Comparing Contemporary Cathedrals of Culture

Fig. 1. Hans Scharoun, Herzog and de Meuron, Hanning Larsen, Snøhetta. The four contemporary concert halls chosen as subjects for study. Locations and dates vary.

> "The concept of contemporary architecture is one that is fully implicated in contemporary tradition, practices, and ideas. There is, therefore, a symbolic dimension to architecture which leads it to become a manifestation of those themes. Therefore, as a form of art practice… as a cultural production… it is obviously the manifestation of the spaces within which we see practices and lives taking place…."
>
> - Prof. Mohsen Mostafavi, Dean Harvard Graduate School of Design

UNESCO defines culture in a two-fold dimension:

1) The constitutive definition: as a way-of-life, values, attitudes, knowledge, skills, individual and collective beliefs, and 2) the

functional definition: as an organized sector of activity. With this in mind, one can easily see how architecture must address both of these definitions in the design of large-scale cultural institutions such as performance halls. Such venues must take into consideration the contemporary and historical cultural aspects of the local (and global) society they are designed to represent, as well as to be composed in a functional manner. Some of the best examples of such design can be found in the four buildings identified for study:

- Berlin Philharmonic, Berlin, Germany (1963) by Hans Scharoun
- Elbphilharmonie, Hamburg, Germany (2017) by Herzog and de Meuron
- Harpa Concert Hall and Conference Center, Reykjavík, Iceland (2011) by Henning Larsen in co-operation with Olafur Eliasson
- Norwegian National Opera House and Ballet, Oslo, Norway (2007) by Snøhetta

These cultural cathedrals present our most celebrated art forms through live performance, education, and artistic immersion. Within their walls, we honor our own humanity and experience the wonder of creativity. The walls themselves are imbued with countless efforts of many designers, artists, and architects. These buildings stand as shrines to the growth and evolution of the human spirit.

An essential design element in performing arts venues is acoustics. Along with acoustic engineers and material designers, architects attempt to shape performance venues to achieve singular and memorable acoustics. However, modern music and artistic tastes are incredibly diverse, leading to a wide variety of acoustic needs for

each performance. Thus, these venues must be able to accommodate a varied and dynamic production palette to ensure proper expression of many unique sounds. Investigation of the chosen spaces explore this desire for flexible acoustics and attempts to gauge each building's success or failure in adapting to changing artistic needs.

Almost as important to the acoustic performance of a building is how it integrates with the public. Typically, we see a venue's facade more than the stage inside. While many of these buildings represent their cities and countries as iconic landmarks, they must be able to interface with the public as well. How do cultural landmarks, such as performing arts halls, stay active and relevant when there isn't a performance going on inside? What else can a performance venue be to a diverse public? These are some themes explored herein.

Concert halls and performance venues have the power to be a catalyst for urban change. At this scale, architecture has the capacity to change or add to a city's identity, weave together the urban fabric, and even instill social transformation. On the other hand, such large-scale interventions could have an opposite isolating effect. Each of these buildings is analyzed regarding their urban context to determine how their presence affects, or is affected by, their surroundings.

While each of these venues has received a myriad of international media coverage for their extravagant forms, what is essential as performing arts institutions is whether they function efficiently and memorably for everyday users. Through detailed analysis of each of these four venues, this essay attempts to critically analyze some of the less publicized details that are vital to the everyday use of each building. This includes a focus from both the visitor's experience, as

well as from that of a performer. This study also analyzes the social and economic cost these venues have on their surroundings and societies. The essay aims to show how contemporary concert halls are more technological and multi-functional than ever before, demonstrating how architecture redefines the modern-day performing arts experience.

Berlin Philharmonic by Hans Scharoun

Fig. 1. Hans Scharoun. Exterior view of Philharmonic concert hall. Berlin Philharmonic, Berlin, 1963.

> "In the Philharmonie, Hans Scharoun...has drawn a contrast between the extreme darkness that threatens us with its wasteland and our profession of faith in the arts. This is the purest sound of our fellow humanity and, hence, an expression of our faith in the power of freedom."
>
> - Dr. Adolf Arndt, German Minister for Science and Art, at the opening of the Berlin Philharmonic, 15 October 1963

What we tend to think of the traditional form of the concert hall as one developed in the second half of the 18th-century: A large rectangular room with an audience on one side and a proscenium stage on the other. This form set the standard that all well-regarded

concert halls followed for the next 150 years. Visitors treated live music performance as something of a religious affair, and it is no coincidence that formally the interior of concert venues mimicked those of cathedrals with a group of people faced perpendicular to a central focus point at the end of a large rectangular volume, often terminating at large house organ. In those times, going to hear a performance was a once-in-a-lifetime opportunity for most people, and thus was treated as a lofty event elevated beyond that of everyday experience.

In contemporary life, with the rise of digital media forms such as radio and television, access to recorded music and performance is more accessible than ever before. What this accessibility means is that society has become more conditioned to not only hearing music but seeing it as well, with the result being that interest of concert-goers is no longer solely dedicated to auditory stimulation but also to the performance's visual presence, and thus the interaction between the two.

Hans Scharoun understood this change in society intimately, and with this idea of stimulating all aspects of a visitor's experience in mind he designed the Berlin Philharmonic in 1957-63. By bringing the audience closer than ever before in a concert hall venue, and by making the process of music making accessible from every angle, he unwittingly created a new prototype for music hall design for the next century. The 'vineyard-style' hall, as it has been described for the organicly shapped overlapping seating balconies stacked radially around the stage, has since been utilized in many contemporary concert halls and performance venues worldwide. It can be argued that this

building is the first contemporary concert hall, fundamentally changing the way architects design for live performance. Examples of this paradigm shift can be seen in the main auditoria of contemporary venues such as Renzo Piano's Parco della Musica in Rome, Jean Nouvel's Danish Radio Hall in Copenhagen, and Herzog and de Meuron's newly completed Elbphilharmonie in Hamburg. Understanding the history of this building, as well as the architectural aspects that contribute to the Berlin Philharmonic's acoustic and social successes, are vital to designers of any performance space. This essay attempts to elaborate on the details that make this venue so unique.

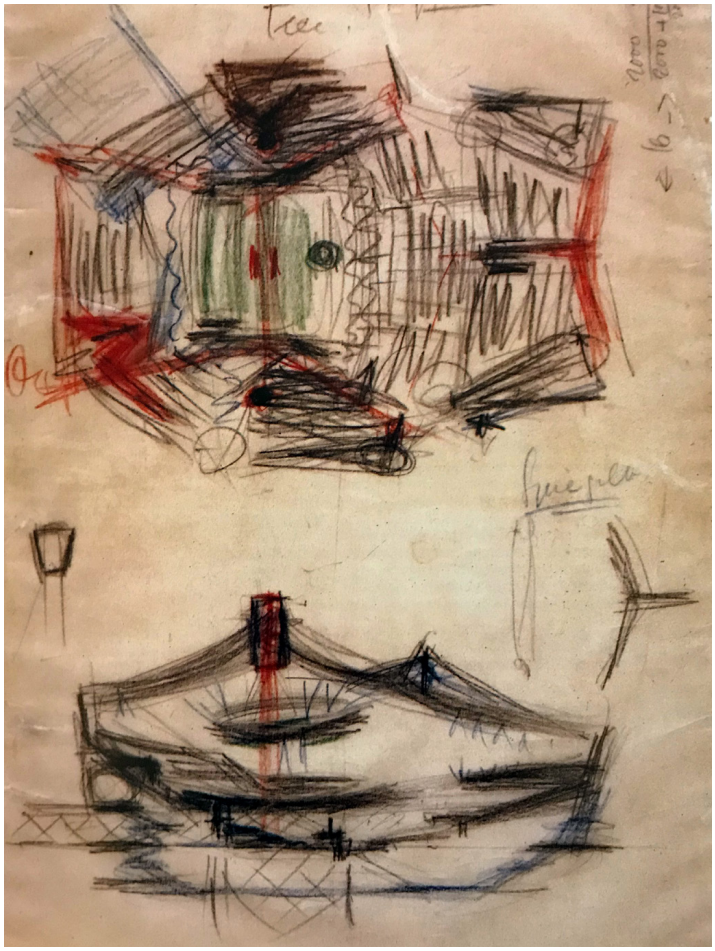

Fig. 2. Hans Scharoun. Original plan and section sketch designs. Berlin Philharmonic, Berlin, Germany, 1963. Image credit Akademie der Künste, Berlin.

History

Fig. 3. Hans Scharoun. Aerial view overlooking site c.1963. Berlin Philharmonic, Berlin, Germany, 1963. Photo credit Otto Borutta/Archive of Berlinische Galerie.

The chronicle of designing a purpose-built Philharmonic hall for Berlin is one of political and historical complexity. While the construction of the Philharmonic is directly ingrained with two major architectural competitions held between 1956-1959, the story truly begins in 1882 when 42 members of the prestigious Berlin Orchestra declared their artistic independence from the aristocracy-sponsored performance group. Seceding from the traditional format, which forced artists to rely on the favor of often a single wealthy member of society's elite, the members of the new Philharmonic Orchestra sought to create a democratic orchestra that brought live entertainment to all economic and social levels. Following six years of performing in make-shift and borrowed venues, in 1888 the orchestra found a new home

in a converted roller-skating rink. Over the course of the next fifty years (and numerous renovations to the building), the Berlin Philharmonic Orchestra would establish itself as a world-class performance group within this space. This success was brought to an abrupt end in the midst of global political strife.

Fig. 4. Hans Scharoun. Aerial view of site after bombing. St. Matthews church seen to the left c.1946. Berlin Philharmonic, Berlin, Germany, 1963. Photo credit Landesarchiv Berlin.

On the evening of 30 January, 1944, the old Philharmonic Hall was reduced to rubble in an air raid. World War 2 was raging throughout Europe, and Berlin was in the throws of destruction. The orchestra again found itself without a home, fleeing from venue to venue and struggling to survive. After the war, a slap-dash modernist concert hall was constructed at the Academy of Music in Berlin, but its relatively small capacity of 1200 failed to satiate the growing desires of both the public and performers alike. The orchestra again found itself pining for a new home.

By 1956 a group of over 800 members of the public organization The Society of the Friends of the Berlin Philharmonic raised enough funds to announce a by-invitation architectural competition for a new concert hall. For the first time in the history of architecture, the design had to take account not only of particular programmatic requirements but also of clearly defined acoustic considerations. The organizers stipulated a reverberation time of two seconds, identical to that of the old Philharmonic Hall and on-par with that of the most internationally celebrated concert venues such as the Musikverein in Vienna. Organizers also required seating for at least 2000. Of the twelve architects invited to participate, ten submitted anonymous proposals. After 16 hours of deliberation, the jury announced the winning architect to be Germany's own Hans Scharoun.

Initially envisioned as an addition to the Joachimsthalsches Gymnasium on a site behind the University of the Arts, Scharoun's proposal was formally distinct from most concert halls around the world at that time, as it placed the audience surrounding the orchestra at the focal center of the space. Almost immediately the proposal was met with intense scrutiny from fellow architects and engineers who objected that Scharoun's design was impossible to realize, as they claimed the lack of orthogonal angles would render the building's construction impractical. Nearly three years passed, during which questions arose of the suitability of the proposed site, rising budgetary concerns, and political criticism stagnated progress of the project.

In early 1959 another design competition would help pave way for the future of the Philharmonic. A large scale urban design competition called 'Hauptstadt Berlin' was held to redesign a large swath of land

in the city center which had been completely razed by a combination of zealous former Nazi city planners and the proceeding bombings that took place throughout Berlin. The second prize was awarded to Scharoun, whose design principle was the creation of a cultural forum as a counterpoint to the isolated Museum Island on the eastern edge of the city. Included in the proposal were plans for a new National Library, museums, cafés, and a site for the Philharmonic Hall, this time as a free-standing building. By the autumn of 1959, Scharoun was able to redesign his winning concert hall and present it to explain how "the restored St. Matthew's Church (the only structure left standing in the area) can be combined with the new Philharmonie to create a felicitous ensemble." The contract in early 1960, with the foundation stone laid on 19 September 1960. As construction began, it would seem that the forces working against the Berlin Philharmonic had been overcome, but alas another threat was looming less than 500 feet away.

In August 1961, on the eastern edge of the building site, a fifteen-foot tall concrete wall was constructed separating East and West Berlin. The Philharmonic, which had been conceived and planned as the nucleus of a new cultural center to be celebrated by the whole of Berlin, now found itself on the very edge of the concrete division in the Allied-controlled West Berlin. As a result, the Philharmonic became a symbol of a future that seemed conceivable only as a utopian fantasy for those on either side of the wall. The Berlin Philharmonic celebrated its inaugural season in 1963/64 and, along with the long-planned addition of the Chamber Music Hall in 1987, now serves as the premiere model for new concert halls all over the world.

Site

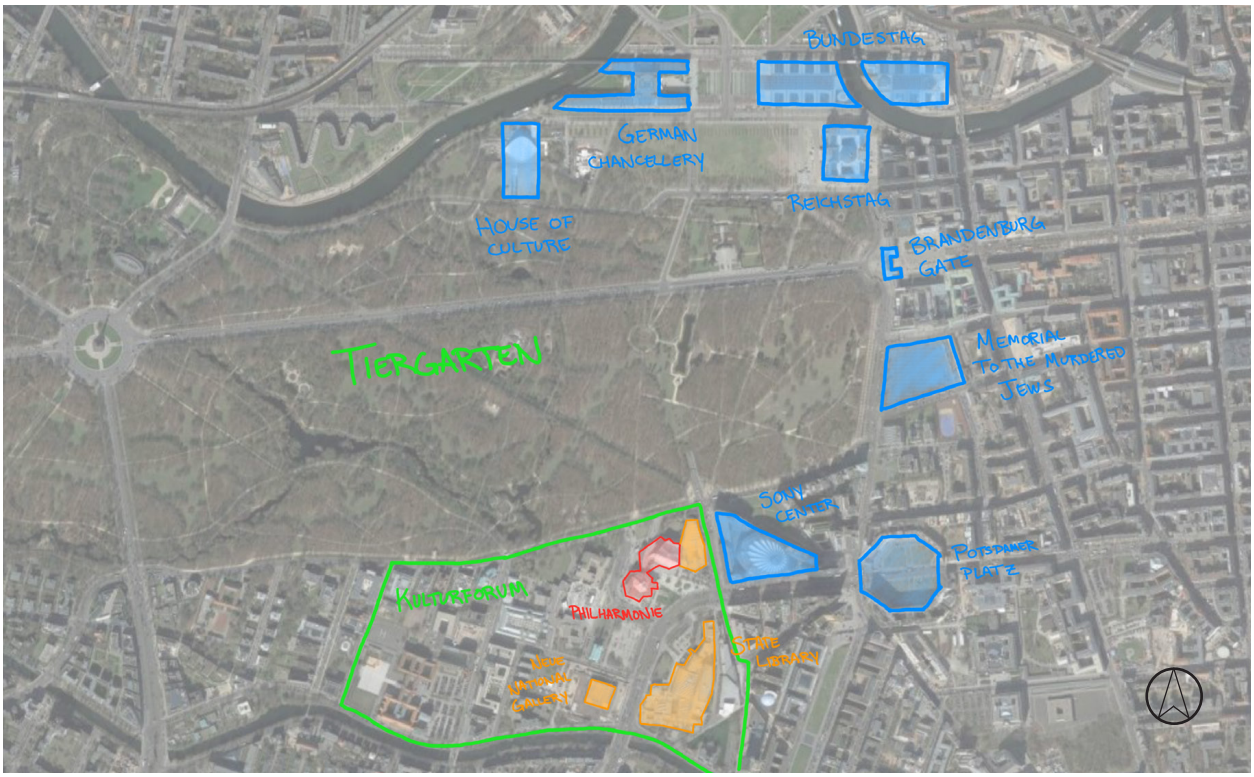

Fig. 5. Hans Scharoun. Aerial diagram of the site and surrounding landmarks. Berlin Philharmonic, Berlin, Germany, 1963.

In 1958 the German House of Parliment proposed to look into suitable alternatives for what was then the preferred site of Hans Scharoun's winning proposal for the Berlin Philharmonic. Conceived as an addition to what is now the University of the Arts on Bundesallee in West-Central Berlin, they argued that the Philharmonie was a matter of public importance to the whole of Berlin and that the chosen site was too geared towards the needs and short-term desires of the West half of the city. At the same time, the 'Hauptstadt Berlin' urban design competition was being held, with Scharoun himself offering an alternative site for his own design. The site along the Kemperpletz was already marked out as one of four possible sites for cultural

activities by the government, so it seemed a logical compromise to the dilemma. In hindsight, how fortunate a decision it turned out to be, as just three years later the political escalation between Soviet and Allied forces led to the construction of the Berlin Wall, which would have left Scharoun's original proposal abandoned halfway through construction in East Berlin.

Scharoun's Kulturforum proposal sought to use the sculptural tent-like form of the Philharmonie as an icon for the new post-war Berlin. Located on the southern edge of the Tiergarten, the largest public park in the city, the Philharmonie sits in proximity to some of Berlin's most well-known destinations: The Brandenberg Gate, the Reichstag (German Parliament Building), Bundeskanzleramt (German Chancellery), Potsdamer Platz city square. Neighboring the site is St. Matthew Protestant Church, the only structure in the area that survived allied bombing during the war. It is important to remember that before the war the area around Kemperplatz had been one of the most fashionable parts of the inner city to live. During the 1930's, Hitler and his architect Albert Speer had located an essential axis of their "Germania" project here and had begun demolition of this previously prosperous area. In his desire to reflect the area's historic past, Scharoun wanted his proposal to be seen as a democratic alternative to the Nazi's notions of grand urban development. The Philharmonie was to be a symbol of this urban renewal, located near the heart of the city and as visible as possible from all sides.

In 1968 Scharoun's friend and contemporary Mies van der Rohe debuted his contribution to the Kulturforum, the renown Neue Nationalgalerie. This building, along with Scharoun's own Neue

Fig. 6. Han Scharoun. View of the Kulturforum shortly after the opening of the Neue Nationalgalerie by Mies van der Rohe c.1969. Berlin Philharmonic, Berlin, Germany, 1963. Photo credit Ludwig Ehlers/Bundesarchiv.

Neue Staatsbibliothek (Berlin State Library) and the painting gallery Gemäldegalerie, were the only projects that Scharoun planned that had started construction in his lifetime. Since his death in 1972 many additional museums and institutions have taken up residence in the immediate vicinity, including the overhaul of Potsdamer Platz by Hilmer and Sattler in 1998 and the imposing Sony Center by Helmut Jahn in 2000, detracting somewhat from Scharoun's original intent. This left the three aluminum clad volumes of the Philharmonic, the Chamber Music Hall, and the Music Instrument Museum as a unified shining island amongst a sea of other cultural islands characteristic of this part of the city. Today, the Kulturforum continues to stand as one of the most important cultural sites in Germany, even if it has lost most of its originally planned pedestrian accessibility.

Visitor's Experience

Fig. 7. Hans Scharoun. Interior view through the overlapping mezzanine levels into the lobby at intermission. Berlin Philharmonic, Berlin, Germany, 1963.

Located in a high exposure area of central Berlin offers many different approaches to the Philharmonic. The site is bordered on three sides by high-vehicular traffic streets and one low-traffic boulevard used primarily for public bus stops. Parking facilities on site are very limited and are reserved for performers and handicapped visitors, so people often arrange to take taxis or get dropped off at the front entry. Due to its central location, the most utilized approach is to walk to a performance, especially in the summer when many visitors include the time to enjoy an evening walk from their hotels through the Tiergarten.

One essential design consideration made by Scharoun is the multiple access points of entry to the site. The "concert hall for the people" as Scharoun described in his initial proposal has dozens of

methods of approach, highlighting the desire of this building to be one of democratic nature. Formally the building also fits this description, like a giant golden festival tent dotted with porthole windows and balconies sharing the activity within. The primary entrance to the Philharmonie is located to the west of the building's main volume; Once in the venue, visitors notice this asymmetric placement. Scharoun deliberately chose to set the entrance off-axis from the auditorium, enhancing a sense of discovery as one progresses through the building. The landing foyer funnels visitors past the box office to the ticket collectors, compressing everyone from both sides and from above. Flights of stairs can be seen to the right of the ticket collector's line; they take audience members to the concert hall on the mezzanine level and a further labyrinth of ascending stairs. Visitors seated on the left pass by the coat check facilities through a large foyer with variously shaped columns, pillars, walls, and circular stairs before they reach the more lofty volume of the main lobby. Due to the unpredictable nature of this entry sequence, first time visitors can find themselves quite confused.

After arriving in the voluminous terraced void of the main lobby, highlighted in part by the amber-red glow of Alexander Camaro's massive circular stained-glass installation, visitors are again compressed as they make their way up one of three stairs to an upper mezzanine level, leading again to more stairs labeled in small capital letters corresponding to one of 23 seating areas in the hall. As one gets closer to their destination, the paths get more and more constricted, until ultimately you arrive at a single-wide door leading into the main hall. As visitors pass through this threshold, they again are

met with a tremendous feeling of release, as the cavernous hall opens up before them.

The multi-faceted and multi-focal concert hall of the Berlin Philharmonic has been celebrated as a marvel of modern ingenuity since its opening. The auditorium is imbued with a sense of communal gathering, and no one patron is given preference over another. Each of the 23 groups of seats is composed of 128 individuals, equal to the number of performers in a full-sized orchestral arrangement. This was deliberately orchestrated by Scharoun so that each member of the audience feels a sense of personal connection to a member of the orchestra, placing them in equal standing in the hall. In addition, no seat is less than 30m from the visual focal point of the room, the conductor, creating a sense of intimacy. The layout of the 23 seating groups is such that it allows members of the audience to move uninterrupted from any one seat in the auditorium to another without ever leaving the hall. This further emphasizes the democratic nature of Scharoun's approach and ensures that if a place amongst the floor level blocks in front of the orchestra is left empty before intermission, shortly thereafter it will be filled with an eager and willing patron who spotted it from higher up.

