program of a cultural building of this size. Not only the performance but also the creation of music is exhibited and part of the audiences experience by visiting this building.
1877  
first recording of sound (Edison; Mary Had A Little Lamb)

1888  
National Phonograph Company - first ever record company / wax cylinders

1897  
first 7-inch records on market (duration: 3:00 minutes)

1902  
first 10-inch record on market (duration: 3:30 minutes)

1948  
first vinyl record on market

1957  
Stereo LP vinyl record

1965  
MusiCasette

1988  
Compact Disc (CD)
**Music Industry Crisis** record market decreases due to music downloads

- **1997**: Development of file sharing communities in legal grey zone
- **1999**: Increase in concert ticket prices
- **2001**: Amount of original CDs has dropped from 210 to 146 million
- **2005**: Sporadic development of file sharing communities
- **2006**: Flatrate for streaming legally music
- **2008**: Spotify
- **2014**: Increment in concert ticket prices
REFERENCES

Fig. 1. Photograph - Convention Center Montreux

Fig. 2. Photograph - Auditorium Stravinsky
Auditorium Stravinsky

Montreux Music and Convention Centre
Montreux, Switzerland, 1973

The auditorium Stravinsky is part of the 2m2c (Montreux Music and Convention Center) in Montreux Switzerland. This Convention Center is hosting the festival called “Montreux Jazz Festival”, which takes place annually during July so, the convention center is not only a concert venue, but also host for a multitude of happenings. Besides musical events the hall also hosts congresses and seminars, for which the auditorium can be set up for a variety of spectator distributions.

Since its opening in 1973, the 2m2c has made regular investments to increase its audience capacity and improve its technical equipment, most notably during two major expansions in 1981 and 1993. In 2011, the acoustic amendments and the modernization of the entire technical system of the Auditorium Stravinski enable it to become one of the most multipurpose halls in Europe (www.swiss-congress.ch 10.01.2013)
Fig. 4. "Keine überschneidende Verknüpfung"
Dee and Charles Wyly Theatre

Joshua Prince-Ramus, Rem Koolhaas

Dallas, USA, 2010

This radical design for a theatre introduces a new intention to the usually introverted design of theatre buildings. The stage becomes part of the public space and is a visible feature to it’s surroundings.

Contradictionary to the hermetic design of the swiss project described above this theatre building tries to show the program of the interior and stimulate the atmosphere this way. This is a feature the dutch office OMA is trying to introduce to their latest project that inhabit performing arts. Also the Casa da Musica in Lisbon features a huge glass wall behind the stage in the concert hall. A connection to the surrounding city is achieved and the atmosphere of the interior of the concert hall is influenced by it. In this sense the building is connected to the city in a new way.

The Dee and Charles Wyly theatre at the AT&T Performing Arts Center, located in the Arts District of downtown Dallas, Texas (USA). It is one of four venues that comprise the AT&T Performing Arts Center and was dedicated October 12, 2009. The 80,300-square-foot building is twelve stories and holds about 600 people, depending upon the stage configuration. It is the new venue for the Dallas Theater Center, Dallas Black Dance Theatre and Anita N. Martinez Ballet Folklorico. This Wyly Theatre was designed by REX | OMA, Joshua Prince-Ramus (partner in charge) and Pritzker Prize winning architect Rem Koolhaas. It features a groundbreaking design with an unprecedented “stacked” vertically organized facility that completely rethinks the traditional form of theatre.

(http://en.wikipedia.org/wiki/Dee_and_Charles_Wyly_Theatre)
Denmark

Fig. 6. Denmark within Europe
Copenhagen
Fig. 8. Districts of Copenhagen
Districts of Copenhagen

A  Indre By
area of 4.65 km², has a population of 26,223

B  Nørrebro
area of 3.82 km² and a population of 71,891

C  Østerbro
area of 11.84 km² and a population of 68,769

D  Bispebjerg
area of 5.39 km², has a population of 40,033

E  Brønshøj-Husum
area of 8.73 km², has a population of 39,588

F  Vamlsøe
area of 6.69 km², and has a population of 36,115

G  Værlby
area of 9.23 km² and has a population of 46,161

H  Vesterbro / Kongens Enghave
area of 8.22 km² and a population of 53,351

I  Amager Vest
area of 8.60 km² and a population of 49,705

J  Amager Øst
area of 9.11 km² and a population of 50,900
Fig. 9. Plan of inner Copenhagen
Kvæsthusbroen

Kvæsthusbroen is a historically significant place, both in terms of its location and for the role it played as an access point for ships arriving at Copenhagen port. It was the arrival spot for ships carrying goods to central Copenhagen. Also, the location is very special as it is directly within an urban axis spanning from the marble church, the castle of Amalienborg and the new opera house.

