RESONATING SPACES: 3D IMAGING OF THE BERLIN PHILHARMONIC

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ABSTRACT: The Getty Research Institute's (GRI) exhibition Berlin/LA: Space for Music (April 25–July 30, 2017) celebrates the fiftieth anniversary of the sister city partnership between West Berlin and Los Angeles, established in June 1967, by focusing on two buildings that have captured the public imagination and become iconic features of the urban landscape of both cities: the Berlin Philharmonic (1960–63) in Berlin, designed by Hans Scharoun, and the Walt Disney Concert Hall (1999–2003) in Los Angeles, designed by Frank Gehry. Original physical working models created by Gehry in designing the Walt Disney Concert Hall give visitors insight into how its expansive interior was created, however no working or presentation models of Scharoun's Philharmonic are extant. The interior of Hans Scharoun's Berlin Philharmonic, which ranks among the most influential concert hall designs of the twentieth century, is a very complex and multifaceted space. The bold decision made by the GRI's curatorial team to commission a 3D digital and printed model of the Philharmonic interior allows the curators to communicate to gallery visitors the innovative nature of this complex space in a manner much more evocative than photographs alone could convey, making this a truly groundbreaking undertaking.

1. INTRODUCTION

The Getty Research Institute's (GRI) exhibition *Berlin/LA: Space for Music* (April 25–July 30, 2017) celebrated the fiftieth anniversary of the sister city partnership between Berlin and Los Angeles, established in June 1967, by focusing on two buildings that have captured the public imagination and become iconic features of the urban landscape of both cities: Hans Scharoun's Philharmonic (1960–63) in Berlin and Frank Gehry's Walt Disney Concert Hall (1999–2003) in Los Angeles. The exhibition was to feature models created by Gehry in designing the Walt Disney Concert Hall, intended to give visitors insight into how its expansive interior was created; however, no working or presentation models of Scharoun's Philharmonic are extant. Exhibition curators, Maristella Casciato and Emily Pugh, and Imaging and Digital Media Architect for the Getty, Chris Edwards, worked with the Cultural Heritage Digitization unit of Germany's Fraunhofer Institute to create laser scans of the Philharmonic in Berlin, enabling a direct comparison between Frank Gehry and Hans Scharoun's buildings and their working processes. The resulting model of the Berlin Philharmonic was included in the *Berlin/LA* exhibition, alongside a working model for the Disney Hall's interior of the same scale. In this presentation, Mr. Edwards will explain the processes by which the printed model was created, while Dr. Pugh will explain how the model functioned within the exhibition and how it is being used to conduct continued research on Hans Scharoun's Berlin Philharmonic.

2. MAIN ASPECTS

In order to understand the genesis of the project to scan Scharoun's building, it is helpful to recount a bit of the history of Scharoun's Philharmonic as well as its relationship to Disney Hall in Los Angeles. The Berlin Philharmonic was built from 1960 to 1963, inaugurated in October 1963 with a concert conducted by Herbert von Karajan. In his designs for the Berliner Philharmonic, expressionist architect Hans Scharoun (1893–1972) adopted a revolutionary form that

completely modified the spatial conception of the typical concert hall. Instead of the familiar proscenium arrangement, the interior of the Berlin Philharmonic is arranged as if a terraced vineyard landscape: the orchestra is installed at the bottom of the "valley," while spectators occupy the side terraces. The acoustic qualities of this interior landscape configuration, tested and refined by Scharoun's sound engineer, Lothar Cremer, are among the most renowned in the world. Scharoun's design for the main concert hall of the Philharmonic was the major source of inspiration for the Walt Disney Concert Hall designed by Frank Gehry (b. 1929), which opened in Los Angeles almost exactly four decades after the Berlin Philharmonic, in October 2003.

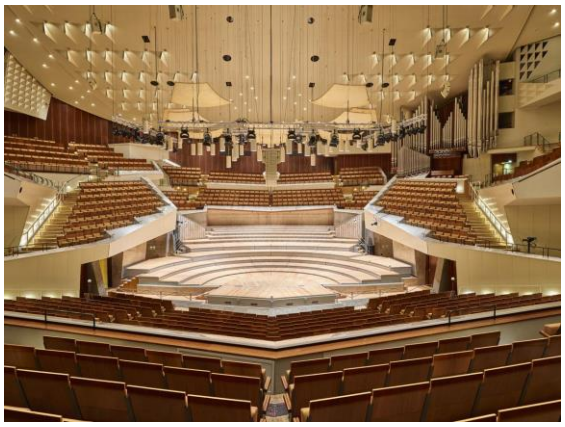

FIGURE 1: *Interior of main hall, Berlin Philharmonic.*

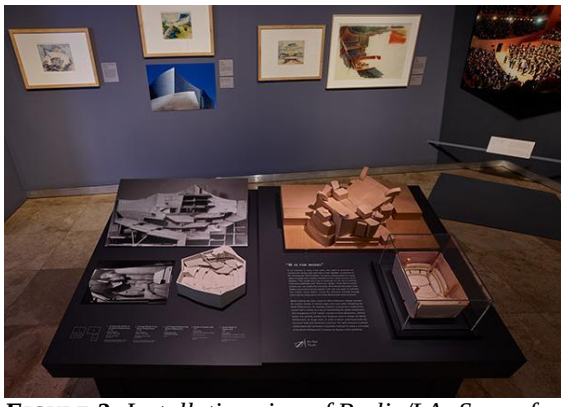

FIGURE 2: *Installation view of Berlin/LA: Space for Music showing the table of architectural models at the center of the exhibition.*