A somewhat amazing occurrence happens at the end of concerts and performances: the hall easily empties within two to three minutes. As confusing as the entry sequence is through a cacophony of crisscrossing stairways and platforms, the exit sequence is just the opposite. Like a flow of water down a hillside, the next flight of stairs is always within a visitor's direct sight, gracefully leading from the auditorium, through the lobby, to the exit.

Upon leaving the main hall, a visitor may notice some details lost during the frantic build up during entry: the exposed texture of wood grain on the board-form concrete pillars, the spherical chandeliers in the lobby each composed of 72 overlapping pentagonal polyamide pieces, numerous abstract modernist sculptures, or the mosaic glass tile flooring by the artist and close personal friend of the architect, Erich F. Reuter. These and other works of art scattered both inside and around the building site contribute to a sense of social awareness, providing the public with infinitely more cultural value than a ticket alone could provide. Being open every day except Mondays, the building allows for many visitors to experience these works of art without needing to pay for admission.

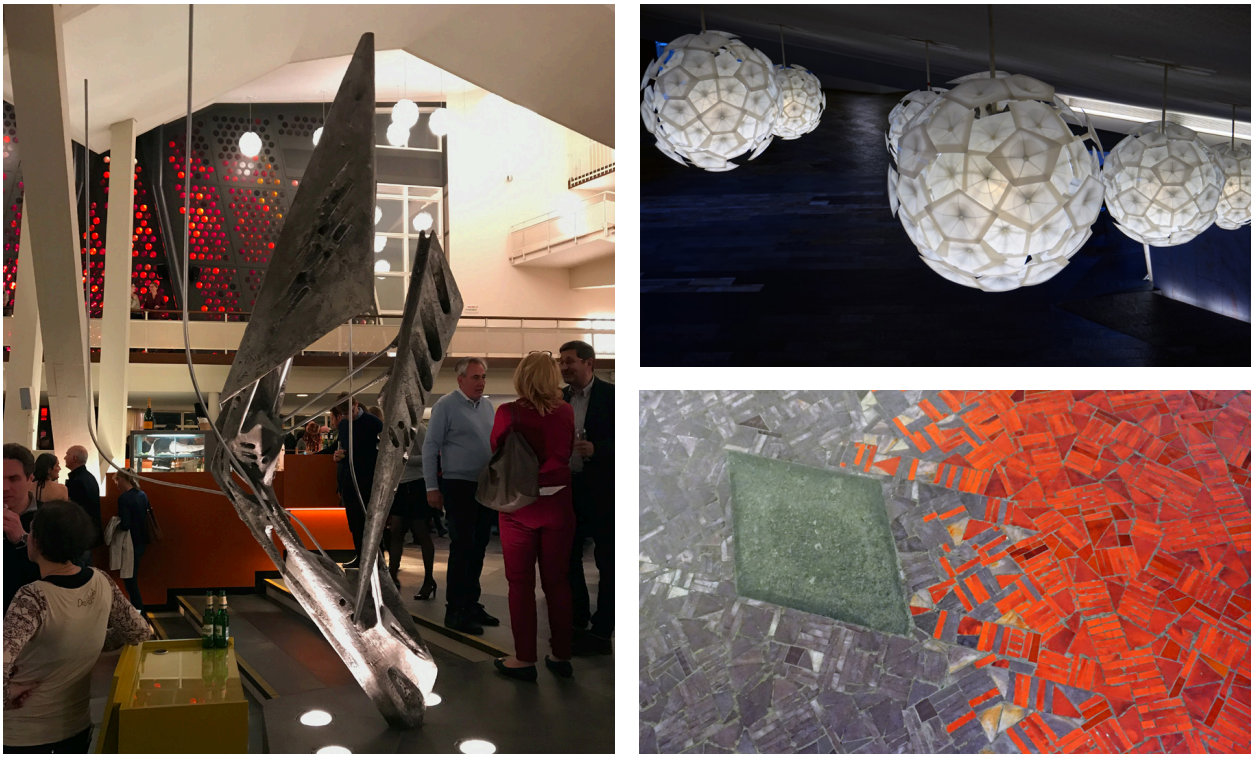

Fig. 8. Hans Scharoun. Public art is displayed throughout the interior and exterior of the building. Berlin Philharmonic, Berlin, Germany, 1963.

Performer's Experience

The sequence of entry for performers at the Berlin Philharmonic has been carefully considered. Housing one of the most famous Philharmonic Orchestras in the world, Scharoun sought to provide as many comforts to the full-time professional residents as possible. The main entry for performers takes place on the East side, the opposite side of the building from the main public entry. This artists entry was significantly expanded as part of the 1987 addition of the Chamber Music Hall. After clearing security, artists immediately ascend to the second floor, which is primarily dedicated to performers. A large private foyer with its own dedicated canteen serves as the central hub of activity, around which are located five group dressing rooms, each dedicated to a different group of orchestra members, two soloist dressing rooms, two private conductor suites (one for the resident conductor and one for visiting conductors), climate controlled storage for specific wood instruments, and a private group orchestra room used for tuning or practice. The largest of the private dressing rooms is reserved for the concertmaster, or the lead violinist, of the Berlin Philharmonic. Backstage areas also include space for at least four grand pianos available for any orchestra members' use, including a dedicated Steinway piano that is reserved exclusively for the Chief Conductor of the Philharmonic, a post currently held by Sir Simon Rattle. Lastly, the private foyer provides direct access to the stage, with four sets of large double doors on either side, making the transition from private (dressing room) to public (stage) very easy and efficient.

The stage of the concert hall at the Berlin Philharmonic is

highly adaptable to whatever type of performance that takes place. The surface of the stage is divided into nine semi-circular segments that can individually be adjusted depending on the configuration desired. During a performance of the Berlin Philharmonic Orchestra, eight of the segments are raised in a stepping pattern forming a tiered amphitheater-like arrangement. This allows each member of the orchestra a clear line of sight to the conductor. In choral arrangements, the tiers are adjusted in both height and number based on the size of the performance group. In the rare instance that the hall is used for electronically amplified music, as experienced by the author during a performance from the American band Pink Martini, the stage is set completely level. During this particular performance, seats were also added onstage to allow visitors to experience the performance even more intimately.

Fig. 9. Hans Scharoun. Private performers entry and artist's backstage canteen. Berlin Philharmonic, Berlin, Germany, 1963.

When the Philharmonie first opened, there were complaints made by prominent musicians who were simply unable to come to terms with the hall's new and unusual panoramic design. In the case of Hans Knappertsbusch, the flamboyant German conductor who specialized in arranging Wagner and Strauss, the idea that he would be surrounded by spectators while he was performing caused him to cancel his concert.

In time, the unique shape of the hall has been embraced by performers, especially considering that many more contemporary halls have adopted this audience in-the-round style as well. Overall, the performer's experience at the Philharmonic is simple but well organized, and backstage areas provide comfortable accommodation to both Philharmonic Orchestra members as well as visiting performers.

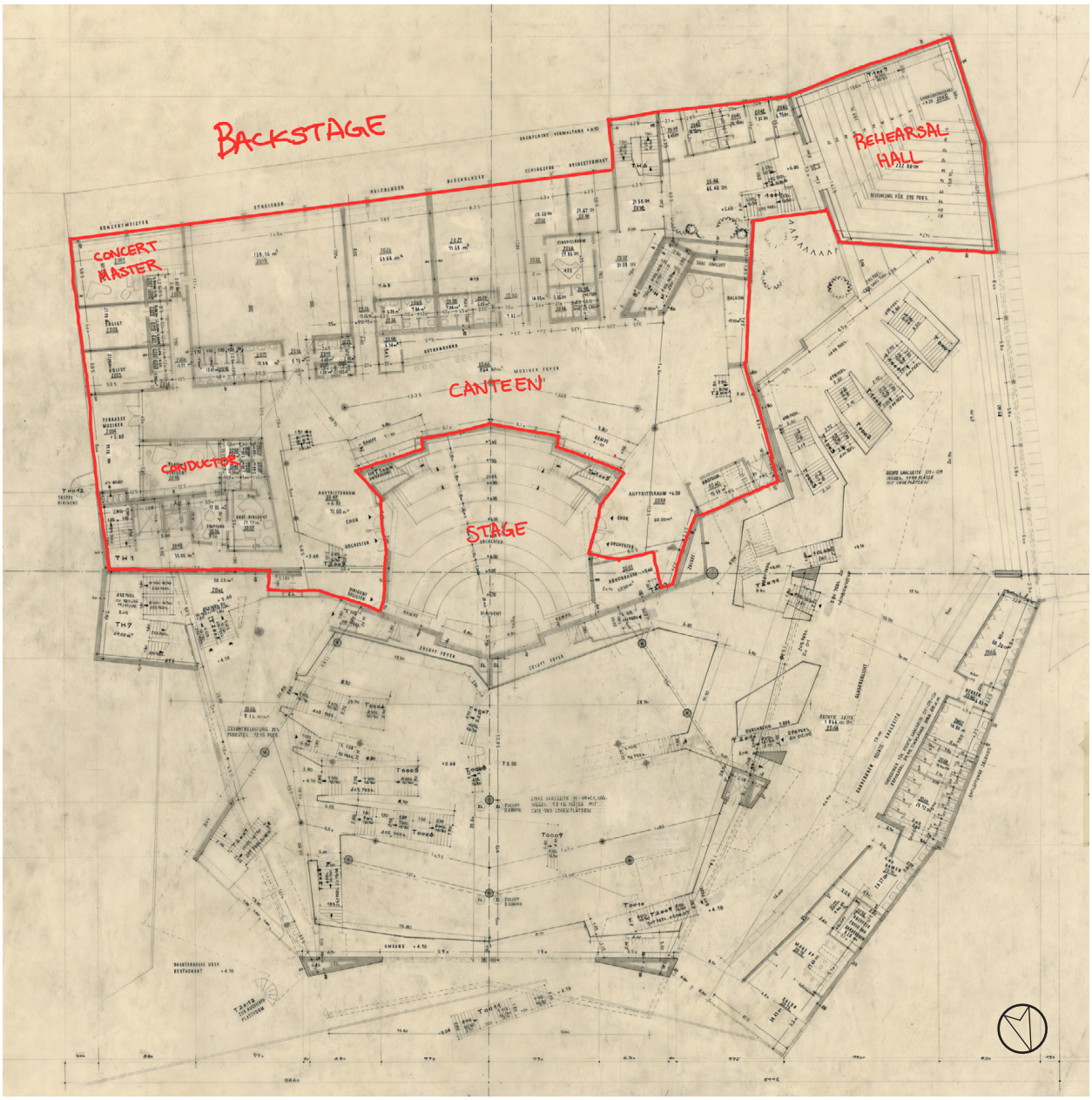

Fig. 10. Hans Scharoun. Original plan by Hans Scharoun, with backstage areas highlighted. Berlin Philharmonic, Berlin, Germany, 1963. Image credit Akademie der Künste, Berlin.

Acoustics

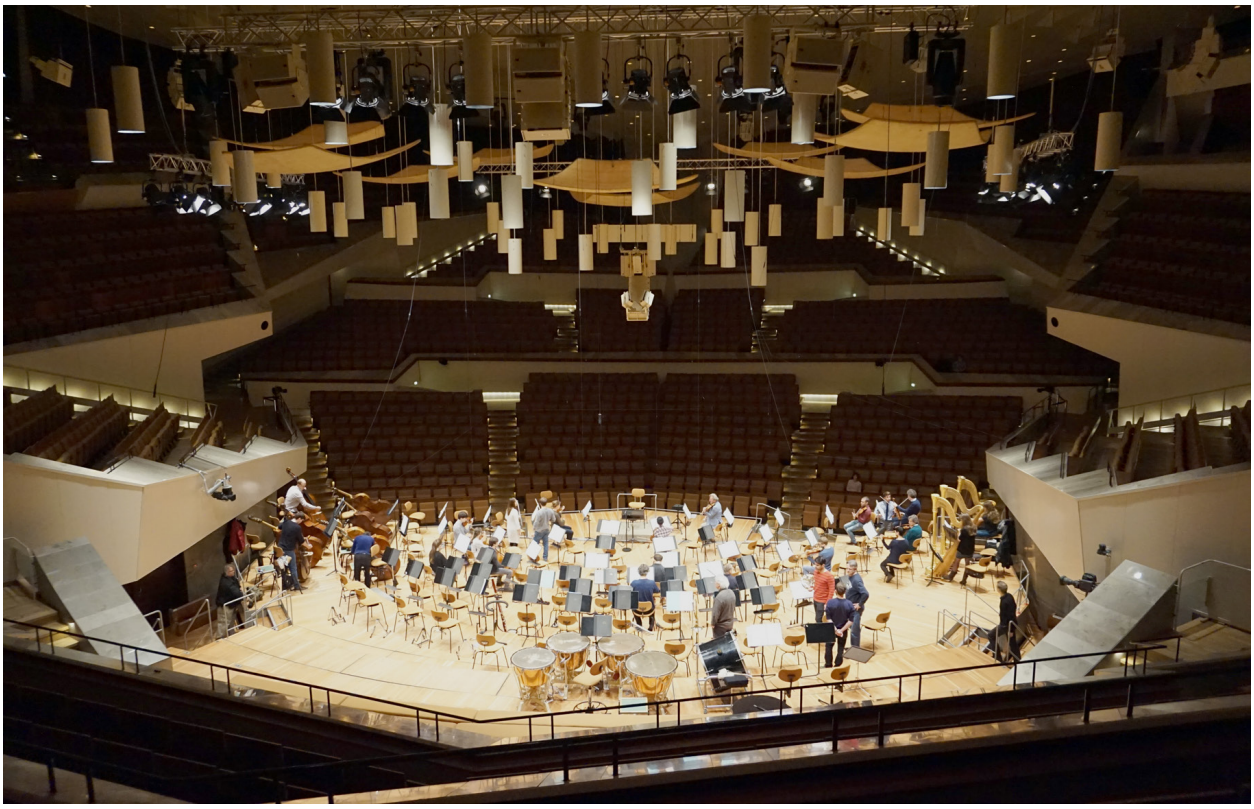

Fig. 11. Hans Scharoun. Interior view of the main concert hall during rehearsal of the Berlin Philharmonic Orchestra. Berlin Philharmonic, Berlin, Germany, 1963.

During an early stage of his work on the Philharmonie, Hans Scharoun enlisted the assistance of Lothar Cremer. An expert on acoustics, Cremer was the then head of the Institute for Technical Acoustics at Berlin's Technical University and was initially very skeptical of this radical new performance hall shape. He felt the architect had given less thought to the acoustic aspects of the hall than to the desire to "create a new society." In fact, Cremer even attempted to dissuade Scharoun from this centrally-focused form by drawing his attention to possible acoustic complications. Ultimately Scharoun's stubborn will persisted, and Cremer agreed to work with the architect to ensure the hall met the stringent acoustic requirements.

The demand for meeting the required 2 second reverberation time outlined in the original competition criteria turned out the be the least of the designers' concerns. Reverberation in a room is determined by a relatively straightforward mathematical equation. It depends primarily on three factors: what finish materials are used, how many people (or seats) are desired, but above all what the volume of the space is. In the case of a performance hall with a capacity of 2,250 seats, the acoustically necessary volume of the Philharmonie's auditorium is approximately 26,000 cubic meters. Using this volume as a base consideration helped roughly determine the size and shape of the double concrete shell that encloses the hall. This shell also acoustically isolates the auditorium from the rest of the building, blocking out all outside noise and keeping the sound of the music contained.

A more difficult challenge is that of ensuring that the performers could hear each other. In a traditionally shaped 'shoebox' style hall whose stage is framed with flat walls in a rectilinear volume, it is easy to ensure that a space has adequate first-reflections. In a space this is open in every direction, such as in the Philharmonie, it is more difficult to ensure first reflections reach both the furthest corners of the space as well as other orchestra members at roughly the same time. This is especially applicable to instruments with specific direction characteristics, such as trumpets, violins, and especially the human voice. Acoustically this is known as 'preferential direction' of sound. In order to reflect the sound evenly in every direction, each of the vineyard-style seating terraces are fitted with reflective surfaces perpendicular to the central focal point of the stage.

These vertical planes running around the perimeter of each of the seating terraces direct first-order lateral reflections to those seated in nearby seating blocks, as well as back to the stage.

Cremer also determined that a sound reflector be fitted above the stage as the ceiling was too high to reflect back the sound and disperse it. It was initially planned to be a single large reflector, but this was determined to be too visually distracting. Instead, ten sound reflectors referred to as 'clouds' are suspended at the height of 12m above the stage platform. These convex reflectors were originally made of bent plywood with micro-perforations but were later replaced with the current polyester and fiberglass shapes to reduce their weight. Each of the ten clouds can be individually adjusted in terms of height and angle to provide optimal first and intermediate reflections to the stage-level seats.

Fig. 12. Hans Scharoun. The acoustic elements of the hall ensure proper sound reflections and reverberation time. Berlin Philharmonic, Berlin, Germany, 1963.

One acoustic drawback to a vineyard-style hall is the relative lack of spatial impression. This effect is described by acoustic specialist Michael Ermann as being "fully immersed on all sides by music" and is achieved by designing a space to ensure that sound reaches an audience member equally from three equidistant angles (or from the front, and from both sides). Ermann goes on to explain that due to the lack of large, flat surfaces on either side of every seat in a terraced hall, the binaural quality index (or BQI) of a terraced hall is usually lower than that of a shoebox or horseshoe-shaped auditorium. To combat this effect, Cremer designed the tent-like ceiling of the hall to act similarly to side-reflectors. Made of three convex arches, the ceiling shape helps ensure that sound is equally diffused around the hall. Towards the outer edge of the ceiling, 136 pyramid-shaped diffusers were also installed to help ensure that low-frequency sound doesn't over resonate in the volume, which would cause an effect known as flutter.

These design elements all play an important role in ensuring that listeners in the blocks of seats behind the raised platform are more or less equally able to hear the music coming from the stage. An interesting phenomenon is experienced during an orchestral performance at the Berlin Philharmonic in that each member of the audience, due to their proximity to the performers, can hear every single sound and pinpoint with surprising accuracy where that sound is coming from. As batons are tapped, pages are turned, and bows are drawn, an audience member is drawn to each minute sound. This effect personalizes each performance and makes it much more memorable.

Details and Materials

Fig. 13. Hans Scharoun. Exterior of primary entry between the two auditoriums. Berlin Philharmonic, Berlin, Germany, 1963.

There are several unique details in the Berlin Philharmonic that help make it such a unique venue. The most obvious feature of the two halls comes in their striking color: a shimmering anodized aluminum and zinc composite panel colored in a golden yellow. However, the present facing was not added to the building until the construction of the Chamber Music Hall in 1987. Since the late 1950's when Scharoun started working on his design proposal, he struggled to find a suitable exterior sheathing worthy of his "golden vision" of a freestanding sculpture floating in open space. The primary concerns at that time were cost and availability of materials. With a modest budget of 17.5 million DM (approx. 125-150 million USD today) and the continued

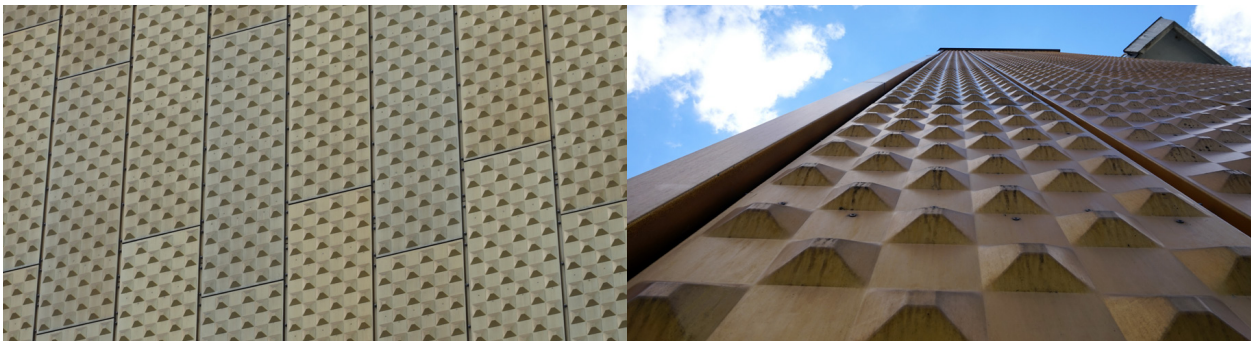

Fig. 14. Hans Scharoun. The golden-colored aluminum and zinc facade panels change their appearance depending on the time and angle of view. Berlin Philharmonic, Berlin, Germany, 1963.

scarcity of various metals following the war, Scharoun was forced to use a temporary ochre-colored paint that was intended to recall the traditional color of many of the manor houses of nearby Brandenburg. What was expected to be a temporary solution became more lasting, as after the architect's death there was much debate as to what his original intentions were. Ultimately it was determined that enough evidence existed in drawings that a metallic finish would be added to the exterior, achieving a golden shine that changes color depending on the time of day and angle of view.

Visible from afar, the dramatic curved roof forms are a symbol for the Berlin Philharmonic's unique qualities. Crowning this structure on the North side is 'The Phoenix', a light-metal sculpture with the outstretched wings of a bird designed by artist Hans Uhlmann. Centrally located above the concert hall, it calls to mind Scharoun's desire for Germany to "rise from the ashes" of war and rebuild itself as a democratic society for all.