As of now, a development underneath the ground of the Kvæsthusbroen site is in construction. Since there is too little parking space for cars to support the needs of the new opera house and the new royal playhouse building, which are just close to the site, a three-storey car park is being built. During the construction of this building, also the flooring of the site is being renewed. The project was developed by the Real Dania group with advise by Danish Architecture firm Lundgaard and Tranberg. This is the same company responsible for the design of the new royal playhouse, next to the Kvæsthusbroen pier. In a competition, that saw more than three hundred entries from all over the world, Lundgaard and Tranberg’s proposal was selected winners. The project was one of the few to leave the pier as it is and place the building on the tip of the Nyhavn, paying respect to the urban axis of Amalienborg.

Along with the theatre Lundgaard and Tranberg also proposed the design for a pedestrian bridge, connecting the site with the other side of the port. The pedestrian bridge was proposed due to the very difficult connection to the opera. As of now, the opera can only be reached via car in a very narrow connection through the Christianhavn district or by taxi boat. Upon the construction of this bridge no decision is taken yet due to appeal house owners in Christianhavn (the neighbouring district). A bridge at the tip of Nyhavn is currently in construction and set for completion in the summer of 2014. If the pedestrian bridge at the Kvæsthusbroen pier gets erected the space at the pier could transform into a lively area, connecting activities from the opera, the new playhouse, and cultural buildings to come in this area with the urban life of central Copenhagen. The site south of the opera, which is now inhabited by a paper production plant is also in consideration for a refurbishment into a museum. In this sense the area can be seen as a future performing arts center by taking all these different buildings into account.

The transformation of the area is based on a masterplan worked out by Henning Larsen in 2000. The masterplan worked out a scheme for the northern part of the harbor, proposing the development of cultural buildings.

(See: Christopher Kaelson 2014, www.ckarlson.com)
Kvaesthusbroen / photographs

Fig. 10. Ancient photograph of Kvaesthusbroen 1878

Fig. 11. Ancient photograph of Kvaesthusbroen
Fig. 12. Recent installation at Kvaesthusbroen - Ofelia Beach

Fig. 13. Photograph of Kvaesthusbroen
Fig. 14. Areal photograph of Copenhagen
Event spaces

- Opera
- Royal Danish Theatre

- Nyhavn

- Loppen - jazz / pop music
  capacity 400

- The Black Diamond
  national library

- Mogens Dahl Koncertsal - classical events
  Auditorium for 200 people

- Concert Hall (DR Koncerthuset) - classical events
  Auditorium for 1800 people
Redevelopment of the harbor

For centuries, Copenhagen had depended on its Inner Harbor (Inderhavnen) and the strong maritime network the area has served to the Baltic Sea. Developed as a deep channel that cuts between two islands, the harbor was the center of urban activity, teeming with lively, exotic, dirty, and sometimes dangerous elements. But by the second half of the 20th century, the shipping industry had changed with new technologies and greater demands on urban infrastructure. Proximity to the downtown was becoming obsolete as goods were packed into huge steel containers stacked by cranes the size of buildings on the decks of giant freighters, demanding enormous ports with vast areas of land for daily operations.

Copenhagen and virtually every large historical port city had developed similar symptoms: dilapidated docks, abandoned warehouses, and fences sealing downtown off from the quieted waters. The great urban project of the postindustrial age was to heal the coastal scar left by the evacuated maritime industry.

In 2000, the municipality of Copenhagen initiated a development strategy for the entire harbor area, divided into three geographical sections, each analyzed by a separate design studio. Henning Larsen Architects was commissioned to analyze the Inderhavnen area and outline different alternative solutions to exhibit the possibilities of new urban growth on the waterfront. The conclusion of the work relied on mixing residential and commercial buildings with emphasis on large public cultural institutions to create a dynamic city life. Functionally, no building was permitted to „turn its back” to the harbor, complimenting already defined plans of public promenades and squares along the entire harbor fairway with the purpose of stressing and strengthening waterfront activities.

The large cultural „magnets” would later be defined as the Royal Danish Playhouse and the Copenhagen Opera House. (See: Christopher Kaerlson 2014, www.ckarlson.com)
Landmarks harbor

The Black Diamond (see page 36/37)  Holmens Kirke  Nyhavn / Bars, Restaurants  Marmorkirke (see page 44/45)
Royal Playhouse (see page 40/41)
Amalienborg (see page 42/43)
Opera (see page 38/39)
Paper plant
The black diamond / National library

Architect: Schmidt Hammer Lassen
Completion: 1999
Function: Library; Auditorium; Museum of Photography

This Project was initiated as an extension to the Royal Danish Library. Apart from its function as a library, the building houses a number of other public facilities.

The facilities include a 600-seat auditorium, the Queen’s Hall, used for concerts—mainly chamber music and jazz—literary events, theatrical performances and conferences. There are also exhibition spaces, a bookshop, a restaurant, a café and a roof terrace. Two museums are based in the Black Diamond, the National Museum of Photography and a small museum dedicated to cartoon art.

