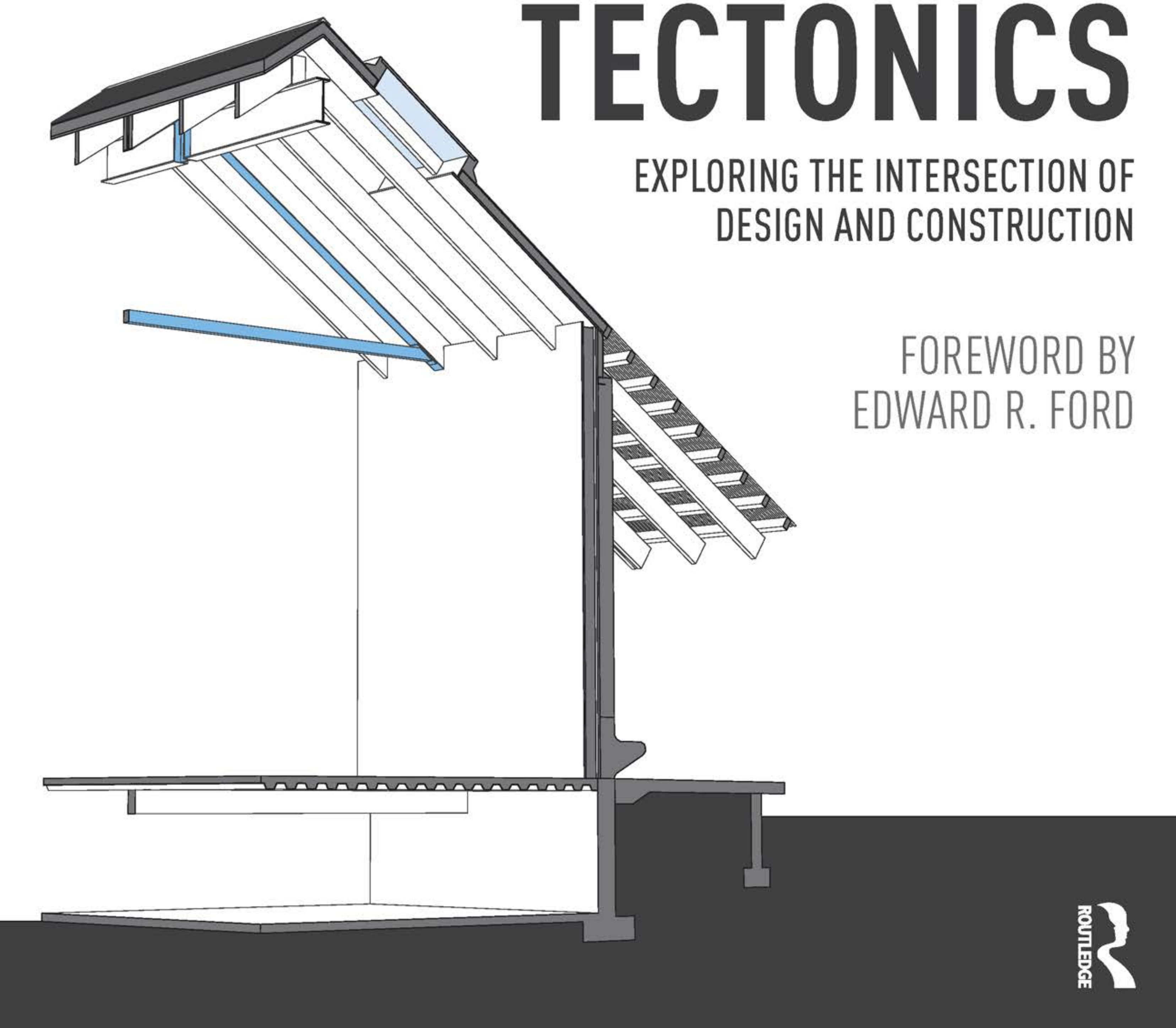
CHAD SCHWARTZ

INTRODUCING ARCHITECTURAL TECTONICS

EXPLORING THE INTERSECTION OF DESIGN AND CONSTRUCTION

FOREWORD BY
EDWARD R. FORD



ROUTLEDGE

INTRODUCING ARCHITECTURAL TECTONICS

Introducing Architectural Tectonics is an exploration of the poetics of construction. Tectonic theory is an integrative philosophy examining the relationships formed between design, construction, and space while creating or experiencing a work of architecture. In this text, author Chad Schwartz presents an introductory investigation into tectonic theory, subdividing it into distinct concepts in order to make it accessible to beginning and advanced students alike.

The book centers on the tectonic analysis of 20 contemporary works of architecture, located in 11 countries, including Germany, Italy, the United States, Chile, Japan, Bangladesh, Spain, and Australia, and designed by such notable architects as Tadao Ando, Herzog & de Meuron, Kengo Kuma, Olson Kundig, and Peter Zumthor. Although similarities do exist between the projects, their distinctly different characteristics – location and climate, context, size, program, construction methods – and range of interpretations of tectonic expression provide the most significant lessons of the book, helping you to understand tectonic theory. Written in clear, accessible language, these investigations examine the poetic creation of architecture, showing you lessons and concepts that you can integrate into your own work, whether studying in a university classroom or practicing in a professional office.

Chad Schwartz is an architect and educator currently serving as Assistant Professor in the School of Architecture at Southern Illinois University, USA. He teaches both design and building technology, continually seeking to merge the two bodies of knowledge. His research focuses on the introduction of critical making, tectonic investigation, and design/build into the classroom.

"Schwartz's clear content outlines logic that designers can use for creating structures and choosing materials for their integrated designs. This logic makes these case studies relevant learning tools, particularly for younger design students."

Charlton N. Lewis, University of Texas at Austin, USA

"This book fills the void between treating the concept of detailing and tectonics in a theoretical way, and focusing on construction practicalities. I particularly like the grouping of architectural building types, and the projects are very appealing. The quality of the graphics is excellent and there are drawings at a variety of scales, explaining the details well and situating them within the overall building and site context."

Greg Johnson, University of British Columbia, Canada

"This book provides a much-needed introduction to the themes of place and tectonics in architecture. The theoretical material forms the basis for in-class discussions, and the case study projects exemplify analytic methods that students can apply to additional cases as well as their own design projects."

Michael McGlynn, Kansas State University, USA

"Schwartz appraises buildings critically with complete descriptions, useful photographs and drawings, balanced opinions, and no jargon. The book is both concise and a clearly written text on architectural theory, which is rare. This will help architecture students and designers move on from the superficiality of current fashion."

Angus Macdonald, University of Edinburgh, UK

INTRODUCING ARCHITECTURAL TECTONICS

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Chad Schwartz

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I dedicate this book to my parents, Roger and Judy Schwartz, for 38 years of unconditional love and support.

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Peninsula House from the southeast, Sean Godsell Architects, Melbourne, Australia, 2002

[T]he primary principle of architectural autonomy resides in the *tectonic* rather than the *scenographic*: that is to say, this autonomy is embodied in the revealed ligaments of the construction and in the way in which the syntactical form of the structure explicitly resists the action of gravity.

Kenneth Frampton, “Towards a Critical Regionalism,” 1998

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Foreword

Edward R. Ford

In 1969, in his conclusion to *The Architecture of the Well-Tempered Environment*, a history of the effect of environmental controls, or perhaps the lack thereof, on modern architecture, Reynar Banham wrote:

> The . . . history . . . in the previous chapters can be summed up in two ways: either as the final liberation of architecture from the ballast of structure, or its total subservience to the goals of mechanical service.
>
> [. . .]
>
> [W]e have to face the fact that the architect as we know him at present, the purveyor of primarily structural solutions, is only one of a number of competing environmentalists, and that what he has to offer no longer carries the authority of . . . necessity.[1]

Three years later in 1972, Robert Venturi, Denise Scott Brown, and Steve Izenour, in *Learning from Las Vegas*, turned the last screw in the coffin lid of constructive rationalism, at least in their own minds. They wrote: "The relevant revolution today is the . . . electronic one. Architecturally, the symbol systems that electronics purveys so well are more important than its engineering content."[2] This was also the year Intel introduced the 8080 chip, making practical the first personal computers and sparking the digital revolution that followed.

In retrospect, this moment marked a major shift in the direction of modern architectural theory. Structural rationalism seemed to disappear altogether. The notion that the modern style was based on a kind of constructive inevitability was replaced by the sense that it was just another style. Formalism, the idea that we understand a building through the relationship of its parts – whether the form is closed or open, whether the elements are multiple or singular – gave way to semiology and all that followed, the idea that we understand art by symbolic association, that we *read* buildings as a text rather than understanding them as assemblies in equilibrium. The decline of the idea of a structural understanding of architecture took with it, understandably, Heinrich Wölfflin's idea of empathy, that we relate to a work of architecture by understanding the forces and weight within a building in the same way we understand of the forces and weight in our own bodies.

Much of contemporary theory assumes that the fundamental basis of architectural history has changed, that the contemporary condition, especially the digital revolution, has altered not just the future but also the past, and that if history is relevant today, and to some it is not, it must be rewritten to remain so. Many of modernism's fundamental understandings of architecture – the relation of form to structure, of construction to design, and the idea that the building's interior, both constructively and spatially, has a role in determining its envelope – are gone.

Most of this thinking is absent from this text. While others see a radical theoretical break in the architectural history of the last 200 years, Chad Schwartz sees a great deal of continuity. It is a premise of the book that nineteenth-century theory, or at least the best parts of it, is key to understanding twenty-first-century practice. Not just nineteenth-century theory, but Germanic tectonic theory in particular – the constructive symbolism of Karl Bötticher, the empathetic formalism of Heinrich Wölfflin, the structural rationalism of Arthur Schopenhauer, and most importantly for Schwartz, Gottfried Semper's concepts of the four primary architectural elements (hearth, roof, wall and mound), his historical model of frame and cladding and the resulting languages that grew out of them.

Semper is rarely mentioned in early modernist texts, but Schwartz is not alone in this interest. Joseph Rykwert began Semper's resurrection in his article of 1973, followed by Wolfgang Herman's monograph of 1984 and Harry Malgrave's of 1996. Malgrave's translation of *Der Stil* in 2004, 142 years after its publication, finally made it available in English. Schwartz's principle ally here is, of course, Kenneth Frampton. In 1995, on the eve of the digital revolution, Frampton, in his *Studies in Tectonic Culture*, applied Semper's mode of formal characterization to a variety of modern buildings. While there is evidence that architects like John Root, Frank Lloyd Wright and Bernard Maybeck were well aware of Semper, Frampton sees Semper's relevance extending well beyond to Carlo Scarpa and Peter Smithson. At one point, Frampton implies that Semper's four elements are "cosmogonically encoded,"[3] suggesting they evoke some conscious or unconscious archetype that transcends direct influence; but more commonly the architects discussed were, in Frampton's view, if not aware of an influence, a part of the tradition it created. Thus H. P. Berlage is strongly influenced by Semper, while Herman Hertzberger, even if unaware of Semper, is a part of the tradition that Berlage created along with Jan Duiker and others.[4] But whether encoded or acquired, these readings remain valid to Frampton, regardless of the technological upheaval of the twentieth century.

Is this true? There are some large problems. The fundamental assumptions of all of these writers were based on the analysis of stone, load-bearing masonry buildings with few if any environmental controls, in most cases the classical orders of Greece; and continued belief in these principles requires the assumption that they do not change with technology, however radical the change may be. Setting aside the magnitude of recent technological change, equally problematic is the fact that, with few exceptions, most eighteenth- and nineteenth-century theorists – Marc-Antoine Laugier, E. E. Viollet-le-Duc, and Semper – found it necessary to fabricate their own creation myths of the origins of architecture, which to most of them meant the Greek orders. It is remarkable, even allowing for the fact that anthropology was in its nascence, just how inaccurate these mythologies were. The *primitive* men they envisioned, who built these *primitive* huts, were seen by these writers as rational and empirical, blessed with the condition of starting from scratch and unencumbered by precedent. While generalizations of any kind are dangerous in anthropology, we know that there was little creativity in Neolithic societies, including archaic Greece in which tradition was paramount and in which the distinction between science and magic, so essential to us, was unknown. Semper's version may be more plausible, but not necessarily more accurate.

But despite all this, I am in substantial agreement with the author. I wrote in 1990 that the bulk of our contemporary ideas about good building came not from an analysis of the conditions of modern construction but from nineteenth-century theories; and despite the rhetoric to the contrary of the last 25 years, to me it remains true. I would argue for a slightly different genealogy for these ideas. Certainly the French, not to mention the Dutch and English, deserve equal time with the Germans. For example, Thomas Carlyle's *Sartor Resartus* (*The Tailor Retailored*) was probably far more important to Wright's ideas about clothing/cladding and their relation to the body/structure than Semper's *Der Stil*. But in principle Schwartz has it right; despite our efforts to displace them, the work of Schopenhauer, Bötticher, Wölfflin, and Semper remain correct in their general, if not specific, conclusions, regardless of the inaccuracy of much of the historical analysis used to support them. Their conclusions as to how we best understand a building are based on perceptual phenomenon that while affected by technological change, are not eliminated by it and which remain the basis for the deepest of our architectural understandings.

Recent years have seen changes for the better in some quarters. Wölfflin's formalism is enjoying something of a comeback, particularly in the work of Nick Zangwill. Notions of empathy that have long been neglected in favor of *reading* are being actively re-examined by writers such as David Summers. Even Mark Wilson Jones, who has done as much as any to dismantle the notions of the constructive origins of the orders, finds some virtue in these writers – Semper in particular. Despite the technological transformations of the last 50 years and the innumerable errors of both fact and opinion to be found in the constructive theoreticians of the early modern era, the fact remains we have yet to produce better theory to replace them. It seems abundantly clear that weight and empathy are the basis for our abstract, as opposed to our symbolic, understanding of architecture; and Semper's notion of layered building, while never meant to be a formula for constructive practice, still has a meaningful connection with modern perceptions of building. That clothes are to the body as architectural cladding is to the structural frame is a thought one can find as readily in Herzog & de Meuron as in Otto Wagner.

Notes

1 Reynar Banham, *The Architecture of the Well-Tempered Environment* (Chicago: University of Chicago Press, 1969), 265; 267–8.

2 Robert Venturi, Denise Scott Brown, and Steve Izenour, *Learning from Las Vegas* (Cambridge: MIT Press, 1972), 151.

3 Kenneth Frampton, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture* (Cambridge: MIT Press, 2001), 13.

4 Frampton, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture*.

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Preface
Building a Foundation

In the opening lines of "The Tell-the-Tale Detail," the late architect and educator Marco Frascari wrote:

> Elusive in a traditional dimensional definition, the architectural detail can be defined as the union of construction, the result of the *logos of techn*é, with construing, the result of the *techné of logos*.[1]

In the Greek language, *logos* means discourse or the communication of thought through conversation while *techné* refers to the practice of making an object using previously gained knowledge.[2] Frascari's *logos of techné*, therefore, can be translated as a conversation about making and constructing. Its counterpart, the *techné of logos*, reads as the making of conversation or a discussion leading to the understanding of meaning.

This quotation – as well as the rest of Frascari's essay – serves as a catalyst for the study of the architectural detail, of the making of things, and of the theoretical premise of the tectonic. Frascari asserted that the joining of elements is not simply an act of construction, but a process that helps to define the space created *through* construction. This dialogue is essential for the development of a comprehensive architectural curriculum and has the potential to help fill some of the voids found in many current curricular models. For instance:

- Despite the efforts of many to minimize the separation of design, construction, and theory in schools of architecture, the divide still exists. Moments of intersection are too infrequent to properly prepare young minds for the complexity of architectural practice. Given the multifaceted structure of higher education (regulated course loads, core requirements, accreditation guidelines, etc.), full integration is impossible in most situations, but opportunities do exist for meaningful conversation between these knowledge bases.
- Novice students, more often than not, struggle with architectural theory. In many cases, the formal grammar, discipline-specific terminology, and surplus of unknown references lead to confusion and reluctance to independently pursue advanced lines of thinking. Avoiding theory altogether during these early years can lead to equally dismal

results. In order to prevent such outcomes, improved instructional tools need to be developed to assist in using theory as a productive part of a student's development.

- The study of precedents is crucial for the development of young architects. Exposure to a variety of ways of thinking about the built environment leads to a greater knowledge base from which to draw while working. These studies, however, need to be carefully calibrated as they often result in merely superficial engagement. Instead of alluring imagery, students must excavate critical lessons from these case studies; images alone explain very little of what a precedent has to offer. Instead, studies should focus on analyzing HOW the project works, responds, or engages.
- Many architecture students, especially those in their first years of study, lack the understanding that each line he or she draws is a representation of something real. Drawing lines and assembling space are significantly different undertakings, but they are intricately linked. Studying the translation of architectural representations to the reality of the built environment leads to better development of the critical thinking skills necessary to practice architecture professionally.

This book is a direct response to these realizations. It endeavors to deliver to you an understanding of the integrative potential of architectural tectonics. Just as Frascari did in "The Tell-the-Tale Detail," this text presents a conversation about the making of architecture that will hopefully resonate with you as you begin (or continue) your investigation of the built environment.

Notes

1 Marco Frascari, "The Tell-the-Tale Detail," in *Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory 1965–1995*, ed. Kate Nesbitt (New York: Princeton Architectural Press, 1996), 500. (Originally published in *VIA 7: The Building of Architecture*, 1984, 23–37.)

2 Adrian Snodgrass, "On 'Theorising Architectural Education'," *Architectural Theory Review* 5, no. 2 (2000), 89.

0.2
GC Prostho Museum Research Center, main gallery, Kengo Kuma & Associates, Kasugai, Aichi, Japan, 2010

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Acknowledgments

I want to first thank Max Underwood and Leslie Van Duzer for their ongoing mentorship, guidance, and inspiration in all matters, including the genesis of this book. Their advice and support gave me the confidence to take on this immense project. I also want to thank two architects – Michael Underhill and Mark Ryan – whom I studied under while working in their respective offices. The education they provided me as a novice architect pushed me to study the details of our practice and to embrace the relationship developed between design and construction. The line of inquiry presented in this book would not be possible without their tutelage. In addition, many of the faculty in the School of Architecture at Southern Illinois University (SIU) have been incredibly supportive of my efforts in writing this book. In particular, Walter Wender, Craig Anz, and Laura Morthland – along with Leslie Van Duzer – donated their valuable time to read portions of the book and provided feedback that helped refine the work of this first-time author. I also want to give a special thanks to Stewart Wessel. His almost daily inquiries about how the book was coming along, what chapter I was working on, or if I had met my deadlines always reinvigorated my dedication to continue writing. I cannot thank him enough for the motivation his continued interest in my work provided.

The initial explorations for the investigations in the book were undertaken in my third-year architectural studios. I want to thank the students in my sections of ARC351 during the fall semesters of 2013 and 2014 for being guinea pigs and starting the process of tectonically analyzing architectural works. In particular, I want to acknowledge Lauren Ovca. Two of her diagrams of Rafael Moneo's National Museum of Roman Art were reconceived and included in this book. In addition to these groups of students, I need to thank the team of intelligent and motivated undergraduate and graduate students from the School of Architecture at SIU who worked with me directly on the project. Without their help, I never could have completed the work that needed to be done within the available time frame. Anthony Michael spent his time primarily in the library assisting with the research for the book and helped to develop the initial proposal submitted for review. Nicholas Ouellette, Aaron Neal, and Robert Konzelmann spent countless hours creating, refining, and editing many of the drawings and diagrams found throughout the project chapters. Zoey Koester took on the challenging roles of assisting with the editing of the text and with the creation of abstracts and other written work. And, finally, Suzanne Abell and Aaron Neal, two of the brightest students I have ever had the privilege of teaching, spent an academic year coauthoring four of the project chapters in the book. Suzanne helped to pen the chapters on Olson Kundig's Brain Studio and Lake|Flato's Government Canyon Visitor Center while Aaron cowrote the chapters on Kengo Kuma's GC Prostho Museum Research Center and KieranTimberlake's Loblolly House. These two students responded to my challenge to extend the reach of their education, and their commitment and dedication to this process was greatly appreciated.

I must thank SIU, the College of Applied Sciences and Arts (CASA), and the School of Architecture for believing in me and this project enough to provide resources to support my research assistants. Funding was also provided by CASA and the School of Architecture to cover the costs of obtaining copyright permission to use many of the photographs found in the book. I offer a special thanks to Nadine Wojnarowski for all of her efforts in processing the enormous pile of paperwork required to utilize much of this funding.

I also received a great deal of assistance from outside the university. I need to thank the architects, firms, librarians, photographers, marketing directors, and archivists who contributed their resources, time, and effort to assist me in accumulating the information required to complete this project. I must thank Edward Ford for graciously agreeing to write the Foreword for the book. His research into architectural detail was one of the catalysts that inspired my venture into this realm of architectural investigation. I am honored for him to have been a part of this process and for his contribution to the book. I am also grateful for his patience and guidance in our collaboration.

I need to thank the staff at Routledge – Wendy Fuller, Grace Harrison, Alanna Donaldson – and the rest of the publishing team for their dedication to helping me realize this project and for educating a novice author about the process of publishing a book.