Gehry's Disney Hall replicates Scharoun's idea of the interior vineyard landscape. Moreover, the acoustical design of this encompassing space, supervised by Nagata Acoustics engineers Yasuhisa Toyota and Minoru Nagata, is, like that of the Berlin Philharmonic, considered among the most successful in the world.

Models were important to the exhibition's conception because a key focus of it was the extraordinary spatial landscapes Scharoun and Gehry created *inside* their concert halls, as well as the examination of each architect's design process and how this process generated the resulting structures. Examples of Scharoun's watercolor sketches from the 1940s were to be displayed alongside photographs of his working models of the Philharmonic to provide insight into the evolution of the Berlin building's unique form. Juxtaposing Scharoun's working materials and models with Gehry's sketches and models was intended reveal to visitors the profound effect Scharoun's design for the Philharmonic had on Disney Hall. While conducting research for the exhibition, however, Dr. Pugh discovered that although many photographs of the various models Scharoun used in designing the concert hall and planning its construction had survived, the models themselves had been lost or destroyed. This discovery was, of course, a disappointment to the exhibition's curators, who proceeded with a plan to use only the photographs of Scharoun's models, in place of the three-dimensional objects. However, after presenting the exhibition to their colleagues at the GRI, imaging specialist Chris Edwards had another idea: to scan the interior of the built structure and produce a physical model of the Philharmonic using a 3D printer.

The scanning team, which included Pedro Santos, Matevz Domajnko, and two research fellows from the Fraunhofer Institute as well as Mr. Edwards and Dr. Pugh, gathered in Berlin to begin to digitize on in January 2017, only four months after they initially contacted the Fraunhofer Institute about the project. Because of the size of the concert hall interior, Dr. Santos and his team recommended laser scanning as the most appropriate approach for creating the point cloud that would needed to print a physical model. Because of the complexity of the Philharmonic, the team had to place the scanner in 95 different locations within a short period of time, while also scanning at two different heights (1.5m and 4m). The scanner chosen was the Faro Focus3D X 330 HDR, which provided accurate measurements but which also, due to its extremely light weight and portability, was ideal for use in a project that required its placement in almost 100 different locations.

The scanning team confronted several challenges during the digitization process. Materials of some surfaces in the room could be problematic for laser scanning, because of their reflective properties for example, but for reasons Dr. Pugh will explain below, most of these were out of scope of the scanning project and could largely be ignored. Time constraints were another significant challenge. The Philharmonic is in near-constant use, and as a result, there were only few hours per day available for scanning. All scanning had to be accomplished over the course of four nights, six hours per night, from 23:00–5:00. Once the scanning work was done, the post processing and printing of the model was done by the Fraunhofer team in Darmstadt. The model arrived at the GRI in March 2017 and was immediately installed in the exhibition.

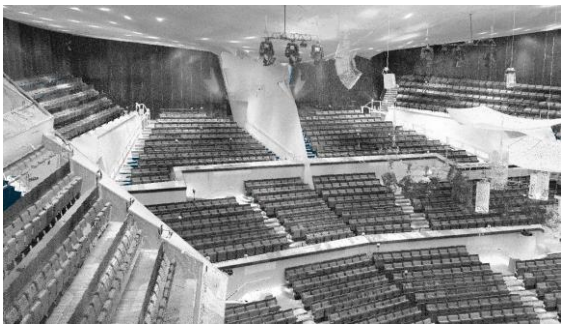

FIGURE 3: *Point cloud rendering of the main hall of the Berlin Philharmonic.*

The goal of scanning the Philharmonic interior was first and foremost to create a model for inclusion in the *Berlin/LA* exhibition. The creation of a 3D model of the Philharmonic interior allowed curators to communicate to gallery visitors the innovative nature of this complex space in a manner much more evocative than photographs alone could convey. Whereas drawings and plans provide only a glimpse of the spatial arrangement of the concert hall interior, Scharoun's "vineyard landscape" is readily apparent to the visitor by looking at the model. This is particularly true because the curators requested that many of the details of the interior--the seats and handrails, for example, as well as ceiling and lighting fixtures--be removed. Not only did the omission of these elements simplify the scanning process, obviating the need to accommodate reflective surfaces and other difficult forms, the resulting simplified model focuses the visitor's attention on the overall spatial form and arrangement of the hall.