The building was designed by Danish architecture company Schmidt, Hammer & Lassen K/S and is one of the most distinctive buildings on the new central harborfront. The mass is cut in two by an atrium, which rises through all of the buildings seven floors and tries to connect the foyer with the waterfront this way. The atrium is bordered by undulating balconies, from which there is access to the reading rooms and carrels. All of the groundfloor level is open to the public and houses a café, a restaurant, and a book store as well as an auditorium for 400 people.

(See: Kim Dirckinck-Holmfeld / Martin Keiding / Marianne Amundsen, 2004, p. F314)
Fig. 19. Photograph - National Opera Copenhagen

Fig. 20. Photograph - National Opera Copenhagen
**Opera**

Architect: Henning Larsen  
Completion: 2005  
Function: Opera; Capacity: 1500 seats

The Opera, taking up a floor area of 41,000 sqm, lies in the Dokoen site, precisely on the Amalienborg axis. A factor that was of great importance for the client. The symmetry around this axis is also a decisive feature of the building as a whole and also for its detailing. The auditorium of the opera seats around 1,400 persons, distributed on the floor and on three balconies, while the orchestra pit can seat 110 musicians. From the foyer’s four balconies, of which the upper one serves as a restaurant, there is a wide view over the harbor and the city. Footbridges from the balconies to the auditorium, and stairways between the balconies create a dignified and festive space, where many people can see and be seen. Deep under the building there’s a large rehearsal room for the royal orchestra.  

Problematic is still the accessibility to the building as the main access is achieved by taxi boat. The original idea of constructing a bridge to the kvaesthusbroen site was not laid out due to public appeal.
Fig. 21. Photograph - Royal playhouse Copenhagen

Fig. 22. Visualization - Royal playhouse Copenhagen
The royal playhouse / National Theatre

Architect: Lundgaard & Tranberg
Completion: 2008
Function: dramatic Theatre; Capacity: 1500 seats

An open, international competition sponsored by the Ministry of Culture in 2001, determined the location and design of the new theatre. The winners, Boje Lundgaard & Lene Tranberg, were chosen among 289 submissions. The jury was taken by the winning proposals sensitive attention to Frederiksstaaden’s rococo architecture and its discreet distance to the Amalienborg axis. A raised Platform, which protrudes out into the harbor, provides additional space for the large building scheme, and creates a number of dignified and visually inspiring access opportunities to the theatre. From the Foyer, which faces the harbor one can recognize the three theatres: the large and small as well as the rehearsal hall.


The Layout of the design tries to sensitively adapt to the surrounding architecture, by keeping the building height at the same level of the surrounding houses. Also the usage of bricks for the first and second story of the theatre is a metaphor to its surroundings. These bricks have been specially fabricated for this building. A very narrow shape was produced in England. The massive part of the building is broken down to several blocks to adjust the scale to the neighbours. The visual concept of the third floor is to bring out something from the inside of the functions to the waterfront. The theatre’s auditorium, providing space for 1,500 seats is made of bricks like the outside is too. The feeling of being in a cave is tried to be evoked.

(See: Alexandra Onderwater (2008), page 114-123)

As the wooden terrace towards the waterfront works quite well and attracts people coming from Nyhavn to explore it, the opposite side seems more problematic. The theatre turns it back towards the city, and is not clearly visible.
Amalienborg / Castle

Architect: Nicolai Eigtved
Completion: 1750-60
Function: Residence of the royal family

The four palaces and the palace square are theslately center of Frederikstaade, a new city quarter founded in 1749 on the initiativ of Frederik V. The plan lies at the junction of Frederiksgade and Amaliegade streets and forms an octogon square at the center. From here there is an axial effect along Frederiksgade with the Marmor Church as a magnificent climax. Joint standards for the buildings determined a common height for windows. and cornices, and Eigtved’s fast grip on the stret buildings is evident in Amaliegade 17. The church was not built according ti Eigtved’s plans, but the four palaces and the palace square were his major work. As the most significant work in Danish rococo architecture it can be compared to the best in Europe. The four identical palaces radiate a natural elegance and reserved stateliness, and together define the palace square as a precise, spacious and exclusive urban space. (Arkitektur DK 1997, 224)
In 1749, construction began with the rococo church which was built after plans of N. Eigtved. After his death in 1754, his colleague Nicolas-Henri Jardin altered the project to a classical church in marble, which was too expensive, so it got never built. So, for more than 100 years the unfinished building stood as a ruin. In 1874 C.F. Tietgen purchased the site and the building and attempted to complete the building. F. Meldahl was then chosen as Architect to finish the design of the church. It was the last work of Architect Ferdinand Meldahl. The church’s exterior is said to be Meldahl’s most successful endeavor. (See: Kim Dirckinck-Holmfeld / Martin Keiding / Marianne Amundsen 2004, F82)