And finally, I want to thank my wife Katherine and my three beautiful daughters: Charlotte, Amelia, and Addison (who joined our family during the process of writing the book). Their love, patience, and support made this book not only possible, but also worthwhile.

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GUIDING PRINCIPLES

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Introduction
Developing a Framework

Whether sitting in a classroom, at the office, in a library, or in your living room, if you have picked up this book then you are likely a student of architecture. This book is written for you. The intent is to deliver to you a clear and concise introduction to the central ideas of architectural tectonics; an introduction that is accessible to even the newest students of architecture, while sophisticated enough to satisfy the intellectual appetites of more advanced readers. This study begins, as the title states, with the intersection of design and construction. Each of these terms carries distinct meaning and ultimately defines the framework for this exploration of tectonics.

What is Design?

> Design in architectural practice is a process of connecting all the parts and details that are included in the concepts of durability, utility, and beauty into a convincing, buildable entity.[1]
>
> Jadwiga Krupinska, *What an Architecture Student Should Know*, 2014

Although also used to refer to the resulting product, *design*, in this context, refers to the active process of conceiving, developing, and representing the future of the built environment. This definition centers on the journey – the working through of a given problem. This process is driven by intuition and rigorous analysis, by creativity and critical thinking; it can be intimate for the designer, yet it can also be shaped by a substantial set of contextual influences, often requiring the integration of many points of view and multiple perspectives to ultimately achieve success. Design also exists at all scales, from the largest city plan to the most discrete building detail. We must, as Eliel Saarinen has stated, “Always design a thing by considering it in its next larger context – a chair in a room, a room in a house, a house in an environment, an environment in a city plan.”[2]

Architectural design is often thought of as the creation of the aesthetic image of a building, but that is a rather limited understanding of the term. Design is not just concerned with appearances, but also with the development of the relationships between systems, components, ideas, and contextual influences. Architecture, after all, is systemic;[3] it is the weaving of physical (structure, plumbing, construction), nonphysical (circulation, light, security), and even metaphysical (time, weight, embodiment) systems into spatial constructs. In *Designing Architecture*, Pressman says:

> Design is not something that is tacked on after analysis, or after solving the space-planning puzzle; nor is it purely aesthetic. The unsung element is the set of intangibles or cognitive processes that arise from a passionate and deeply personal involvement – with a project at every step of its development – from engaging clients to examining materials, components, and systems, to construction.[4]

Although *design* can refer simply to the cognitive act of conceiving ideas, with respect to architecture we must look beyond conception to the process of making representations. Design itself is not tangible, but the ideas generated through the design process have the potential to become real through translation into the sketches, drawings, models, renderings, and specifications that represent them. These representations are the architect's plan for action, the products of the design process that serve as a blueprint for construction.

What is Construction?

As with design, *construction* is not viewed in this text as just a product, but also as a process of making. The act of constructing is an embodied practice. Juhani Pallasmaa states:

> The authenticity of architectural experience is grounded in the tectonic language of building and the comprehensibility of the act of construction to the senses. We behold, touch, listen and measure the world with our entire bodily existence, and the experiential world becomes organised and articulated around the center of the body.[5]

Construction unites the body with the material world in a physical act of joining elements together to create a whole. This process also involves translating the architect's graphic and written set of instructions; it is the *enactment* of the plan for action.

Although the current "maker" revolution is slowly bringing design and construction closer together, most architectural works are built with precious little hands-on influence from those who designed it. Stephen Kieran and James Timberlake believe that:

> The design of how we go about designing, and ultimately making, circumscribes what we make. It controls the art found in its quality, scope, or features and also the resources of time and money expended on its production. This reality is completely contrary to the artistic and contractual structure of much current architecture, which specifically excludes the architect from participation in the "means and methods" of making, thus turning architects into mere stylists.[6]

In past eras, architects frequently apprenticed at a construction site as part of their education. This practice is scarcely utilized today. With a few notable exceptions, most architects are educated in the university and in the office. Despite a recent surge of design/build programs in schools of architecture,[7] rarely are contemporary architects trained through the extensive making of "real" things. These individuals, however, must intuitively understand the construction processes at work to be able to embed appropriate instructions within their representations. Juhani Pallasmaa refers to this as instructing the "surrogate hands" that execute the work[8] – a difficult proposition for those who have never built anything themselves.

What Exists at the Intersection of Design and Construction?

Architecture is often described as the intersection, or perhaps *collision*, of art and science. These two distinct realms, however, cannot be set in opposition; they must be cooperatively utilized in the creation of the built environment. Architecture is an integrative art, one that combines the design of productive space with the tangible realities of gravity, material properties, and assembly sequences, amongst others. In order for architecture to succeed, it must be thought of as a whole. The study of tectonics can help to accomplish this goal. Tehrani states:

> [O]ne might argue that a building is intensified through the elaboration of its own medium – *a language of sticks and stones* – to induce a state of architecture. The "material" that underlies architecture is somehow rooted in construction and its details, and yet beguilingly, the devices that engage the building practice are most often in tension with the seemingly direct necessities of fabrication. Herein lies one of the most fertile and debated topics in architectural theory: the subject of tectonics. At the heart of this debate is the dilemma posed by the necessities of fabrication, which rarely coincide with the intended expression of a building, even in those projects whose authors profess an ethic of truthfulness or honesty to the facts of material construction.[9]

Tectonics has many definitions, but they all tend to focus on the relationships between those architectural elements we tend to hold apart: space and construction, structure and ornamentation, atmosphere and function. Architectural tectonics seeks a relationship between the design of space and the reality of the construction that is necessary for it to exist. The discussion of this relationship permeates this text.

How is this Book Designed and Constructed?

The main content of this book is delivered in two parts: an introductory essay on tectonics and a series of precedent analyses. The introductory essay is the foundation of the book and provides a fundamental grounding in the theory of tectonics. It contains three types of critical information. First, the essay introduces key individuals responsible for creating and advancing a theory of architectural tectonics. Second, it introduces terminology that is built upon later in the book. And finally, the essay establishes a framework of core concepts that are subsequently used to analyze the precedents. These concepts are presented in topical sections, each drawing from different lines of historical and contemporary thought:

- Anatomy: the study of the primary components and systems of a building inspired by Gottfried Semper's proposal for four elements of architecture.

- Construction: the study of the means and methods of construction as well as the materiality of the built environment. This topic contains two important subdivisions: Tectonic (the study of the lightweight assembled components of architecture) and Stereotomic (the study of the heavy mass components of architecture).
- Detail: the study of the joints and other critical conditions that make up the smallest scale of the built environment. This topic includes an important subdivision called Intersection, which is focused on the juncture between primary building components or systems.
- Place: the study of the impact of a specific place or context on the tectonic makeup of a building.
- Precedent: the study of past built work for the purpose of inspiring projects yet to come. The focus here will, of course, center on the adaptation of tectonic strategies from one project to another.
- Representation + Ornamentation: the study of the relationship between the actual construction of the building that is required for stability or enclosure and the cladding or ornamentation that is used to create the aesthetic scheme.
- Space: the study of the relationship between the creation of space and the construction and representational qualities of a building.
- Atectonic: the study of conditions that run contrary to typical tectonic ideas.[10]

At the heart of this book are 20 chapters that each present a precedent analysis of a masterfully built work of architecture. Studying the work of others through a process of careful analysis is a potent way of learning how to do things yourself. The process is reflective of an apprentice model: learning through the close examination of someone else's methods of practice, as from the hands of a master.

Simon Unwin acknowledges, however, that architecture students can be reluctant to engage with precedent studies because they "believe that their own originality and greatness will prosper best by insulating their creative genius from 'corruption' by the ideas and accomplishments of others," but "[b]oth evolutionary development and contradictory revolution depend on understanding what has gone before."[11] Precedents provide key lessons that can be drawn from, expanded upon, and utilized as a foundation for design work. Drawing from the analysis of a work of architecture is merely copying only when what is taken is superficial. If instead its critical lessons – relationship of components, systems of order, means of connection, conceptual partis, to name just a few – are examined and used as building blocks to help create new architecture then the precedent becomes a spark of inspiration.[12]

This book provides a platform for engaging with high-quality samples of the built environment that can provide this spark. The projects selected for study have distinctly different characteristics: location and climate, context (urban, suburban, and rural), size (under 40 square meters to over 4,600 square meters [400 square feet to 50,000 square feet]), program, and construction. Similarities do exist between the projects and, in some cases, these are specifically identified in the text to allow for cross-comparison. However, the strength of the lessons stems from the range of interpretations of the tectonic expressed in this set of projects.

Each project chapter is presented in a similar format, utilizing a combination of written explanations, diagrams, images, and drawings to deliver its lessons. The first component of each chapter is the base information – square footage, location, and program. Included in this information are the global positioning coordinates for each project (except single-family residences), allowing you to locate the works on a map or even in person. A brief introduction to the architect (or firm) responsible for the design of the building follows the base information along with an introduction to the project itself.

The body of each chapter centers on the analysis of the precedent through the topics outlined in the introductory essay. Although the topics remain the same from chapter to chapter, their order, inclusion, and relative significance varies based on the lessons offered by each project. To offer as many outlets as possible for continuing the exploration of ideas, each chapter concludes with two lists of sources: a selection of additional references and a selection of additional projects by the architect or firm.

This book is not intended to be a complete anthology of tectonic thought. *Introducing Architectural Tectonics* is, as the title states, an introduction; it provides a significant starting point and robust foundation for what could be a meaningful and informative study of architecture's essential elements. I hope that by reading through these pages, your interest in architecture and tectonics is piqued and that this book can serve as a catalyst for a lifetime of investigation into the design and construction of our built environment.

Notes

1 Jadwiga Krupinska, *What an Architecture Student Should Know*, trans. Scott Danielson (New York: Routledge, 2014), 118.
2 Eliel Saarinen as quoted in Matthew Frederick, *101 Things I Learned in Architecture School* (Cambridge: MIT Press, 2007), 92.
3 A comprehensive explanation can be found in: Valerio Di Battista, "Towards a Systemic Approach to Architecture," in *Systemics of Emergence: Research and Development*, ed. Gianfranco Minati, Eliano Pessa, and Mario Abram (New York: Springer, 2006).
4 Andrew Pressman, *Designing Architecture: The Elements of Process* (New York: Routledge, 2012), 16.
5 Juhani Pallasmaa, *The Eyes of the Skin: Architecture and the Senses* (Hoboken: John Wiley & Sons Inc., 2007), 64.
6 Stephen Kieran and James Timberlake, *Refabricating Architecture: How Manufacturing Methodologies are Poised to Transform Building Construction* (New York: McGraw-Hill, 2004), 7.
7 As a licensed architect practicing and teaching in the United States, much of this commentary is focused on US practices both professionally and academically.
8 Juhani Pallasmaa, *The Thinking Hand: Existential and Embodied Wisdom in Architecture* (Chichester: John Wiley & Sons, Inc., 2009), 63.
9 Nader Tehrani, "Foreword: A Murder in the Court," in *Strange Details*, by Michael Cadwell (Cambridge: MIT Press, 2007), xii.
10 These ideas were first explored in Chad Schwartz, "Investigating the Tectonic: Grounding Theory in the Study of Precedents." *The International Journal of Architectonic, Spatial, and Environmental Design* 10, no.1 (2015).
11 Simon Unwin, *Analysing Architecture*, 4th ed. (New York: Routledge, 2014), 5.
12 These ideas were first explored in Schwartz, "Investigating the Tectonic."

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Investigating the Tectonic
Unpacking the Guiding Principles

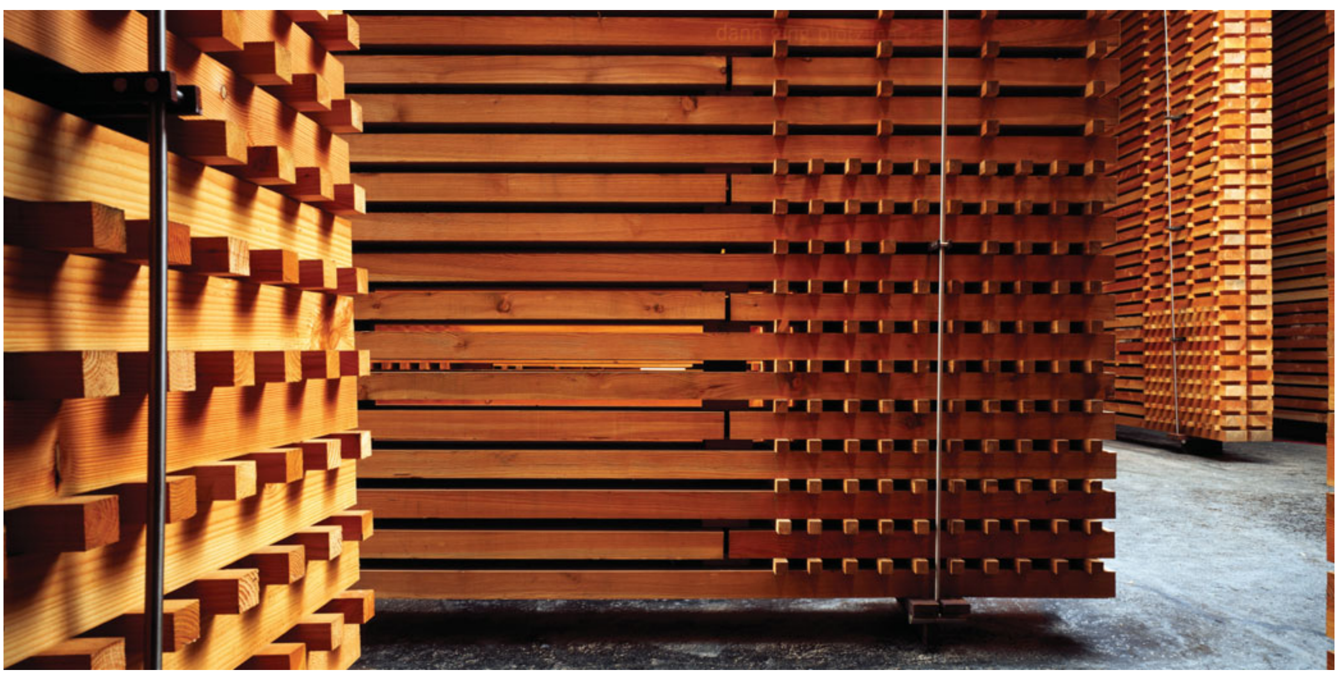
Kunstform = art form = the exterior or visible description of the underlying mechanically necessary systems (Kernform)

architectonic = the primer of architectural form given in accordance with the principles of tectonics.[2] For ease of reading, the word tectonic is typically used throughout the book.

We conceive of tectonics in the more narrow sense: the activity of building or of making objects of use, as soon as this activity is *ethically suffused*, and can rise to the charges placed upon it by intellectual or physical life. At that point, this activity not only seeks to satisfy mere needs by *forming a volume* in accordance with material necessity but instead may elevate that volume to a ***Kunstform***.

Thus, we conceive of the tectonic activity in two groups: the group of the *pure built work*, or the **architectonic**; and that of the smaller forms, of the *tectonic of useful objects*. Both are based upon the same principles of formal constitution. The architectonic, because of the scope of its duties and the compass of its means, requires that these principles be described more broadly and drastically.[1]

Karl Bötticher, *Die Tektonik der Hellenen*, 1844



00.1
Interior view of the Swiss Sound Box, Peter Zumthor, Hannover, Germany, 2000

> I think that the *dressing* and the *mask* are as old as human civilization and that the joy in both is identical to the joy in those things that led men to be sculptors, painters, architects, poets, musicians, dramatists – in short, artists. Every artistic creation, every artistic pleasure, presumes a certain carnival spirit, or to express it in another modern way, the haze of the carnival candles is the true atmosphere of art.[3]
>
> Gottfried Semper, *Style in the Technical and Tectonic Arts*, 1861

Tectonic theory is integrative; it examines "the interwoven relationship between space, function, structure, context, symbolism, representation, and construction. No single definition exists that conveys the full meaning of the term tectonic, primarily because it has evolved over time."[4]

In Europe in the mid-1800s, tectonic theory developed as a response to contemporary architectural practice. **Neoclassicism**, amongst other styles, was building a strong following in architectural circles and, as such, aesthetic appearance carried great weight in the evaluation of the built environment. Tectonic theory challenged the predominant assumption that what lay below the surface of a building was secondary to its ornamented cladding. It sought exterior expression for the underlying structural systems and mechanics that allow for the creation of built space.

Neoclassicism = a period during the eighteenth century and early nineteenth century characterized by the widespread use of Greek ornament, motifs, and characteristics in architecture and the arts

Tectonic expression was originally rooted in **historicism** focused on the ancient civilizations of Greece and Rome. However, 160 years of cultural change and technological advancement have necessitated a constant evolution of the built environment, leading to a shift in the understanding of tectonics. The original intent has been pushed and pulled; at times it has been simplified and at other times, perhaps corrupted. The soul of tectonics, however, remains: the belief that the construction of architecture – the **ontological** core of the built environment – is worthy of being expressed in the design of architectural space. In his lauded work *Studies in Tectonic Culture*, theorist Kenneth Frampton discusses the "constantly evolving interplay of three converging vectors, the *topos*, the *typos*, and the *tectonic*."[5] Frampton believes this integration of place, typology, and construction does not favor a particular architectural *style*, but does form a foundation for investigating our built environment.

historicism = the theory that past cultures were built on timeless principles that should be adapted for contemporary use

ontology = the study of the nature of existence or being or, in architectural terms, the study of the essence of a building that is simultaneously both its fundamental structure and its substance[6]

The etymological origins of *tectonic* reinforce its theoretical foundations. Tectonics derives from the Greek words *techne* (or *techné* or *tekhne* depending on the source) and *tekton*.[7] Originally, *tekton* translated as carpenter. Over time, however, the word evolved to include a broad definition of making and eventually led to the emergence of the term *architekton* or master builder. *Techne* refers to an act of making that is driven by both a predetermined goal and the existing knowledge necessary to achieve that goal. It "may be defined as the conscious, willful working or reworking of matter until it becomes not only what it was not but also what it was our intention that it should become."[8] It is the inclusion of utility or purpose in *techne* though that connects the terminology of tectonics to its conceptual origins in Europe.

The underlying concepts of tectonics arose in the late 1700s in Prussia. Between the late 1700s and the 1820s, the architectural culture of the Germanic states blossomed. The first German school of architecture was founded in Berlin in 1799 – the Berlin *Bauakademie*.

The founding of this school led to others, and by the mid-1820s, the development of critical scholarship was underway within the architectural circles of Berlin, Karlsruhe, Dresden, Stuttgart, and Munich. The emergent German lines of thinking (both architectural and non-architectural) would soon be considered amongst the most prolific in Europe.[9]

Immanuel Kant

Immanuel Kant, a well-known German scholar of the period, contributed to this development with an overarching theory of beauty (Figure 00.2). A component of this theory investigated two significant concepts of the era with respect to the fine arts: the ideas of *purpose* and *purposiveness*. *Purpose* is defined by Kant as "the object of a concept, in so far as the concept is seen as the cause of the object"[10] (Figure 00.3). Essentially, a maker has an idea of the need for an object, and this concept is the driving force for the object's development. This process involves the human acts of design and making.[11] *Purposiveness*, on the other hand, is "the causality of a *concept* in respect of its *object*."[12] To be purposive, an object needs to serve a useful function despite the fact that it was not purposely designed to do so. Scholar Harry Francis Mallgrave refers to purposiveness as "the essential inherent form by which the brain reads and appreciates art,"[13] finding higher purpose in the utilitarian purposeless. With this distinction, Kant laid the groundwork for the separation of the aesthetic qualities of architecture from its purpose-driven nature – an initial catalyst for the development of tectonic thought.