In addition, because the model was printed at 1/200 scale, the same scale as the Disney Hall model included in the exhibition, the striking similarities as well as differences between Scharoun's and Gehry's buildings are much more directly and clearly conveyed (see Fig. 2). The model of the Philharmonic does not replace original or working models, nor is it intended to. Nonetheless, the digitally-created model was very effective in enhancing and helping convey the overall thesis of the exhibition *Berlin/LA: Space for Music*.

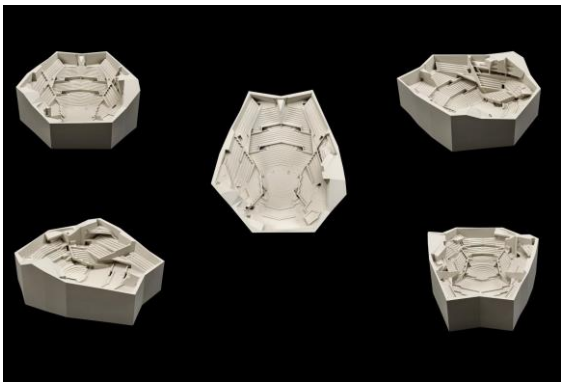

FIGURE 4: *3D printed model of the Berlin Philharmonic main hall*

In addition to the very effective didactic role it played in the *Berlin/LA* exhibition, the 3D-printed model of the Philharmonic also proved a useful tool for analyzing the interior space of Scharoun's concert hall. Indeed, in addition a secondary goal of the project was to explore the research potential of the scanning process as well as the 3D renderings that resulted. More specifically, Dr. Casciato, Dr. Pugh, and Mr. Edwards wanted to consider what advanced 3D imaging technology could show us about Scharoun's building that we could not see before. In other words, what role can digital remastering of built works serve as a tool for architectural historical research?

Hans Scharoun's Berlin Philharmonic has written about quite extensively, yet the majority of the scholarship on the Philharmonic focuses on the same three topics: 1) the building's place in Scharoun's oeuvre; 2) the hall's high-quality acoustics; and 3) the building's role as a symbol of democratic community.[1] While these aspects of the building are all important, there are other details about the Berlin Philharmonic and its construction we feel have been overlooked. In particular, we are examining the role of technology in the building's construction. Only fifteen years or so earlier, this complex

structure might have remained confined to paper, like many of Scharoun's visionary watercolors of the 1940s. What (in addition to economic factors) made the impressive, vaulted space of the interior hall realizable in the early 1960s? Were cutting-edge tools and techniques developed to realize Scharoun's Berlin Philharmonic? It is not only building technology that we are considering. Our analysis of the 3D renderings of the building's interior made obvious the spatial importance of a prow-like shape to the back of the hall. Consulting original technical drawings, we discovered this was to be a "television room (*Fernsehraum*)," suggesting that the building's appearance in images, both still and moving, was a key consideration in its design. Our continued research will employ both the created 3D visualizations and evidence from secondary and primary sources to discern how engineering and imaging technologies might have influenced the design and construction of Scharoun's Berlin Philharmonic. 3D imaging technologies will allow us to analyze as well as explore details of the structure's construction *in* three dimensions.

3. CONCLUSION

3D capture is fast becoming a valued technology in museums and special collections libraries, although it is not yet universally employed at this time. The obvious value of 3D digitization is that it is the inevitable next step in the cultural heritage imaging chain. As the technology becomes easier to create and deliver, the tools become cheaper and more user friendly, our institutions incorporate the work of creating 3D surrogates into their core services, and the pubic becomes accustomed to fully dynamic media experiences, 3D imaging will be a normalized part of our capture process. This is the true value of 3D in the future of libraries and museums: It helps us to meet our core mission of documenting our collections and interacting in meaningful ways with our patrons. The Fraunhofer Institute is a leader in creating custom viewing environments for 3D objects and this collaboration will enable the Getty to create truly cutting-edge solutions for the use and display of any resulting digital representations. Partnering with the Fraunhofer Institute will furthermore allow the Getty's imaging staff to learn advanced techniques, which will provide a solid foundation for growing our internal processes. Although 3D printing techniques are already used in architecture schools, the potential of this technology for the study of architectural history has not been extensively considered. This project allowed the GRI to explore how advanced imaging techniques can contribute to the study of architectural history and examination of space.

4. ACKNOWLEDGMENTS

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5. REFERENCES

See for example Jones, Peter Blundell, *Hans Scharoun* (London: Phaidon Press, 1995): 174–90; Campbell, Hugh, "'The Bright Edifice of Community': Politics and Performance in Hans Scharoun's Berlin Philharmonie," *Arq: Architectural Research Quarterly* 11, no. 2 (2007): 159–66.