Fig. 15. Hans Scharoun. "The Phoenix" sculpture. Berlin Philharmonic, Berlin, Germany, 1963.

Social and Economic Responsibility

The Berlin Philharmonic is perhaps one of the most socially aware structures ever built. As a symbol of a war-torn country's desire to redefine its global image, the venue has not only met but exceeded all iconographic expectations. Scharoun designed a music hall for the people with democratic principles ingrained in the very form of the building. This democratic nature continues to be a driving factor in its day-to-day operations even today. Starting in the 2009/10 season, the Berlin Philharmonic introduced a new way of presenting their performances: the Digital Concert Hall. The orchestra offers live and recorded multi-camera streams of the performances, making the concerts accessible internationally online for the first time. When discussing this new offering, chief conductor of the Berlin Philharmonic Sir Simon Rattle explains:

> "It seemed so obvious that [the Digital Concert Hall] is the future. As it gets more difficult for the normal recording industry, it seemed more and more important that we give people access to what we do. I am sure that in the future this will be seen as a prototype for not only concerts but prize fights, theatre, and opera..."

It seems fitting that within the venue seen as the architectural prototype for successful orchestra halls to follow that Sir Rattle would recognize a new media prototype for connecting with audiences worldwide. This type of forward thinking and risk taking may be exactly what is needed to continue to be successful as a musician in a

changing digitally-interconnected society. By bringing the Philharmonic into the living rooms and pockets of any interested person, the Orchestra is helping to spread Scharoun's architectural vision in living form. This increases both the social and economic value of the building, both as a tourist destination as well as an educational one. The building that was criticized by engineers as being impossible to realize has since proven to be the shining example of a contemporary concert hall that continues to be ranked amongst the world's best.

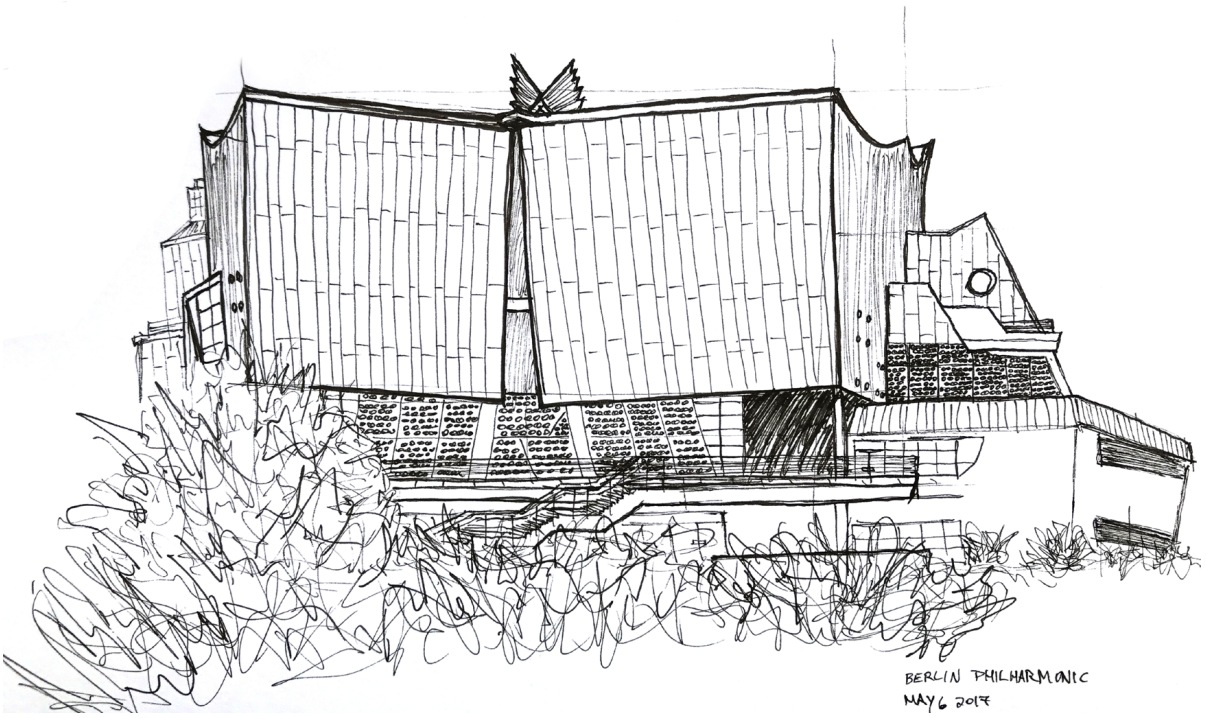

Fig. 16. Hans Scharoun. Exterior sketch of North facade. Berlin Philharmonic, Berlin, Germany, 1963.

Elbphilharmonie by Herzog and de Meuron

Fig. 1. Herzog and de Meuron. Exterior view of the Elbphilharmonie at dusk. Elbphilharmonie, Hamburg, Germany, 2017.

> "This project is a contribution to the city, because it is an expression of its spirit. Just like churches used to stand for something and skyscrapers represent an economic boom, this concert hall also expresses something...now there is a new benchmark."
>
> - Jacques Herzog, founding partner of Herzog and de Meuron

The second building studied is the Elbphilharmonie by Swiss architects Herzog and de Meuron. It is located in Germany's second largest city, Hamburg, which holds a storied place in music history as the birthplace of composers Johannes Brahms and Felix Mendelssohn.

This state-of-the-art venue is set to be the new premier destination for the performance of classical music in all of Europe, if not the world. The underlying concept for this waterfront philharmonic hall is envisioned as a glass corpus set atop a brick base - the crystal on a plinth. Dominating its place in the Hamburg harbor, this crystalline monolith with a tent-like roof shares a distinct formal similarity to the Berlin Philharmonic by Han Scharoun. As the most costly musical performance venue ever built the building is set to define Hamburg and Germany as a center of culture for the immediate future. Whether this definition will come to stand as a symbol of a contemporary democratic power or a negative reminder of political and economic failure is yet to be determined. Regardless, its position as a contemporary icon of modern construction is already beginning to be established. Analysis of this building seeks to shed light on the successes and failures of the design of this building from the viewpoint of both the everyday visitor as well as a visiting performer. Whether the investment of over $1 billion was worth this one-of-a-kind concert hall will also be considered.

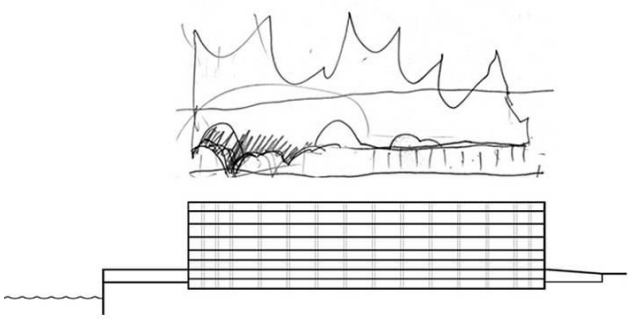

Fig. 2. Herzog and de Meuron. Original sketch concept of building. Elbphilharmonie, Hamburg, Germany, 2017. Credit Herzog and de Meuron Architects.

History

Fig. 3. Herzog and de Meuron. View of site and city of Hamburg from Elbe River. Elbphilharmonie, Hamburg, Germany, 2017.

Hamburg is a city built around its relationship to water. Once the busiest maritime port in Europe (it is still the 2nd largest), the harbor of Hamburg dominates the economic and social landscape of this historic German city-state. Historically, an affluent merchant class was supported by high volumes of trade centered on the harbor and its many canals and tributaries. The merchant class then invested in imposing houses and palaces that now make up the historic city center of Hamburg. Due to the advent of globalization, EU free trade, and massive container ships, the historic harbor, a UNESCO world heritage site along the Elbe River, was abandoned by the city it helped to shape. The undeveloped land across the river on it's southern banks would emerge as the successor to the city's evolving shipping activity

leaving the historic harbor without a clear future. In the mid-1990s, the city's downtown core was in significant need of renovation. Looking for a reinvigorating urban strategy to combat a declining inner-city population, Hamburg's government determined that the adjacent dockland was an opportunity for growth. Following an urban master-planning competition in 1997, the Dutch firm KCAP and German firm ASTOC were selected to collaborate on the future of this prime location. Labeled "the largest urban construction initiative ongoing in Europe," the result is a hugely ambitious 388-acre, 10-district development known as HafenCity. The project aims to repurpose the deteriorating Speicherstadt warehouses for contemporary uses while the deserted piers of the old harbor are planned to become home to a new urban district of offices, housing, schools, university facilities, and parks. The cultural hub anchoring the entire development, on the site of the Kaiserkaispeicher warehouse, is the Elbe Philharmonic Hall (known as the Elbphilharmonie). Private developer Alexander Gérard proposed transforming this monolithic brick edifice on the banks of the Elbe River into a philharmonic concert hall paired with a five-star hotel and apartments to help subsidize the cost of this new center for the arts. In December 2001 he contacted his personal friends and former students, architects Jacques Herzog and Pierre de Meuron, to offer them the opportunity to design this ambitious facility. During this initial informal meeting, the architects sketched a conceptual design on the back of a postcard. This spontaneous conceptual idea helped pave the way for a project that would go on to become the 16th most expensive building ever made.

In 2003 the design for the Elbphilharmonie was approved by the

Hamburg city government with a projected cost of €241.3 million, €114.3 million of which was public funds. During the next eight years, numerous delays and cost overruns occurred, including an early determination that the structure of the Kaispeicher A warehouse would not be sufficient to hold the weight of the new building addition. This resulted in the complete demolition of the core of the historic warehouse, retaining only the facade. Following a redesign of the main concert hall, gypsum acoustic wall panels created through a collaboration with world-renown acoustician Yasuhiso Toyota took over three years to produce, further delaying the project. In 2011 construction on the building came to a total standstill after the primary contractor, HochTief, believed the steel structure was insufficient to support the 3,800-tonne roof. As a result of this delay, the city of Hamburg sued the contractor, who themselves blamed the architects due to differences between the plans. While the courts decided the fate of the Elbphilharmonie, the construction site sat idle until 2013 when the contractor initiated a new deal to ensure the concert hall's completion. After an additional four years of construction, the building was finally completed in October 2016,

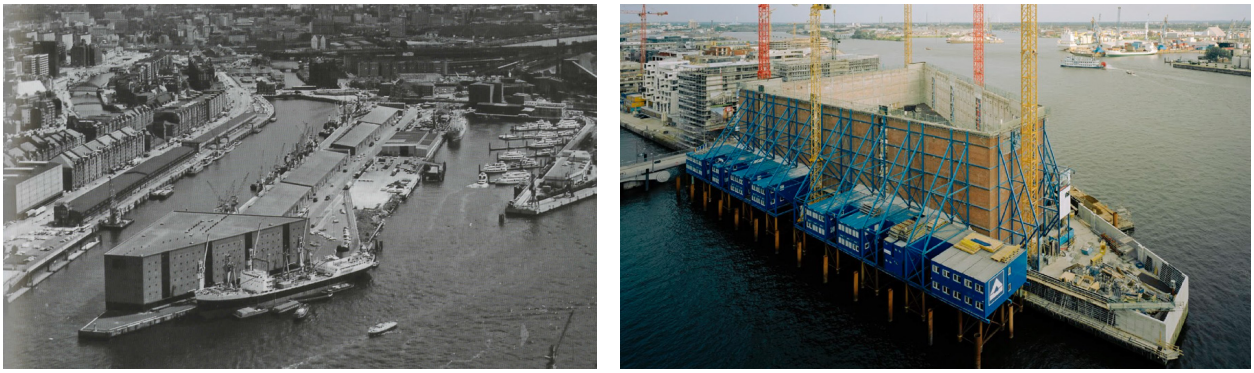

Fig. 4. Herzog and de Meuron. Speicherstadt harbor c.1960. Kaispeicher A facade after demolition of core. Elbphilharmonie, Hamburg, Germany, 2017. Photo credit Oliver Heissner/Elbphilharmonie.

almost 15 years after initial discussions on the design began. The final cost came in at €789 million (over $1 billion) making it the most expensive performing arts venue ever built.

The inaugural concert took place on January 11, 2017, with a performance of the NDR Elbphilharmonie Orchestra, resident orchestra of the new Grand Hall. The opening season sold over 500,000 tickets in the first 48 hours of the initial offering, showcasing the highly anticipated debut of this venue. Today the building welcomes thousands of visitors every day as it seeks to become the new premiere cultural destination of not only Hamburg but the whole of Western Europe.

Site

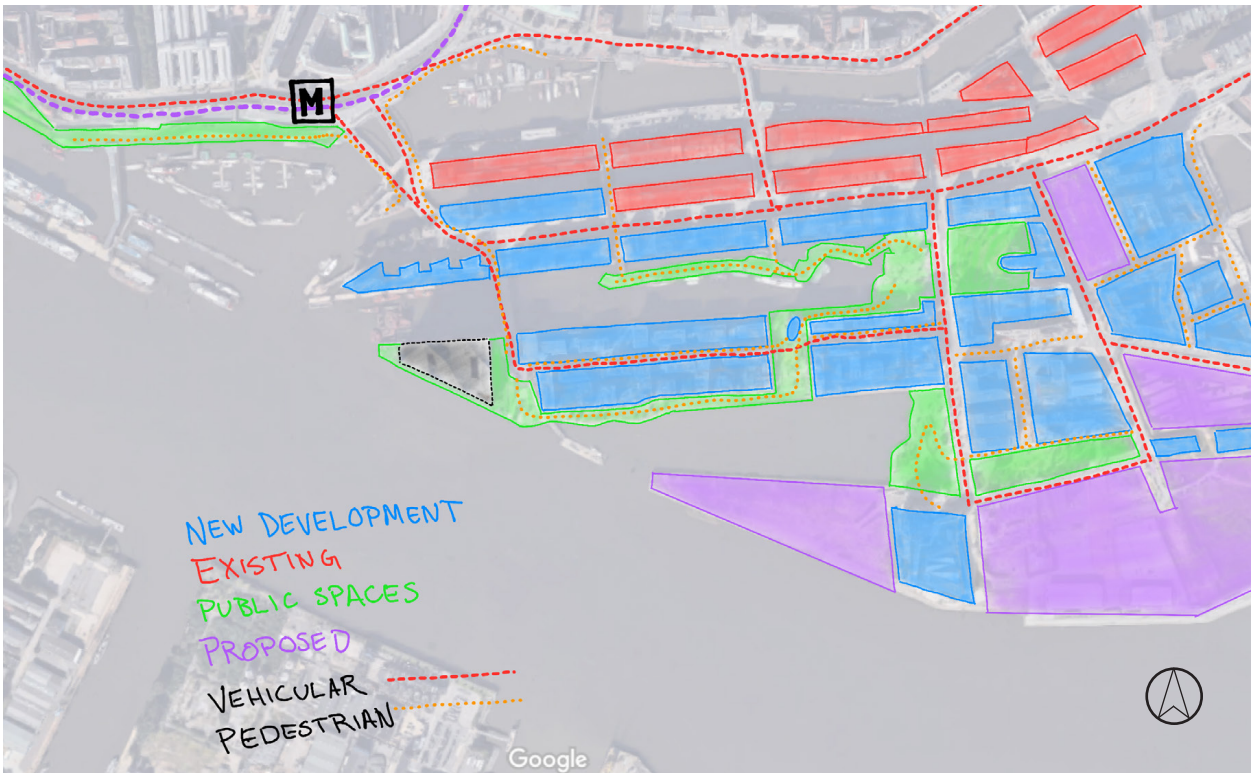

Fig. 5. Herzog and de Meuron. Aerial diagram of the site and surrounding context. Elbphilharmonie, Hamburg, Germany, 2017.

The Elbe Philharmonic serves as the cultural hub of the urban masterplan project known as HafenCity (or Port City). The building is located at the hinge point between the historic city and the container shipping port across the Elbe River. It is surrounded on three sides by water on the site of the former Kaispeicher A warehouse. The original modernist trapezoidal red-brick structure was built after World War 2 by Hamburg architect Werner Kallmorgen. It was designed to project its function as a warehouse for the bulk storage of cocoa, coffee, and tea, and had sat empty since the mid-1990's. To the north of the site lies the Speicherstadt - the heritage site containing the world's largest warehouse district - and the historic city center.

The new Philharmonic hall's location follows the guidelines of HafenCity's master plan in creating 'urban magnets'. Strategically located on the outer perimeter of the entire development instead of toward the center, the 'urban magnets' shape the ten independent quarters with specific civic and cultural functions. In this way, the Elbphilharmonie and its direct surroundings are suited to accommodate large tourist crowds while reducing the negative impact on newly constructed housing and office developments. Many of these neighboring developments are luxury apartments, each with its own expressive and unique form.

A diversity of form is a primary stipulation of the HafenCity masterplan, and this allows for a variety of building types and neighborhoods with the flexibility to adapt to unforeseen circumstances. This innovative approach to city planning has lead to a diverse, high-quality form of live/work balance supported by buildings by local and international architecture firms. Furthermore, site sustainability requirements ensure long-term performance on a site that is known to flood two or three times a year. To ensure resiliency against the elements, major pedestrian pathways are set 15 feet above water level, while street levels are set even further up to 25 feet. This effectively separates major vehicular and pedestrian traffic throughout the development. Along with close proximity to a public transit hub, this has lead to substantial pedestrian traffic presence - at times overwhelmingly so. The vehicular street in front of the concert hall is often overrun with crowds queuing to try to enter the roof level of the former Kaispeicher, now an elevated plaza sandwiched between the 'new' and 'old' elements of the building that offers panoramic views

of the surrounding city at 120 feet. The elevated plaza serves as the main entry to the concert halls, as well as an extension of the lobbies for both the hotel and private apartments. As such, it is constantly filled to near capacity with a wide variety of visitors.

Topping the old warehouse building above the elevated plaza are the new crystalline glass forms, designed to mirror the two natural features of their surroundings: sky and sea. Custom curved glass panels shaded by a printed anti-glare coating were not intended to emphasize transparency but rather to reflect the fluid nature of the Elbe River, as well as to highlight the grey-blue sky the building curves upwards to meet. Rather than mimicking traditional brick or industrial forms of the harbor, the Elbphilharmonie seeks to reflect its surroundings so the city can see itself in the design.

Fig. 6. Herzog and de Meuron. A wide variety of neighboring building forms in Westliche HafenCity and the Speicherstadt warehouse districts. Elbphilharmonie, Hamburg, Germany, 2017.

Visitor's Experience

Fig. 7. Herzog and de Meuron. View of pedestrian approach to site from metro station. Elbphilharmonie, Hamburg, Germany, 2017.

There are a variety of approaches to the Elbphilharmonie. The neighboring harbor offers sea-faring visitors the ability to take a ferry in to attend performances, and an integrated garage allows vehicular visitors to park on site. However, the most used method of approach is on the pedestrian level. Being near the Baumwell Embankment metro station, many people choose to take the elevated train to this stop and walk to the site. Upon exiting the metro stop, visitors finds themselves on the Elbpromenade, a newly constructed tiered berm that doubles as a pedestrian plaza and viewing platform looking back towards the concert hall. This promenade, finished shortly after the Philharmonic, has imbued a sense of arrival to pedestrian visitors and has animated a previously industrial dock into a gathering space by the water. The visitor then heads towards the western edge of HafenCity, over the mouth of the inland port, past the historic

Fig. 8. Herzog and de Meuron. Pedestrian access to the elevated plaza involves buying a ticket, arriving at an assigned time, and going through security. Elbphilharmonie, Hamburg, Germany, 2017.

Speicherstadt warehouses, across the Mahatma Gandhi Bridge, and arrives at the site of the Elbphilharmonie. The imposing brick face of the former Kaispeicher A warehouse gives way to the looming glass monolith sitting on top. An open public square, often overflowing with visitors and tourists, obscures the entrance, a nondescript shaded slit at the base of the building. Here, the visitor can make their way to an underground parking garage, the hotel check-in, the ticket lobby, or to the primary entrance to the Elbphilharmonie: a massive, curved escalator that terminates at an elevated plaza providing 360-degree views of the city and harbor.

This escalator is designed as a transitional zone, ascending visitors from compressive and dark to open and light. Covered in glass discs reminiscent of the dot-matrix screen patterning on the glass facade, the grand escalator draws visitors through the depths of the old warehouse base and lands at an open, airy plaza of glass, sea, and sky. Originally this plaza was intended to be completely public, accessible 24/7 to visitors and residents as the new meeting center of the Westliche HafenCity district. However, due to unforeseen tourist popularity and security concerns, visitors hoping to experience the views must pay €10 for a ticket with assigned times for entry. This has turned what should be a dramatic and democratic entry sequence

into a massive queue like those for an amusement park attraction, with crowds overwhelming ticketing staff and regular police presence. This also prevents free exploration around the base of the building. Those lucky enough to secure tickets for scheduled performances at one of the three concert halls are the only members of the public that can access the elevated plaza without an additional ticket, though entry is limited to two hours before each scheduled performance.

Just as the commanding masses of glass and brick define the outward presence of the Elbphilharmonie within its seaside context, the open void between these two volumes also defines the heart of the complex. The plaza is presented as an interface between two worlds: the continuous brick floor of the Kaispeicher warehouse gives way to a mix of stucco, glass, and wood that emphasizes the new cultural magnet. The shared lobby serves as the central hub to all aspects of the visitor experience: a panoramic viewing balcony, the main hotel lobby, two restaurants, a café, a gift shop, and entry to the two main concert halls through grand, spiraling concrete stairs. In the lobby visitors feel the energy and weight of the main concert hall suspended overhead, dipping into the shared space like a bulging white belly. On the North and South sides of the plaza,

Fig. 9. Herzog and de Meuron. Visitors ride up a curved escalator to reach the plaza. Elbphilharmonie, Hamburg, Germany, 2017.