Kant went on to state that:

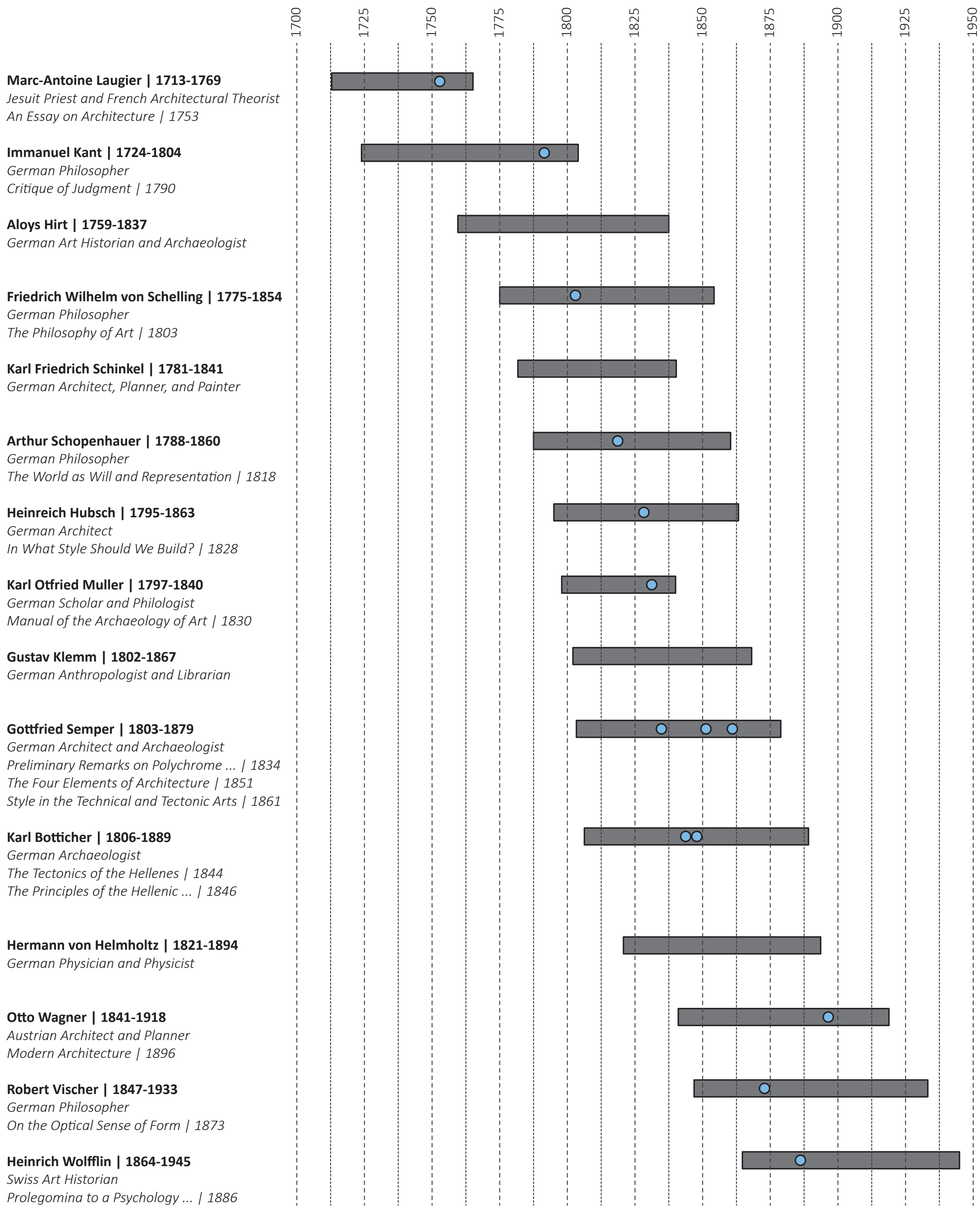
> There are two kinds of beauty: free beauty (*pulchritude vaga*), or merely dependent beauty (*pulchritude adhaerens*). The first presupposes no concept of what the object ought to be; the second does presuppose such a concept and the perfection of the object in accordance therewith.[14]

There is a significant line drawn here between the beauty of a work of art that holds no greater purpose and beauty that is founded with purposeful intent; for example, the creation of a building or a utensil. This distinction marks a prominent stance on the relationship between architecture and the other fine arts (music, painting, sculpture, etc.). For many early nineteenth-century scholars, including Kant, the reality of purpose and dependency on mechanical rules relegated architecture to the lowest level of the fine arts.[15]

Friedrich Schelling and Arthur Schopenhauer

In many ways, this demotion of architecture planted the seed of architectural tectonics. In the early 1800s, while some scholars like Heinrich Hübsch fully embraced the purposeful core of architectural expression through the implementation of **structural rationalism** (providing hints of the Modern Movement to come), others, such as Friedrich Schelling and Arthur Schopenhauer, sought out ways to integrate the *purposeless* essence of art into the practice of architecture.[16] Schelling separated purposiveness into two divisions: subjective and objective. Subjective purposiveness referred to the primary role of architectural form as fulfilling or displaying the building's purpose.

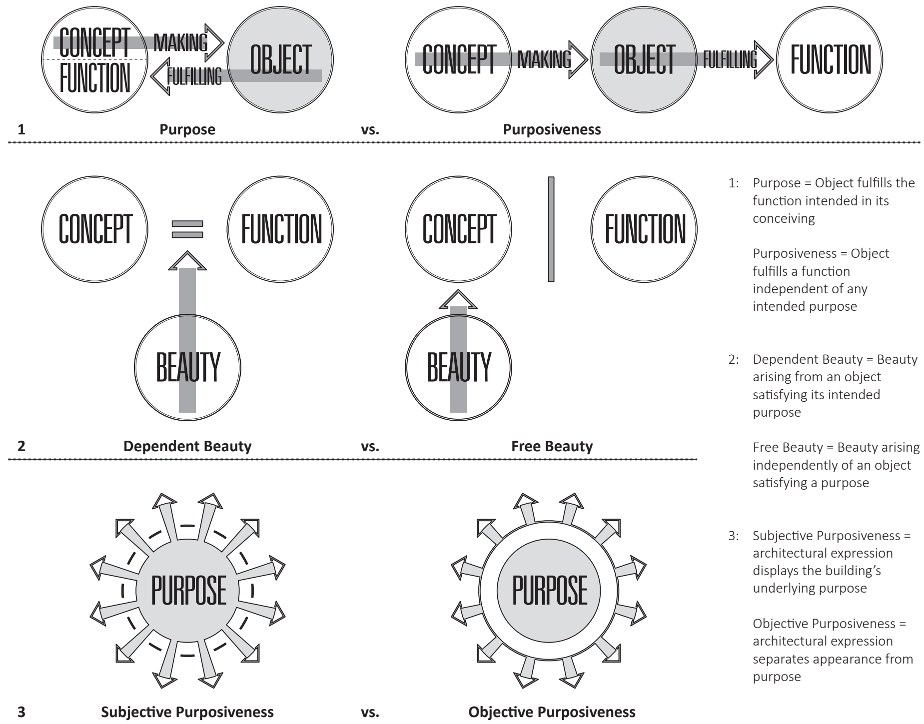
structural rationalism = a nineteenth-century architectural theory stating that form should be based on the study of structural principles



*This chart is not meant to be a comprehensive list of contributors to the development of the theory of tectonics. It consists solely of individuals specifically mentioned in the text. The written works listed are also those referenced in the book.

00.2
Timeline of key individuals

00.3
Theoretical concepts



Objective purposiveness, on the other hand, required separating the appearance of a building from these utilitarian needs (Figure 00.3).[17] Pursuing the development of the objective, Schelling proposed that the appearance, or ornamented dressing of the building, should be inspired by nature and that there are three levels of quality to this practice. At the lowest level is direct imitation of natural form – such as plant life. This is followed by the imitation of advanced natural works like the human body. Finally, the highest level of incorporation is through the "invoking [of] nature's higher laws."[18] At this level, architecture is built on "arithmetical and geometric relationships"[19] (higher laws) and avoids imitation altogether in its development. Schelling described the integration of the highest reference of nature into architecture as "solidified music"[20] and believed that through this strategy, architecture would attain a higher purposiveness through the integration of the essence of art and architectural purpose.

Schopenhauer takes a different stance from that of Schelling.

> Now if we consider *architecture* merely as a fine art and apart from its provision for useful purposes, in which it serves the will and not pure knowledge, and thus is no longer art in our sense, we can assign it no purpose other than that of bringing to clearer perceptiveness some of those Ideas that are the lowest grades of the will's objectivity. Such Ideas are gravity, cohesion, rigidity, hardness, those universal qualities of stone, those first, simplest, and dullest visibilities of the will, the fundamental bass-notes of nature.[21]

Schopenhauer believed that architecture's only aesthetic objective is the demonstration of the continuous battle between the rigidity of the structure and gravity's pull towards earth.

Each building component plays a critical role in this conflict as "every part must have so necessary a relation to this stability that if it were possible to remove some part, the whole would inevitably collapse."[22] Schopenhauer concludes that architecture develops a relationship with the user not through symmetry, form, or other traditional architectural concepts but, instead, through "those fundamental forces of nature, those primary Ideas, those lowest grades of the will's objectivity."[23] However, like his contemporaries, he believed that to elevate the status of architecture, the architect must achieve aesthetic ends despite its subordination to the practicality of its core objective.

Karl Friedrich Schinkel

Amongst those who were influenced by Schelling and Schopenhauer was Karl Friedrich Schinkel, the preeminent German architect of the nineteenth century (Figure 00.4). Early in his career, Schinkel wrote that "purposiveness is the basic principle of all building [and] determines the greatest possible presentation of the Ideal; it is the character or the physiognomy of the building, its artistic value."[24] Examining Schinkel's body of work, however, reveals a broad exploration of the intent and reality of architecture, an investigation of both purpose and purposiveness leading to a wide range of expressions. In his later writings, Schinkel states: "Architecture is construction. In architecture everything must be true, and any masking or concealing of the construction is an error. The real task here is to make every part of the construction beautiful within its character."[25] These beliefs tied the construction of architecture directly to its outward projection. They began to bind together the utilitarian purpose of architecture with its exterior art-form. Among countless others, Schinkel's architectural attitudes provided a theoretical base for two individuals who studied and worked with him in Berlin in the middle of the nineteenth century: Karl Bötticher and Gottfried Semper. From these two men arose the theory of architectural tectonics.

00.4
The front façade of the Altes Museum, Karl Schinkel, Berlin, Germany
Source: © Michal Bednarek | Dreamstime.com

Karl Bötticher

Karl Bötticher arrived at the Berlin *Bauakademie* as a student in 1827 and studied under Schinkel.[26] In 1844, after qualifying as an architect and teaching at several other schools, Bötticher was appointed a professor of architecture at the *Bauakademie*. During the 1840s, he wrote extensively on his forming theory of architectural tectonics. The most comprehensive of his writings was *Die Tektonik der Hellenen* (*The Tectonic of the Greeks*), which was first published in 1844 and soon after became the principle architectural text at the *Bauakademie*.

In addition to his mentor, Bötticher was influenced by a range of ideas presented by other key thinkers of the late eighteenth century and early nineteenth century including Schelling, Schopenhauer, Hübsch, and Schinkel's mentor Friedrich Gilly. Despite these relationships, Bötticher's ideas about architecture ran contrary to numerous normative beliefs of the era. Many philosophers of the period elevated the individual, while Bötticher elevated the social; these philosophers saw external nature as the starting point for symbolic representation, but Bötticher started with the internal mechanical workings of the building; these philosophers saw utilitarian purpose (dwelling needs, materials, etc.) as subservient to artistic representation, and Bötticher saw exactly the opposite.[27]

Bötticher was also a classical archaeologist; his mindset and approach to architecture were significantly affected by his knowledge of past. While teaching at the *Bauakademie*, Bötticher was inspired by another archaeological mind – that of antiquities professor Aloys Hirt. Hirt's writings focused on classical rules of beauty. He believed that contemporary architecture was best conceived using rules, laws, and principles derived from ancient sources, particularly the Greek. Bötticher adapted Hirt's position and drew heavily on ancient Greek architecture in the development of his theory of tectonics.

Bötticher's tectonics also built on Schinkel's emphasis on the importance of space in the development of a building. Bötticher believed that architectural design should center on the enclosure of space,[28] citing once again the ancient Greek: "The Hellenistic building, in both plan and structure, proves itself to be an ideal organism, one that is skillfully articulated in order to produce a spatial entity."[29] In this spatial construct, Bötticher sought "a synthesis between the ontological status of the structure and the representational role of the ornament."[30] However, the ornamental cladding of the building could not obscure the construction that it adorned; instead, this cladding needed to express its underlying form. The integration of ornament and core was a new approach, and it was contrary to current practices. While many theorists were focused on the imitation of objects or styles, Bötticher decided to focus his efforts on illuminating a building's internal processes, utilitarian nature, and "infinite universe of forces."[31]

Gottfried Semper

Gottfried Semper was educated as an architect in Paris in the late 1820s after having already studied mathematics at the University of Göttingen in the first half of the decade.[32] In France, he studied at the private school of Franz Christian Gau, an architect and archaeologist who is credited with reviving Gothic architecture in Paris during the first half of the nineteenth century. Soon after, Semper began his archaeological travels in Italy and Greece, where he found himself in the center of a great architectural debate regarding classical **polychromy**. On his return north in 1833, Semper stopped in Berlin to discuss his findings with Schinkel, who would prove to be integral to Semper's career as an architect in the coming years. In 1834, Semper was named professor at the Dresden Academy of Fine Arts and enjoyed great professional success until 1849 (Figures 00.5 and 00.6). In that year, Semper's political activism would doom him to exile as he found himself on the losing side of the Dresden Uprising. Banished from Germany and unable to practice successfully as an architect abroad, Semper began his work as a theorist. Over the next decade, Semper published several significant books and papers including *The Four Elements of Architecture* in 1851 and *Style in the Technical and Tectonic Arts* in 1860.

polychromy = the practice of using color in the design of architecture

The relationship between Semper and Bötticher was established on December 13, 1852. At this time, Bötticher had been actively investigating architectural tectonics for over a decade. However, Semper had not yet been introduced to Bötticher's writings. On this date, it is recorded that Semper checked out Bötticher's *Die Tektonik* from the library at the British Museum. "What he read must have given him a shock: views that he had considered to be his most original had been voiced by someone else in a book published almost ten years before."[33] Despite initial outrage, Semper agreed with, and may have even adopted, some of Bötticher's ideas, including the term *tectonic*, which Semper had not used prior to this point in time.[34]

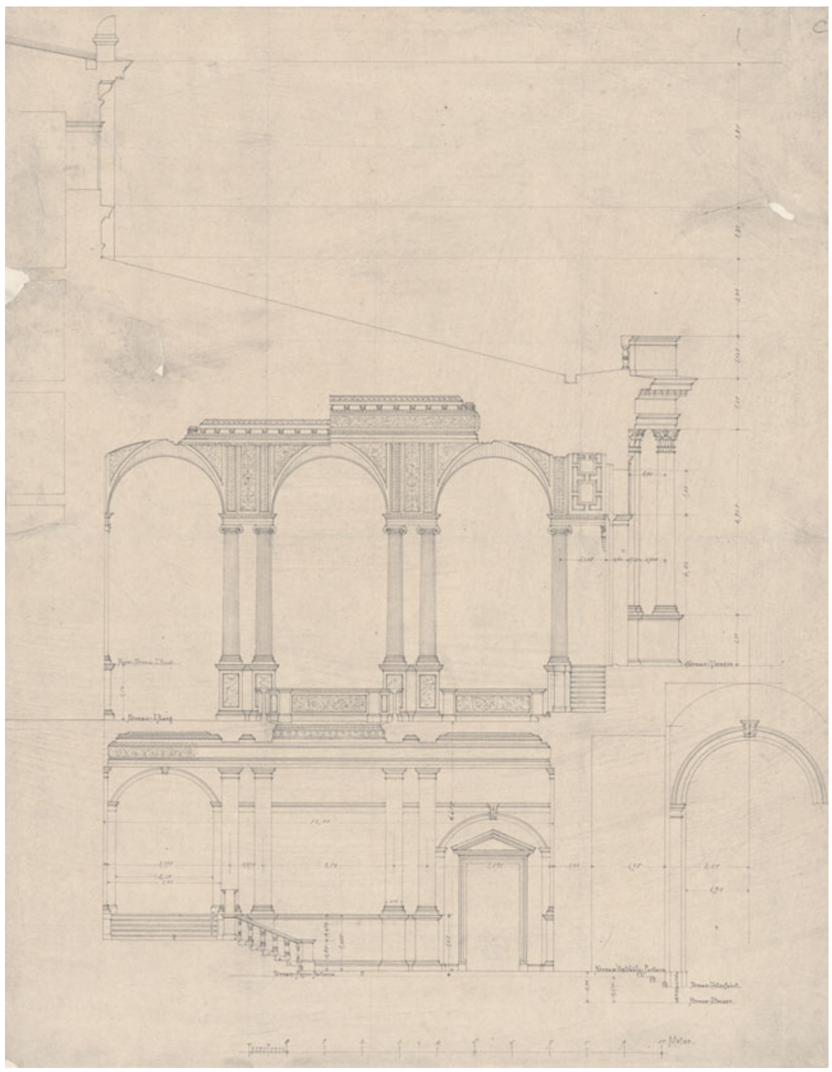
Many of Semper's primary beliefs, however, depart from Bötticher's line of thinking despite the two having shared several common catalysts for their work, including Schinkel's mentoring. Semper was inspired by the growing science of anthropology. He sought to study not just the creation of built form, but all human artifacts. He also departed from contemporary convention by examining cultural work through ritual use rather than aesthetic appearance.[35] These lines of inquiry might be taken for granted today, but in the mid-nineteenth century, this approach was cutting-edge philosophy. Semper's extensive anthropological studies led him to develop a series of principles on the origins of building. He believed that architecture developed not from construction, but from the need for enclosed space. This focus on space was derived from examining the development of social separation between the interior and exterior worlds in primitive cultures. Semper's particular fixation on the cladding of space led him to further develop these ideas into his theory of *Bekleidung* (dressing). In this theory, Semper states that "*the beginning of building coincides with the beginning of textiles*"; this would later develop into an examination of the relationship between the making of crafts and the making of architecture.[36]

Tectonic Principles[37]

Precedent

> Just as the abundance of technical means is an embarrassment to us, even more so are we perplexed by the immense mass of historical knowledge, which increases daily. Every trend of taste is familiar to us, from the times of the Assyrian and Egyptian styles to the age of Louis XVI and beyond. We can do everything, we know everything except ourselves.[38]
>
> Herrmann, *Gottfried Semper*, 1984

00.5
The front façade of the Zweites Hoftheater (it was reconstructed in the 1870s after a fire destroyed must of the structure), Gottfried Semper, Dresden, Germany
Source: © Delstudio | Dreamstime.com



00.6
Section of the Zweites Hoftheater, Gottfried Semper

In this quote, Bötticher emphasized a growing understanding of history and its impact on the practice of architecture, but also urged caution. He, along with Semper, believed that the "senseless copying of historical work" became easier to do with increased knowledge of historical styles.[39] But studying precedent is not about choosing an aesthetic appearance and pasting it into the contemporary landscape. On the contrary, both theorists urged moving beyond eclecticism and sentimentality to a deeper understanding of the principles and culture that could properly inform contemporary work.[40]

As discussed earlier, one of Bötticher's primary inspirations was the architecture of the ancient Greeks. Hellenic building practices were under intense scrutiny in the beginning of the nineteenth century in Europe, and Neoclassical tendencies permeated the fine arts. Great debate existed regarding the source of inspiration or precedent for the Greek culture. Bötticher believed that Hellenic tectonics arose from the "potency of the Hellenic race of expressing any concept in an artistic way."[41] Essentially, he surmised that Greek architecture and art did not evolve from outside sources but was, instead, self-generated by the Greeks. Semper, with his anthropological mindset, disagreed, believing "nothing arose in isolation and nothing that had ever been created ceased to have an effect."[42] He offered the following response to Bötticher's theory:

> With shortsighted zeal, a fanatic and fallacious Hellenomania took the classical spade and systematically cut off the widespread roots and fibers that provided the lofty plant of Hellenic civilization with the basic conditions for its existence and gave it support.[43]

This disagreement was expressed prominently in the analysis of the Greek temple (frequently cited as a microcosm for Greek architecture as a whole). Hirt, the archaeologist, had determined through his research that the stone construction found in Greek architecture had evolved from earlier wood construction.[44] His determination centered on the evidence

00.7
West pediment of the Parthenon showing representation of wood construction, Athens, Greece
Source: © Dpikros | Dreamstime.com

of wood construction detailing in many stone temples (Figure 00.7). This positon was not new; in the middle of the nineteenth century, Marc-Antoine Laugier proposed similar ideas in *An Essay on Architecture*.[45] Semper paralleled Hirt's beliefs on the origins of temple construction, but not his reasoning. Semper, instead, believed that the timber-like forms found on Greek temples were representational ornamentation inspired by "features originally used to tie down textile fabric covering the roof."[46]

This premise was countered by Hübsch who believed that structural rationalism and economic considerations would have prevented such a transfer between vastly different materials with different structural properties. Bötticher sided with Hübsch, believing that the Greek temple had always been constructed with stone as its principle material. This difference of opinion did not mean Bötticher and Semper's readings of Hellenistic building were entirely different. They each believed that the Greeks derived their building principles from nature and that contemporary ornamentation must be derived from these Hellenic principles. Bötticher had a "classicistic view of Greek architectonic forms" and developed a mindset centered on the pictorial representations of the natural environment,[47] while Semper's beliefs paralleled Schelling's theory of ornament, discussed earlier; symbolic ornamentation must not directly imitate nature but should instead be inspired by its innate qualities.

Beneath the surface, Bötticher looked elsewhere for construction precedent. He believed the Gothic style was far superior to that of the Greeks with respect to construction technology. He states, "[t]hose who dismiss it as Germanic and barbaric overlook the enormous step forward represented by the medieval system of widely spanned spaces, with its escape from the structural limitations of material."[48] The pairing of Gothic constructional technique and Hellenic ornament defines Bötticher's concept of architectural tectonics.