The building forms an ensemble combined with the castle of „Amalienborg“ and is located at an urban axis in line with the new opera house of Henning Larsen Architects.
Fig. 25. Stroget - walking path through inner Copenhagen
Two of Copenhagen’s most significant urban redevelopment projects would assist in Henning Larsen’s proposed master plan for Inderhavnen - the ‘car-free zones’ of Strøget and Nyhavn. The sequence of streets known collectively as Strøget was the beginning of a successful string of pedestrian-only streets developed in the 1960’s that became a strong reaction to the congested automobile culture in downtown Copenhagen. Evolved from one clogged traffic artery, the city began systematically banishing cars from gracious squares and narrow streets that had degenerated over time, encouraging people to commute by foot or bicycle again. A controversial plan at the time, it is now one of the longest pedestrian streets in Europe and is considered a highly influential study in contemporary urban design (influenced by Danish architect and urban planner Jan Gehl). The sequence of streets is a major pedestrian boulevard through the center of Copenhagen, from Radhuspladsen (City Hall Square) to the large bustling square of Kongens Nlytorv (King’s New Square). Nyhavn, one of the oldest waterfront districts in the city, soon would follow the trend. In the 1980s the large car-park and once-forlorn canal of Nyhavn was incrementally converted into a pedestrian area that was immediately invaded by cafés and shops, full up all year round, becoming Copenhagen’s most often portrayed public space and a catalyst to the harbor’s waterfront development.

(See: Christopher Karlson 2014, www.ckarlson.com)

When Strøget in Copenhagen was changed into a pedestrian street in 1962, it was after much debate and with considerable reservations. If, at the time, anyone had predicted that the city center would have six times as many car-free areas 34 years later, and that car traffic and parking possibilities would be substantially reduced, it would have been met with a great deal of skepticism. That life in the city center could flourish markedly would simply have been too unbelievable.

(Jahn Gehl, 1999, page 1)
Photos Strøget

Fig. 26. Photograph - City Hall Square

Gammeltorv / Nytorv
New Market Square

Fig. 27. Photograph - New Market Square

City Hall Square
Fig. 28. Photograph - Amager Square

Fig. 29. Photograph - Kongens Nytorv
Analysis Infrastructure
The site at Kvaesthusbroen is well connected to the center of Copenhagen. To connect the opera at the other side of the port a bridge now under construction (see Fig. 31) This pedestrian bridge shell connect the Nyhavn directly to Cristianshavn. This will create a path to walk to the opera, as there was no direct connection so far. There is still another bridge in consideration spanning directly from the Kvaesthusbroen sit to the plot just next to the opera. A design by architecture company Lundgaard and Tranberg was proposed. Due to public appeal to the proposal no decision upon construction was taken yet. As of now the errection of this bridge has been postboned due to the current construction next to Nyhavn.
Sound Criteria / Definitions

The definition of sound criteria related to by competitions, having a concert hall as a subject mostly refer to the international standard ISO 3382 ("Acoustics .. Measurement of the reverberation time of rooms with reference to other acoustical parameters). Detailed information about the acoustic isolation can be found in the international standards EN ISO 717-1 and 2, as well as EN 140 (parts 1 to 14), as well as in other relevant standards.

(See: Eckhard Kehle 2010, www.sinfoniavarsovia.org/konkurs)

Subjective parameters and objective criteria

In room acoustics, it is oftenly distinguished between "subjective parameters" and objective criteria". On one hand Subjective parameters describe the the various qualitative characteristics of the room acoustics, while on the other hand objective criteria are the parameters calculated from the objective measures of the impulse responses of the room and describe the acoustic response of the room between a source and a receiver. The objective criteria are defined to quantify the subjective characteristics of the room. Several scientific studies have derived relationships and correlation between these different criteria in order to establish a consistent correspondence between objective criteria and subjective parameters. These relationships can be applied to any room shape.

(See: Eckhard Kehle 2010, www.sinfoniavarsovia.org/konkurs)

Reverberation and reverberance

A first objective criteria used to describe the acoustic quality of a room or in this specific topic, a concert hall, is the reverberation time (RT). This term describes the time it takes for a sound to decay by 60dB after the sound source has been switched off. The subjective parameter related to this objective criteria is the term of the "perception of the reverberation" or reverberance. In actual terms it is distinguished between the reverberation perceived during the musical phrase (running reverberance) and that perceived once the musical phrase is over (final chord reverberance). The latter is the one directly linked to the reverberation time of the room, while the other one is related to the early decay time and often is calculated over a decay of 10 or 15dB. A reason why the RT is generally the first criterion used for the validation of a concert hall is that it is the only criterion that does not (or only narrowly) vary with the source and receiver positions. For this reason it characterises the reverberation of a room uniquely, and is well suited for comparing different types of concert halls.