Fig. 10. Herzog and de Meuron. The viewing plaza overlooking the harbor is an incredibly popular attraction, especially at sunset. Elbphilharmonie, Hamburg, Germany, 2017.

soaring white stucco-clad arches appear carved out of the ceiling plane, opening up view corridors meant to emphasize the church towers that dominate the skyline of the historic city center. Marking these views are over 500 spherical globe lanterns grouped near entries and exits, and these lights provide a subtle way-finding element. This airy space provides the perfect release from the condensed feeling of the escalator entry. It is unfortunate that a plaza meant to become an extension of the public realm is now reserved for those lucky enough to afford to pay to see it.

Performer's Experience

Visiting or resident performers enter through the long first-floor passageway (or Nordgang) past the ticket office to a set of private elevators on the eastern corner of the Elbphilharmonie. Due to the peculiarity of the concert hall being located 12 stories above ground, the building is also equipped with a massive freight elevator and two private banks of elevators specifically for performers and performance equipment. One of these elevator banks terminates at the shared plaza on Level 8 while the other continues up to the main Grosser Hall on Level 12. This floor serves as the domain of the visiting performer. Unlike so many concert halls around the world, where dressing rooms and rehearsal areas are tucked away in the bowels of a basement or regulated as afterthoughts in the design, those at the Elbphilharmonie are afforded some of the most luxurious accommodations in the complex. Each of the six soloist's rooms, the two conductor's chambers, the shared performer's café/lounge, the dedicated tuning room, the break room (also know as the green room), as well as the numerous group dressing rooms are equipped with floor to ceiling windows providing performers with open views across the city and port of Hamburg. The conductor's chambers are particularly hospitable, with dedicated rooms for meetings and full en-suite bathrooms. Group dressing rooms come equipped with built-in lockers, each designed to meet the needs of the specific instruments and performers.

Fig. 11. Herzog and de Meuron. Second violin group dressing rooms with built-in lockers. Elbphilharmonie, Hamburg, Germany, 2017.

Nearly every backstage area is provided with either an operable oval aperture or a convexly curved glass balcony, granting easy access to the open sea air. Just like residents of the luxury apartments or visitors to the four-star Westin Hotel located within the building, the performer's spaces are designed to treat them as welcome guests.

Backstage areas directly servicing the main stage are accommodating; however, the location of some of the diagonally structured support columns tend to restrict circulation in certain spots. Also, because the dressing rooms are distributed over three levels, it can be more difficult for a performer to accomplish things like quick costume changes without alternative accommodation. While not specifically necessary in a philharmonic hall meant mainly for musicians, the Elbphilharmonie also welcomes opera and alternative art performances, which often prefer such backstage flexibility. Another unusual feature of the backstage area is the direct proximity to one of the penthouse residences. This four-bedroom luxury apartment shares a stair entrance with the backstage area, and although it would

Fig. 12. Herzog and de Meuron. Artist's lobby on Level 12. Elbphilharmonie, Hamburg, Germany, 2017. Photo credit Nina Struve.

not commonly be used as a primary method of entry, it does feel uncomfortable that a private resident and performers could cross paths so freely, not to mention raising security concerns. More than likely a result of designing the program to fit within the trapezoidal footprint of the building, these backstage elements are nonetheless peculiar in their execution. Even though backstage areas suffer from a lack of flexibility, dressing rooms are located too far from performance spaces, and proximity to residential units are a concern, the generous consideration of shared backstage areas and material finishes are highly successful.

The Elbphilharmonie contains three dedicated performance venues: a flexible black-box called Kaistudio 1, a wood-wrapped Recital Hall, and the heart of the Philharmonic, The Großer Saal (Grand Hall). Performances have also been held in the plaza, as well as in the multi-story Großer Saal foyer.

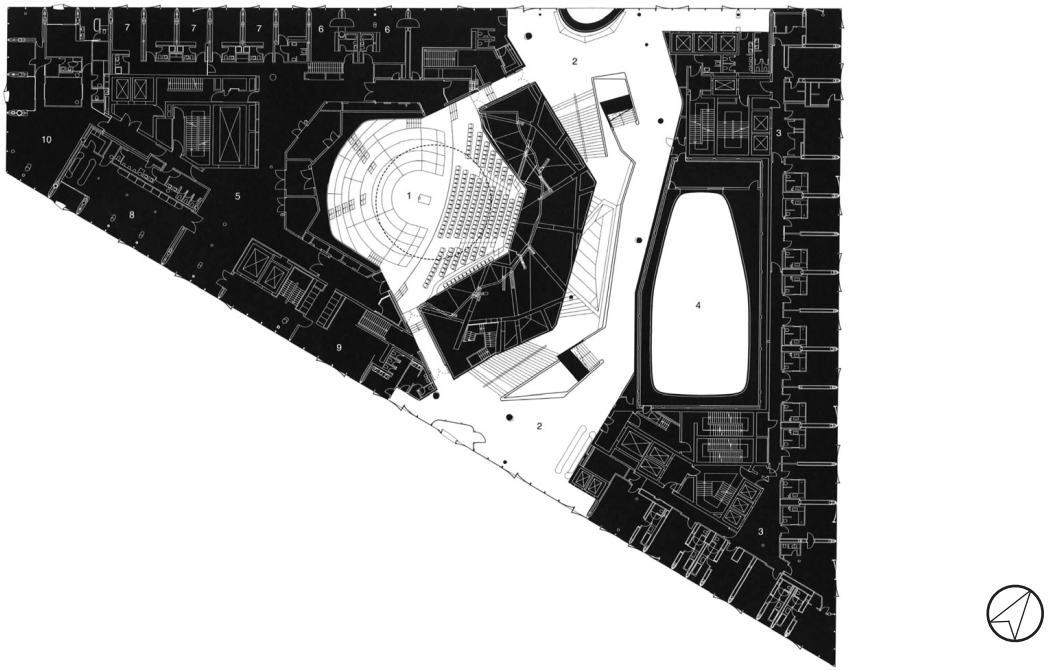

Fig. 13. Herzog and de Meuron. Plan of Level 12 includes Großer Saal main stage, backstage areas, dressing rooms, green room, and tuning room. Elbphilharmonie, Hamburg, Germany, 2017. Image credit Herzog and de Meuron Architects.

Acoustics

Fig. 14. Herzog and de Meuron. Interior panorama of the Grand Hall. Elbphilharmonie, Hamburg, Germany, 2017.

In their interview with Architecture + Urbanism magazine, Elbphilharmonie architects Jazques Herzog and Pierre de Meuron described the interior of the concert hall as a combination of three distinct performance venues from history: the Greek Amphitheatre at Delphi, Shakespeare's Globe Theatre in London, and a marquee or festival tent. Having become world-renown for their art gallery and exhibition spaces, the architects took on their first Philharmonic concert hall design with these three sources of inspiration in mind. They invited the Japanese acoustician Yasuhisa Toyota of Nagata Acoustics to collaborate on the design of the Grand Hall. Known for his acoustic success at venues like the Walt Disney Hall in Los Angeles and Shanghai Symphony Hall, Toyota was an integral member of the design team from early in the project. Starting in 2006, the design team visited numerous performance venues, taking the best elements from each. Thankfully they did not have to travel very far to reach the most revered music hall to the German people: Hans Scharoun's

Berlin Philharmonic. Herzog and de Meuron were inspired by the democratic nature of this concert hall for the people, and they were drawn to the vineyard style arrangement of the audience wrapping the stage and enveloping the performance. The form of the Berlin Philharmonic coincides with the shape of the original inspiration venues, the Globe and the Theatre at Delphi, and mimics the roof form of the curvilinear draping of a festival tent. To make this design their own, the architects had to contend with the limited footprint of the trapezoidal shape of the Kaispeicher A warehouse. Birgit Föllmer, Project Manager for the concert hall of Elbphilharmonie at Herzog and de Meuron, describes the differences between these two German performance halls:

> "Scharoun's design [is] like a hall carved out of a soft landscape. He had much more room to realize the cascading vineyard style. Here the site is more restricted, we have less space to work with. The balconies are more vertical, everything is much taller, but that allows the space to be more intense and intimate. While the original idea was the same, the site forced us to come up with something unique."

By exploiting the constrictions of the limited floor area, the six levels of balconies are pulled so close to the stage that they enclose it like a protective shell. This proximity is part of the effort to make a 2,800 seat concert hall feel intimate: No seat is less than 30 meters from the conductor, which helps to break down barriers between performers and audience members. The effect is akin to sitting in the front row no matter where your seats are actually located in the hall.

The architects imagined the Grand Hall to feel as if it is carved out of stone. This, along with the acoustic demands of the venue, leads to the unique interior finish of the wall surfaces. Over 10,000 acoustic gypsum fiberboard panels clad the space, and each is individually milled to form, with no two alike. Mounted on vibration isolating springs, the panels are the result of computer simulations by Toyota and Nagata Acoustics to replicate the acoustic effect of plaster sculpture and ornamentation traditionally found in 18-19th-century music halls. These plaster statues help scatter sound evenly throughout a performance space, often leading to excellent acoustic performance. The high-density gypsum panels achieve this effect as well. They are created through a process of mixing recycled parchment paper pulp with gypsum powder, then compressing this mixture at high heat to achieve a very dense but porous finish. After drying, each panel is finished with hundreds of unique CNC-milled concave indentations called microshaping that ensure sound is distributed optimally to each patron. Custom algorithms determined the individual depth, density, and arrangement of each panel, which then took over three years to manufacture. Described as biomorphic coral or elephantine in their appearance, this gray skin visually defines the interior of the hall.

Fig. 15. Herzog and de Meuron. The milled gypsum panels achieve similar acoustic effects as plaster ornamentation used in 19th century concert halls such as Symphony Hall in Boston, MA. Elbphilharmonie, Hamburg, Germany, 2017.

Numerous other acoustic elements help refine the performance of the Grand Hall. Due to the sheer verticality of the balconies, the back wall is undercut, and the ceiling pulled up and tilted inwards, resulting in traditional house-like sectional forms that create right angled planes facing the stage. This allows sound to reflect back towards the performers on stage and around the back of listeners, creating a sense of acoustic immersion. In addition, the underside of the balconies are sloped to ensure uninterrupted sight-lines, difficult to achieve in such a tall volume.

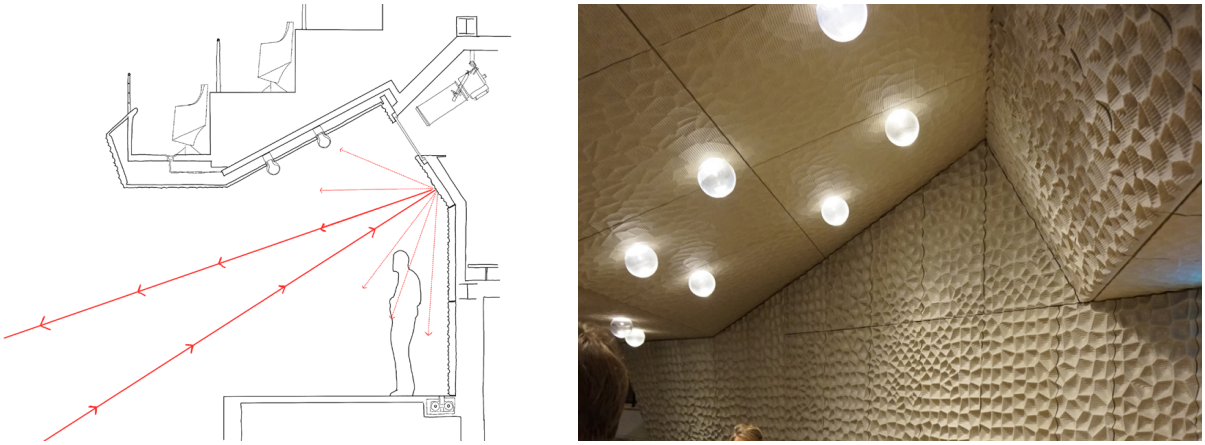

Fig. 16. Herzog and de Meuron. Unique shapes of back walls underneath balconies create surfaces for direct sound reflections and improved sight lines. Elbphilharmonie, Hamburg, Germany, 2017.

Although the Grand Hall was designed for unamplified music performance, the space can also adapt to other types of performance styles. A series of over 1000 m^2 of retractable acoustic curtains can be utilized to dampen amplified music. These curtains extend out of the ground using a modified sun-shade system, and they can be individually adjusted through automation to fit the acoustic needs of the performance. In addition, speakers were added along the upper neck of the suspended sound reflector, as well along the underside of balconies, to allow for spoken word or electric music performance.

The most visually apparent acoustic element is the 15m tall sound canopy suspended over the center of the hall. Given the additional height of the Grand Hall, the architects were forced to lower the ceiling above the stage in order for an orchestra to hear each other clearly during a performance. Rather than utilize many smaller acoustic sails and clouds, as seen in the Berlin Philharmonic, Herzog and de Meuron opted for a large sculptural object that serves many different functions within the space. This mushroom-shaped chandelier not only reflects sound but also features integrated spotlights, speakers, and microphones. Its support structure is strong enough for rigging points and even includes a satellite interface of the hall's pipe organ, known as the Echo, which allows the in-house organ player to perform from a dramatic elevated location above the audience. A ladder and a series of catwalks, hidden behind a scrim-like fabric wrapping the neck, allow for ease of access to this suspended object from above.

Fig. 17. Herzog and de Meuron. The suspended sculptural sound canopy integrates retractable speakers, spotlights, microphones, and lighting rigs. Elbphilharmonie, Hamburg, Germany, 2017.

Details and Materials

Material use within the Elbphilharmonie is an essential consideration of the design. In an overall effort to emphasize the difference between old (Kaispeicher A) and new (glass volume perched above), the architects strove to highlight the industrial characteristics of the existing port while juxtaposing it with a light and airy language in the new mass above. This effort is most evident in the elevated plaza, where the brick of the original warehouse has been replicated as the plaza flooring, while sinuous concrete and white plaster swoops overhead. Between the two materials is a series of undulating glass faces, evocative of the waves of the Elbe River twelve stories below. In addition to the brick flooring, a subtle accessibility-themed way-finding element is found on the floors throughout the Elbphilharmonie. Small raised pills of textured metal are installed in the median of all high-volume areas, leading to circular discs that act as nodes between destinations in the building. They allow those with limited sight to feel their way around the building, a detail that often goes unnoticed by many visitors.

The curved glass found in the plaza is also used along the faces of the new crystalline volume above. Two types of curvature were chosen to create a variable and dynamic flow to the all-glass facades, and variations on mirroring and inversions achieve a high variety of visual forms. These curves also allow for each of the 244 hotel rooms, as well as each of the 45 apartments, to have access to natural sea air. Elongated porthole-style apertures can be opened to allow the smells and sounds of the Elbe into each unit. Added to the glass

is a double printing of both dark and reflective dots that shade the glazing at the edges while leaving a clear view in the middle. This, along with individually controlled automated shade canopies, provide an element of privacy to guests behind the glass facade. In this way, the dot matrix pattern frames the user's view out and helps protect against excessive direct solar heat gain.

Fig. 18. Herzog and de Meuron. Variations on two curved glass forms allows for a dynamic facade, as well as places for operable windows and balconies. Elbphilharmonie, Hamburg, Germany, 2017.

One detail that is not as thoughtfully considered is found within the Grand Hall. To make the space as visually cohesive as possible, handrails are very seldom installed. Also, due to the unique biomorphic form of the space, many of the stairs are of a different dimension from tread to tread, fluctuating between 8-16 inches deep depending on their location. As many of the visitors enter the hall, and doubtlessly look up to marvel at the space, they are in danger of tumbling down these inconsistent stairs. The author witnessed this effect numerous times, a real danger considering that many of visitors are above the age of 65. This safety concern may be one detail that will force renovation at some point in the future.

Social and Economic Responsibility

Architecture is not created in isolation. The circumstances buildings are design and constructed within influence the result of any project. In democratic societies, these influences include politics, financial institutions, media, and public opinion. In the case of the Elbphilharmonie, the project started out as the idea of a private investor. Initial designs were overwhelming embraced by the public, however, the project ended up changing hands to the government representing those people. During this transition, a cacophony of constituent voices from a variety of interest groups had a significant effect on the timeline of the project. The public's elation with the initial design, published in newspapers and online worldwide, carried the project for the first few years. However, rampant delays in planning, political oversight, infighting amongst planners and the general contractor, and rapidly rising costs complicated the construction. At one point the completion of the entire project was threatened. These complexities came at an immense social and economic price to the people of Hamburg. Media outlets throughout Germany published hundreds of articles outlining, and often intensifying, the soap-opera drama that followed the construction process. Herzog and de Meuron even presented an exhibit on the coverage at the Venice Biennale of Architecture in 2012. The exhibit covered how the initial euphoria that followed the project slowly gave way to criticism, and ultimately protest and bitterness from many outside voices. It wasn't until the building was completed in January 2017 that these concerns begin to abate.

Due to the imaginative design and exceptional quality of the finished product, the Elbphilharmonie has thus far overcome years of consternation to deliver a well-regarded architectural success. However, this success does come with ramifications, some of which have already begun to affect the day-to-day operations of the Philharmonic Hall. The elevated public plaza on the roof of the former Kaispeicher warehouse, originally designed and advertised to be open year-round as a new public plaza, has been reserved for ticket holders since the building's inauguration. By restricting this space behind a pay-wall, the plaza now imbues the building with a sense of privilege and exclusivity This is the opposite of the original intent to showcase it as a hub of democratic and social gain. As opposed to Scharoun's 'gift to the people' at the Berlin Philharmonic, the Elbphilharmonic comes across as a seaside fortress rather than a welcoming beacon. The dominating presence of the plaza and glass addition high above the harbor in Hamburg only enhances this perception.

Perhaps anticipating these adverse preconceptions, the author is glad to see that those running the Elbphilharmonie are investing in many new educational opportunities to help make the building more accessible to the local community. Christoph Lieben-Seutter, general director of the Elbphilharmonie, introduced new concert formats and educational offerings at locations throughout the city starting in 2009. Those educational opportunities are planned to increase from 50 to 150 annually at the Elbphilharmonie, and this includes seven studios dedicated solely to that use. The author also had the pleasure of attending a performance in the Grand Hall of composer Terry Riley's >>In C<< that featured an orchestra composed of over 500 local

performers and volunteers, ranging in age from 6 to 87. This performance showcased the immense public desire to learn and participate in the everyday life of the building. Along with dedicated education outreach programs, these examples bring hope that the Elbphilharmonie will not fall victim to its oversized budget, and that it will welcom the pulbic as the premier destination for music performance in Europe.

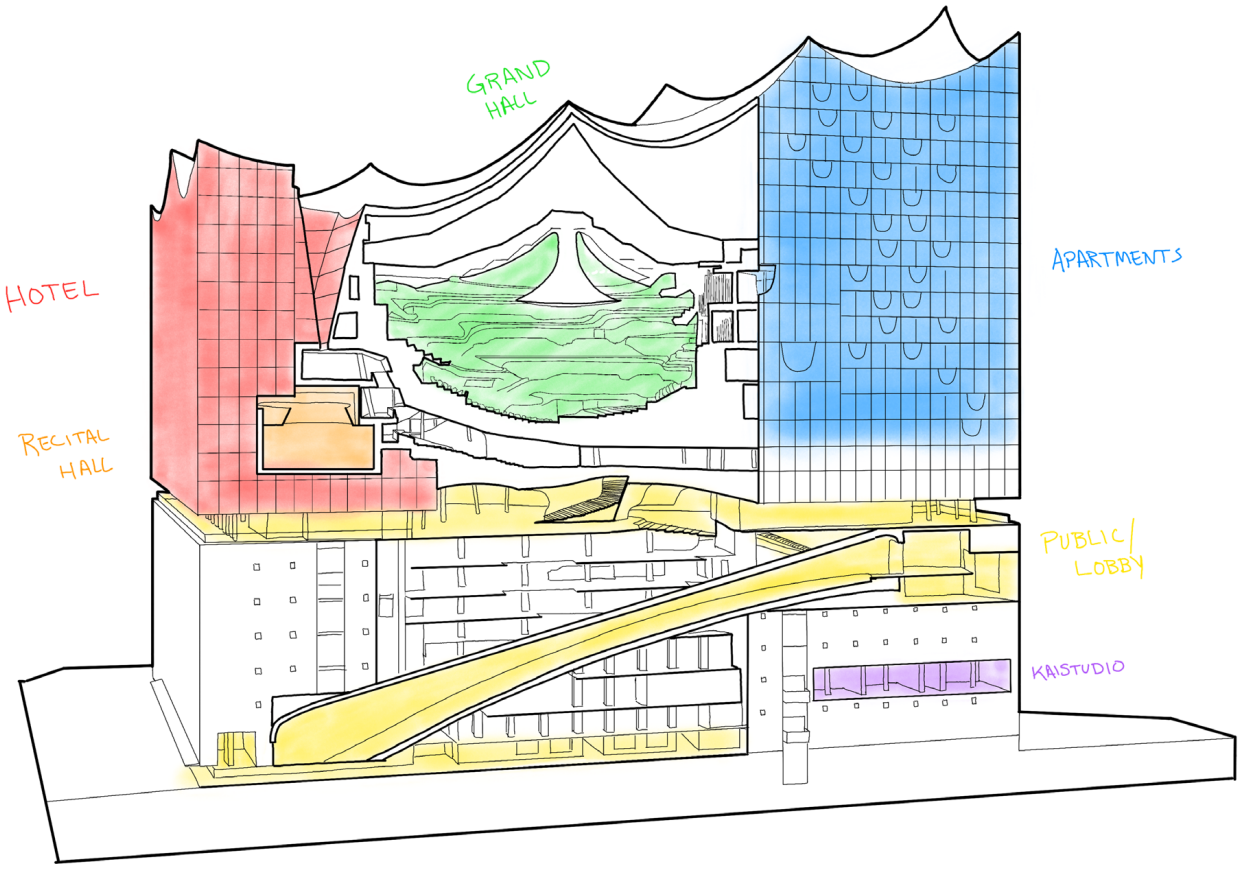

Fig. 19. Herzog and de Meuron. Sectional perspective program diagram. Elbphilharmonie, Hamburg, Germany, 2017.