Beyond the precedent of the Greeks, Semper had other inspirations as well. Unlike Bötticher, who looked forward in time, Semper looked backwards to the fundamental beginnings of the built environment. Here, he would find his greatest inspirations in a comprehensive study of primitive vernacular building.

Place

From his research on vernacular building, Semper was able to identify two fundamental typologies: the wall-dominated courtyard building and the roof-dominated roof-hut. These two configurations were driven by local conditions of culture and environment; they were rooted to *place*. The warmer climates of the south forced the development of the courtyard-style building in response to solar conditions, while the colder climates further north necessitated protection from heavy precipitation and led to the development of the roof-hut.[49] As in the earliest buildings, the relationship to place continues to significantly impact the design and construction of our built environment. From the foundations to the roof, architecture can (and should) be configured to meet the local social, cultural, and climactic needs.

The site is also influential in the production of built space. Vittorio Gregotti says:

tympanum = the triangular space below the traditional roofline of a temple

> Before transforming a support into a column, roof into a **tympanum**, before placing stone on stone, man placed a stone on the ground to recognize a site in the midst of an unknown universe, in order to take account of it and modify it.[50]

Marking the ground is the first stage of the creation of architecture, a central tenet that separates it from the other fine arts. Buildings must be physically attached to the earth in order to transfer loads and resist gravity's pull. In addition, "the actual start of cultural staging coincides with the appearance of ownership: a principle concomitant with fixed abode and legal regulation."[51] Therefore, the preparing of the earth provides a stable foundation for the physical building as well as a cultural connection to place through the marking of territory. With each of these roles, "[o]ne cannot disregard the enormous importance of the plane separating above and below. That plane is basic to the tectonics of building. . . . It is the beginning of our taking possession of the land."[52] "Situated at the interface of culture and nature, building is as much about the ground as it is about built form."[53] Bulldozing the irregular topography of a site to create a flat working plane promotes placeless architecture. However, stepping the building to match that uneven terrain locates the tectonics of construction within a specific context or place (Figure 00.8).

Contemporary design practices are becoming highly responsive to their place in the world. Annette LeCuyer has defined the most sensitive of these projects as exercises in the radical tectonic.[54] She states:

00.8
Hillside home Casa Tóló, Álvaro Leite Siza, Alvite, Portugal, 2005

> The reintegration of craft with industry makes it possible to move beyond necessity, beyond the mere technical imperatives of construction to explore once again its expressive and representational potential. Distancing itself both from the abstraction of modernism and the overt signs and symbols of postmodernism, the radical tectonic looks to the construction itself – shaped by craft, culture and context – as the source of its iconography.[55]

In this contextually driven philosophy, buildings are intimately linked to a particular place and time. They are shaped by their location and, in turn, reveal "intrinsic, invisible energies that are latent in their sites."[56] Whether engaging environmental factors, the surrounding infrastructure, or the cultural needs of the inhabitants, architectural tectonics is being redefined by the world around it. These influences, however, are not new considerations. Conversely, they are the very same elements that Semper believed shaped the first architectural works.

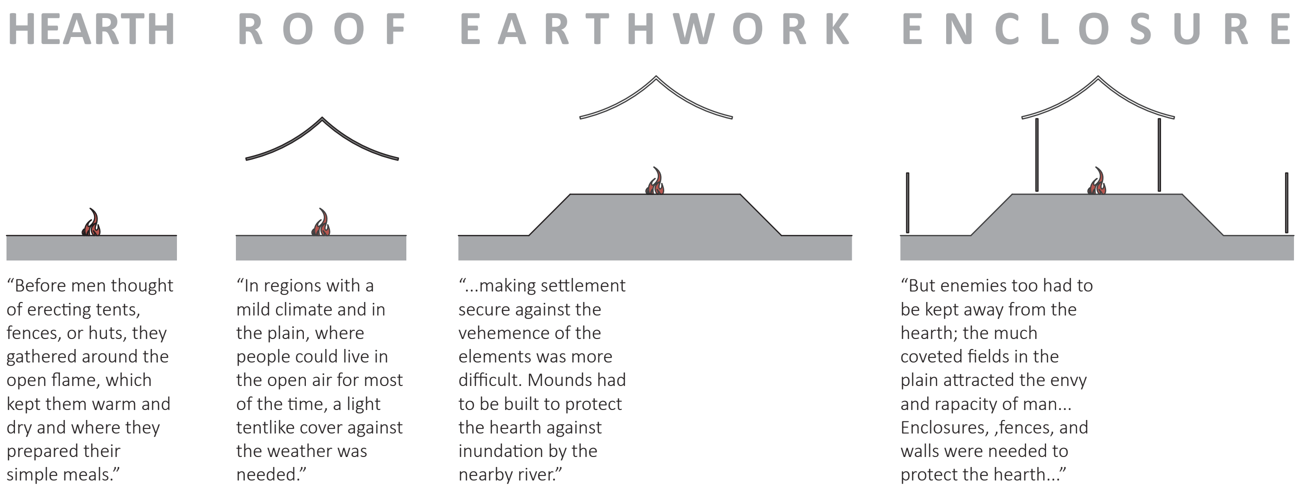
Anatomy

Semper divided buildings into a series of key components known as the four elements of architecture. He was not the first, however, to create an architectural classification system. Centuries earlier, Vitruvius proposed that architecture must be formulated around *utilitas*, *firmitas*, and *venustas* (function, durability, and beauty). In the mid-eighteenth century, Laugier developed his own set of primary architectural elements, which departed distinctly from that of Vitruvius: the column, the entablature or ceiling, and the pediment or pointed roof.[57] In the 1840s, a librarian and ethnographer working in the Royal Court in Dresden named Gustav Klemm would develop a new set of building elements drawn from ethnographic studies done in the late 1700s in the South Pacific. Klemm named "the social hearth, earthen or masonry platform, matted walls, and timber roof" as the primary building blocks of the native cultures of the region.[58]

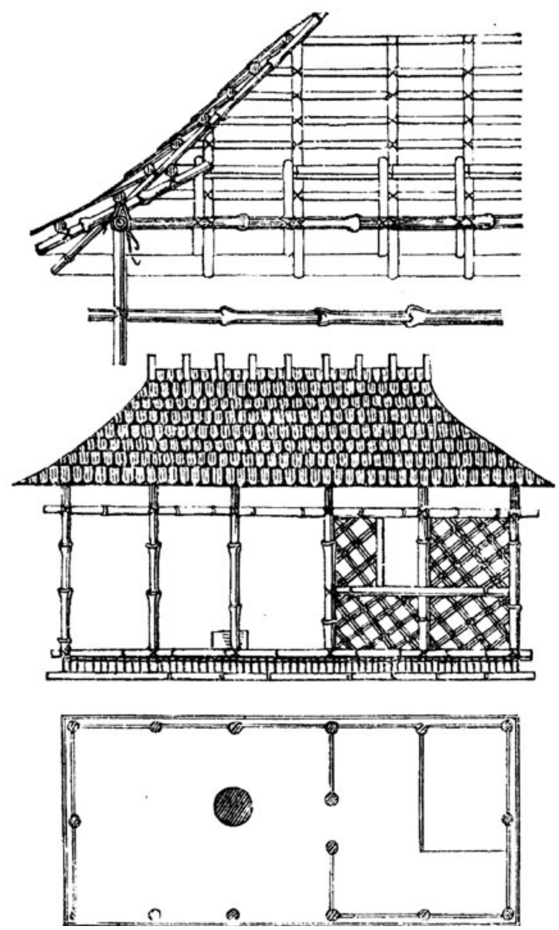
Semper was also in Dresden at this time. Although there is no record of their interaction,[59] it is likely they discussed these matters as Semper would propose a nearly identical set of elements in his writings: the hearth, the earthwork, the framework and roof, and the enclosing membrane or cladding (Figure 00.9). Semper, however, would primarily attribute his catalyst for this study to a Caribbean hut displayed at the Great Exhibition of 1851 in London[60] (Figure 00.10).

The earthwork, as discussed in the last section, is the foundation; it receives the building, elevates it (in some cases) for protection, and serves as a place of connection between the man-made structure and the ground. Extending upwards from the earthwork is the framework. This element is typically structural and defines the limits of the claimed space, both horizontally and vertically. Bötticher also found significance in the framework, specifically in the roof. He believed that as the primary sheltering element, the roof drove the building's form. Its required supports directly shaped the spaces below.[61]

Semper believed that the primary space-defining element of architecture is the cladding that wraps the framework and defines boundaries. He proposed that cladding evolved from the practice of hanging textiles to divide spaces. As such, he created two separate wall typologies: *die Mauer* (a massive fortified wall) and *die Wand* (a lightweight screen).[62] The



00.9
Semper's four elements of the first domestic house[63]



00.10
Semper's illustration of Caribbean hut on display at the 1851 Great Exhibition in London
Source: Illustration by Gottfried Semper from *Style in the Technical and Tectonic Arts*, p. 666

lightweight screen, tasked with dividing space, was his vision of the cladding. The fortified wall, on the other hand, was constructed through massing or piling of material; it served as an extension of the earthwork and as a barrier or protective element.

These three elements – the earthwork, the framework, and the cladding – all serve to protect the hearth. The hearth incorporates "in a single element the public and spiritual nexus of the built domain."[64] The hearth is an integrated part of the earthwork. It began as a simple fire, utilized for heat, but grew to represent the social center and served as a catalyst for the human need to build. Paired with cloth or fabric, the hearth was heralded by Semper as one of "two primary archetypes . . . the *Urherd* (the hearth) and the *Urtuch* (the cloth). They were the first mark of settlement and the first fabrication."[65]

Semper paired these four elements with crafts, linking the building of architecture with the utility of the industrial arts. Central to this pairing are the innate properties of materials and the effect of those material characteristics on created objects and, at the scale of architecture, on space. The earthwork is tied to masonry, which is hard and durable; the framework is tied to carpentry, which is ductile; the cladding is tied to textiles, which are elastic; and the hearth is tied to ceramics, which have an underlying softness to their creation.[66] It is imperative, therefore, to "interpret Semper's 'elements' not as specific entities, such as a wall or mound, but rather as thematic processes generating formal development."[67]

Construction

Semper's four elements classify into two construction typologies: *tectonic* and *stereotomic*. (Figure 00.11). The term stereotomic derives from *stereotomy* or the practice of cutting and shaping stone for construction. Stereotomic construction is characterized by piled or stacked mass elements such as stone, brick, or earth. The earthwork and the hearth are traditionally stereotomic; they are rooted to or embedded in the site. The other half of this pairing is the tectonic. Here, tectonic takes on a more specific definition as opposed to its characterization of the entire field of study, referring to lightweight, assembled structures.[68] This distinction is characterized by its root *tekton*, which is focused on the practice of carpentry (per the previous discussion). Timber "has a finite length and width and therefore invites the artisan to treat construction in a dimensional and scalar sense. In addition, timber is discontinuous and so it begs the skill and knowledge of jointing."[69] Semper's framework and cladding are the tectonic elements of his classification system. They are traditionally jointed members that Semper believed to have evolved from the practice of weaving.

For Semper, material choice was crucial to the development of architecture. Materials need to be specifically chosen for the task at hand. "Let the material speak for itself; let it step forth undisguised in the shape and proportions found most suitable by experience and science. Brick should appear as brick, wood as wood, iron as iron, each according to its own statical laws."[70] Choosing the correct material for each particular condition, according to Semper, allowed for an ideal expression in the building and, ultimately, beauty. Bötticher, on the other hand, was much more concerned with the function of each component than its materiality. Each member in a constructed system was configured to resist the forces of the world. For Bötticher, material was not the concern; instead, beauty arrived through the creation of stability and an ideal relationship between parts.

00.11
The stereotomic mass of an Incan stone wall and the tectonic assembly of the Eifel Tower
Sources: © Bryan Busovicki | Dreamstime.com (Incan wall) and © Andrey Kuzmin | Dreamstime.com (Eifel Tower)

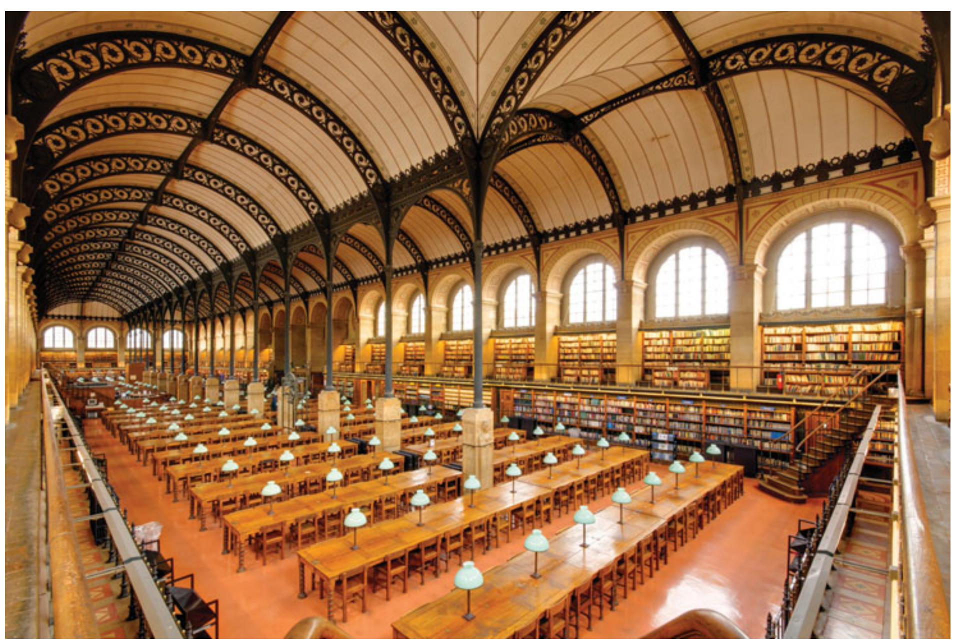
In the early 1800s, a revolution in construction practices led to experiments with a new material as the primary structural system of a building. According to Bötticher:

> No longer can stone alone form a new structural system of a higher stage of development. The reactive, as well as relative, strength of stone has been completely exhausted. A new and so far unknown system of covering . . . can appear only with the adoption of an unknown material, or rather a material that so far has not been used as a guiding principle. . . . Such a material is iron.[71]

Bötticher's focus on construction over materiality allowed him to embrace this new technology. In 1844, Bötticher's writings were solely focused on the Hellenic and the Gothic. Just two years later, however, it became apparent that he realized the potential of iron and began to adapt his thinking to match the progression of construction technology.[72] For Botticher, iron construction was the next stage of evolution. The dematerialization of architecture and the structural spans achieved with stone construction in the Gothic period could only be enhanced through the use of iron (Figure 00.12).

In 1965, under a new wave of tectonic thought, professor and architectural historian Eduard Sekler published a paper examining the relationship between construction and structure in contemporary architectural tectonics. Sekler proposed:

> Through tectonics the architect may make visible, in a strong statement, that intensified kind of experience of reality which is the artist's domain – in our case the experience of forces related to forms in a building. Thus structure, the intangible concept, is realized through construction and given visual expression through tectonics.[73]



00.12
Reading room of the Bibliotheque Sainte-Genevieve, Henri Labrouste, Paris, France
Source: © Marie-Lan Nguyen | Wikimedia Commons

Structure, according to Sekler, involves the establishment of a series of principles or rules that are activated through the construction of the building.[74] Structure is abstract; it is not tied to a particular material and can be realized in a number of different ways. Construction, on the other hand, brings materiality to the structural system; it involves the optimal assembly and spatial arrangement of materials with regard to the established structural rules.

Sekler's understanding of structure likely evolved from Bötticher. Bötticher's tectonic theory centered on the existence of an underlying core-form within a building called the *Kernform* (or later the *Werkform*). The *Kernform* is the mechanically necessary system; it is functional, structural, and durable. This core-form serves the role of structure in Sekler's definition while also providing the constructed, load-bearing reality of that system. Each member of the core-form has a specific structural or architectural function that it fulfills, determined by "technical necessity,"[75] directly reflecting Kant's concept of purpose.

Bötticher's core-form resides in the sphere of technological advancement. As such, it evolves to align with current cultural demand and innovation.[76] This belief has played a significant role in the evolution of tectonic thought. Carles Vallhonrat states:

> Seldom has a new technique altered the imagery of building with anything less than a full cultural transformation. The evolution of Gothic structures and the development of modern construction, with the appearance of carbon steel in the second half of the nineteenth century, are cases in point. Such transformation requires a fusion, a oneness of formal and tectonic creativity that must be absolute to exist.[77]

Here, Vallhonrat depicts technological advancement in construction as a transformative tool. However, he also states that evolution cannot exist without a binding relationship between formal and tectonic creativity. New technology can only be embraced when modes of thinking align. Despite his acceptance of iron construction, Bötticher struggled to align his tectonic stance with realities of the new technology. At the end of his career, he had yet to successfully integrate iron construction into his tectonic theory despite his eagerness to do so.

While Bötticher struggled to properly incorporate iron construction into his theoretical work, Semper refused to embrace it outright. He condemned the technology, primarily because iron could support great loads with far less volume than the bulky stone alternative.[78] As a material purist, Semper did not believe material should be enhanced to do the work of a different material system. He also believed the "cheap industrial simulation of one material by another, above all through casting, stamping, and molding" corrupted a building's ability to convey symbolic meaning.[79]

Today, construction is advancing at a rapid rate, and fabrication techniques that Semper may have questioned are poised to revolutionize the practice of architecture. As new materials – plastics, composites, etc. – and techniques – digital fabrication, 3d printing, etc. – evolve into traditional building practices, the role of construction in creating and experiencing the built environment is potentially expanding. New technology leads to new techniques and new characteristics for architecture. Materials become lighter, spans become further, and joints become few and far between (or completely concealed).[80] The shift from building in stone to building in iron may pale in comparison to technological shifts that will happen in the not too distant future, significantly impacting the understanding of built space as well as the makeup and expression of tectonic core-form.

Representation

The core-form was only half of Bötticher's tectonic construct however. As he says in *Die Tektonik Der Hellenen*:

> the relationship between the mechanical role played by a structural component alone and the measure of its connection to all other components of the overall form appear to the eye as commensurate and harmonious by virtue of the analogous proportions of its cubic schema and the formal expression of its decoration.[81]

Bötticher's theory required that the core-form be fully concealed beneath an equally important system: the *Kunstform* or art-form. The inspiration for this pairing may have been derived from a similar set of ideas expressed by German scholar Karl Otfried Müller in the mid-1800s about the development of fine art.[82] Whereas Bötticher's core-form performs the mechanical work, his art-form is

> the functionally descriptive characteristic. This characteristic embodies not merely the essence unique to that member but also its relationship to the members tangent to it. . . . And so, just as all members are unified mechanically in a static whole, so, too, do the conjoining symbols unify pictorially all the members in a single, inseparable organism.[83]

In other words, the art-form is ornamentation that clads the construction but visibly expresses the structural forces, rules, and physical manifestation below the surface. For example, a simple cylindrical post carries gravity load from the structure above. However, if ornamentation is added at the column's capital that can visibly animate the receiving of that load then the column is transformed into an Order[84] (Figures 00.13 and 00.14).