The reverberation time is directly related to the acoustic volume and the absorption area, and the reflective abilities of its surfaces, of a room. Given the fact that for a concert hall the total absorption area is essentially provided by the seated audience, the RT is directly related to the total acoustic volume per person in the audience. Additionally it is related to the actual area taken by the seated audience, which is why acoustically a dense seating area is preferred and seat dimensions shall not be excessive. The favoured maximum value for classical concerts, covering for instance romantic repertoire, sometimes with choir, is between 2.1 - 2.2 seconds. Varying in locations the maximum value of the RT shall be greater than 2 seconds for classic music. Concerning amplified music the RT can be much lower as the sound source is much louder. Obtaining such a value one must plab to create an acoustic volume of 11m³ per audience member.

(See: Eckhard Kehle 2010, www.sinfoniavarsovia.org/konkurs)
**Loudness and acoustic power**

The subjective parameter of loudness is related to the objective strength criterion G. The criterion “G” measures the loudness and amplification abilities of a room. It is defined as the ratio (in dB) of the acoustic pressure measured at a given point of the room (response of the room) to the acoustic pressure generated by an omni-directional source radiating the same sound power (in Watts) and measured at 10m from the source in free field conditions. This criterion is a function of the position of the source on the stage and of the position of the receiver. The human ear is very sensitive to acoustic power. The importance gets immediate as one thinks of the fact that the awareness of persons is reduced as the audience does feel as being part of the event. For large concert venues there is a consensus that G must be positive (greater than 0dB for the mid-frequencies) for all seats. Furthermore a general consensus is considered for an ideal value range of G between +2dB and +8dB.

(See: Eckhard Kehle 2010, www.sinfoniavarsovia.org/konkurs)

**Early energy and presence of sound**

Recent studies demonstrated that the perception of acoustic power is a very complex, promoting it’s more than the simple correlation with G or with the room amplification. The human ear - and also the brain - differentiated the information in two different “data streams”. One being in relation with perception of the source, while the other one is related to the perception of the space. This is logical for a cognitive point of view - seated in a concert hall. One is trying to get information concerning the source, especially concerning it’s musical message, and to get information concerning the environment you are in. Therefore, the design shell aim at optimising independently the early response (presence of the sources) and the late responses (presence of the room). The presence of the source is related to the early energy of the room response. In a large concert hall - excluding the seats that are very close of the stage (i.e. 3 to 5 m from the sources) - between 90% and 99% of the acoustic energy comes from reflections of the surfaces and no more from the source itself!

(See: Eckhard Kehle 2010, www.sinfoniavarsovia.org/konkurs)

The cognitive system of the human hearing system integrates the energy of the reflections into the energy of the direct sound if the reflections arrive no longer than 80ms delayed from the original sound. Longer delays will make undesired effects like echoes, which are strictly to be avoided. Creating a good, perceivable presence of the sources one needs to integrate reflector panels. These should, as mentioned above, send sound reflections to the audiences ears with no longer delay than 80ms. A delay of 80ms corresponds to a difference of 27m in the ray trajectory. Since the sound waves have to travel from the source to reach the reflective surface and then travel onwards towards the perceivers ear, the reflective panel needs to be installed close to the source and/or audience less than 10 to 15m. Creating an efficient design of the reflectors is one of the most important challenges in the design of a concert hall.

(See: Eckhard Kehle 2010, www.sinfoniavarsovia.org/konkurs)
Late energy and envelopment

Scientific studies and analyses of various rooms since the 1960’s have shown the importance of the spatial characteristics of the sound field. This means that our hearing system “prefers” receiving a substantial part of the information of the reflected energy in a lateral rather than frontal manner. When the reflected energy reaches the ears from the sides, each ear is receiving a different sound field which is perceived as a feeling of acoustic envelopment. Spatial perception is thus created and, consequently, the audience is surrounded or even immersed in the sounds and feels like it is participating in the event rather than simply listening and observing it passively from a distance. Lateral reflections (with a minimum angle of 25 degrees in respect to the trajectory of the direct sound) are more advantageous than the reflections from the ceiling - unless the latter reach the ears of the listeners in a lateral manner, by means of reflectors installed near the sides of the ceiling with optimised angles.

The subjective effects of lateral energy are two-fold. Firstly, early lateral energy is more closely related to “apparent source width” (ASW), corresponding to a broadening of the source. Secondly, listener envelopment is more closely related to the strength and homogeneity of the late reverberant sound field.

Spectral balance and building materials

An excellent transmission of the frequency spectrum from the stage to the listener is required. For a large room, greater reverberation time at low frequencies (compared to mid frequencies) is desirable. For high frequencies, a slight decrease of both the RT and the sound level is required above 2kHz to avoid a harsh and aggressive sound.

The bass absorption should be kept under control (avoiding increased absorption by plate resonances). Therefore, the materials used for the reflective surfaces must be sufficiently dense and heavy, generally a minimum of 30kg/m² to 70kg/m² surface mass. For high frequencies, in addition to the natural absorption in the air, a slight additional absorption must be created either by adding a very small amount of absorbing materials effectively only above 2 kHz or, by introducing acoustic diffusion above 2 kHz which leads to a slight increase of absorption. This can be done by adding surface texture or relief to certain areas in the room.