Harpa Concert Hall and Conference Center by Henning Larsen Architects

Fig. 1. Henning Larsen Architects. Exterior view of the Harpa Concert Hall and Conference Center, Reykjavík, Iceland, 2011.

> "Architecture consists of the same elements as music, namely, a form, a pause, rhythm; the way in which form and space are linked together."
>
> - Henning Larsen, founder of Henning Larsen Architects

Contemporary concert and performance halls have become more than acoustically tuned vessels in which to experience live music and dance. More often they come to stand as symbols of greater significance, as great monoliths to a shared cultural identity. They can also represent a rise from difficult times and the dawning of a prosperous future. The Harpa Concert Hall and Conference Center by Henning Larsen Architects attempts to embody these aspirations. Completed in the midst of a

massive financial crisis in Iceland in 2011, Harpa shines as a hopeful beacon towards what this island nation has the capability of becoming. Perched on the shore of the Greenland Sea in the harbor of Iceland's quaint capitol city, Harpa's glittering form towers over the water to create an instant visual landmark. Rather than feeling imposing, this unique glass structure serves as a gathering point inspired directly by the stunning natural topography that surrounds it: ice covered volcanoes, hexagonal basalt columns, and the technicolor light show of the Aurora Borealis. As the country emerges from their financial lows, the Harpa Concert Hall and Conference Center stands ready to welcome a new age of Iceland as a must-see destination.

In their self-published book on their own contemporary music venues, Peer Teglgaard Jeppesen, and Louis Becker, current partners at Henning Larsen Architects, describe the firm's approach to designing such spaces:

> "Operas, concert halls, and other music venues are not only for listening. They are also about seeing and being seen…[they] are based on a unique incorporation of daylight to create distinctive architectural spaces with a special Nordic atmosphere. The open spaces and feeling of transparency in the buildings facilitate and promote social interaction. In our view, this is the essence of architecture."

While visually and experientially the Harpa Concert Hall and Conference Center is an undeniable architectural icon, socially and financially the project is still a work in progres. In a time when many Icelandic

people were losing their homes and businesses, the government took it upon itself to take full control over the project, sinking billions of Icelandic Króna into completing construction. As the novelty of a new glacier-like performance venue wears off, will this building stand as a symbol of resurgence or a painful reminder of what could have been? Only time will tell. Analysis of this building explores how the architects, along with artistic collaborator Olafur Eliasson, took inspiration from naturally occurring formations to create a concert hall fitting to its place and site.

History

Fig. 2. Henning Larsen Architects. Context view of downtown Reykjavik from the tower of Hallgrimskirkja Church. Reykjavik, Iceland, 2011.

The Harpa Concert Hall and Convention Center was born out of a 120 year desire for a music house by the citizens of Iceland. Serious discussions for a dedicated concert hall began in 1983, with private music enthusiasts calling for donations to the raise funds. This proved to be a fruitless endeavor, as a country with a population of under 300,000 couldn't possibly afford to raise funds necessary for construction on private backing alone. It wasn't until the mid-1990s when the state of Iceland and the city of Reykjavik decided to take part as a partial-public backer that plans really began to take shape. The project was officially initiated in 2004 as a PPP-competition, which means that the competing project teams were responsible for financing, construction and operations themselves. The competition

was won by the design team of Copenhagen-based Henning Larsen Architects, Icelandic firm Batteríið Arkitektar, and artist Olafur Eliasson, with the primary support of the private Icelandic bank Landsbanki. Construction began in 2007 as the impetus of what would soon follow: an ambitious and massive redevelopment project titled "World Trade Center Reykjavik". This redevlopment would include not only a concert hall, but also a congress center, a five-star hotel and wellness center, an academy of fine arts, a bank headquarters, a cinema, a new shopping street and urban plaza, and a number of residential and commercial buildings along the shores of the formerly industrial fjord. After Iceland's economic crash of 2008, it was discovered that the project's primary investor had not actually placed any real capital into the project. With all loans coming from the now defunct bank construction was halted and Harpa was left as half-complete concrete shell in the harbor.

After much public debate, the Icelandic government decided that rather than leave the building a ruin, it would be better to seize control of the project and see it through to completion. In 2009 construction resumed, and for nearly 2 years it was the only ongoing construction project of any scale in the entire country. Although exact figures are debated, it is said that an additional $145 million was needed to complete construction. Henning Larsen Architects were also were asked to develop a plan to revitalize the area around the new theater and East Harbor. The building was inaugurated in May 2011 with a performance from the Iceland Symphony Orchestra, which now calls the building home. The venue was given its name 'Harpa' on the Day of Icelandic Music, December 11, 2009. In Icelandic, Harpa

Fig. 3. Henning Larsen Architects. Proposed masterplan for the East Harbor. Image credit Henning Larsen Architects. Harpa Concert Hall, Reykjavik, Iceland, 2011.

literally translates to the word 'harp' but also refers to the first month of summer in the old Nordic calendar. 'Harpa' is also one of the most popular government approved names for newborn girls in Iceland. Today the 28,000 m^2 venue hosts a wide variety of performances and conferences on a variety of scales, utilizing four performance halls, exhibition spaces, large overlapping pedestrian balconies, and several meeting rooms scattered throughout the multi-level, 24/7 accessible public lobby.

Site

Fig. 4. Henning Larsen Architects. Aerial diagram of the site and surrounding context. Harpa Concert Hall, Reykjavik, Iceland, 2011.

The old harbor on the shores of the Greenland Sea is the heart of Reykjavík. Iceland has always been a maritime country with an explicit affiliation for the sea. The island nation, founded by Nordic sailors around the 9th century, was first settled in Reykjavik. The city essentially grew out of the ocean, and the harbor was the lifeblood of the community for its food supply and trade to mainland Europe. In recent years, as sea-based industry in the region has waned, tourism has emerged as the primary economic industry in Reykjavík. The Harpa Concert Hall and Conference Center is located adjacent to the old harbor, across the fjord from the small Engey Island. Serving as a backdrop to the site are some of the many active volcanoes of Iceland.

Ambitious expansion plans for the East Harbor are just starting to be realized, and new plans for a mid-rise luxury hotel, an art academy, a cinema, and a new shopping center are currently under construction on the neighboring site to Harpa.

The historic Icelandic building type is generally a two-story 'sea-shanty' often with colorful corrugated metal siding. Many examples of this construction can be found clustered throughout Reykjavík, most notably up and down Laugavegur, the main road running the length of the city. This shady, cobblestone-lined pedestrian street terminates at a large hillside park, which overlooks the Harpa site. In contrast to these traditional buildings and streets, the isolated location of Harpa at the edge of the water allows the facades of the concert building to absorb and reflect changing climatic and light effects. Harpa's massive glass facades were specifically designed to fluctuate and change throughout the day and night, sometimes blending in with the overcast sea sky, sometimes shining proudly against the natural beauty. This prime peninsula location also assures Harpa constant visual exposure from all sides. As stated by the architects, this intent to "see and be seen" is instrumental in the design of the ever-changing glass facades and is achieved no matter how a visitor approaches the site.

The glass facades, designed as a permanent art installation through a collaboration with Icelandic-Dutch artist Olafur Eliasson, are the main aesthetic draw of this building. The most striking side is the main south-facing facade. Composed of over 1,000 unique hexagonal glass and steel blocks, they are inspired by the crystallized basalt column formations found in Iceland. This effect is an ever-changing

kaleidoscope of color that serves as the public face of the concert hall and its most memorable feature. In some instances, this could be considered as reducing a building to a skin, but here the collaboration works so seamlessly with the rest of the building that it becomes more than just a pretty face. The intricate facade defines and highlights the one of country's best natural features, its dramatic light. This heavy use of glazing, possible only in a subarctic climate such as Iceland, enables visual access features of the natural land and water surrounding the site.

Fig. 5. Henning Larsen Architects. Panoramic view of the site and surrounding new construction from Arnarhōll Park. Harpa Concert Hall, Reykjavik, Iceland, 2011.

The glass also changes at night through LEDs embedded within the glass blocks. Harpa even holds a yearly design competition for light installations. These installations are sometimes interactive multimedia pieces that engage with the local community, as seen in the installation "PONG" by Atli Bollason and Owen Hindley in 2014, that encouraged visitors to play the classic arcade game on their smart phones and see it displayed on the 6-story tall south facade. These interactive installations, along with new construction around the site, point towards new interest in re-vitalizing the harbor.

Visitor's Experience

There are two primary methods of approaching the site of the Harpa Concert Hall and Conference Center. If arriving by car, visitors travel on the Sæbraut highway along the eastern shore to a 545-space parking garage built into the basement levels of the venue. However, most visitors choose to walk to the site from the city center or along the waterfront from their hotels. Due to the orientation of the building, it doesn't necessarily have a front or a back; rather, it has directions of approach. As such, each entry is tuned to those who would most likely use it. The main entry to the public lobby is tucked underneath the three-dimensional expressive glass block facade facing South towards the city center. To the West is an entry which leads directly into the main conference hall, and this is used exclusively for private events. To the East, next to the loading dock, is the most private entry used by performers, office workers, and everyday staff of the premises.

Fig. 6. Henning Larsen Architects. Main entry, performers entry, and entry for private events. Harpa Concert Hall, Reykjavik, Iceland, 2011.

Approaching the building on foot, visitors cross over one of three pedestrian paths, over a shallow wading pool dotted with sculptures dedicated to the arts, and follow a gentle stream to the

public entry. Passing by a sizable gift shop featuring the work of local Icelandic artisans, the visitor arrives in the main lobby. The lobby is a six-story tall, light infused collection of overlapping balconies and stairs. As it is accessible at nearly all times, this space is full of things to do and includes the box office, 2 restaurants, an art gallery, a store specializing in high-end Scandinavian furniture and clothing design, and access to 2 large exhibition/gathering halls. The multi-level collection of stairs and balconies surrounding the lobby allows visitors to enact the design intent, "to see and be seen". This is most evident in the monumental front stair that runs the length of the south facade. It is organized as a series of landings for small informal group gatherings. Described by Danish philosopher and architecture critic Christian Bundegaard,

> "…the furnished platforms are the perfect, vertical catwalk to see and be seen now that you have dressed up and gone out…"

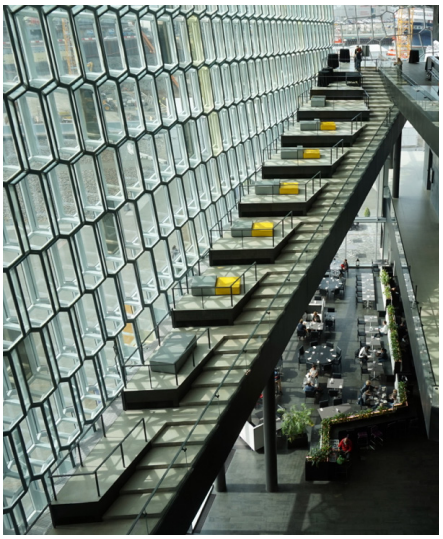

Fig. 7. Henning Larsen Architects. Tiered stair landings. Harpa Concert Hall, Reykjavik, Iceland, 2011.

The public lobby wraps around the two central cores of the building, which hold private meeting rooms, offices, and the 4 concert halls. These massive cores are realized in a dark black concrete tinted using local volcanic ash. They provide an eloquent backdrop to the play of colored light dancing through the facades during your visit. Looking up, visitors notice that they are also being viewed from above by a ceiling covered with hexagonal mirrors

angled perpendicular to the glass bricks of the facade. This lofty volume is reminiscent of both a cathedral lined with stained glass as well as an interactive science and education center for children. This inhabitable work of art elicits an element of public amusement and enthusiasm rarely seen in the built form. Throughout the author's time on site, this lobby was continuously populated with people fascinated by this ever changing and highly engaging space.

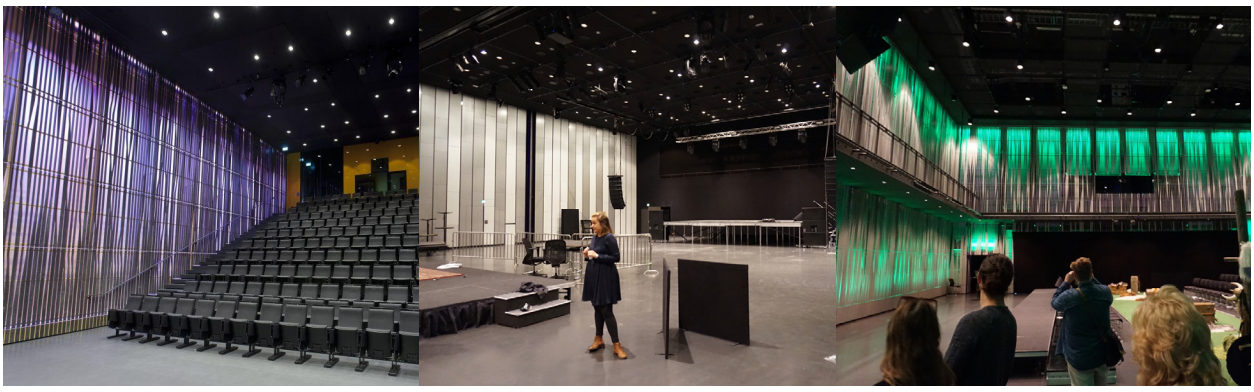

Fig. 8. Henning Larsen Architects. Interior of performance halls: Kaldalón, Silfurberg, and Nordurljós. Harpa Concert Hall, Reykjavik, Iceland, 2011.

As the visitors rise up the broad, central staircase from the lobby to the second level, the dark concrete walls envelop them and the enclosed halls become more apparent. The names of the main halls stand in subtle contrast against the black walls, and each plays on the historic and poetic mystery of the Icelandic tundra. Kaldalón is named after a blue-colored bay in Iceland, Silfurberg means 'silver rock' after the locally characteristic calcite crystal formations, Nordurljós is translated to mean 'the northern lights', and the largest of the halls, Eldborg, is the fire-breathing name given to Iceland's largest volcano.

The halls are designed to function independently of each other so that different events can occur in tandem without interference. This

allows many different types of visitors to come in contact with each other along the overlapping, irregular balcony levels. The performance halls and their lobby-balconies face towards the South, so at night guests can take in a view of the city rather than the blackness of the cold ocean. This is based on custom that fishermen have traditionally built their houses with the living room facing the land so they do not have to look at their workplace while at home. Of all the venues studied herein, the Harpa Concert Hall certainly contains the most visually dynamic public lobby space.

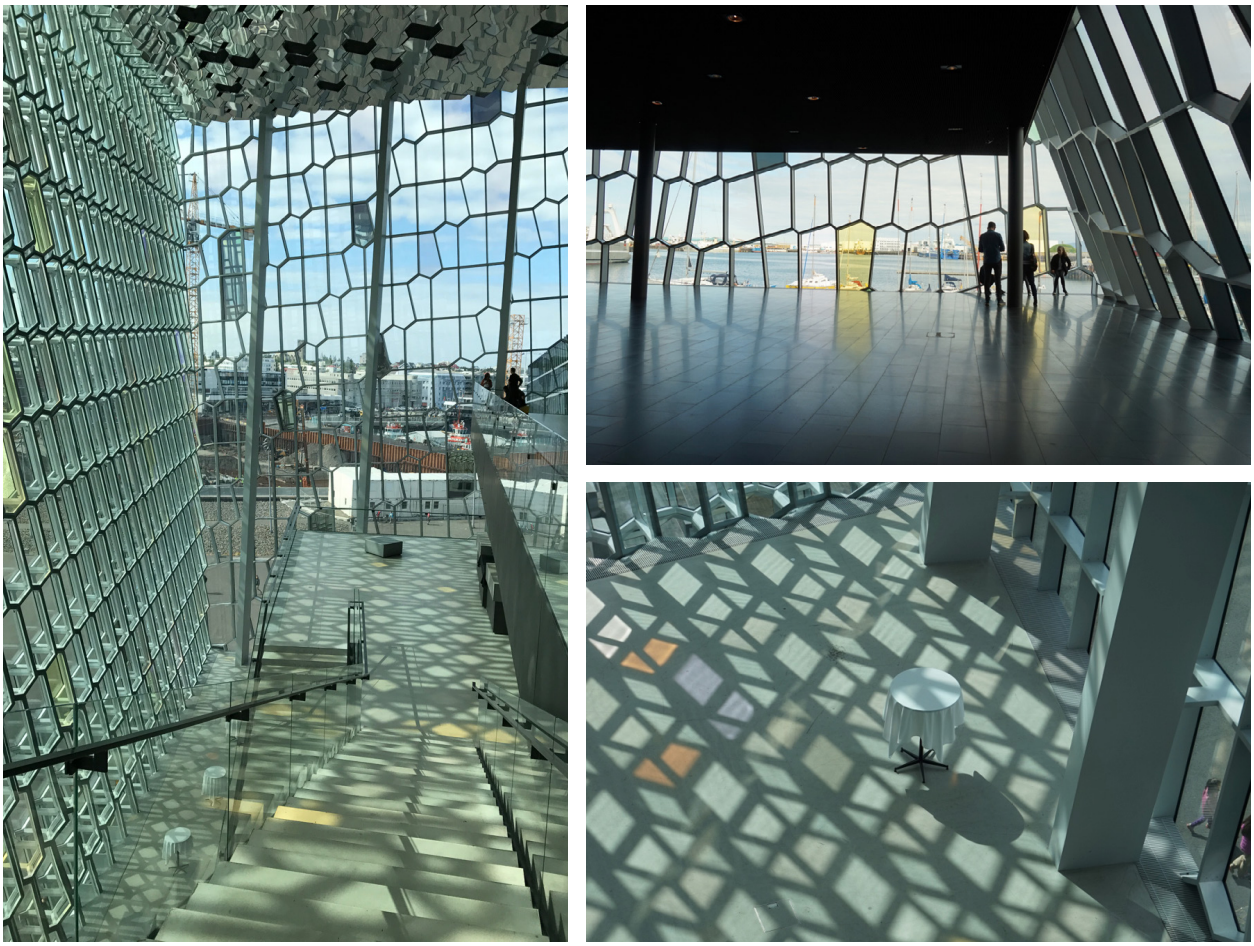

Fig. 9. Henning Larsen Architects. Interior of public lobby and facade lighting effects. Harpa Concert Hall, Reykjavik, Iceland, 2011.

Performer's Experience

The performer's sequence of arrival begins in one of two ways: through a private service entrance at the North-East side of the building, or through the public lobby to a card-access required hallway running along the North facade. The entirety of the Northern side of the building is dedicated to the performers, stage-managers, and stagehands, which includes 8 levels of dressing rooms, storage areas, dedicated backstage access to 3 of the 4 performance spaces, a freight elevator for loading and unloading of large sets, rehearsal space, and a private kitchen/café for the sole use of the performers. Rather than all this activity taking place behind closed doors, the architects gave visual priority to this experience, providing the performers with expansive panoramic views over the Greenland Sea. Visitors arriving from sea or viewing the building from the harbor can clearly see all the activity happening in this area through the Northern facade.

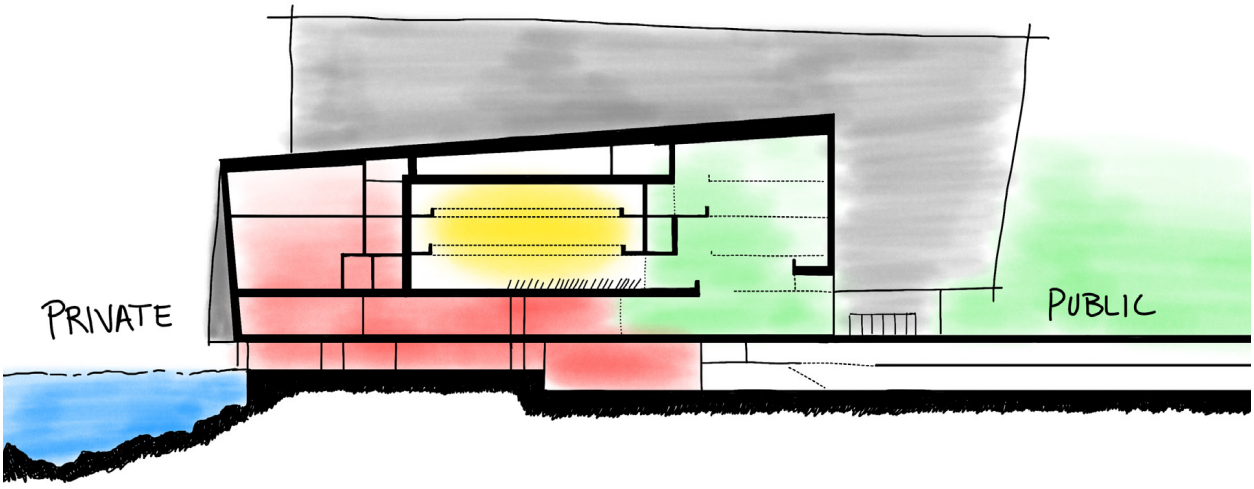

Fig. 10. Henning Larsen Architects. Public/private sectional diagram with performance halls separating these areas. Harpa Concert Hall, Reykjavik, Iceland, 2011.