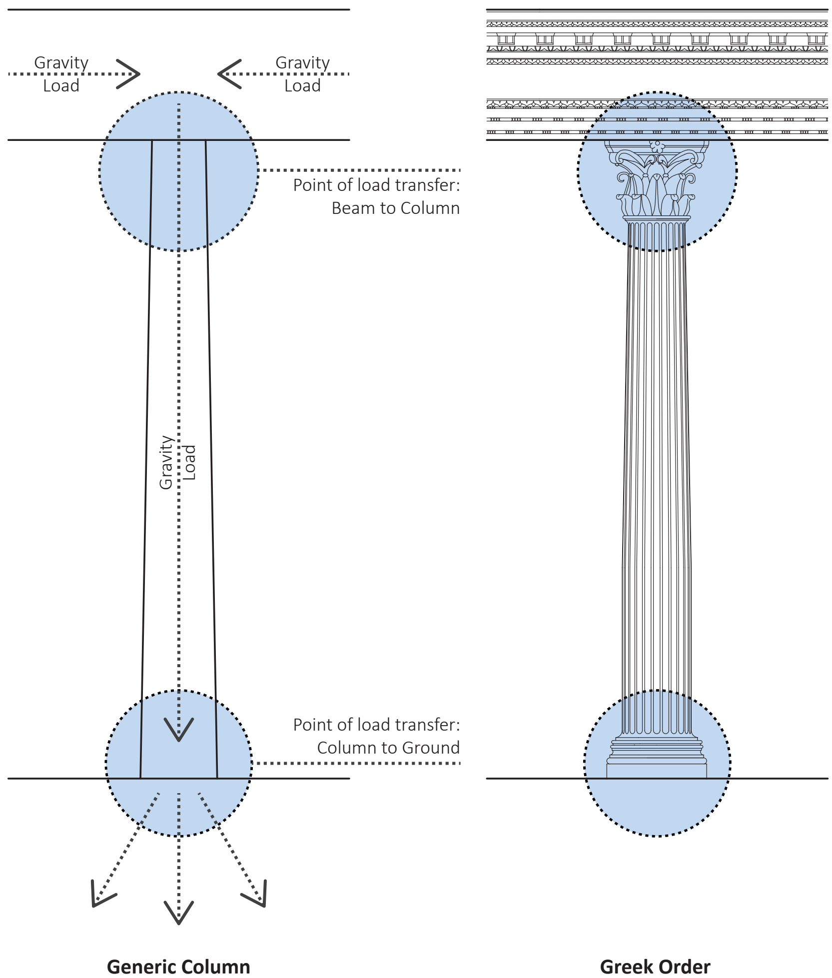
Within this relationship, Bötticher views the core-form as the dominant component of the system.

mutulus = projecting flat blocks on the underside of a cornice used in classical ornamentation

dentils = a series of closely spaced rectangular blocks used in classical ornamentation

> Neither the base nor the capitol of a column, neither the decoration at the end of the beam nor the **mutulus**, neither the **dentils** nor any symbol of the joinery is structurally necessary, nor is it structurally justified. Nowhere is it assumed that either coherence or static integrity will be increased by the decorative clothing.[85]
>
> The kernel of each structural component, denuded of all decorative attributes, is in its naked corporeality already capable of fulfilling all functions of a building. . . . This fundamental truth makes it possible to clothe the kernel form in stucco, plaster, mosaic, bronze, etc.[86]

The clothing of a building – the art-form – is derived from the core-form; art arises from construction and then covers it to transform a mere building into fine art. As stated



00.13
Analysis of a Greek column

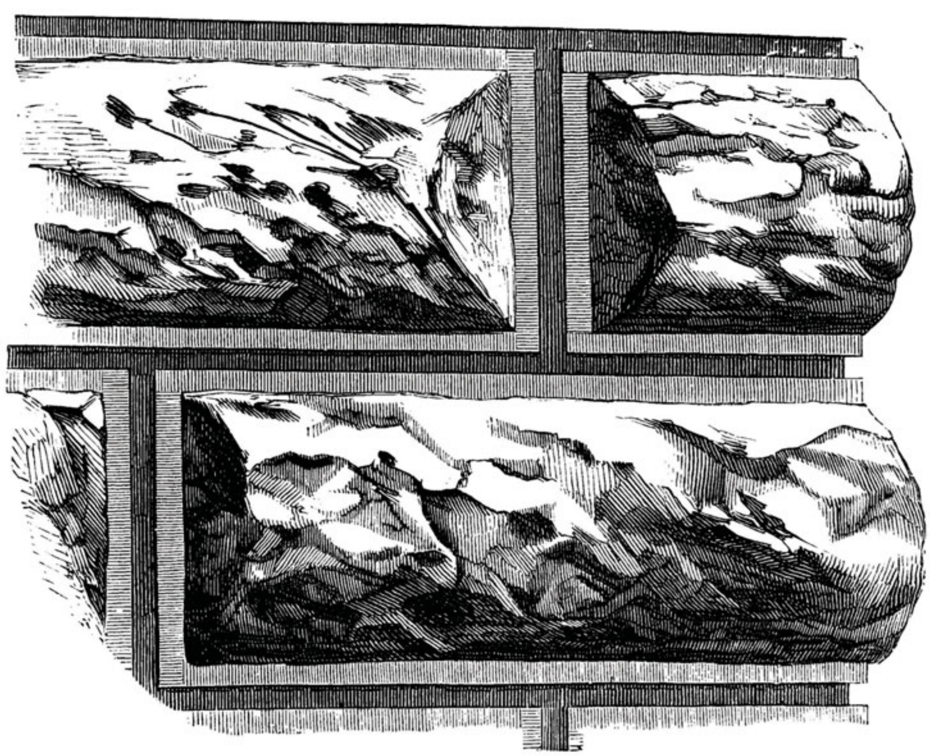
00.14
Columns at the Temple of Apollo, Turkey
Source: © Oxanam | Dreamstime.com

earlier, Bötticher conceded that the core-form must necessarily progress with technological advancement. The art-form, however, was a representation of ideal beauty and was required to reflect Greek forms that represented a "sense of timeless" and "universal creativity" to the Germans.[87]

Semper, perhaps as a response to Bötticher's work,[88] proposes a similar pairing of core and surface: the structural-technical, which fulfills the role of the *Kernform*, and the structural-symbolic, which fulfills the role of the *Kunstform*. The structural-technical is the underlying order and substance of the building; this functionality is expressed within the earthwork and framework of Semper's four elements. The structural-symbolic, on the other hand, is the expressive presentation of that underlying order. The hearth fulfils the role of the cultural symbolic, while the cladding, although tangible, is the primary expressive component of the built form.

ashlar = precisely cut building stone that permits very thin mortar joints

In Semper's Dresden Museum, the relationship between the surface and the underlying structural-technical is demonstrated in the treatment of the exterior walls.[89] Here, the bottom section of the wall is exposed **ashlar**. While the blocks are rough-cut and bulge outwards, each block has a refined edge condition (Figure 00.15). This manipulation of material – a form of ornamentation – expresses the load of the building pushing downwards on the lower walls, inducing the bulging that is restrained by the perimeter band. Mallgrave has likened this technique to Schelling's notion of "solidified music": a static, but expressive, representation of the rules of nature at work in the building.[90]



00.15
Drawing of the ashlar on the Dresden Museum
Source: Illustration by Gottfried Semper from *Style in the Technical and Tectonic Arts*, p. 731

Ornament

Semper's primary contribution to the representational qualities of tectonics, though, is through *Bekleidung* or his theory of dressing. Semper believed that "[t]he art of dressing the body's nakedness is presumably a more recent invention than the use of coverings for encampments and spatial enclosures", and as noted earlier, "*the beginning of building coincides with the beginning of textiles*."[91] As evidence, Semper cites woven fences made of sticks and braided grasswork, which eventually lead to the invention of weaving.[92] He argues that while these activities provided a foundation for the practice of constructing, the development of architecture or monumental works originated in the dressing of open scaffolds used for ceremony and festivity. These events, centered on performance, spectacle, and ritual, led to more permanent monuments as people began settling in place.[93]

Semper's theory contained strong evolutionary components as well. Architectural historian Wolfgang Herrmann states:

> The covering of the wall retained . . . meaning even when *other materials* than carpets were used either because these materials lasted longer or because they were cheaper, easier to clean, or more magnificent, as for instance when carpets were replaced by stucco, paneling, alabaster, or metal plates.
>
> For a long time the character of the new covering followed that of the prototype. The artists who created the painted or sculptured decoration on wood, stucco, stone, or metal, following a tradition that they were hardly conscious of, imitated the colorful embroideries of the age-old carpet-walls.[94]

Semper proposes that construction – the patterning of a woven carpet in this example – becomes transposed over time into ornamentation reflective of the historical past. Ornamentation, in this case, serves as a cultural reference. Andrea Deplazes refers to this type of reference as a dialogue between "technological immanence" and "cultural permanence."[95] A similar dialogue occurs in the evolution of ancient clay vases. Scholar Demetri Porphyrios has studied vases from many cultures, all decorated with stylized bands. He argues that this ornamentation derives from constructional techniques as, historically, vases evolved from flasks made from animal hide that needed to be stitched together. The stitching transformed into abstract artistic form when they were no longer structurally necessary.[96] Again, ornamentation serves as a sign or reference of a cultural construct long since abandoned.

Semper's theory of raiment or dressing and Bötticher's separation of the art-form from the core-form are primary catalysts for the evolution of tectonic thought. In the 1800s, many architects experimented with architecture that either utilized alternate ornamentation or abandoned traditional ornamentation altogether. After the introduction of iron construction, Bötticher himself explored the use of alternate forms of ornament. He felt that ornament derived from nonorganic signifiers would relate more directly to the structural properties of the contemporary structural system.[97] This adaptation created a potential bridge between ornamentation and current cultural expression (as opposed to a historicist viewpoint), but Bötticher was unable to fully realize this theory in his lifetime.

The most notable architect of the era to minimize his use of ornament was Schinkel. He progressively removed historical references and ornamentation from his work; instead, he focused on developing a style based solely on constructional logic or the "structural lines of constructional forms"[98] (akin to the later definitions of these two concepts provided by Eduard Sekler). By the mid-1820s, Schinkel's sketches became devoid of historical and stylistic content.[99] In 1835, however, Schinkel wrote:

> But the more I considered the problem, the more I saw the difficulties opposing my efforts. Very soon I fell into the error of pure radical abstraction, by which I conceived a specific architectural work entirely from utilitarian purpose and construction. In these cases there emerged something dry and rigid, something that lacked freedom and altogether excluded two essential elements: the historic and the poetic.[100]

Despite Schinkel's reflections, however, the seed was planted that architecture from a master's hand could be derived without the raiment of history draped across its façade. The transfer of the role of historical and representational ornament to other systems continued in the years after. Otto Wagner, who is largely seen as the direct successor to Bötticher and Semper, built on their work under the premise that "every form of building has arisen from construction and successfully become artistic form."[101] Although Wagner continued the migration away from historicist ornament, he had not yet reached the "naked building"; his work, instead, primarily explored cladding built forms with panels or tiles[102] (Figure 00.16). In 1881, theorist Rudolf Redtenbacher published a book entitled *Tektonik* that responded to, in his opinion, Wagner's relatively timid step away from Bötticher's work. Redtenbacher pleads in this text for the removal of excessive detail that distracts the viewer and muddies the understanding of the relationship between architecture's diverse parts. Contrary to Wagner, he states that "architecture begins with construction and ends where there is nothing left to construct."[103]

00.16
The Church of St. Leopold, Otto Wagner, Vienna, Austria
Source: © Digitalpress | Dreamstime.com

In later decades (prominently the late 1800s and early 1900s), the separation between core and cladding developed by both Bötticher and Semper came to be read as an opposition between the "corporeal kernel" and the "ornamental hull."[104] Over time, the raiment or hull developed a negative connotation. Instead of being integral to expressing the nature of the construction within, the art-form or ornamentation came to be seen, once again, as stylistic.[105] This understanding, in many ways, was a reversion to the decorative applications Semper and Bötticher had vehemently rallied against. By the turn of the century, the shifting definitions of these components ultimately led to the desire to "free the kernel from the hull."[106]

Frampton posits that Semper's *Bekleidung* theory "became a model for the progressive dematerialization of architecture, liberating the mind from the stereotomic obtuseness of matter and focusing it instead on a reticulation of surface and thus on a dematerialization . . . of form into light."[107] Cladding evolved into a conceptually lightweight and pliable architecture. In his 1886 essay *Moderne Bautypen* (*Modern Building Types*), Joseph Bayer states that "the kernel of the Modern style" has its roots in the separation of the core and the surface forms. Bayer acknowledges the "powerful limbs" that have lain dormant

> behind the applied stylistic masks and draperies. And once these forces are thoroughly organized and matured, then certainly the beautifully ornamented historical stylistic hulls will fracture away; they will disappear forever, and the new kernel will emerge naked and clear in the sunlight.[108]

These sentiments helped lay the foundation for the modernist attitude towards the elimination of ornamentation from architecture. Scholar Werner Oechslin believes that the movement to **modernism** started with Otto Wagner and the rejection of historical raiment.[109] Although radically transformed, the tectonic played a key role in the rise of the modern style and would continue to evolve well beyond its tenure.

Modernism = a twentieth-century architectural style characterized by efforts to connect architectural design with the rapid advancement of technology and the modernization of society

In *Internationale Architektur*, Walter Gropius states:

> In the era recently past, the art of building fell prey to a sentimental, decorative approach that saw its purpose in the external application of motifs, ornament and contours of past cultures. These elements covered the building's mass without regard for a necessary immanent relationship. The building was thus reduced to the bearer of dead exterior ornamental forms, instead of being a living organism.[110]

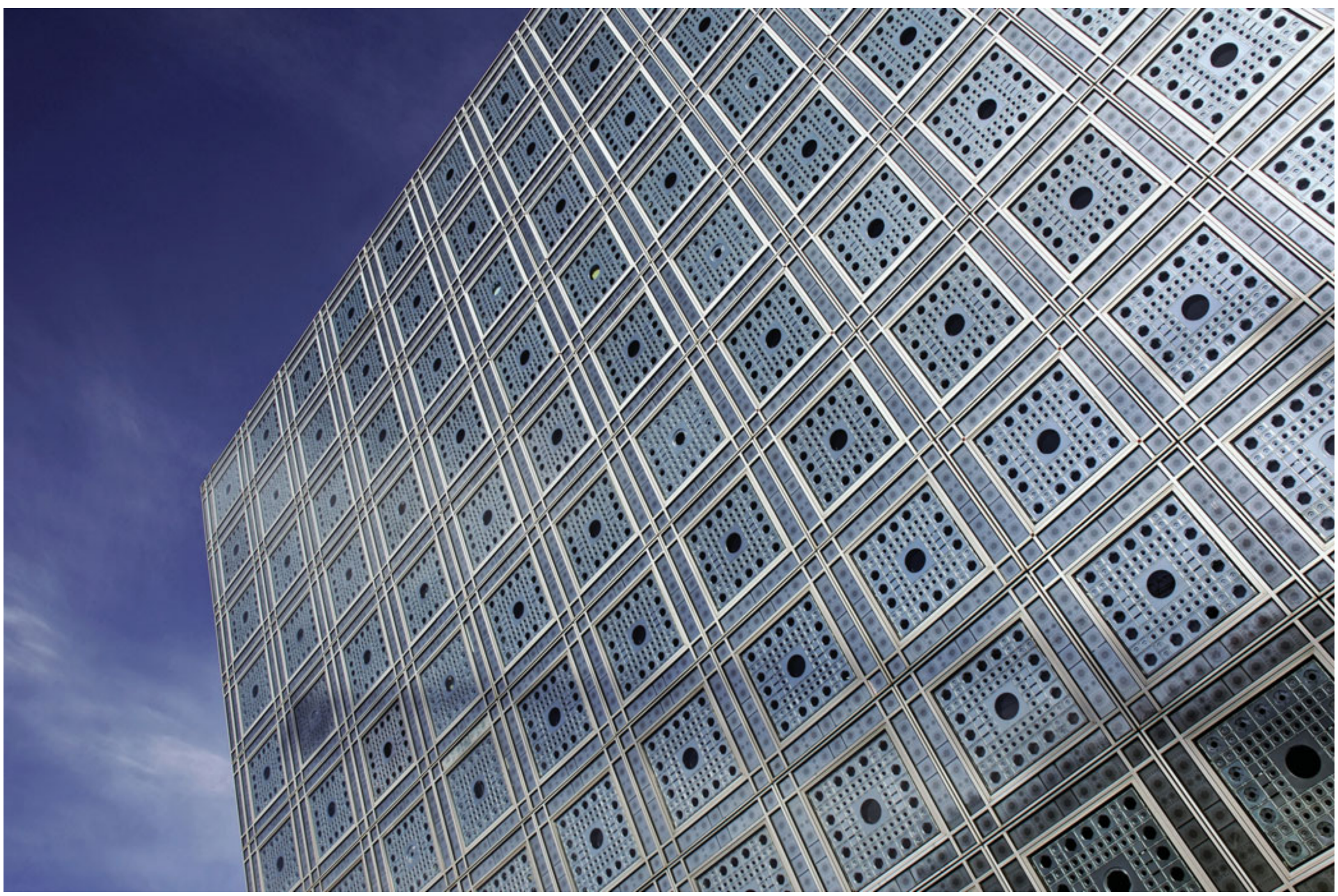
For decades, architecture was progressively stripped of ornament, allowing abstract ideas and construction techniques to dominate the aesthetics of the built environment. Recently though, Andrea Deplazes has stated that the architectural community has "a newly discovered enthusiasm for ornamentation."[111] Contemporary ornament, however, is distinctly different from the historical symbols of the mid-1800s. In 1975, Louis Kahn wrote the following lines in *Light is the Theme*:

> The joint is the beginning of ornament
> And that must be distinguished from

> decoration which is simply applied.
> Ornament is the adoration of the joint.[112]

Kahn illuminates, in this passage, a contemporary view of ornament; it must be integral to the architecture. This sentiment is very closely linked to the tectonic ideals of Bötticher and Semper. Ornament has become, in many situations, a means of understanding the assembly of the built environment. Deplazes adds that contemporary ornament is also frequently based on the scaling and multiple repetitions of non-right-angled surfaces.[113] But these surfaces are rarely just aesthetic. Paired with contemporary technology and attitudes towards creating sustainable cities, the surfaces of buildings are often tasked not with revealing the forces at work in the building, but those working *on* the building. Oechslin describes this ornamentation as the superimposition of a new hull on the naked kernel using a series of networks coordinated with Semper's textile theories. This new hull is independent of the kernel and can be illustrative of the construction but often has other agendas. In particular, he cites the Institut du Monde Arabe (Arab World Institute – 48°50′56″N, 2°21′26″E) in Paris as an early example of performative ornament with its field of motor-controlled apertures on the south façade[114] (Figure 00.17).

00.17
South façade of the Institut du Monde Arabe, Architecture-Studio and Jean Nouvel, Paris, France
Source: © Rene Drouyer | Dreamstime.com



As in the Arab World Institute, contemporary ornamentation is rarely focused on historical reference (at least not overtly) but, instead, searches for meaning through contemporary culture. It can be argued, however, that architecture has a far broader context through which it derives its meaning. The practice of architecture, as Kahn stated, involves the adoration of the assembly of space and, in turn, the careful study of the arrangement of its parts both large and small.

Detail

The adoration of the joint is significant in Semper's philosophy of dressing, which embraces a particular textile connection: the knot. According to Semper, the knot is the oldest technical symbol of human culture.[115] If the origins of architecture are rooted in the production of textiles, then the knot represents the original joint or architectural detail. In *Style in the Technical and Tectonic Arts*, Semper explains how the knot has developed into a powerful symbol:

> Given that the binding and linking element that combines two or more surfaces into one is of almost primeval validity and significance as an artistic symbol, it is not surprising that it also gained a mystical and religious significance that is associated everywhere with the traditions of the oldest civilizations and that is in fact the surest way of identifying them. Among these civilizations, however, no symbol has a secret meaning that is more far-reaching and more broadly disseminated than that of the mystical knot – the *nodus Herculeus* . . . the bow knot, the labyrinth, the loop, or any other related form and name for this sign.[116]

The practice of joining materials, such as with the knot, is tied to place and culture. Porphyrios states that the Greek *demo* means "to construct" and derives from *dama* (Sanskrit) and *dem* (Indo-European), both meaning "joining and fitting together." He explains that in many cultures, the connotation of building is etymologically tied to the nature of the construction undertaken in that location, centered on the joining of parts. In Latin, *aedeificare* means "to build," but ties to the practice of molding clay by hand; in Old French, *bastir* means "to build," but its roots refer to "binding together by plaiting"; in Welsh, *adeilad* means "to build," but directly refers to wattling or the practice of interweaving sticks for fences.[117]

The act of construction or joining, however, is just one role that details play in the development and understanding of architecture. As with Semper, Bötticher believed the assembly of components provides expression of both construction knowledge and symbolic meaning.[118] Marco Frascari builds on Bötticher's ideas, claiming that architectural details are "minimal units of signification in the architectural production of meaning."[119] He continues by explaining that the detail's relationship to a building or space can be related to a word's relationship to its sentence. Change one word for another and the sentence takes on a different meaning; change a detail or strategy for detailing in a building and the understanding of the place changes as well. Architect Vittorio Gregotti concurs, stating:

> detailing should never be regarded as an insignificant technical means by which the work happens to be realized. The full tectonic potential of any building stems from its

> capacity to articulate both the poetic and the cognitive aspects of its substance. . . . Thus the tectonic stands in opposition to the current tendency to deprecate detailing in favor of the overall image.[120]

This reconciling of dualities is also expressed by Edward Ford in *The Architectural Detail.* In the closing lines of the book, Ford states:

> Details are not a class of objects, a library of symbols, or a collection of clever devices. They are the evidence of a necessary mediation between the way in which we see a building and the way we feel a building, between abstraction and animation, between material reality and idealized forma, an impossible to quantify informing of one set of attitudes with the other.[121]

The potential meaning embedded in details, along with their constructed qualities, indicates they are not interchangeable. A detail that works well in a specific location of a building may not work in other places in the same building, or in other projects. Details also come in all sizes; scale is relative in the built environment. The bolt connecting a wood slat to its support; the connection of column and beam at a capital; the entry porch that connects the exterior environment to the interior living environment; and the bridge that connects the farmland on the east side of the river to the city on the west side are all joints within their respective environments. Frascari would label the first two as "material joints" and the latter two as "formal joints,"[122] but all have the potential to play a role in the understanding of place.