(See: Eckhard Kehle 2010, www.sinfoniavarsovia.org/konkurs)
Achieving good acoustical conditions for a variety of events, ranging from different classical music to jazz or pop events different conditions have to be met. Meeting different conditions the reverberation time can be mentioned as a value of comparison. So, it’s highly desired that the tuning of the early and late energy indicators are made as independently as possible.

To obtain a good variability of the early energy, acoustic curtains (or movable reflectors) must be located close to the sources – this can achieve the different optimisations for smaller and large orchestras. The variability of the late response and early-to-late ratio C80 requires the installation of variable acoustic elements far from the sources, not covering the reflectors that provide early reflections.

Optimizing the quality of acoustic quality for different types of events, as the proposal of this work is meant to host acoustic classical shows as well as amplified rock, jazz or pop shows shows the reverberation time has to be adaptable. This works best when the acoustic size of the venue is made variable. Generally, there are two concepts or achieving such a volume variation, and those two can be combined into a third concept.

(See: Eckhard Kehle 2010, www.sinfoniatarnowo.org/konkur)

Reverberation chambers

In this option the idea is to create a moderately-sized concert hall with excellent acoustic conditions. So, for larger events, or for shows with different affordances an additional surrounding volume (the reverberation chambers can be added to the moderately sized volume of the inner concert hall. So, the venue is able to adapt to events with different sound power levels, be it acoustical or amplified events. As an example for such venue the KKL Concert Hall in Lucerne (Jean Nouvel) can be mentioned.

The echo chambers of the KKL Luzern make up an additional volume around the front of the concert hall. When the doors are opened, the hall volume increases by 6,000m³ to 25,000m³. The acoustic varies due to the position of the doors, allowing the reverberation time to increase up to 3 seconds.

(See: Eckhard Kehle 2010, www.sinfoniatarnowo.org/konkur)

Moving Ceilings

In this case the idea is to create a bigger acoustic volume by raising the ceiling. Examples for such construction are the Stavanger Concert Hall, Norway or the Milton Keynes Theatre in England.

(See: Eckhard Kehle 2010, www.sinfoniatarnowo.org/konkur)
Typologies of Concert Halls

The shoebox concert hall

Characteristically for most shoebox halls – and particularly the historical ones – is their “fullness” of sound, the importance of the room effect and the sensation of being surrounded by sound. Apart from the direct sound, there is little early acoustic energy and early reflections, while the late energy and the feeling of a late sound field are dominant. This works quite well for small halls with moderate ceiling heights but not for large rooms: the lack of early energy becomes noticeable and the presence of the source, the definition and speech intelligibility become too small. The lateral balconies and more particularly their lower surface play a major role in the acoustics of shoebox concert halls. In most large halls, the seats on the ground floor receive less early reflections from the ceiling than from the horizontal soffits of the lateral and back balconies. Above the highest balcony, there is generally sufficient ceiling height to allow build-up of reverberation between the lateral walls. There is a limit to the ceiling height: the echo corresponding to a distance of 17m (return path of 34m or 100ms delay). A ceiling height of 17m above the stage is detrimental to the listening comfort of the musicians themselves.

(See: Eckhard Kehle 2010, www.sinfoniavarsovia.org/konkurs)
**Vineyard concert hall**

The typical model of a vineyard hall is the Berliner Philharmonie (Berlin Philharmonic). It is interesting to note that the concept of vineyard halls has been developed by Lothar Cremer, the acoustician for this hall, as a response to architect Hans Scharoun’s wishes to locate the orchestra as close as possible to the centre of the room and to surround it on all sides by the audience. The original concept of Scharoun was to have a completely circular hall with a shape close to an amphitheatre where the orchestra director would be standing exactly at the centre of the circle, under a dome shaped ceiling – an acoustically very dangerous concept as this geometry is prone to serious acoustic focusing. The principle behind Scharoun’s concept was to position the orchestra as close as possible to the centre and thus create the most “democratic” hall. To respect the fundamental rules of acoustics, Cremer suggested a ceiling with a tent shape rather than a dome and to break up the symmetry of the hall by using convex curves. He replaced the concave curves, which tend to focus sound, with convex curves, which diffuse sound. The idea of a central orchestra was kept.

It is very important to realise that the partial walls are not the only elements that guarantee the acoustic quality of such halls. The surface area of these walls is often insufficient to provide the necessary reflections to cover the entire audience. Other elements play an important role, such as the shape of the ceiling, which must be designed to allow a homogeneous distribution of the reflections over the entire hall and a sufficient acoustic volume above the musicians.

(See: Eckhard Kehle 2010, www.sinfoniawarszawa.org/konkurs)
The early reflection design concert hall

Two particular types of concert halls can be distinguished in this category.