Backstage areas at the Harpa Concert Hall are organized in a utilitarian manner to meet the needs of most types of performance. However, when presenting drama, opera, or musical theatre, the halls tend to be limited in their options of artistic expression. In these types of performance, directors and set designers typically prefer large, open, stages in a neutral color (usually black) free of any ornamentation. This allows a company to insert their own sets, backdrops, and props in order to create the artificial world of the show. They also typically prefer fully adjustable walls or curtains between the stage and the backstage areas so that large set pieces or mulitple cast members can freely move between the two spaces. Thus, the performance halls at Harpa have two major disadvantages: the stages are not aesthetically neutral, and the areas from backstage to on-stage are either physically restricted or nonexistent. In the smallest hall, Kaldalón, there is no backstage area at all. The only access in and out of the space is through the main public entry at the back corners of the house. This limits the space to amplified music (as a grand piano could not fit), conferences, meetings, movie screenings and speaking engagements. In the second largest hall, the adaptable black-box Silfurberg, the main stage area opens directly into a shared loading hallway, again without a dedicated backstage area. This design is more understandable, as black-box theaters usually have dozens of different configurations, stage locations, and seating arrangements, leaving dedicated backstage areas less useful. The third largest hall, the Norðurljós recital hall, has a similar configuration to Silfurberg except on a larger scale. With it’s wraparound balcony and adjustable partition walls, this hall has even more possible configurations, but

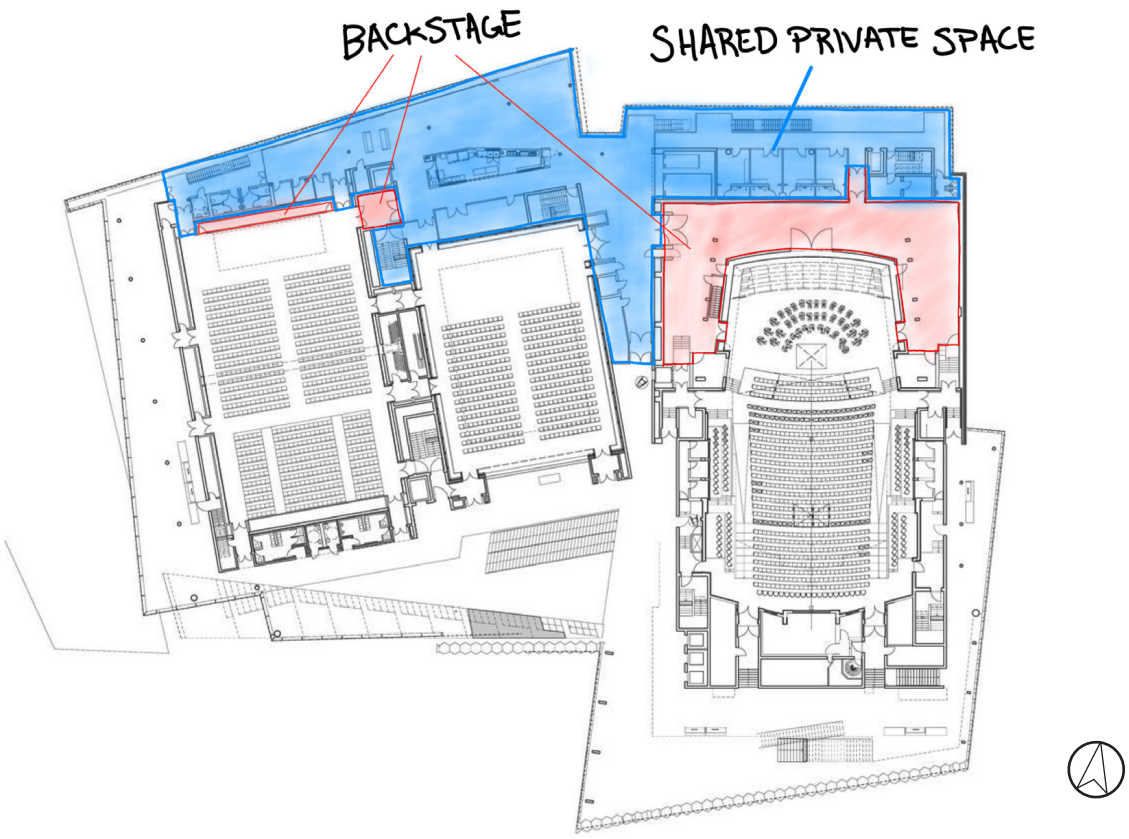

Fig. 11. Henning Larsen Architects. Shared private/backstage areas between three performance halls in plan. Harpa Concert Hall, Reykjavik, Iceland, 2011. Plan credit Henning Larsen Architects.

it again suffers from a lack of dedicated backstage areas. In addition, custom LED-backlit twisted wall panels wrap the hall and do not provide a neutral setting. The largest of the performance halls, Eldborg, should be the space most dedicated to grand theatrical performances. Although the hall does have a generous stage and backstage floor area, the two spaces are separated on three sides by 3-story tall solid walls. Access from backstage, known as 'the wings', to the stage is only accessible through 4 small individual doors or one 12' wide double door. These physical restrictions prevent large props, furniture, or set pieces from being used during performances. If such pieces are needed, they would have to be loaded ahead of time on the two hydraulic lifts at the front of the stage and remain on

stage throughout the entirety of the performance. Furthermore, the stage is wrapped in the same deep red-stained birch veneer as the rest of the hall. This wood stands out against set pieces and envelops the audience within the confines of the hall rather than letting them escape into the world of the performance. While the continuous red birch provides an aesthetically cohesive interior finish, it does limit the usability and flexibility of the performance space. Regarding this limitation, Steinunn Birna Ragnarsdottir, Harpa's current music director, explains,

> "The opera people will have to come up with unusual solutions. There is an orchestra pit, but from the point of view of staging, it will be a test of the imagination of the stage designer…the singers can simply stand and sing. Let the public imagine the rest!"

Overall, the experience of the performer and backstage user is quite successful. Back of house areas are centralized to one side of the building, and they are shared by 3 of the 4 main performance halls. They also provide quick access to the dressing rooms and loading dock areas. Usability of the performance spaces appears to have been sacrificed for aesthetic gains, which does limit how the spaces can be used. However, the preference given to the experience of both public and private users makes up for this limitation. As most of the spaces were designed with flexibility of use in mind, it is understandable that the halls are not tailored to specific performing arts styles.

Acoustics

Fig. 12. Henning Larsen Architects. Interior panorama of main hall. Harpa Concert Hall, Reykjavik, Iceland, 2011.

When they agreed to commit public funds to the Harpa project one of the primary desires of the city of Reykjavík was to create an internationally renown concert hall that not only competes with but exceeds the acoustic qualities of the best performance venues in Europe and North America. In addition, they knew that this new concert hall had to cater to a highly varied performance program which appeals to many different tastes in music. This made great demands of the four auditoriums' acoustic flexibility. As such, the main 1,800 seat concert hall, Eldborg, was designed as a traditionally shaped but greatly adaptable acoustic volume.

Partnering with acclaimed theater design specialists Artec Consulting Inc., the architects designed the main hall with four primary acoustic elements. The first is the basic shape of the hall, a typical 'shoebox' style ideal for performance of unamplified music. The 'shoebox', which describes the long rectangular shape of the hall, has long held a sterling reputation for acoustics worldwide.

Michael Erman, acoustician and Associate Professor at Virginia Tech's School of Architecture + Design, describes the advantages of a 'shoebox' style hall:

> "The rectangular shape provides both spatial impression from lateral reflections and acoustic intimacy from early reflections…coupled with shallow side balconies, massive building materials, and other surface irregularities [which] diffuse incident sound to avert acoustic defects (echo, flutter, and acoustic glare)."

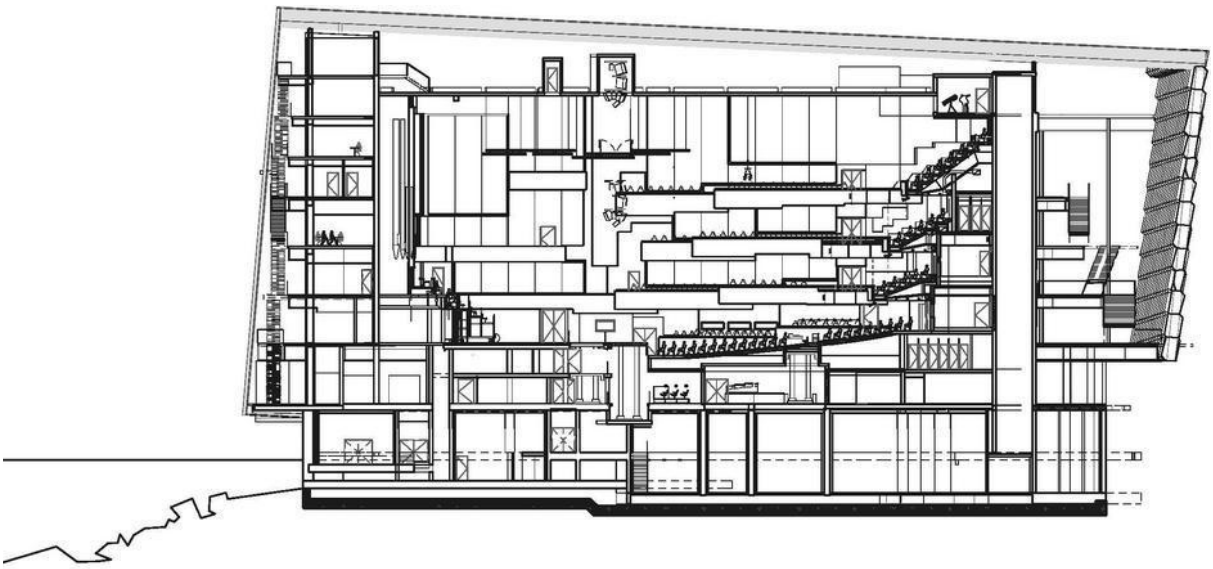

Fig. 13. Henning Larsen Architects. Section through Eldborg Hall. Harpa Concert Hall, Reykjavik, Iceland, 2011. Image credit Henning Larsen Architects.

Eldborg Hall follows this ideal design, with shallow side balconies no more than two rows deep, large parallel wall surfaces allowing sound reflections to build on both sides of the audience (an effect known as binaural immersion), as well as the ability for an unamplified performer to be heard clearly through direct line of sound to the back of the house.

The second acoustic element is two coupled volumes wrapping the hall, located on opposite sides behind the upper balconies. These volumes, fully adjustable via a series of 30 ft tall automated acoustic panels, act as a modulator that can change the reverberation time in the hall from 1.7-3 seconds. This allows the hall to have advantages of both reverberance (the persistence of a sound after it stops) and clarity (each note decays rapidly so that the next can be heard clearly). This is ideal for a variety of unamplified performance types. Erman describes this effect

> "Musicians play on stage, and most of the sound energy is delivered to the audience…but some of the sound energy slips past the ajar doors into the coupled volume, where it bounces between surfaces like a pinball between bumpers. The audience hears the sound that never left the main part of the concert hall, and later, the sound that leaked into the coupled volume and back into the main hall."

The volumes allow for much greater acoustic variability than that of a similarly shaped un-coupled concert hall.

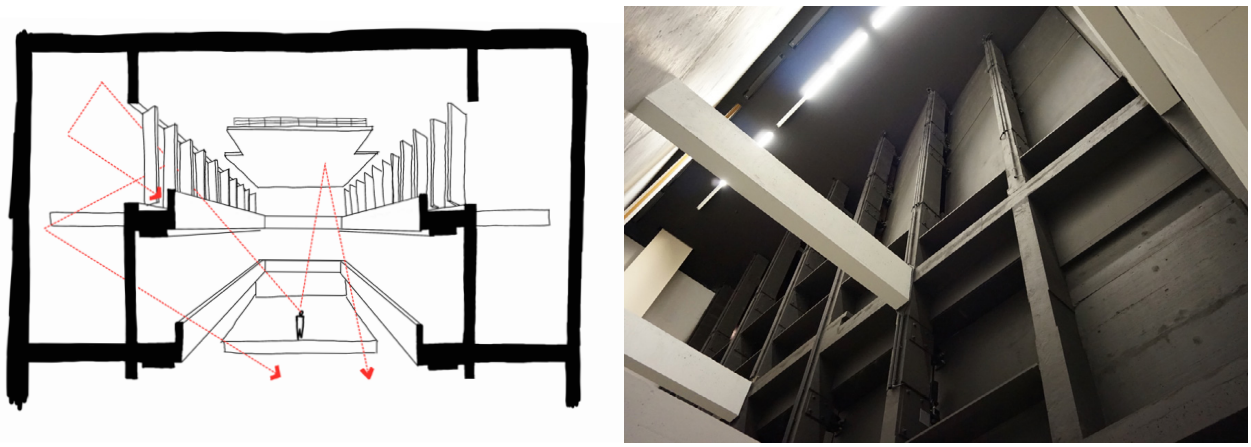

Fig. 14. Henning Larsen Architects. Section diagram and picture from within the dual coupled volumes of Eldborg Hall. Harpa Concert Hall, Reykjavik, Iceland, 2011.

The third element is one often found in performance halls designed for unamplified music: a suspended sound-reflecting canopy often referred to as a ‘cloud’. What makes the cloud canopy in Eldborg hall unique is its size. Weighing in at over 70 tons, this massive collection of 8 wood and steel platforms hangs suspended over all stage and partially over the first few rows of seats. Capable of being raised nearly from floor to structure, either individually or as a group, this massive canopy serves as a sound reflector, a lighting rig, and a decorative object suspended in space. It helps direct early sound reflections back to the performers so they can hear one another clearly. The cloud also sends early reflections to the first rows of the audience, preventing high-ceiling echo in a volume of this size.

The final acoustic element comes in the finishes of the hall itself: red-stained birch veneer panels arranged Tetris-style around corrugated felt textiles. The hard polished surfaces of the birch veneer encourage side reflections throughout the hall, while the corrugated felt diffuses the sound to prevent echo and provide a sense of warmth to the tone. The felt, coupled with the similar velvet-like finish of the auditorium seats, allows a performance to sound nearly identical in an empty hall as with a full capacity audience.

Overall the quality of the acoustic design of Eldborg Hall is of the utmost quality. It has achieved an N1 acoustic design designation, which indicates that acceptable noise levels from exterior sources is less than or equal to the human threshold of hearing. This enables the hall to achieve total acoustic isolation, allowing any visitor to step into a different world once inside. The acoustics of Eldborg have been lauded by music and art critics since the venue opened to the public.

Describing the tenor Jonas Kaufmann's concert inaugurating the hall in 2011, music journalist Orests Silabriedis described the experience thus:

> "the singer's voice, like a silky snakeskin, fills the space up to the darkest corner; sound infiltrates everything, and the hypnotized listener is wholly transported to a different world."

The variable acoustics of this hall provide many styles of performance to occur within it's walls. This is important to a venue that deals almost exclusively with international tourist revenue rather than local ticket sales. A wide variety of acts appealing to many different types of visitors is crucial to the future success of Harpa as a destination attraction.

Fig. 15. Henning Larsen Architects. Interior of Eldborg Hall. Harpa Concert Hall, Reykjavik, Iceland, 2011.

Details and Materials

Much of the appeal of the Harpa Concert Hall and Conference Center comes from the complex geometry and architectural details of the four massive glass facades. The crystalline steel and glass structure, the result of the collaboration between the architects and artists Olafur Eliasson and his collaborator Einar Thorsteinn, captures and reflects light. This dynamic effect promotes a dialogue between the building, the city, and the surrounding landscape. One of the main design ideas was to enhance the building's surroundings including the city lights, the waves of the ocean, and the glow of the Scandinavian sky. For this reason, the expression of the facade changes according to the angle of the viewer. Eliasson was very cognisant of this effect, and he worked with the glass manufacturer Scholl to achieve his desired color variation. The designers also wanted to activate the building at all times, leading them to design the massive glass blocks in three dimensions. These 'quasi-bricks', as the artist describes them, are installed at such an angle that sunlight not only travels through them, but bounces within each encased volume. When viewed from afar, this creates a shimmering light effect that changes throughout the day and throughout the year. Reflecting the continuously changing scenery, the building will appear as an endless variation of colors.

The remaining facades and the roof are made of sectional representations of the geometric glass-brick system. The result is two-dimensional glazed faces of five and six-sided structural steel frames. Every so often, one of these glazed surfaces includes a mirror-like laminated finish, creating a play of light across the less articulated facades as well. The spirited colored effects provided by

these facades are performances unto themselves. Throughout the day many tourists wander the lobby with cameras in tow snapping pictures of the slowly changing kaleidoscopic effects reflecting around the lobby. In fact, these glass details are a more popular attraction than many of the performances.

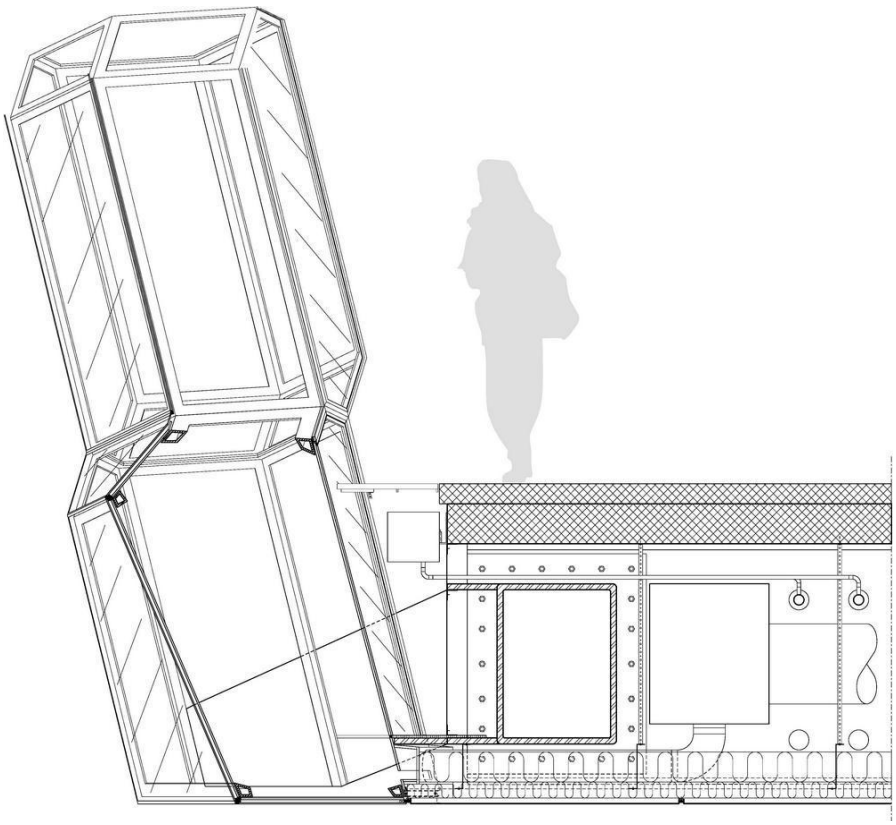

Fig. 16. Henning Larsen Architects. Section detail of geometric glass brick facade by Olafur Eliasson. Image credit Henning Larsen Architects. Harpa Concert Hall, Reykjavik, Iceland, 2011.

Social and Economic Responsibility

Fig. 17. Henning Larsen Architects. Exterior glass facade above public entrance. Harpa Concert Hall, Reykjavik, Iceland, 2011.

In 2013 the Harpa Concert Hall won the Mies van der Rohe Award, the European Union's award for contemporary architecture. Despite this architectural achievement, the Icelandic government has suffered financially throughout the building's inaugural years, and operations lost more than 1 million Icelandic Króna every hour in 2012, or nearly $240,000 a day. This is due mainly to the initial construction cost overruns, the nearly 2 year delay in completing the project, unexpectedly high property taxes, and lower than expected ticket revenue. Contrary to officially reported numbers, the venue has seen steadily dropping attendance since it opened. During the author's

visit, which coincided with the peak of the summer tourist season in Reykjavik, attendance to every performance stagnated in the double-digits at most, with one mid-week afternoon performance dropping to single digits. It is not the talent of the performers that is lacking. To the contrary, the vocals of soprano Eyrún Unnarsdóttir and mezzo-soprano Kristín Sveinsdóttir in the reoccurring Harpa-exclusive show, "Pearls of Icelandic Song", were some of the most memorable of the entire study. When asked about the paltry attendance after the show, Ms. Sveinsdóttir commented that word is still getting out about the acoustic capabilities of the halls at Harpa. Along with an Icelandic economy that is starting to see signs of revitalization, she expressed hope that as people visit the building more interest will be generated and ticket sales will improve. Harpa's cost overruns became so expensive that in the summer of 2013 the possibility of closing the new venue was debated. Under pressure from local government and vocal public skepticism, Harpa's chairman, Haraldur Flosi Tryggvason, issued a statement considering the move. Ultimately, Harpa's Managing Director, Halldór Guðmundsson, persuaded the government to stick with the project, claiming that closing the concert hall would have wasted over $250 million of taxpayer funds to construct the building. This debt to the people of Iceland, he argued, should be paid back by encouraging and promoting the venue as much as possible.