Of specific importance in the construction of architecture is the moment of intersection between two distinct construction systems. Unlike the typical architectural detail, intersections involve significant points of dialogue, not just between distinct elements but also between construction systems, ordering principles, narrative paths, or other systems that have a profound impact on the understanding of architecture. One such intersection that is embraced by Frampton occurs between the tectonic assembly of parts and the stereotomic piling of mass (Figure 00.18). Frampton believes that "Semper's emphasis on the

00.18
Intersection of a contemporary stair and Roman stone wall at Trajan's Market, Rome, Italy

joint implies that a fundamental syntactical transition is expressed as one passes from the stereotomic base of a building to its tectonic frame, and that such transitions are of the very essence of architecture."[123]

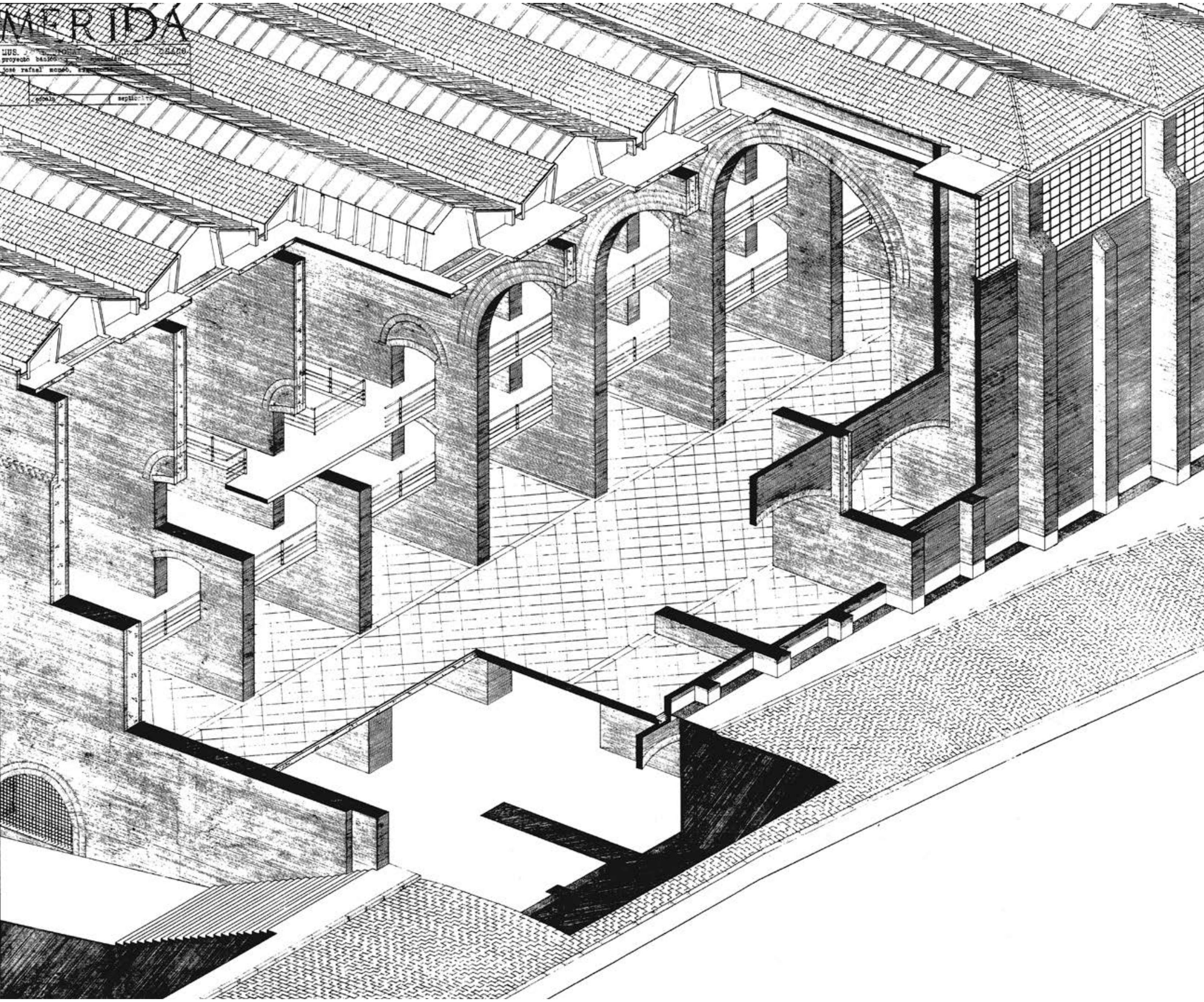
Details also need to have a relationship to each other and to the overall built work. Bötticher argued that since all members of a system are derived from the whole, each is indispensable for the operation of the system. The tectonic arrangement and integration of parts determines the relationship between them.[124] He continues, "Aside from the particular function of the structural component, the decorative characteristic should also represent that component's integration – juncture – into the concept of every tangential structural component."[125] Not only is the structural detail creating a relationship with the whole, but the representational detail is as well. To understand tectonics is to "grasp how all single elements of a building are integrated into a harmonious and organic spatial whole."[126]

Space

The development of this "organic spatial whole" was essential for Bötticher, who drew many of his ideas about the spatial dimension of tectonics from Schinkel. Schinkel believed that architecture was centered on the spatial distribution of the plan; the construction was a result of this distribution and aligned with the spatial requirements of the program. In "Ontology and Representation in Karl Botticher's Theory of Tectonics," Mitchell Schwarzer outlines Bötticher's three steps for the generation of architecture derived from the development of space.[127] First, the plan for the building is designed around human need. Identifying how users will inhabit and use a building determines spatial arrangement. The arrangement is also based on society's social customs, rooting the decisions in time and place. Second, a roof and its supporting structure are introduced (Figure 00.19). Bötticher believed that the covering of space was the primary shaper of that space.[128] The organization of the structure required to support the roof was significant, linking the generation of social space in the building with the constructional necessity for supporting its enclosure. The third step, then, is framing architectural space with the solids and voids created by these constructed elements. In Bötticher's tectonic model, the social operations of the building play a key role in the definition of space.

Semper introduced a different conception of space in his tectonic theory. He argued that the first enclosure of space was accomplished with woven mats that were used to create a sense of personal or private space through separation from the exterior environment. Semper is careful to make a clear distinction between mats and other elements used in the construction of the first dwellings. Although stone walls, other piled masses, or frameworks were used for defensive or structural purposes, he did not see them as space defining. Textiles, instead, defined the separation and character of interior space,[129] and Semper believed that these wall surfaces must never lose their original meaning of enclosure.[130] At stake was the comfort of the inhabitant, which could only occur with the interior dressing of walls, even if that involved covering a solid underlying construction.

In 1828, Hübsch noted that people seek to "obtain the necessary solidity through ingenious construction rather than through a mere accumulation of heavy masses. . . . Successive new building becomes lighter while remaining safe."[131] One such "ingenious construction"



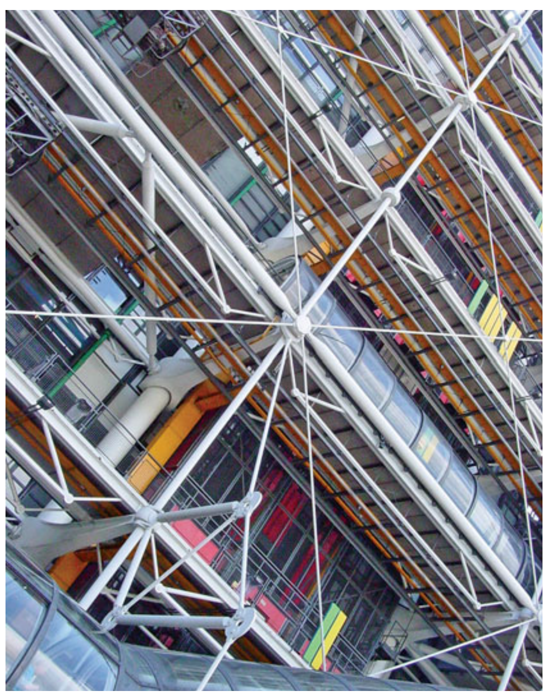
00.19
Axonometric drawing of the National Museum of Roman Art, Rafael Moneo, Mérida, Spain

is iron. As previously noted, the introduction of iron construction was a point of contention between Bötticher and Semper, a conflict that was primarily spatial in nature. While this new structural system integrated fairly well into Bötticher's theoretical framework, the volumetric reduction of the structure from mass walls to iron frames conflicted with Semper's understanding of spatial definition. Herrmann comments that "Semper had the same feeling of mistrust and unease toward construction in iron as the classically trained architect of the preceding centuries had had toward the Gothic style."[132] Semper believed that there needed to be a clearly defined relationship between the proportion and scale of the structural system and the feeling of stability produced for an individual in the space. An iron frame would, according to Semper, create doubt in the user of the building's stability. His apprehension and his understanding of our ability to read or feel the stability of a building are directly tied to two theories that grew out of the lineage of tectonics: perception and empathy.

In "The Tell-the-Tale Detail," Frascari describes the impact of details on the perception of space.

> In architecture, feeling a handrail, walking up steps or between walls, turning a corner, and noting the sitting of a beam in a wall, are coordinated elements of visual and tactile sensations. The location of those details gives birth to the conventions that tie a meaning to a perception. The conception of the architectural space achieved in this way is the result of the association of the visual images of details, gained through the phenomenon of **indirect vision**, with the geometrical proposition embodied in forms, dimensions, and location, developed by touching and by walking through buildings.[133] (Figure 00.20)

indirect vision = the theory that details are perceived individually through visual and tactile sensations before being coordinated into an understanding of space[134]



00.20
Exterior facade of the Centre Georges Pompidou, Richard Rogers and Renzo Piano, Paris, France, 1977

Utilizing the work of noted physician Hermann von Helmholtz and philosopher Walter Benjamin, Frascari defines perception as the idea of an object resulting from our interpretation of information gathered utilizing our senses; this process is an unconscious relationship with our surroundings.[135] The construction of space has a significant impact on its perception as each detail contributes to our reading of that space. The study of perception is one of several key lines of thought that developed in the second half of the 1800s based, in part, on concepts drawn from nineteenth-century tectonics.

Another late 1800s theoretical construct was *Einfühlung* or empathy. This theory was also partially derived from tectonic thought, carrying with it concerns for space, construction, and the outward expression of built form. Philosopher Robert Vischer, the father of *Einfühlung*, defined the term as the projection of bodily form and of the soul into the form of another object.[136] Vischer gives the example of a looming cliff face that stands proudly at attention and seemingly in defiance; its outward projection instills in the viewer the feeling of lunging forward.[137] Historian Heinrich Wölfflin added that people have the ability to empathize with the physical forms of the world around them through their own physical embodiment. We have an innate understanding of gravity and strength, of pressure and release. “Physical forms possess a character only because we ourselves possess a body.”[138] A person can identify with an inanimate object, such as a work of architecture, bringing new life to both in the process. The soaring Gothic church, for example, stretches upwards, defined by a combination of spatial proportion and construction elements, bringing us up with it to God (Figure 00.21). It follows, then, that not only can we empathize with architecture, but the tectonic makeup of architecture can be manipulated to solicit empathetic reactions and to heighten the experience of immaterial events, such as spiritual enlightenment.

00.21
Gothic chapel of Sainte Chappelle, Paris, France
Source: © Emanuele Leoni | Dreamstime.com

Atectonic

Opposing the architectural tectonic is the concept of the atectonic, for which there are two potential definitions. The first definition involves designing architecture without using tectonic principles or without following tectonic thinking outright. In *Studies in Tectonic Culture*, Frampton posits that architect Adolf Loos "embraced an atectonic strategy in that his spatially dynamic ***Raumplan*** could never be clearly expressed in tectonic terms."[139] This design strategy involved the masking of the underlying mechanical construct and, therefore, went against the core ideas of the tectonic.

Raumplan = the hierarchical design of three-dimensional space as the primary generator instead of plan, section, structure, or other traditional organizational strategies

Porphyrios offers another interpretation of this definition:

> it seems to me that any aesthetic theory which interprets tectonics simply as a set of signifying gestures added onto everyday practices of construction is thoroughly misleading. In some instances, this may well be the case (as for example, with the theory of the decorated shed adopted by postmodern classicism and postmodern modernism) and yet a few pilasters or some riveted joints thrown in as referential signs of a constructional order are not enough to give a building a tectonic presence.
>
> Whenever we feel something is lacking in a building it is because it does not hang together. It is because we feel that there is no sense of the necessary, no sense of something that needs to be said and can only be said in that way.[140]

A second definition for atectonic involves architecture that purposefully exaggerates or distorts the outward tectonic expression. This variation is closely linked to perception and empathy and their impact on the reading of our environment. Mallgrave, in his discussion of Wölfflin's ideas, states: "If a building appears unbalanced in its composition . . . we respond intuitively with a physical sense of unease because it disrupts our own corporeal balance."[141] This unbalanced condition could be unintentional – a flaw in the design – or it could be purposeful to create a desired effect in the user. Sekler outlines a series of tectonic conditions that are abnormal compared to the ideal expression of the core-form. First, the construction and the structural principle could be out of alignment, as in a building built out of stone using the details of another medium, like wood. Second, the tectonic expression could be vague, such as in a building that appears to be floating (Figure 00.22). Or third, the tectonic elements could be highly exaggerated as in the bracketing of a Japanese temple.[142]

Atectonic conditions can be expressed dramatically, but many times they are very subtly integrated into a building's design scheme. The atectonic occurs at any point, according to Sekler, in which the expressive interaction of load and support in architecture is visually neglected or obscured. As an example, Frampton points out that in the great iron and glass structure of the 1851 World's Fair – the Crystal Palace by Joseph Paxton – the cast-iron columns are all the same diameter but carry different loads through unseen variation in the thickness of the column's wall.[143] The outward expression of the columns in this project is equal, yet the internal forces at work are not.

00.22
The main entrance of the Arabian Library, richärd+bauer, Scottsdale, Arizona, United States

Concluding Thoughts

In *On Architectural Style*, Gottfried Semper says:

> Permit me still one other practical application of the fable! People reproach us architects for a lack of inventiveness – too harshly, since nowhere has a new idea of universal historical importance, pursued with force and consciousness, become evident. We are convinced that wherever such an idea would really take the lead, one of the other of our young colleagues will prove himself capable of endowing it with a suitable architectural dress. . . . Until that time comes, however, we must reconcile ourselves to make do as best we can with the old.[144]

Semper, clearly, was reluctant to accept change or to adapt his theories to new cultural standards. In this passage though, taken from one of his last prominent lectures, Semper hands the reigns of tectonic thought to yet-to-be-determined "young colleagues" who are capable of progressing the theory forward with the development of culture, perhaps acknowledging the need for change. Over the past 150 years, change has occurred and continues to do so at an increasingly rapid pace. With it, tectonic thought has also shifted and evolved. Some may argue that the ideas have been compromised or simplified, which may be true, but tectonics has *necessarily* adapted. The changes undergone are

> by no means subtle or petty differences, but instead true shifts both in architectural values and in images, concepts and issues. They cannot simply be characterized as oversimplifications. Evaluated as shifts, they support the continuity, even if it is no more than a thin tread of continuity, with previous philosophical structures and theories.[145]

Historically, tectonics was centered on the visual understanding of the forces at work in a building. The introduction of *Einfühlung* (empathy) and later **phenomenology**, along with other lines of thought, have expanded the relationship between the occupant and the built environment. Meaning in architecture has developed into a haptic, bodily experience that moves beyond just visual understanding (although that is still an important component).

phenomenology = a line of architectural thinking centered on the experience of built space through multisensory input[146]

In *The Eyes of the Skin*, Juhani Pallasmaa says:

> I confront the city with my body; my legs measure the length of the arcade and the width of the square; my gaze unconsciously projects my body onto the façade of the cathedral, where it runs over the mouldings and contours, sensing the size of recesses and projections; my body weight meets the mass of the cathedral door, and my hand grasps the door pull as I enter the dark void behind. I experience myself in the city, and the city exists through my embodied experience. The city and my body supplement and define each other. I dwell in the city and the city dwells in me.[147]

Architecture has a profound effect on each of its inhabitants, often in very different ways. "The sensitivity toward physical constructions and space, like the sensitivity to mathematical notions or to music, is unique and cannot be acquired by borrowing or translating from another art."[148] The tectonic makeup of a building must be calibrated to create the opportunity for optimal experiences and it is the job of the architect (hopefully the most sensitive of us) to choreograph these experiences.

Tectonics is still an integrative philosophy; it is still an examination of the interwoven relationship between space, function, structure, context, symbolism, representation, and construction. The tectonic theories of Bötticher, Semper, and others have evolved to be able to successfully integrate into contemporary society, but this "transformation, adaptation and above all the reduction of and simplification of an extremely ambitious theory of tectonics was in fact ineluctable."[149] Despite its shifting, its transforming, and its adapting, architectural tectonics remains a central tenet of both the study of architecture and the practice of its design and construction. The lessons available to all students of architecture that have arisen from this linage of architectural thought have the potential to positively influence our built environment for the foreseeable future.

The following chapters examine the varied tectonic expressions of 20 projects built in recent decades. No single definition of tectonics will satisfy their varied expressions of the relationship between design and construction. Some of the works embrace Bötticher's ideas of spatial tectonics; others are rooted in practices of construction and materiality; while several are at the forefront of the redefinition of ornament in our contemporary culture. You will see clear links between the ambitions of certain projects, but you will find contrasting responses as well. Many of these architectural works look to the past for inspiration, but unlike in the 1800s, they do not linger there. These projects are designed and built to face the future, to be sensitive to their context, and to interact with the people who will spend their days and nights living, learning, worshiping, working, and playing within them.

Notes

1 Karl Bötticher, "Excerpts from *Die Tektonik Der Hellenen*," in *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, ed. Werner Oechslin (New York: Cambridge University Press, 2002), 190, bold added. (Originally published as Bötticher, Carl Gottlieb Wilhelm, *Die Tektonik Der Hellenen*, Potsdam, 1844.)

2 Rudolf Redtenbacher, "Excerpts from *Die Architektonik Der Modernen Baukunst*," in *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, ed. Werner Oechslin (New York: Cambridge University Press, 2002), 217. (Originally published as Rudolf Redtenbacher, *Die Architecktonik der modernen Baukunst*, Berlin: Ein Hulfsbuch bei der Bearbeitung Architektonischer Aufgaben, 1883.)

3 Gottfried Semper, *Style in the Technical and Tectonic Arts: Or Practical Aesthetics*, trans. Harry Francis Mallgrave and Michael Robinson (Los Angeles: Getty Research Institute, 2004), 438 (footnote). (Originally published as Semper, Gotfried. *Der Stil in den technischen und tektonischen Kunsten; oder, Praktische Aesthetik: Ein Handbuch fur Techniker, Kunstler und Kunstfreunde*, 2 vols. Frankfurt am Main: Verlag fur Kunst & Wissenschaft, 1860.)

4 Chad Schwartz, "Investigating the Tectonic: Grounding Theory in the Study of Precedents." *The International Journal of Architectonic, Spatial, and Environmental Design* 10, no.1 (2015), 3. The ideas regarding tectonics expressed in this chapter were initially explored in this article as a component of educational pedagogy.

5 Kenneth Frampton, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture* (Cambridge: MIT Press, 2001), 2.

6 Ibid., 16.

7 The information on etymology was drawn from multiple sources: Robert Meagher, "Techne," *Perspecta* 24 (1988): 158–64; Adrian Snodgrass, "On 'Theorising Architectural Education'," *Architectural Theory Review* 5, no. 2 (2000), 89–93; Frampton, *Studies in Tectonic Culture*; and Demetri Porphyrios, "From Techne to Tectonics," in *What Is Architecture?* ed. Andrew Ballantyne (New York: Routledge, 2002). Please refer to these publications for further investigation of the etymology of tectonics.

8 Meagher, "Techne," 160.

9 Harry Francis Mallgrave, ed. *Architectural Theory. Volume I: An Anthology from Vitruvius to 1870* (Malden, MA: Blackwell Publishing, 2011).

10 Immanuel Kant, *Critique of Judgment*, trans. J. H. Bernard (New York: Hafner Publishing Company, 1951), 55.

11 Hannah Ginsborg, "Kant's Aesthetics and Teleology," *The Stanford Encyclopedia of Philosophy* (Fall 2014 Edition), ed. Edward N. Zalta. Updated February 13, 2013, http://plato.stanford.edu/archives/fall2014/entries/kant-aesthetics/. This website is useful for understanding Kant's writings.

12 Kant, *Critique of Judgment*, 55.

13 Harry Francis Mallgrave, *The Architect's Brain: Neuroscience, Creativity, and Architecture* (Chichester: Wiley-Blackwell, 2011), 68.

14 Kant, *Critique of Judgment*, 65.

15 Mitchell Schwarzer, "Ontology and Representation in Karl Botticher's Theory of Tectonics," *Journal of the Society of Architectural Historians* 52, no. 3 (1993), 267–80.; Mallgrave, *The Architect's Brain*. Both Schwarzer and Mallgrave provide excellent summaries of the complexities of the ongoing relationship between architecture and the fine arts during this time period.