Firstly, at the early stages of the science of acoustics (in parallel with the development of loudspeakers), the aim was to optimise the projection of sound from sources towards the public. The idea was to strengthen the sound from the sources by using early and directed reflections but also to reduce the room effect - partially or as much as possible. The aim was to be able to listen to the sound sources without too much detrimental effect from the room. For loudspeaker listening, “high fidelity” and other “optimised listening rooms” were built, particularly in the US, sometimes with a capacity of several hundreds of seats, resulting in an acoustic as dry and absent as possible.

Secondly, following the discovery of the importance of the spatial effect and lateral reflections, several halls have been designed and called “optimised early reflection halls”. To guarantee a good source presence in halls of large dimensions, reflectors are installed and orientated/optimised so that useful early reflections can be generated for every seat.

(See: Eckhard Kehle 2010, www.sinfoniasuwitsia.org/konkurs)
The arena and amphitheatre concert hall

The arena halls and amphitheatres have been developed from the model of the theatres of the antiquity. This shape works very well acoustically for theatre and speech: the distance between the sources and the listeners is minimised, the direct sound has sufficient energy (particularly if the row profile follows the logarithmic curve raising the rows as they get further from the stage) and a reflective wall is included behind the stage (“choir”). However, this shape creates acoustic problems for music and it is necessary to increase the reverberation and the room effect by closing off the acoustic volume.

A circle – and consequently a sphere – is a geometry that does not favour the creation of a homogeneous sound field. For a source located at the centre of the sphere, there are only reflections along a diameter of the sphere and therefore no lateral reflections for receivers not located at the centre.

To make an arena-shaped hall work, one needs to introduce acoustic elements (strong acoustic diffusion or partial absorption) on the curved walls in order to “break up” the concave shape that generates focusing and to add reflective surfaces inside the volume to obtain a better distribution of the acoustic energy. One can, for example, surround the audience by a large corridor so that the sound does not reach the external concave (and therefore focusing) walls. Additionally, acoustic reflectors covering part of the stage and the audience can be installed for a better energy distribution.

(See: Eckhard Kehle 2010, www.sinfoniavarsovia.org/funktion)
CONSTRAINTS

Urban Axis
Kvaesthusbroen bridge

Fig. 41. Photograph - model for Kvaesthusbroen bridge
Analysis royal theatre - elements / materials

1. wooden terrace
2. block
3. glass box
4. top of stage
Current development - car Park
CONCEPT

Elements


Functions

2 Block

in contrast to the groundfloor the block on top is conceptually a hard shape, which defines the space around it. the block is placed along an urban axis and is set according to the directions given by the site, fitting into its surroundings. in a second operation the block is deformed by the shape of the concert hall inside it.

1 Landscape

the “landscape layer” is supposed to extend the public space of the site and encourage people to hang out. the landscape reaches down to the water at the very tip, suggesting people to enjoy the water. this amphitheatre like gesture is also meant to work for open air events in the summer. a mobile stage can dock onto it. for the floor beneath it, this creates an irritation between the rigid structure of the rehearsal boxes.

0 Boxes

covered by a “landscape layer” on top of the groundfloor level consists of many boxes that function on one hand as artists spaces, like dressing rooms, lounges and instrument storages, and on the other hand as public rehearsal rooms. so, the border of public spaces and backstage areas, usually only accessible for staff and artists is meant to vanish. local bands can rent out rehearsal rooms, and gain popularity by performing in one of the spontaneous event spaces. inbetween these rehearsal boxes, meeting places are set, that are proposed to emerge new musical relationships.
The groundfloor trier is mainly used for standing audience, but can be equipped with seating furniture as well.

The trier rises and increases as its distance gets larger to the stage. This has reasons for acoustic matter as well as for viewing conditions.

The second trier also rises and increases as its distance gets larger to the stage. The surface wraps around the stage and exhibits the musicians in the middle of the volume. A feeling of immersement in the space is trying to be achieved.

The volume for the concert hall is finalized by a domelike roof structure, which also is defined by hanging reflectors to improve the sound conditions.
**Acoustics**

**basic volume**

The arena-shaped proposal for the concert hall is problematic in terms of acoustic as most reflections are targeted towards the center of the hall. To diversify the directions of sound rays, several adjustments can be made.

**reflectors ceiling**

The dome-shaped ceiling works well in raising the room height in the middle of the hall, though reflections are just made at the diameter of the dome. To diversify the reflections, the concave form of the dome is separated into convex-shaped parts that distribute the sound in diverse directions and increase the reverberation time of the venue.

**reflectors railings**

The railings of the first and second tier are bent forwards in order to increase sound reflections towards the audience beneath it. This adjusts the reverberation time.

**reverberation chambers**

As the venue is thought to work well for acoustic concerts as well as it supposed to host amplified concerts, the sound quality, and especially the reverberation time of the hall shall be acoustically variable. In order to achieve the possibility of different reverberation time settings, the acoustic volume of the hall needs to be variable. For this reason, a hallway around the perimeter of the second tier can be added to the basic volume of the hall, thus increasing the reverberation time.
The concert hall is inscribed into the block. Around the upper trier a hallway is added, which works as a reverberation chamber, and can be added to the volume of the concert hall in order to increase the reverberation time.