Cultural institutions, especially those paid for by taxpayers, owe a debt to their people, both economically as well as socially. By investing so heavily in an icon such as Harpa, the Icelandic government now owes it to their people to support the project while it establishes itself as a prime venue for musical performance in

the region. After already receiving multitudes of praise from both the architecture and arts communities, Harpa's next mission is to prove its long term worth through continued efforts to present varied and popular acts to draw higher numbers of international tourists. The memorable public spaces and acoustic flexibility of the main hall make this possible. This, coupled with new construction of hotels and a recently completed expansion of the Icelandic International Airport, paves the way for Harpa to establish itself as the must-see designation it deserves to be.

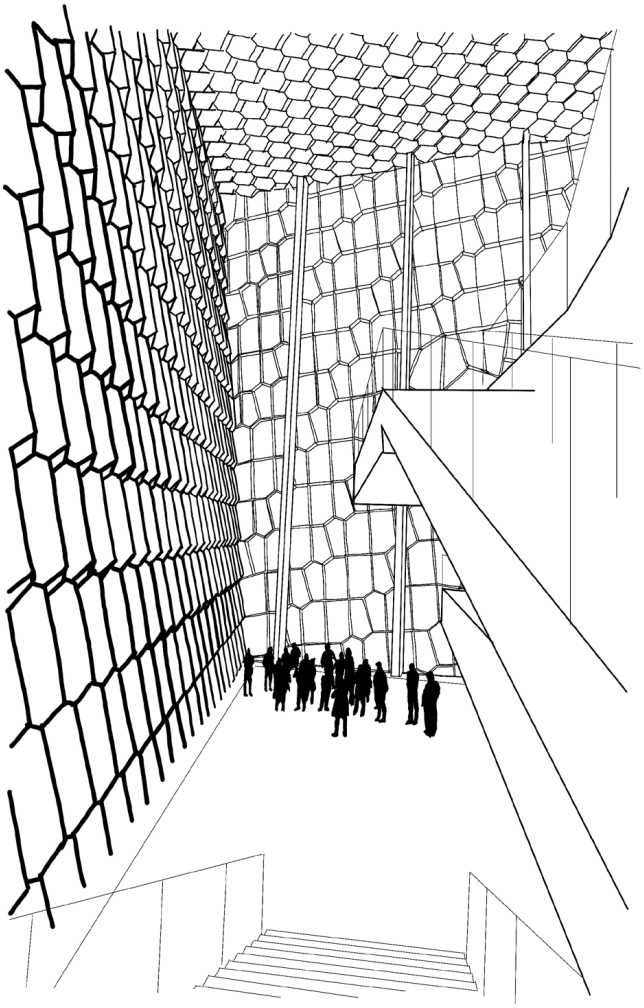

Fig. 18. Henning Larsen Architects. Interior sketch of lobby. Harpa Concert Hall, Reykjavik, Iceland, 2011.

National Norwegian Opera House and Ballet by Snøhetta

Fig. 1. Snøhetta. View of the Opera House from across the Oslo Fjord. Oslo Opera House, Oslo, Norway, 2008.

"If you can step on something, you feel you own it."

- Craig Dykers, partner at Snøhetta

It can be argued that no contemporary performance venue has done more to dispel the traditional notions of opera as an elitist art for the privileged than the last building researched: The Oslo Opera House by Snøhetta, home to the Norwegian National Opera and Ballet. Completed in 2008, the building's dramatic glacier-like form appears to rise out of the waters of the Oslo Fjord and offers visitors and everyday citizens a popular new promenade on which to view the city, meet with friends, or enjoy a meal. It also serves as a home for opera

ballet performances, an academy to train various future performers, and a literal factory to produce the environment to bring these artistic endeavors to life. Much like Jørn Utzon's Sydney Opera House has come to define the identity of its own country, the Oslo Opera House is fast becoming the face of a new, thriving, prosperous Norway.

Of all the performance venues studied, it is of the opinion of the author that this project is the most holistic overall design. Some of the specific challenges facing the design and construction of the Oslo Opera House included a complex program on a polluted waterfront site, flexible acoustic requirements, and the demands of many vocal constituent parties involved in the planning process. The building is distilled down into three conceptual and programmatic elements which address every aspect of these challenges, from siting and form to usability and public engagement. Rather than standing out as flourishes of grandeur, these design elements achieve a subtleness that shifts the focus on the performing arts rather than on the architecture. The Oslo Opera House demonstrates that architects can overcome immensely challenging design obstacles in order to deliver an iconic contemporary arts venue that exists as a social monument rather than a sculptural one. Analysis of this building delves into these obstacles to showcase how such success was achieved.

History

Fig. 2. Snøhetta. Aerial view of the site before construction began. Oslo Opera House, Oslo, Norway, 2008.

The story of trying to get a purpose built opera house in Norway spans back almost 50 years. Historically, while Norway has been a relatively poor country, the Norwegian National Opera and Ballet has been a leader in the art world, compiling over 100 years of lauded performances in borrowed and sometimes make-shift venues. After the oil boom in the 1980's, Norway's political leaders began exploring the idea of a permanent home for opera in the capital city of Oslo. After much debate, it was decided to hold a public design competition for a dedicated opera house. The complex brief stated that the design should be of high architectural quality, be monumental in its expression, and serve as a catalyst to redevelop the surrounding area. More than 250 entries were submitted, reviewed, and displayed in an old warehouse on the nearby Fornebu Island, generating intense public interest.

In March of 2000 the winner was announced to be the local architecture firm, Snøhetta, who then relocated their headquarters across the Oslo Fjord from the site.

The proposed design was described by the architects in three simple architectural expressions: the Carpet, the Wave Wall, and the Factory. In an interview with Simon Ewings, Deputy Managing Director at Snøhetta, these design elements were described as,

> "…a simple way of separating the elements out in terms of an imagery, but also relates to how the building is in three zones: the front of house, middle of house, and back of house. The front of house is the kind of fairy tale environment, which is also related to the roof scape. This is intended to be something you have never seen before and it takes you on a journey. The middle space, and really the back of house space, is very pragmatic: you make your way through them. There's not really architecture there, more logistics solutions, so that is where the idea of the Factory comes in. When we conceptually could explain in a simple diagram that we split the building into elements that relate to different themes of the program, one being very pragmatic, one being the experiential and emotional storytelling, then you get to the heart of the matter, so that it is very easy for anyone on the jury to understand it."

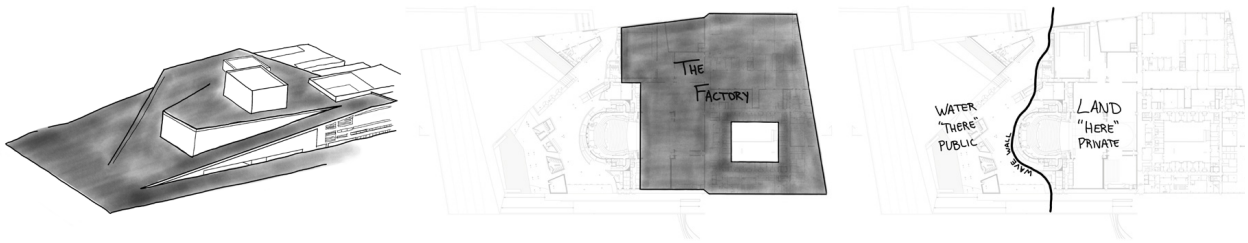

Fig. 3. Snøhetta. Conceptual diagrams of the three design elements: the Carpet, the Wave Wall, and The Factory. Oslo Opera House, Oslo, Norway, 2008.

Construction concluded in 2007, with the official inauguration in April 2008. Costing nearly 300 million NOK (approximately $52 million) under budget, the 415,510 ft^2 building has welcomed over 1.3 million people through its doors to performances and tours. Countless more have taken advantage of the sloping white roofscape.

Site

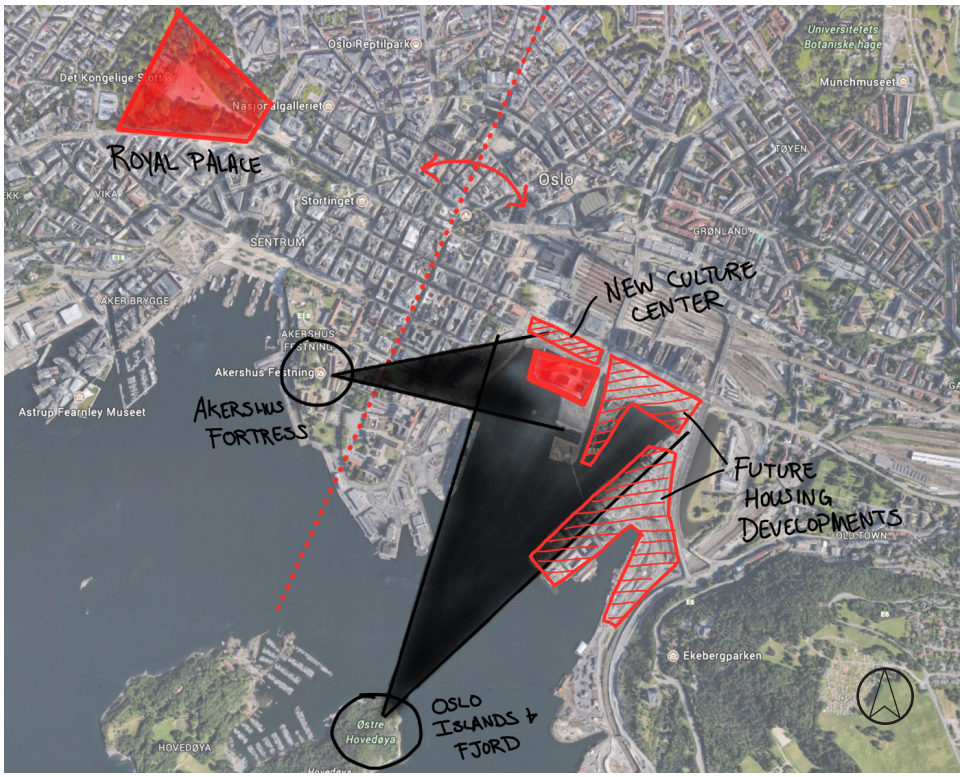

Fig. 4. Snøhetta. Aerial diagram of the site and surrounding context. Oslo Opera House, Oslo, Norway, 2008.

Similar to the Harpa Concert Hall in Reykjavic, the Oslo Opera House sitws on the shore of a major local body of water, the Oslo Fjord. The building is located on a small peninsula on the southern shore, south of the main Oslo Central train terminal, east of the Arkurshus Fortress and historic city center, and north of the Oslo Islands. At the time of the design competition, the area surrounding the site was troubled in many ways: shipping and industrial traffic had recently departed leaving many derelict and empty warehouses; a raised six-lane highway and major railway hub physically separated the site from the neighboring downtown city center; and remnants from a former wood-mill and textile industries had polluted the waters around the

site. As part of the competition brief, the Norwegian government stipulated that the building should serve as an instigator to redevelop the entire area. This location proved to be instrumental in the design of the building, as providing solutions to these challenges ended up creating assets for the design.

Designing a building on the site was technically challenging because about half of the original site was water and the other half included numerous fill layers that had accumulated over years of industrial activity. These conditions necessitated the use of massive concrete pylons, some over 200 feet deep, just to reach stable bedrock to support the building. Due to the marble roofscape flowing into the fjord, the majority of the front of the building, including the whole plaza and foyer, is actually floating above the water. This proved necessary to allow small maintenance boats to sail under the building to access the pylons for inspection. The location of these pylons helped determine the placement of the massive angular support columns that line the perimeter of the glass-encased lobby.

The heavy use of glass is particularly important in this design. As opposed to traditionally monolithic opera houses and theatres, Snøhetta aimed to make the building "more of a social monument rather than a sculptural one." Combined with the western facing sloping roof, which is accessible year round, the high percentage of glazed surfaces encourage community interaction with the art inside. By placing large windows at street level throughout the costume, makeup, and set-making facilities, the architects help incite interactions between artists and the community in everyday situations.

According to Simon Ewings,

> "this added bonus of demystifying how you make opera [makes it] become something that people are interested in seeing. When you go along and walk along the back of house areas and you see the masks through these windows…it becomes like a museum as well."

Fig. 5. Snøhetta. Costume shop windows. Oslo Opera House, Oslo, Norway, 2008.

This design intent is particularly evident during mild weather. Many people can be seen walking and biking around the building, often stopping to inspect the latest mask, costume, or set piece hanging near the large picture windows at street level. One can easily predict that as the area surrounding the site continues to develop, this interaction will only increase.

Following the completion of the Opera House in 2008, many new infrastructural projects have begun in the areas immediately surrounding the site. In 2009, the former elevated highway that had served as a physical barrier was relocated into a tunnel that travels under the fjord, opening up a large swath of land immediately north of the site. In the preceding years this land has been rife with new construction including: a new multi-purpose high-rise residential district known as the Bjørvika Barcode; Deichman National Library of Norway (currently under construction); a high-rise museum housing the works of Norwegian artist Edvard Munch; and a massive public outdoor swimming pool. This and other new construction activity,

Fig. 6. Snøhetta. New construction surrounding the site: Deichman National Library, the Bjørvika Barcode, and the Edvard Munch Museum. Oslo Opera House, Oslo, Norway, 2008.

all within 500 meters of the Oslo Opera House site, provide evidence that the building has met the desires of the Norwegian government and has become a catalyst for the reclemation of the industrial waterfront.

Visitor's Experience

There are two primary methods of approaching the site of the Oslo Opera House. Due to the direct proximity to the Oslo Central station, many visitors arrive by train or metro, then walk two blocks to the waterfront. Connecting the Opera House site to the shore is a single white pedestrian bridge which serves as a transition from the city, over the waters of the fjord, onto the sloping white roof, and into the world of the opera. This intentional transition serves as the primary method of entry for most daily visitors. A second approach is from the back side of the building: a small path runs along the side of the costume shop gallery windows, widening as it runs between the outdoor café seating of the Opera House restaurant and the water, and ultimately reaching the bottom of the sloped roof.

Due to the ongoing construction of housing projects currently planned for the area east of the Opera House, this approach is currently under utilized. The addition of new luxury residential units, along with a planned public beach just south of the Opera House site, could help popularize this arrival, however it lacks the metaphoric transition of crossing the white bridge and is not nearly as dramatic an experience.

Fig. 7. Snøhetta. Two primary methods of entry: a white marble bridge spanning the Fjord, and a paved pathway in the rear of the building. Oslo Opera House, Oslo, Norway, 2008.

Upon arriving at the bottom of the sloped roof, the visitor has many choices: continue down to the water's edge; follow the triangular void to the main entrance; or trek up the stepped roof around and on top of the glass-encased lobby to take in the panoramic views of the fjord. The sloping roof plane - itself a permanent art installation via a collaboration between Snøhetta and artists Kristian Blystad, Kalle Grude and Jorunn Sannes - constitutes the first design element known as The Carpet. Over 20,000 m2 of white Carrara marble was sourced from Italy to create this incredibly popular feature. Along with the lobby, this roof-scape is completely accessible and open to the public 24 hours a day, 7 days a week. During the author's time on site, there wasn't a moment that this feature was not in use by dozens of citizens, even during driving rain. Runners, bikers, fishers, playing children, tourists, photographers, picnickers, young, old, rich, poor, can all be observed enjoying this space. This sense of community ownership
and participation is an essential factor of the building's success.

The entrance to the main lobby occurs through three glass revolving doors. The sloping roof above creates a sense of compression at the point of entry. To the left is the main ticket office, an educational facility, and the Restaurant Argent which serves seasonal delicacies exclusively on nights

Fig. 8. Snøhetta. People use the roof landscape for a variety of activities at all times. Oslo Opera House, Oslo, Norway, 2008.

of performances. To the right, wedged between the lobby and the angled roof, are the gift shop and coat check. Continuing straight ahead leads the visitor to the heart of the Opera House, the glass-encased four story lobby. This light filled atrium provides a soaring sense of relief, both physically and visually, as the ample natural light plays across the rippling surface of the oak Wave Wall, the second major design element. This curvilinear wood core visually defines the transition between main lobby and performance space, while the undulating form creates smaller sub-lobby pockets, each with their own bar to serve concessions during intermissions. During this time, visitors are drawn to the slit-like reveals in this wooden core, looking out through the glass atrium over the fjord and the city beyond. This becomes a second stage, as the view is reminiscent of the composition of a traditional proscenium stage. Simultaneously, visitors below are able to look up and see the opera-goers in a moment of people watching. This play of public theatre adds to the appeal of each visitor, and can be a show worth experiencing itself. The Wave Wall element also serves a practical need: thousands of vertical oak strips of varying depth scatter the sound of hundreds of visitors to prevent echo and reverberation in the largely glass and marble interior volume of the

Fig. 9. Snøhetta. The Wave Wall. Oslo Opera House, Oslo, Norway, 2008.

Fig. 10. Snøhetta. View from the slit-like openings in the Wave Wall. Detail of vertical oak strips wrapping the Wave Wall. Oslo Opera House, Oslo, Norway, 2008.

lobby. Ultimately, the Wave Wall serves to separate the public face of the building from the inner workings of the opera.

Performer's Experience

Entry to the private portions of the building, often referred to as the back-of-house areas, takes place in many smaller locations dotted around the perimeter of the building. The most commonly used entry is through a long glass corridor bordering the southern edge of the water, past the small studio theater, running parallel with the second public entry. This hall sets up a useful transition from the other-worldy feeling of the wood and glass lobby, through an exposed concrete, steel, and glass corridor, and into a simple white and maroon labyrinth of doors. This is the arrival to the third design element: The Factory. This private area holds the key to every production staged at the Opera House, and it includes six stories of dressing rooms, workshops, rehearsal rooms, scene shops, laundry facilities, costume shop, milliners, wig makers, and a ballet academy, all organized around a large central courtyard. The upper two floors also contain a brasserie and large private balconies for the employees and performers. Separating these many programmatic needs from the performance spaces is a tiered atrium hall, referred to as the "Opera Street". This North-South oriented hall serves not only as an acoustic and fire-safety buffer between the stage and the back-of-house, but also functions as a social landmark for the everyday users. During visits

Fig. 11. Snøhetta. Private entry corridor. Oslo Opera House, Oslo, Norway, 2008.

to the site, many different users could be seen taking advantage of this shared space: dancers stretching and practicing technique, costumers with racks, stage managers directing people around, and the public walking through on guided tours. For those lucky enough to experience it, this central hub provides a perfect example of the many different trades and professions needed to mount the performances.

The experience of the performer was deeply considered during design development of this building. Snøhetta spent many months and staged numerous open workshops with many of the end-users during the design to create a cohesive space that worked well for everyone involved. The performers desired dressing areas that were private, had access to natural light, and were in close proximity to the performing halls. The design of The Factory accommodates these needs by arranging all the private and group dressing rooms, each with an operable window, around the six story central courtyard accessible only to performers. This deep courtyard blocks out the sound of the surrounding city and allows each performer access to clean sea air. The addition of a private brasserie and large covered balcony on the East face provides each artist with ample space to prepare mentally and physically for their performance. Each of the six floors of dressing rooms are tailored to the performer who occupies them: lower floors have larger group dressing rooms for chorus and dancers, many of whom have multiple costume changes throughout a production, while upper floors are designed for orchestra members who only utilize a dressing room before and after performances. The orchestra member dressing rooms also have thicker partition walls designed on a 7 degree angle, as well as floating floors that are mounted on acoustic isolating

springs, to allow performers to tune and warm-up without disturbing other users. In addition, the centralization of all the different performers into one area of the building allows for easy communication and organization of the supporting trades, such as costuming and make-up, whose offices form a perimeter around the dressing rooms. This clear and intentional organization of space demonstrates the many advantages of integrating end-users into design development early and often, and shows how complex programmatic needs can be organized into integrated design solutions. It is also of the author's opinion that this building is an example of one of the most generous back-of-house designs for performers in the world.

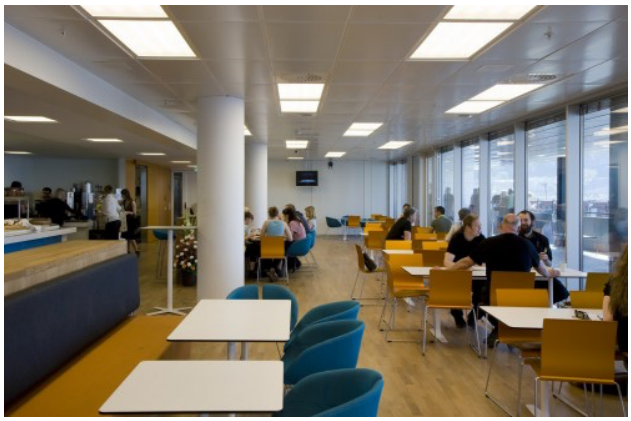

Fig. 12. Snøhetta. Performer's brasserie. Oslo Opera House, Oslo, Norway, 2008.