16 There are numerous references for further investigation of these thinkers. See Heinrich Hübsch, "In What Style Should We Build?," in *In What Style Should We Build? The German Debate on Architectural Style*, ed. Harry Francis Mallgrave (Santa Monica: The Getty Center for the History of Art and the Humanities, 1992). (Originally published as Hübsch, Heinrich. *In welchem Style sollen wir bauen?*. Karlsruhe: Chr. Fr. Müller Mofbuchhandlung und Hofbuchdruckeren, 1828.) See also Friedrich Wilhelm Joseph Schelling, *The Philosophy of Art*, trans. Douglas W. Stott (Minneapolis: University of Minnesota Press, 1989); Arthur Schopenhauer, *The World as Will and Representation*, vol. I, trans. E. F. J. Payne (New York: Dover Publications, Inc., 1969). Overviews are also available in Mallgrave, *The Architect's Brain*.

17 *The Architect's Brain*, 57.

18 Ibid., 58.

19 Schelling, *The Philosophy of Art*, 166.

20 Ibid., 165.

21 Schopenhauer, *The World as Will and Representation*, 214.

22 Ibid., 215.

23 Ibid.

24 Karl Friedrich Schinkel, "Excerpts from Literary Fragments," in *Architectural Theory. Volume I: An Anthology from Vitruvius to 1870*, ed. Harry Francis Mallgrave (Malden, MA: Blackwell Publishing, 2011), 403. (Originally taken from Schinkel's papers (c. 1805) as assembled by Goerd Peschken, *Das Architecktonische Lahrbuch* (Berlin: Deutscher Kunstverlag, 1979), 21–22.

25 Karl Friedrich Schinkel, "Excerpts from Notes for a Textbook on Architecture (c. 1835)," in *Architectural Theory Review. Volume I: An Anthology from Vitruvius to 1870*, ed. Harry Francis Mallgrave (Malden, MA: Blackwell Publishing, 2011), 413. (Originally published as Goerd Peschken, ed., *Das Architeckonische Lehrbuch* (Berlin: Deutscher Kunstverlag, 1979), 149–50.)

26 Schwarzer, "Ontology and Representation." and Frampton, *Studies in Tectonic Culture*. provide more substantial biographies of Karl Bötticher for further reading.

27 Schwarzer, "Ontology and Representation."

28 ibid., 274.

29 Bötticher, "*Die Tektonik*," 188

30 Kenneth Frampton, "Bötticher, Semper and the Tectonic: Core Form and Art Form," in *What Is Architecture?* ed. Andrew Ballantyne (New York: Routledge, 2002), 138.

31 Schwarzer, "Ontology and Representation," 267.

32 For a complete biography of Semper's life, please see Harry Francis Mallgrave, *Gottfried Semper: Architect of the Nineteenth Century* (New Haven: Yale University Press, 1996) or Wolfgang Herrmann, *Gottfried Semper: In Search of Architecture* (Cambridge: MIT Press, 1984). This section also draws from Mallgrave, *The Architect's Brain*.

33 Herrmann, *Gottfried Semper*, 140.

34 Ibid., 150.

35 Caroline A. Van Eck, "Figuration, Tectonics and Animism in Semper's *Der Stil*," *The Journal of Architecture* 14, no. 3 (2009), 325–37. Please see this article for a thorough examination of these issues.

36 Semper, *Style*, 247.

37 These topical sections parallel the sections found in the precedent studies with several noteworthy exceptions. In the introductory essay, Precedent looks specifically at Semper and Bötticher's precedents for their work, making it contribute only indirectly to the same section in the precedent studies later in the book. The section called Construction in the introductory essay is broken into two topics in the precedent studies: Tectonic and Stereotomic. The section called Detail in the introductory essay is broken into two topics in the precedent studies: Detail and Intersection. Finally, the sections called Representation and Ornamentation in the introductory essay are combined in the precedent chapters under Representation.

38 Herrmann, *Gottfried Semper*, 157.

39 Ibid., 158.

40 In a similar manner, Frampton discusses the notion of "falling into sentimentality" within his work on critical regionalism. Kenneth Frampton, "Towards a Critical Regionalism: Six Points for an Architecture of Resistance," in *Essays on Postmodern Culture*, ed. Hal Foster (New York: The New Press, 1998), 29.

41 Herrmann, *Gottfried Semper*, 146.

42 Ibid., 147.

43 Ibid. Originally taken from Gottfried Semper, "Preliminary Notes for *Der Stil*lxtractd into a powerful symbol.gitude and latitudel add these in? Also the TOC gives location of projects whereas the chapter h."

44 Schwarzer, "Ontology and Representation," 270.

45 Marc-Antoine Laugier, *An Essay on Architecture*, trans. Wolfgang Herrmann and Anni Herrmann (Los Angeles: Hennessey + Ingalls, 2009). (Originally published in 1753.)

46 Frampton, "Bötticher, Semper and the Tectonic," 147.

47 Carrie Asman, "Ornament and Motion: Science and Art in Gottfried Semper's Theory of Adornment," in *Herzog & de Meuron: Natural History*, ed. Philip Ursprung (Montreal: Lars Muller Publishers, 2005), 389.

48 Karl Bötticher, "The Principles of the Hellenic and Germanic Ways of Building with Regard to Their Application to Our Present Way of Building," in *What Style Should We Build? The German Debate on Architectural Style*, ed. Wolfgang Herrmann (Santa Monica: The Getty Center for the History of Art and the Humanities, 1992), 150. (Originally published as Bötticher, Carl Gottlieb Wilhelm. "In Welchem Style Sollen wir Bauen?" Allgemeine Bauzeitung 11 (1846): 111–25.)

49 These ideas are expanded upon in: Harry Francis Mallgrave, "Gustav Klemm and Gottfried Semper: The Meeting of Ethnological and Architectural Theory," *RES: Anthropology and Aesthetics*, no. 9 (Spring 1985), and Herrmann, *Gottfried Semper*.

50 Vittorio Gregotti, "Lecture at the New York Architectural League," *Section A* 1, no. 1 (February/March 1983). As cited in Kenneth Frampton, "Rappel a L'ordre: The Case for the Tectonic," in

Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory 1965–1995, ed. Kate Nesbitt (New York: Princeton Architectural Press, 1996), 525, bold added. (Originally published in *Architectural Design* 60, no. 3–4 (1990): 19–25.)

51 Mallgrave, "Gustav Klemm and Gottfried Semper," 71.

52 Carles Vallhonrat, "Tectonics Considered: Between the Presence and the Absence of Artifice," *Perspecta* 24 (1988): 125–26.

53 Frampton, *Studies in Tectonic Culture*, 27.

54 Annette LeCuyer, *Radical Tectonics* (London: Thames & Hudson, 2001), 15–16.

55 Ibid., 20–21.

56 Ibid., 17–18.

57 Laugier, *An Essay on Architecture*, 12.

58 Mallgrave, "Gustav Klemm and Gottfried Semper," 69.

59 For a detailed comparison of the ideas of Klemm and Semper, please see Mallgrave's "Gustav Klemm and Gottfried Semper."

60 Semper's four elements are discussed at length in numerous publications including: Harry Francis Mallgrave and Wolfgang Herrmann, eds., *The Four Elements of Architecture and Other Writings* (New York: Cambridge University Press, 2010); Frampton, "Bötticher, Semper and the Tectonic."; and Herrmann, *Gottfried Semper*.

61 Bötticher, "The Principles of the Hellenic and Germanic Ways of Building," 154.

62 Frampton, *Studies in Tectonic Culture*, 86.

63 Herrmann, *Gottfried Semper*, 198–99.

64 Frampton, "Bötticher, Semper and the Tectonic," 144.

65 Joseph Rykwert, *The Necessity of Artifice* (New York: Rizzoli International Publications, 1982), 129.

66 Frampton, "Bötticher, Semper and the Tectonic," 146–48.

67 Mallgrave, *Gottfried Semper*, 185.

68 Andrea Deplazes utilizes the terms *filigree* and *solid construction* to characterize these two construction typologies. He classifies filigree construction as "a structure of slender members, a weave of straight or rodlike elements assembled to form a planar or spatial lattice in which the loadbearing and separating functions are fulfilled by different elements." Andrea Deplazes, ed. *Constructing Architecture: Materials Processes Structures: A Handbook*, 2nd ed. (Boston: Birkhauser, 2009), 13–14.

69 Porphyrios, "From Techne to Tectonics," 135.

70 Gottfried Semper, "Preliminary Remarks on Polychrome Architecture and Sculpture in Antiquity," in *The Four Elements and Other Writings*, ed. Harry Francis Mallgrave and Wolfgang Herrmann (New York: Cambridge University Press, 2010), 48. (Originally published in 1834.)

71 Bötticher, "The Principles of the Hellenic and Germanic Ways of Building," 158.

72 Schwarzer, "Ontology and Representation," 277.

73 Eduard Sekler, "Structure, Construction, Tectonics," in *Structure in Art and Science*, ed. Gyorgy Kepes (New York: Braziller, 1965), 92. For a detailed discussion on this relationship, please see this article.

74 Ibid., 89.

75 Bötticher, "*Die Tektonik*," 191.

76 Schwarzer, "Ontology and Representation," 278.

77 Vallhonrat, "Tectonics Considered," 131.

78 Herrmann, *Gottfried Semper*, 176.

79 Frampton, "Bötticher, Semper and the Tectonic," 147.

80 Vallhonrat, "Tectonics Considered," 131.

81 Bötticher, "*Die Tektonik*," 191.

82 Müller was such a significant influence on Bötticher that Bötticher dedicated *Die Tektonik* to him. Werner Oechslin, *Otto Wagner, Adolf Loos, and the Road to Modern Architecture* (New York: Cambridge University Press, 2002), 56. For more information on Müller's theories, please see Karl

Otfried Müller, *Ancient Art and Its Remains; or, a Manual of the Archaeology of Art*, trans. John Leitch (London: Henry G. Bohn, 1852).

83 Bötticher, "*Die Tektonik*," 189.

84 Mallgrave, *The Architect's Brain*, 65.

85 Bötticher, "*Die Tektonik*," 194–95, bold added.

86 Ibid.

87 Schwarzer, "Ontology and Representation," 278.

88 Oechslin, *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, 57.

89 Semper, *Style*, 731–32.

90 Mallgrave, *The Architect's Brain*, 73–74.

91 Semper, *Style*, 247.

92 For a thorough understanding of this line of thought, please refer to Semper's *Style*; specifically, pages 247–50 provide an introduction.

93 Ibid., 248–49.

94 Herrmann, *Gottfried Semper*, 206.

95 Deplazes, *Constructing Architecture*, 309.

96 Porphyrios, "From Techne to Tectonics," 132.

97 Schwarzer, "Ontology and Representation," 279.

98 Mallgrave, *The Architect's Brain*, 62.

99 Ibid.

100 Schinkel, "Notes for a Textbook," 414.

101 Otto Wagner, *Die Baukunst Unserer Zeit* (Vienna: Wein A. Schroll, 1914), 60; as cited in Oechslin, *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, 45.

102 Oechslin, *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, 103.

103 Rudolph Redtenbacher as cited in ibid., 73.

104 Ibid., 52–53.

105 Ibid., 86.

106 Ibid.

107 Frampton, "Bötticher, Semper and the Tectonic," 148–49.

108 Joseph Bayer, "Excerpts from Moderne Bautypen," in *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, ed. Werner Oechslin (New York: Cambridge University Press, 2002), 225–26. (Originally published as Joseph Bayer,"Moderne Bautypen," in Baustudien und Baubilder, Schriften zur Kunst, ed. Robert Stiassny, Jena: Eugen Diedreichs, 1919.)

109 Oechslin, *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, 124.

110 Walter Gropius, *Internationale Architektur*, 2nd ed. (München: Langen Verlag, 1927), 5–6; as cited in Oechslin, *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, 122.

111 Deplazes, *Constructing Architecture*, 118.

112 Louis I. Kahn and Nell E. Johnson, *Light Is the Theme: Louis I. Kahn and the Kimbell Art Museum. Fort* (Fort Worth: Kimbell Art Museum, 1975), 43.

113 Deplazes, *Constructing Architecture*, 118.

114 Oechslin, *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, 130.

115 Semper, *Style*, 219.

116 ibid., 155.

117 Porphyrios, "From Techne to Tectonics," 133–34.

118 Ibid., 139; Frampton, "Bötticher, Semper and the Tectonic."

119 Marco Frascari, "The Tell-the-Tale Detail," in *Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory 1965–1995*, ed. Kate Nesbitt (New York: Princeton Architectural Press, 1996), 500. (Originally published in *VIA 7: The Building of Architecture* (1984): 23–37.)

120 Vittorio Gregotti, "Clues," *Casabella*, no. 484 (1982), 13; as quoted in Frampton, *Studies in Tectonic Culture*, 26.

121 Edward Ford, *The Architectural Detail* (New York: Princeton Architectural Press, 2011), 312. For a complete understanding of the nature of the architectural detail, please see Ford's entire collection of written work including this latest publication.
122 Frascari, "The Tell-the-Tale Detail," 501.
123 Frampton, "Bötticher, Semper and the Tectonic," 146.
124 Bötticher, "*Die Tektonik*," 188.
125 ibid., 194.
126 Karl Bötticher, "Entwicklung Der Formen Der Hellenischen Tektonik," *Allgemeine Bauzeitung* 5 (1840); as cited in Schwarzer, "Ontology and Representation," 275.
127 "Ontology and Representation," 275.
128 Bötticher, "The Principles of the Hellenic and Germanic Ways of Building," 154.
129 Semper, *Style*, 248.
130 Gottfried Semper, "The Four Elements of Architecture: A Contribution to the Comparative Study of Architecture," in *The Four Elements and Other Writings*, ed. Harry Francis Mallgrave and Wolfgang Herrmann, (New York: Cambridge University Press, 2010), 127. (Originally published in 1851.)
131 Hübsch, "In What Style Should We Build?," 68–69.
132 Herrmann, *Gottfried Semper*, 177–78.
133 Frascari, "The Tell-the-Tale Detail," 506, bold added.
134 ibid., 505.
135 ibid.
136 Robert Vischer, "On the Optical Sense of Form: A Contribution to Aesthetics," in *Empathy, Form, and Space: Problems in German Aesthetics, 1873–1893*, ed. Harry Francis Mallgrave (Santa Monica: The Getty Center for the History of Art and the Humanities, 1994). (Originally published as Robert Vischer, *Über das Optische Formegefühl: Ein Beitrag zur Aesthetik*, Leipzig: Hermann Credner, 1873.)
137 ibid., 105.
138 Heinrich Wölfflin, "Prolegomena to a Psychology of Architecture," in *Empathy, Form, and Space: Problems in German Aesthetics, 1873–1893*, ed. Robert Vischer, Harry Francis Mallgrave, and Eleftherios Ikonomou, 151. Santa Monica: The Getty Center for the History of Art and the Humanities, 1994. (Originally published as Heinrich Wölfflin, *Prolegomena zu einer Psychologie der Architektur*, Inaugural-Dissertation der hohen philosophischen Fakultat der Universitat Muchen zur Erlangung der hochsten akademischen Wurden (Munich: Kgl. Hof- & Universitats-Buchdruckerei, 1886.).
139 Frampton, *Studies in Tectonic Culture*, 18, bold added.
140 Porphyrios, "From Techne to Tectonics," 136.
141 Mallgrave, *The Architect's Brain*, 80.
142 Sekler, "Structure, Construction, Tectonics," 94.
143 Frampton, *Studies in Tectonic Culture*, 20.
144 Gottfried Semper, "Excerpt from *On Architectural Style* (1869)," in *Architectural Theory. Volume I: An Anthology from Vitruvius to 1870*, ed. Harry Francis Mallgrave (Malden, MA: Blackwell Publishing, 2006), 557. (Originally published in 1869.)
145 Oechslin, *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, 87.
146 For more information on phenomenology, please see Steven Holl, Juhani Pallasmaa, and Alberto Perez-Gomez, *Questions of Perception: Phenomenology of Architecture* (San Francisco: William Stout Publishers, 2006).
147 Juhani Pallasmaa, *The Eyes of the Skin: Architecture and the Senses* (Hoboken: John Wiley & Sons, Inc., 2007), 40.
148 Vallhonrat, "Tectonics Considered," 123.
149 Oechslin, *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, 50.

Typical Project Outline

1 Basic Information

2 Architect | Firm Brief

3 Project Brief

4 Tectonic Principles (not necessarily in this order)

- Anatomy
- Atectonic
- Detail
- Intersection
- Place
- Precedent
- Representation
- Space
- Stereotomic
- Tectonic

5 Additional Resources

- Projects
- References

The concern of tectonics is threefold. First, the finite nature and formal properties of constructional materials, be those timber, brick, stone, steel, etc. Second, the procedures of jointing, which is the way that elements of construction are put together. Third, the visual statics of form, that is the way by which the eye is satisfied about stability, unity and balance and their variations or opposites.

Demetri Porphyrios, "From Techne to Tectonics," 2002, p. 136

Only in conjunction with a concept does a vigorous design process ensue in which the initially isolated technical and structural fragments are at once arranged to fill a consummate, architectural body. The fragments and the whole complement and influence each other. This is the step from construction to architecture, from assembly to tectonics.

Andrea Deplazes, *Constructing Architecture*, 2009, p. 10

PROJECTS

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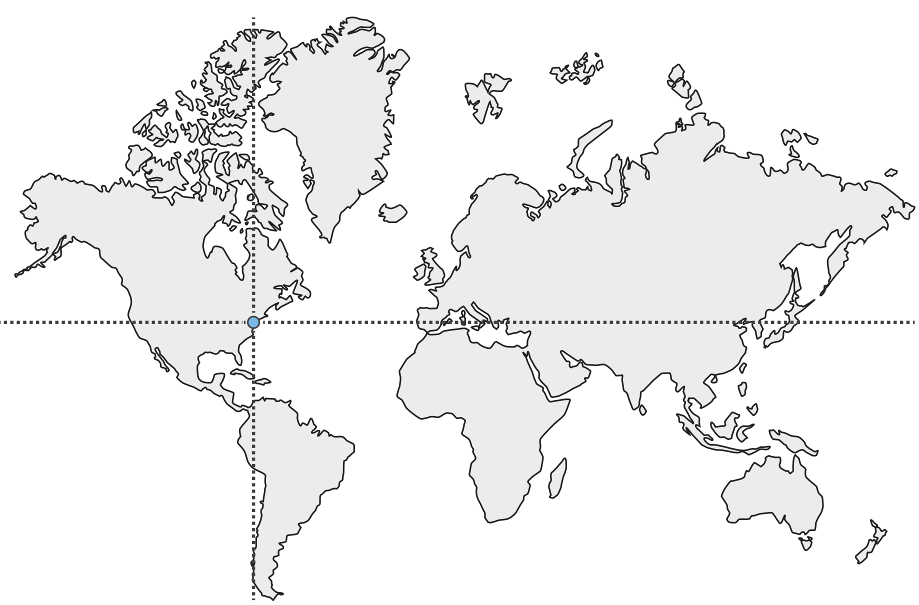
01
Loblolly House
KieranTimberlake Associates

Chapter co-written with Aaron Neal

Firm Brief[1]

Stephen Kieran and James Timberlake were educated at the University of Pennsylvania. After graduating, they worked together in the office of Robert Venturi and Denise Scott Brown before starting their own firm – KieranTimberlake Associates – in 1984. Here, they explore new ways of looking at architecture by utilizing Building Information Modeling (BIM) paired with new fabrication and construction techniques. KieranTimberlake not only fulfill their client's needs, but also strive to evolve the field of architecture. Each of their projects integrates into its character three design philosophies: provocation, research, and environmental sustainability. The firm has been acknowledged numerous times for their work, most prominently with the 2008 American Institute of Architects' Firm Award. Additionally, both Kieran and Timberlake complement their professional work with teaching appointments – currently at the University of Pennsylvania – that give them the opportunity to continue their explorations with future generations of practitioners.



taylor island, maryland, united state
gps | not provided for residence
program | weekend residence
completed | 2006
area | 204 m2 [2,200 ft2]

01.1
Vicinity map

01.2
Loblolly House from the shoreline

Project Brief

> Loblolly House was inspired by the childhood urge to build tree houses. An effort to bring back the magic of a house in the trees – one that requires climbing up to gain a view – Loblolly House appeals to a primal instinct about how we inhabit space. It also represents a home that is uniquely integrated with its setting among the tall loblolly pines from which it takes its name.[2]

Loblolly House is a weekend retreat for Kieran and his family. Located on the Chesapeake Bay, it is perched between the shoreline and a dense forest of native Loblolly Pines (Figure 01.2). Approaching from the east, the house emerges from the trees, elevated off the ground on piles. It is divided into two units – the main residence and a guest wing – connected by a bridge. An entrance walkway leads through a stand of bamboo to a staircase that ascends to entrances on both floors of the house (Figures 01.3 and 01.4). The lower floor of the main residence contains the master bedroom and bath while the main living space occupies the upper floor (Figure 01.5). The guest wing contains bedrooms on both floors along with an internal stair and service space.