A pitched platform is created by extending the outline of the upper trier to the perimeter of the block. The block is deformed by the geometrical conditions of the inscribed concert hall.

The platform created by this extension is used as a viewing platform on the outside and as circulation on the inside. Shows that are taking place on the inside of the building affect the perception of the building.
5 *Sliced block top*

on top of the reverberation chamber, the same operation as on the bottom of it is being undertaken. The block is sliced all around and a void space is introduced.

6 *Concert Hall Roof*

the concert hall’s roof is inscribed in the top part of the block. The surrounding slab is used for the lighting gallery, and also is being used for public functions.

7 *Concert Hall + Block*

the sliced block can be interpreted as a dialogue to the neighbouring royal theatre. The playhouse’s added “crown” is being carved out at the concert hall project.
Dialogue - Context

Adding an illuminated box on top of a block

Carving a volume out of a block
Perspective perception
administration / maintenance / office

artists spaces / dressign / lounge

concert hall + side program (storage, control rooms)

rehearsal spaces / workshops / large rehearsal hall / spontanous events

public spaces - foyer / retail / information / café / restaurant
-1 Delivery / Secret Access
  PARKING LOT
  MAINTENANCE

0 Informal Event Spaces
  BACKSTAGE
  REHEARSAL
  ADMINISTRATION

1 Landscape / Entrance
  CONCERT HALL
  RETAIL
  ADMINISTRATION / BACKSTAGE

2 Foyer / Retail
  RETAIL
  CONCERT HALL

3 Viewing Platform / Reverberation Space
  REVERBERATION SPACE
  VIEWING PLATFORM
  CONCERT HALL

4 Roof Structure / Gallery
  LIGHTNING GALLERY
  REHEARSAL SPACES

PAR KING LOT
M AINTENANCE

B AC K STAG E
R E H E A R S A L
A D M I N I S T R AT I O N
Groundfloor
1st level
2nd level
public space / gallery / café
emergency exits
concert hall / first trier
PLANS

3rd level
circulation / reverberation space
viewing platform / public
emergency exits
PLANS

4th level
lighting gallery

circulation / public space

rehearsal spaces / exhibition

fragmental views to outside
Siteplan 1:3000
-1 Basement

1 Vehicle Access Concert Venue
2 Disabled Parking Lot
3 Parking Spaces Personnel
4 Drive Up / Deliver Instruments
5 Ventilation
6 Maintenance
7 Storage
8 Garbage
9 Technic

A Access Audience
B Access Artists
1 Foyer
2 Info / Box Office
3 Back Office
4 Lockers
5 Retail / CD
6 Retail / flexible
7 Archive
8 Administration
9 TV Studio
10 Lighting
11 Stage Manager
12 Sound Control
13 Stage Access Instruments
14 Stage Door Left
15 Stage Door Right
16 Recording Room
17 Recording Room / Video
1 Gallery
2 Café
3 Retail / Exhibitions
+3  Second Trier / Viewing Platform

1  Circulation / Resonation chamber
2  Viewing Platform
1 Lighting Gallery
2 Rehearsal / Exhibition
Section A
Section B
Elevations
Elevations
ELEVATIONS

West
ELEVATIONS

North
ELEVATIONS

East
**Landscape**

The landscape layer on the 1st level is constructed with concrete. It is supported by the walls of the rehearsal rooms beneath it.

**Gallery**

The gallery in the 2nd story, which is part of the public foyer in the first story, is supported by the boxes of the walls of the first floor.
Viewing platform

**viewing platform**

The curved viewing platform is supported by the walls of the emergency exits in the first floor as well as by the two frameworks, which also support the roof structure above. The carcasses are held by 8 triangular shaped columns which run 10 meters from the first story directly to the frameworks.

**ceiling viewing platform**

The curved ceiling of the viewing platform is supported by the two frameworks beneath. The floor is bearing out for 13 meters at the corners. This is dealt with by an increased thickness of the slab as well as it is supported by a steel structure in the roof.
Framework
The framework is built as a spatial framework sitting on top of the two framework structures below.

The steel structure is visible from the outside and is part of the design of the circulation space around the concert hall. It is being crossed by entering the hall.

The framework is supported by 8 triangular shaped columns, which run from the foyer space to the frameworks. The visible structure is part of the design of the public foyer space. The structure of the building is made "readable".
STRUCTURE

Materials

- **Facade**: Metal
- **Concert hall interior**: Wood
- **Floor viewing platform**: Concrete
- **Boxes first floor**: Brick
- **Floor landscape**: Concrete
- **Boxes groundfloor**: Brick, Copper
Structure - detailed proposal tribune
Visualizations
Section A  Visualization
Section B  Visualization
Entrance
Foyer
Circulation / reverberation chamber
Foyer / Entrance
Terace
Interior
Interior / concert hall
Interior / concert hall
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