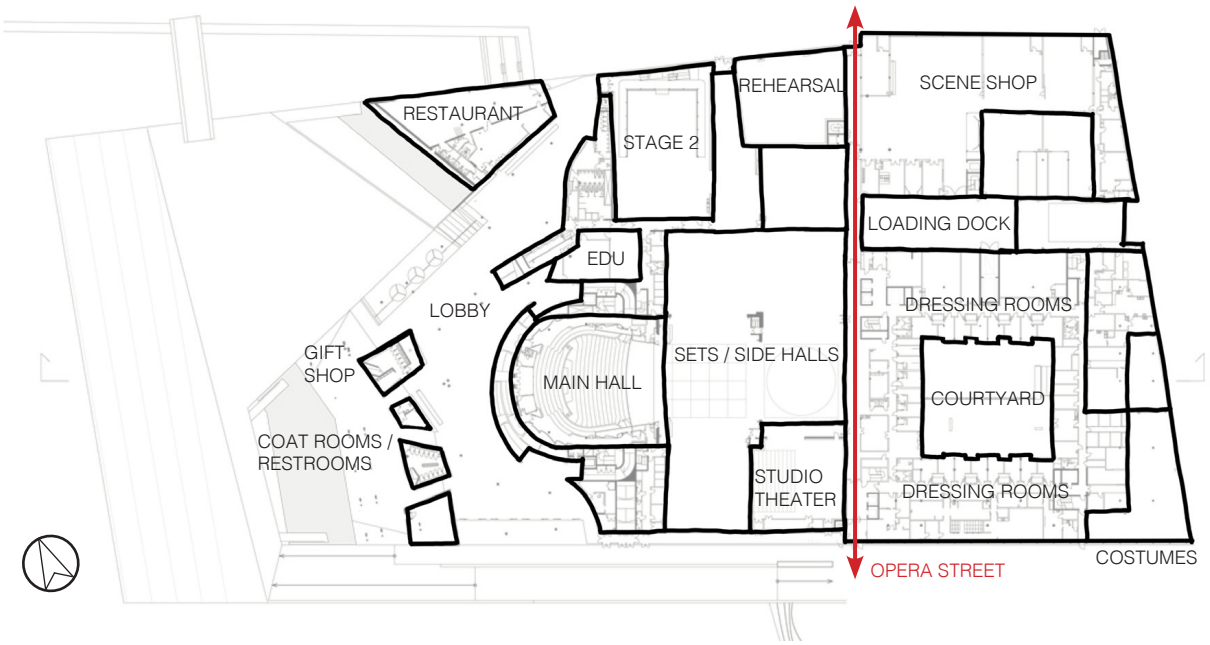

Fig. 13. Snøhetta. Program diagram in plan. Oslo Opera House, Oslo, Norway, 2008.

Acoustics

Fig. 14. Snøhetta. Interior panorama of main hall. Oslo Opera House, Oslo, Norway, 2008.

As opposed to each of the other concert and performing arts halls studied herein, the three-tiered horseshoe-shaped main theater is a much more reserved and understated performance venue. The conventional 1,370 seat hall was designed to be reminiscent of a more traditional opera hall, with the architects drawing influence from the German Staatsopera and other 18th-19th century concert and opera houses. In an interview with architectural historian Victora Newhouse, Snøhetta partner Craig Dykers explained, "We didn't want to reinvent this kind of room. It isn't for experimental theatre. It had to be well protected and a particular shape."[2] Simon Ewings adds:

> "[we] visited a lot of halls and we tried to take the best out of all of them. It really is a continuation of a tradition. The thing about the horse-shoe hall for opera is that opera is a strange mix of musical requirement and theatrical requirement, and of course when you also add in ballet you have a lot of pressure in terms of having closeness to the actor's activity,

good sight lines, good feeling of community in the space, an intimacy of the space, which pushes the horseshoe solution."

In opera, the voice of a solo singer should not only be heard by the audience, but needs to stand out against the accompaniment of an orchestra. What is traditionally difficult about a horseshoe shape, however, are the acoustics. If the horse-shoe shaped hall is too wide in the audience area, the volume loses side reflections, which are important to maintain clarity of speech and the feel of intimacy in music. If the hall is too deep, it can hamper the spatial impression of the space and not allow the singers and the orchestra to hear each other clearly. According to Michael Erman in his book, Architectural Acoustics Illustrated, rooms shaped for opera should be designed with the best of elements of speech and music in mind, which is often a contrast in terms. For example, take a look at his diagrams showcasing the ideal room shapes for speech and for music:

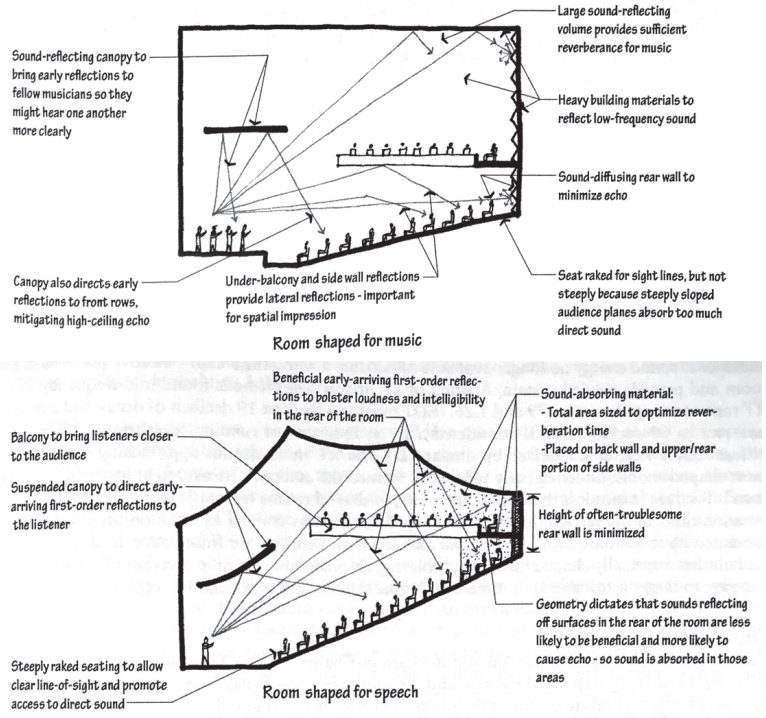

Fig. 15. Snøhetta. Diagrams for ideal acoustic room shape. Oslo Opera House, Oslo, Norway, 2008.

In speech and singing, where clarity of words and intelligibility are key to audience understanding, early arriving reflections are preferred, giving priority to surfaces that bounce sound from the performer to each audience member as directly as possible. Conversely, in un-amplified music performance, long reverberation is preferred, reducing the desire for early sound reflections, and increasing the desire for voluminous spaces where the sound can fill and reverberate within. Both spaces require shallow balconies which bring audience members closer to the source, break up the rear wall of the hall which can cause echo, and allow for overhead reflections to bring sound to the rear seats.

The design of the Oslo Opera House's main hall attempts to capture the best of both speech and musical performance needs. The ideal height-to-depth ratio for opera hall acoustics is $H \geq 1/2D$, realized in this project as 62 ft $\geq$ 1/2(90 ft). This extra height is obscured by a custom LED chandelier suspended inside an oak oval shaped sound reflecting canopy. Each row of crystals and LED lights are spaced differently to optimize the distance of early reflections from the stage to the floor below. The three balcony fronts, finished with the same blonde oak found in the Wave Wall lobby, are curved to provide lateral reflections important in establishing aural intimacy.

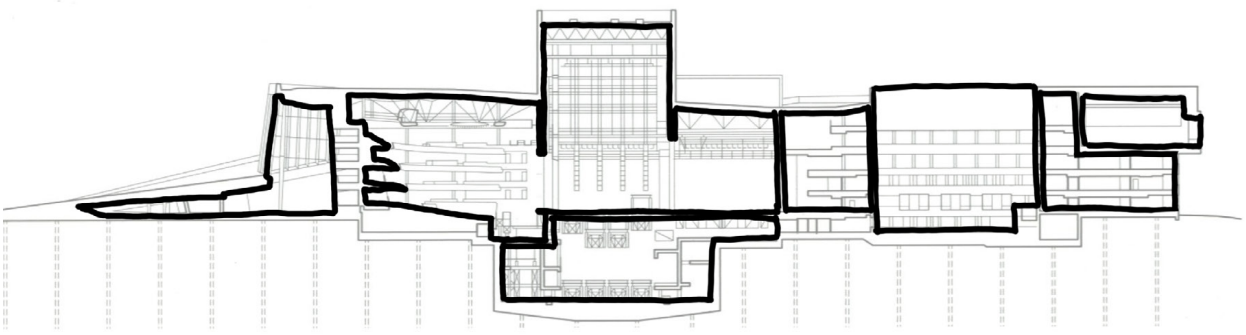

Fig. 16. Snøhetta. Section diagram of interior air volume. Oslo Opera House, Oslo, Norway, 2008.

The seats were even designed with acoustics in mind: a high density foam was used to mimic the sound absorption of a human body; therefore the hall should sound the same empty as it does when full. This is essential to the performers as it allows a company to rehearse in the same conditions as during a performance. On the ground level of the house the seats are raked at ~10 degree angle, which allows for adequate site lines without too much direct sound absorption. The design of the main hall results in an ideal reverberation time of 1.6-1.7 seconds. The overall acoustic effect is typically clear and bright, but often fails to envelop the listener from all sides, surprising for such a visually intimate space.

When the main hall is used for performance other than opera, it is equipped with elements that adapt for acoustic flexibility. Retractable felt curtains run the perimeter of the hall and are designed to reduce the reverberation time down to 1.0-1.1 seconds. In addition there are two 30 ft tall towers on either side of the proscenium stage that can move in or out, depending on the needs of the performance. Overall this can increase or decrease the viewing window by +/- 2m in either direction. Ewings explains,

> "When you have ballet you are more interested in the view of the dancers than you are in the sound quality, so the ballet usually wants to have a very wide viewing window, and in that case the towers are fully out. When you have a musical or a theatrical performance where you have singers, a choir, or even a musical group, you need to get a little bit more first reflections. If the proscenium is too wide, that first reflection takes too long so you want to bring those towers in about 2 meters."

This flexibility allows for the main hall to accommodate other types of performance, including touring productions and amplified concerts, bringing in additional revenue as well as an expanded range of visitors from across Norway who wouldn't traditionally attend opera or ballet. Although not as flexible as some of the other venues studied, the ability to change the acoustic identity of the main hall, combined with the popular roofscape outside, makes for a healthy democratic collection of personalities visiting the building year round.

Fig. 17. Snøhetta. Interior of main concert hall. Oslo Opera House, Oslo, Norway, 2008.

Details and Materials

There are several architectural and artistic details that help the Oslo Opera House stand out from other contemporary performing arts venues. According to Norwegian building law, all public buildings must dedicate 1% of their budget towards the integration of art. With nearly a $800 million proposal, the budget for art was significant for the Oslo Opera House. To take advantage of such a generous opportunity, the partners at Snøhetta created a design committee to nominate and request artist proposals to be integrated within the building. Five major installations were commissioned from this search, and they were designed to be built in tandem with the building, appearing as an integral part of the project's infrastructure.

The largest of these art installations is also the most subtle: the sloped white Italian Carrara marble roof surface. The artistic team of Kristian Blystad, Kalle Grude, and Jorunn Sannes broke down the sloped roof surface into over 30,000 individually sculpted and shifted pieces that are designed to read differently at different time of the day and year, depending on lighting conditions. This piece also helps to break up the roof surface area of 20,000 m2 to a more human and interactive scale. The second art installation is also one that is integral to the building's overall design, but is often unrecognized: the aluminum facade panels of The Factory. Designed by the team Astrid Løvaas and Kirsten Wagle, these aluminum cladding panels are meant to re-enforce the concept that The Factory part of the building is more of an industrial style. The team designed 8 individual panels of 3mm thick anodized aluminum, each composed of embossed and indented half-spheres, which are aggregated across the entire facade. While some

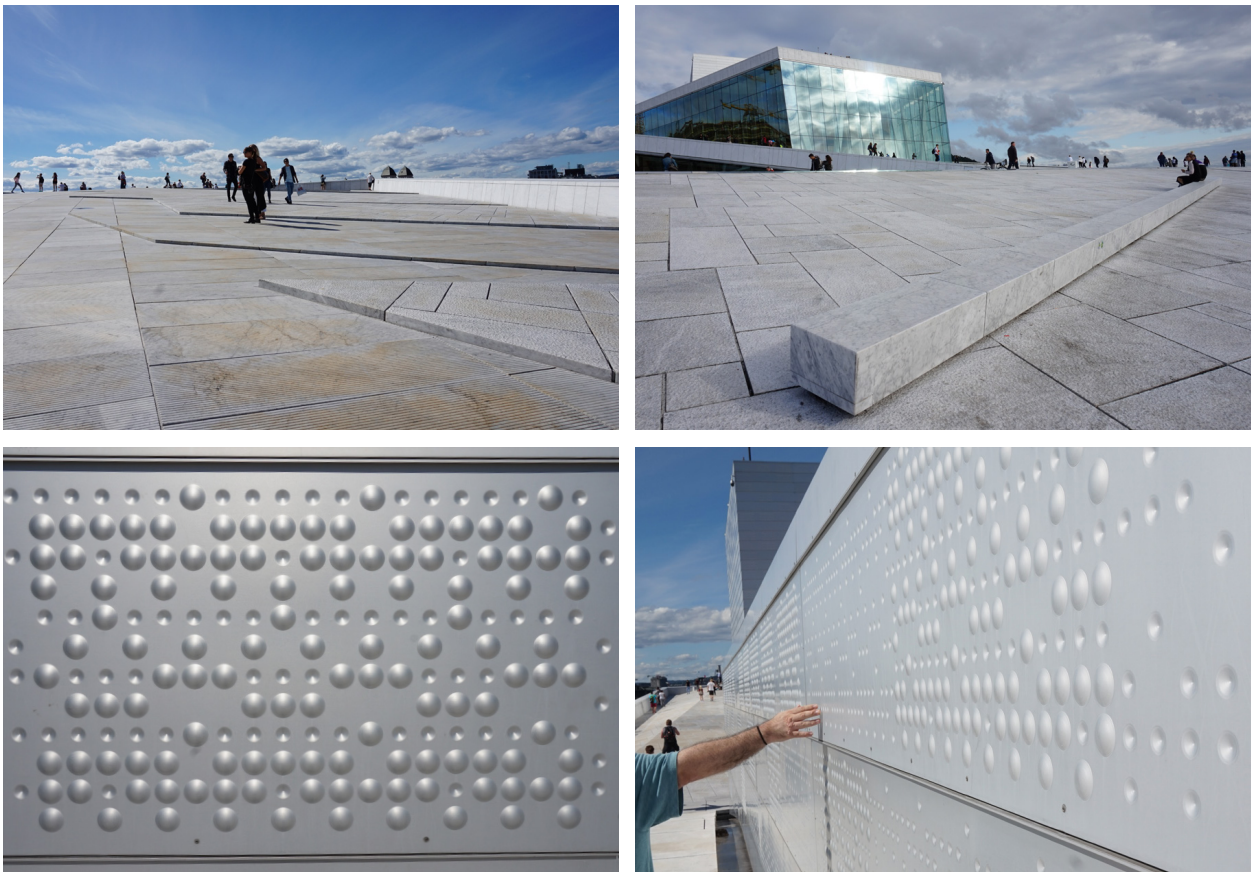

Fig. 18. Snøhetta. Exterior installation material studies. Oslo Opera House, Oslo, Norway, 2008.

visitors mistakenly recognize braille patterns in this design, the intent was to give texture to the flat exterior surfaces and amplify the play of light and shadow. The lobby is the location for the next installation, a perforated geometric cladding wrapping the restrooms and coat storage by artist Olafur Eliasson. The cladding is subtly back lit with colors reminiscent of the Aurora Borealis. It gently changes throughout the day, allowing the visitor`s perception of the lobby areas to change over time. As integral pieces of the building, these three installations are often overlooked. Says Ewings,

> "For us, it doesn't matter if you even see it as art. It is in this strange world between art and building and interior and architecture, and that is a lovely place to exist."

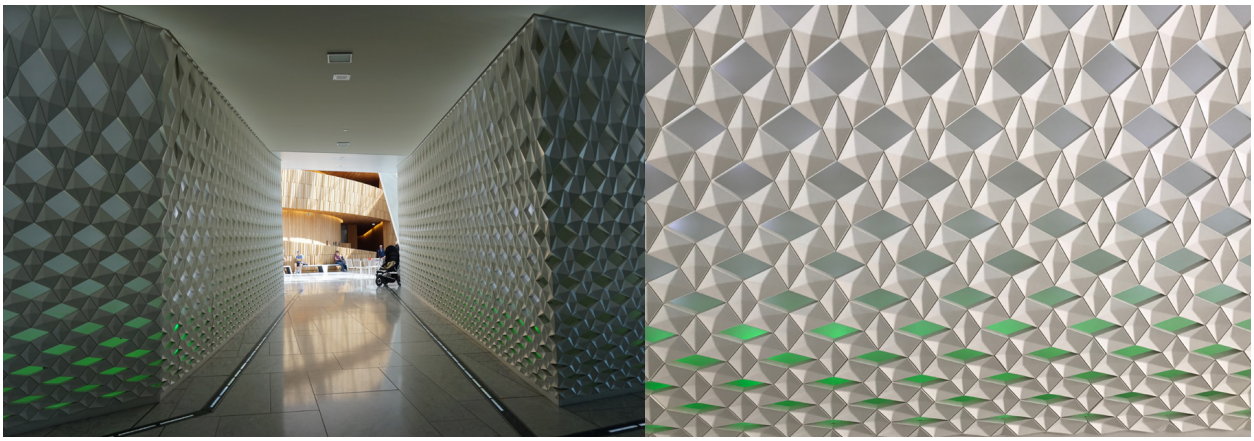

Fig. 19. Snøhetta. Geometric cladding and light installation by Olafur Eliasson. Oslo Opera House, Oslo, Norway, 2008.

Floating in the waters of the Fjord visitors can find a more traditional piece of art, a glass and steel sculpture by Italian artist Monica Bonvicini titled, “She Lies”. This 12 m tall sculpture is designed to freely rotate on its central axis to allow the tides and wind to determine its orientation, as if it were a free floating iceberg. Just like the Opera House itself, the way light plays on “She Lies” makes it appear different every time you see it. The fifth installation is the main hall’s curtain. Conceived through a collaboration with visual artist Pae White, the metallic, jagged finish of the curtain sets a striking tone in the otherwise conventional main hall.

These artistic details help elevate what would otherwise be a simple material finish. Integrated into the design, the installations ingrain cultural relevance into the very fabric of the building. They also instill into the site a unique quality that helps give ownership back to the people. By investing quality materials and details into the design, the general populous are more inclined to take pride in this very public place, further imbuing the project as a vessel of national identity.

Social and Economic Responsibility

Fig. 20. Snøhetta. Interior panorama of lobby before a performance of Puccini's Tosca. Oslo Opera House, Oslo, Norway, 2008.

Arts and cultural institutions, especially those that are publicly funded, should be designed to last and be enjoyed by as many different people as possible. Reserving the right to view and experience art to the privileged few is an elitist and antiquated notion that designers should work diligently to dispel. More important than creating an architectural icon is whether the project can educate and inspire each visitor, regardless of social or economic status.

Due to the careful consideration and care that was put into this project by the designers at Snøhetta, the Oslo Opera House has become a symbol of national pride and cultural identity for the people of Norway. By turning a formerly derelict site into an accessible and welcoming extension of the public realm, the designers have provided a generous gift to the city and its people. The Opera House helps to demystify the process of artistic creation, welcomes visitors of every background to the site, and has helped invigorate new infrastructural

development to a previously undesirable sector of the city. Snøhetta have also made a facility that caters to each type of performer, providing a space in which artistic endeavors can thrive. Through close attention to detail, they have created a state-of-the-art venue that puts the focus on the performance rather than the architecture. The architects have achieved all this while delivering the project significantly under budget, an almost unheard of feat in today's practice of excess and overruns. By properly managing a project funded almost exclusively by the state, and thus by the taxpayers themselves, the designers have given the utmost respect to those who truly own the site: the Norwegian people.

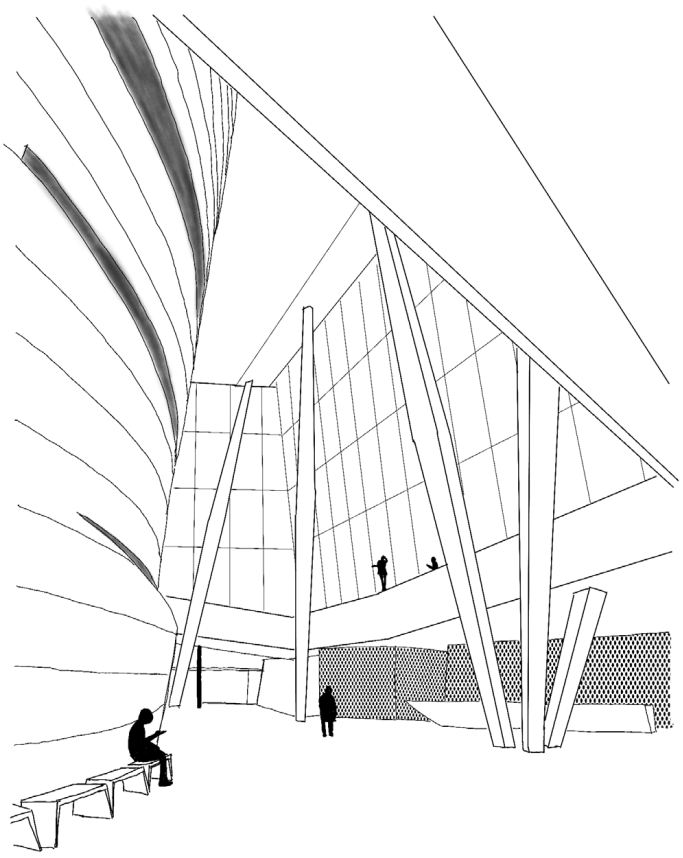

Fig. 21. Snøhetta. Interior sketch of lobby. Oslo Opera House, Oslo, Norway, 2008.

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