Loblolly House reinvents the process of constructing architecture. After researching manufacturing industries, KieranTimberlake designed a prefabrication system that drastically reduces a building's construction time frame. It contains two tightly integrated work flows: one for components manufactured off site and another for site-specific construction. The firm proposes that this system offers a more sustainable way of developing the built environment as the industry moves forward in the coming years.[3]

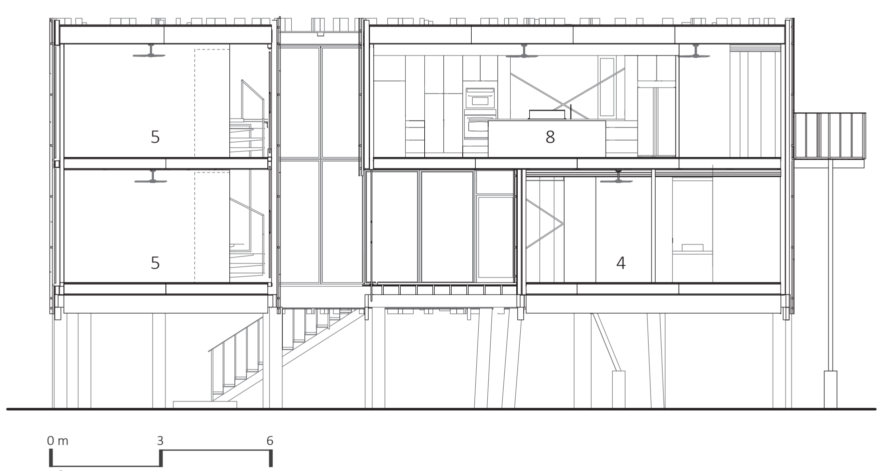
Tectonic Principles

Precedent

Architectural construction practices have not changed significantly over the past century. Manufacturing fields, such as automotive, shipbuilding, and aerospace, however, have thrived due in part to their ability to progressively adapt to change. Kieran and Timberlake's *Refabricating Architecture* presents the firm's research into these industries and calls for a re-evaluation of the practices currently used to design and construct buildings. Manufacturing industries favor nonhierarchical over linear processes primarily because nonhierarchical processes allow for more time to perfect each part and for higher quality control prior to the assembly of the finished product (Figure 01.6). Kieran and Timberlake argue that the building industry would be wise to learn from and adapt some of these practices.[4]

Loblolly House served as a testing ground for adapting industrial practices to architectural production. Most of the house's components were manufactured off site and shipped to the site for assembly. This process places significant emphasis on the quality of the joints between materials, components, and systems. It serves as a direct link to the philosophies of Bötticher, Semper, and later Frascari who all called for careful consideration when joining materials and assemblies. The fabrication of components in an off-site facility allowed for higher quality control with far fewer connections made on site where tolerances are much greater and the construction practices are more imprecise.[5]

01.3
Floor plans

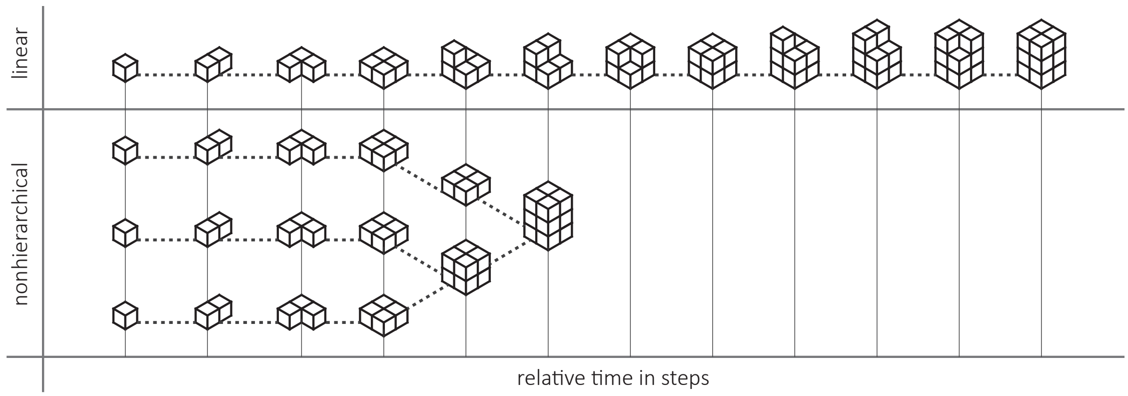


1	bamboo garden	6	mechanical
2	entry stair	7	spiral stair
3	entry	8	living space
4	master bedroom	9	kitchen
5	guest bedroom	10	glass bridge

01.4
Building section

01.5
Main living space

01.6
Chart of working processes



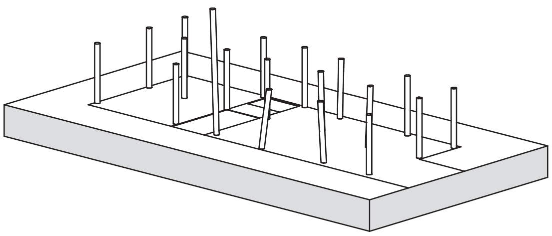
Anatomy

This new conceptualization of building required KieranTimberlake to create a new system for categorizing building components. The model serves as a departure from traditional building nomenclature and from Semper's four elements. The system consists of scaffold, cartridges, blocks, fixtures, furnishings, equipment, and site work (Figure 01.7). *Site work* performs a similar role to that of Semper's earthwork. It is the manipulation of the site to prepare it for inhabitation. In the Loblolly House, the site work consists of driven piles that serve as an elevated ground plane while anchoring the building to the earth. The *scaffold* is the structure of the building and rests on the pile foundation. *Cartridges* are pre-manufactured panels that attach to the scaffold. They enclose and define the space of the building as a primary component of the cladding system. These elements are essentially hung in the scaffold, a procedure that is reminiscent of Semper's beliefs about the hanging of woven mats. Also attached to the system are the *blocks*, which are small, complex spaces (like bathrooms) that require the interrelationship of many trades and are constructed more economically off site. *Fixtures*, *furnishings*, and *equipment* are additions to the building's primary structure. These elements create the quality of the living environment through the regulation of comfort level and the creation of an interior finish palate.

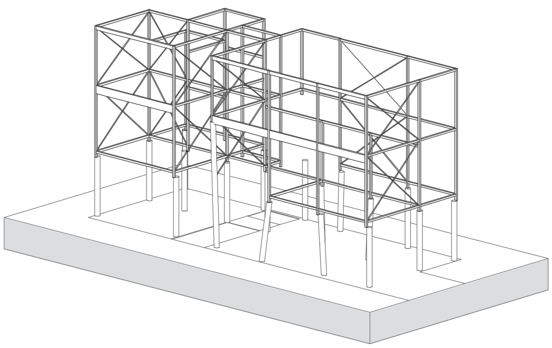
Tectonic

> There are now and have always been two basic ways of lifting and supporting architectural elements above the earth: frames and walls. Frames are capable of transferring loads from great heights through joined members that extend down to the earth. Loblolly is a frame house.[6]

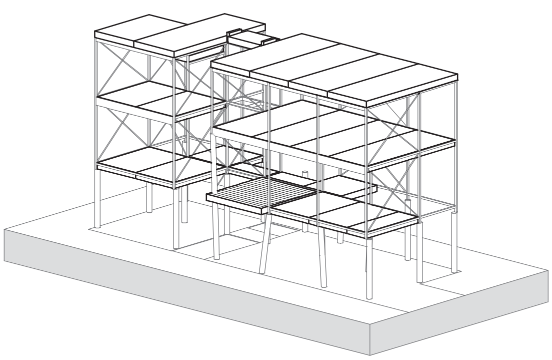
Loblolly House is predominantly a tectonic assembly (Figure 01.8). KieranTimberlake is quick to point out a distinction here between the terms *assembly* and *construction*. Assembly is accomplished with basic skills and a few simple tools while construction is more labor-intensive and requires specialized skills as well as a wide array of tools and equipment.[7] As opposed to construction, an assembly process is simplified, allowing the builder to focus on joint quality rather than joining procedures.



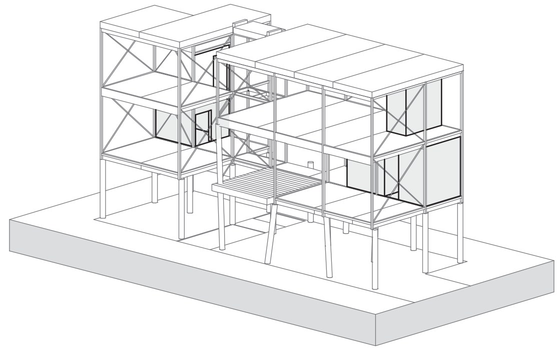
1: Sitework
Log piles serve as the primary sitework or foundation of the house.



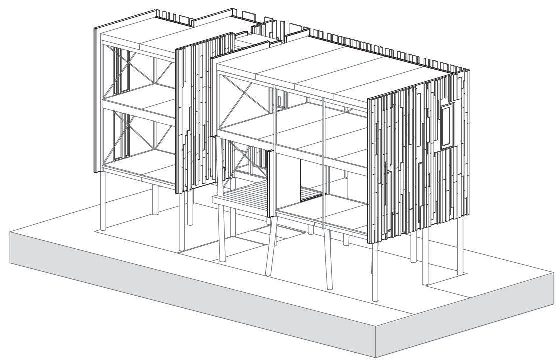
2: Scaffold | Framework
The aluminum scaffold provides the framework for the residence.



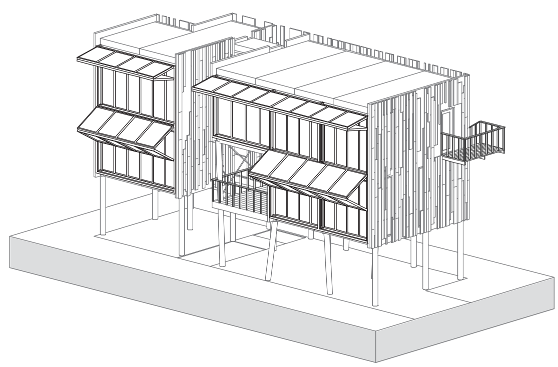
3: Floor Cartridges
These manufactured components create the horizontal planes of the house.



4: Blocks
These components contain the primary mechanical and plumbing systems.

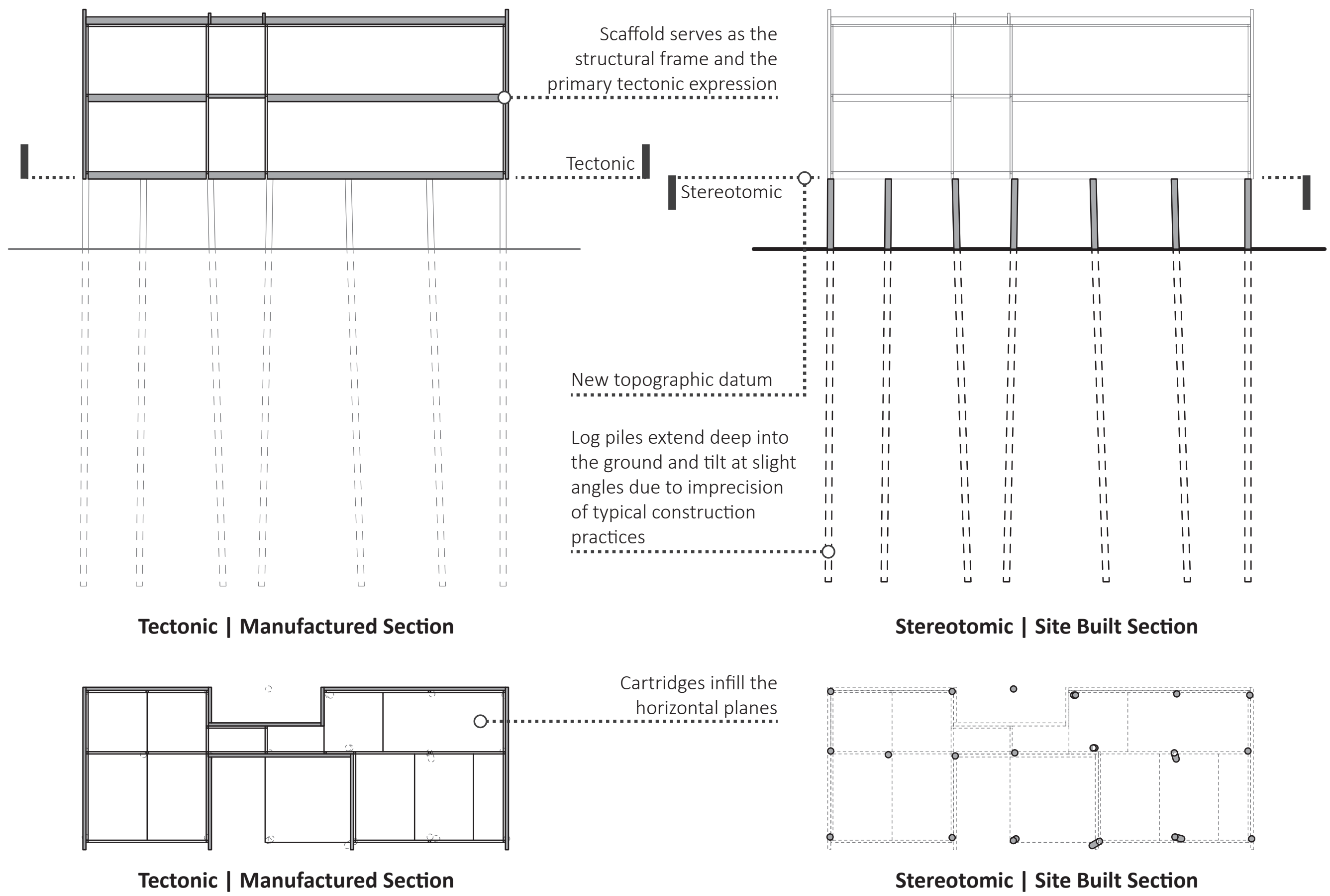


5: Wall Cartridges | Cladding
The wall cartridges provide enclosure for the residence. The exterior expression is created by the vertical slatting.



6: Equipment
These components allow for movement of people and connection to the environment.

01.7
Anatomy



01.8
Tectonic | Stereotomic

The scaffold is manufactured from aluminum, which was chosen for its lightweight composition and ease of fabrication. Its profiles were extruded to set lengths and then connected using a universal joint that can be found throughout the project. This system simplified the manufacturing process and allowed for faster assembly without any dependence on heavy machinery. After erection, the aluminum frame was sheathed with cartridges – wall and floor panel systems consisting of lumber ribs and plywood sheathing. The cartridges were attached to the frame using a modified version of the universal joint. Loblolly House was designed to showcase these tectonic components. The aluminum frame, along with cross bracing used to resist lateral loads, is visible throughout the structure, providing a constant reminder of the nature of the building (Figure 01.9).

Detail

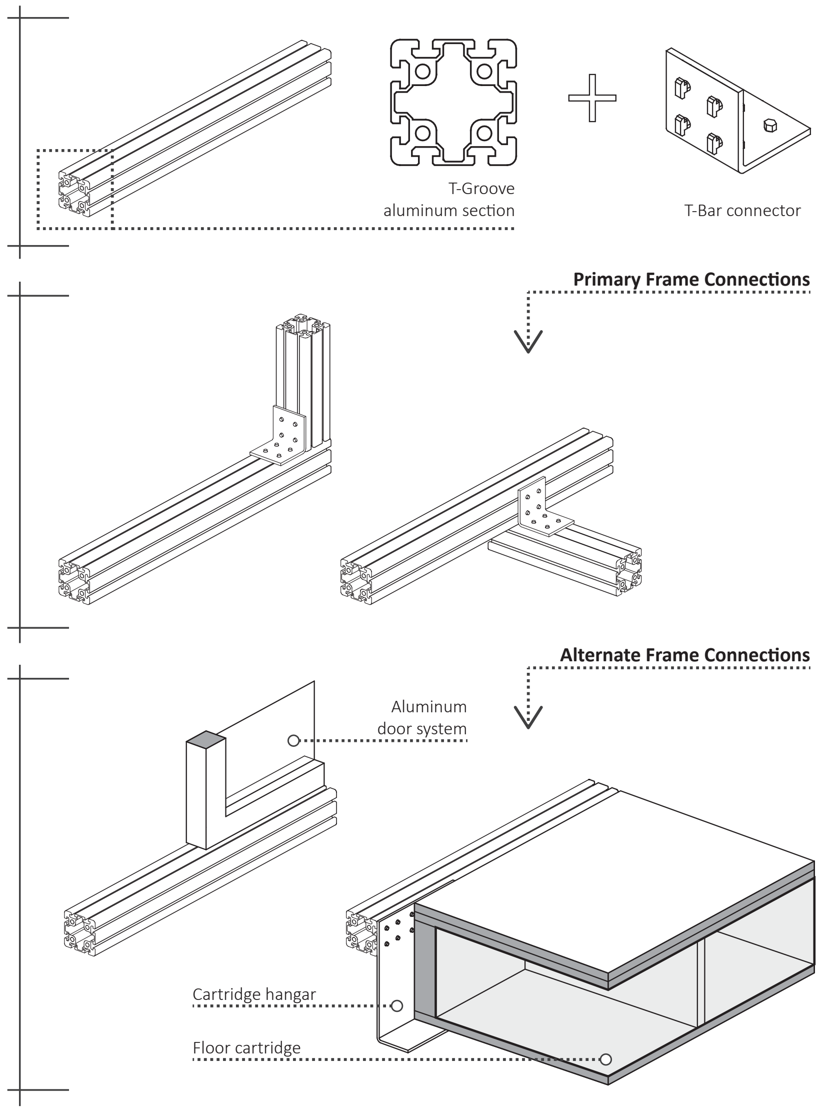
As Jean Labatut stated, “It is the precise study and good execution of details which confirm architectural greatness.”[8] In the Loblolly House, the universal joint serves as a physical realization of the primary objectives of the project. “The source of creativity within the Loblolly scaffold is the simple T-groove, which has been exploited for as many purposes as possible.”[9] Simple, but effective, this groove is a standard inclusion in the extruded aluminum

01.9
Detail of the aluminum frame

profile used in the fabrication of the scaffold; it is integrated into each of the profile's four sides (Figure 01.10). Like Semper's knot, this connection is simple and easy to fabricate, yet it still has the ability to adapt to different situations and needs. And while a process like welding requires special equipment, experience, and considerable skill, this system requires only a wrench to assemble the components with relatively minimal effort.

The universal joint, which is used about 2,100 times throughout the project, allows all the aluminum profiles to be fabricated with the same T-groove, saving time and money. The coordinating connectors have T-shaped bars that slide and lock in the profile's grooves. As this joint serves as the primary structural connection for the building, the aluminum profiles had to be modified from their standard configuration found in a manufacturing environment in order to attain the required structural strength needed to support the multistory building. In addition to structural connections, the universal system was also used for a variety of non-structural purposes, like tracks for the sliding doors.

01.10
Universal joint details

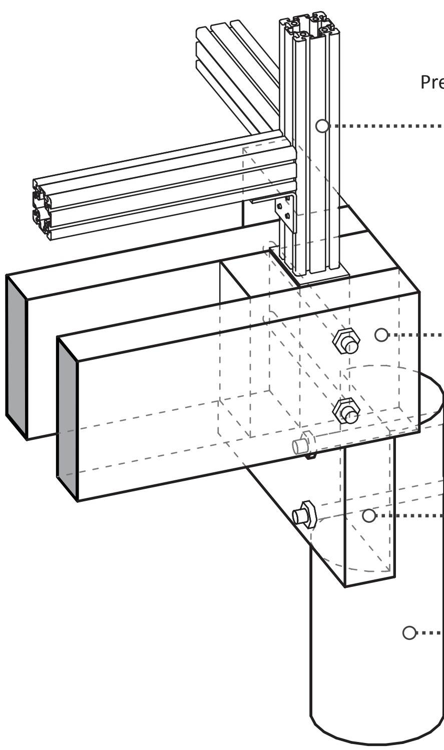


Stereotomic

> When materials are anchored to the ground, they assume the potential for transformation, by circumstance, into architecture. This act of grounding – of fastening what we build to the earth – separates architecture from other acts of design.[10]

Stereotomic usually refers to heavy, piled mass construction that serves as an extension of the earth upwards into the built work. While no traditional stereotomic elements exist in Loblolly House, wooden piles made from local pine act as a powerful connection between the earth and the structure above (Figure 01.11). These piles were the only component of the primary construction created using typical site-based practices. They create a new topography; one that is elevated in the trees. The piles, though, reacted unpredictably when driven

01.11
Loblolly House from the forest



01.12
Collar beam connection

into the ground, tilting slightly in differing directions. The final impression of the constructed pile foundation reflects the subtle irregularity of the forest itself; the building is symbolically supported by its natural surroundings.[11]

Intersection

The juncture between the tectonic and stereotomic is crucial to the success of KieranTimberlake's theory of construction. The pile foundation is irregular, but the scaffolding above was manufactured with factory precision. In order for this way of manufacturing buildings to work, the precise components need to be successfully situated within an imprecise world. To construct the intersection between these two systems, the team designed a two-layered structure to receive the aluminum scaffold (Figure 01.12). The first layer of beams sits in shoulder ledges cut into the top of the piles. The second layer overlaps the first, eliminating the irregularity of the piles and creating a level base to host the scaffold. The pair acts like a "gasket that allows the prefabricated elements to align with what is an inherently irregular foundation."[12]

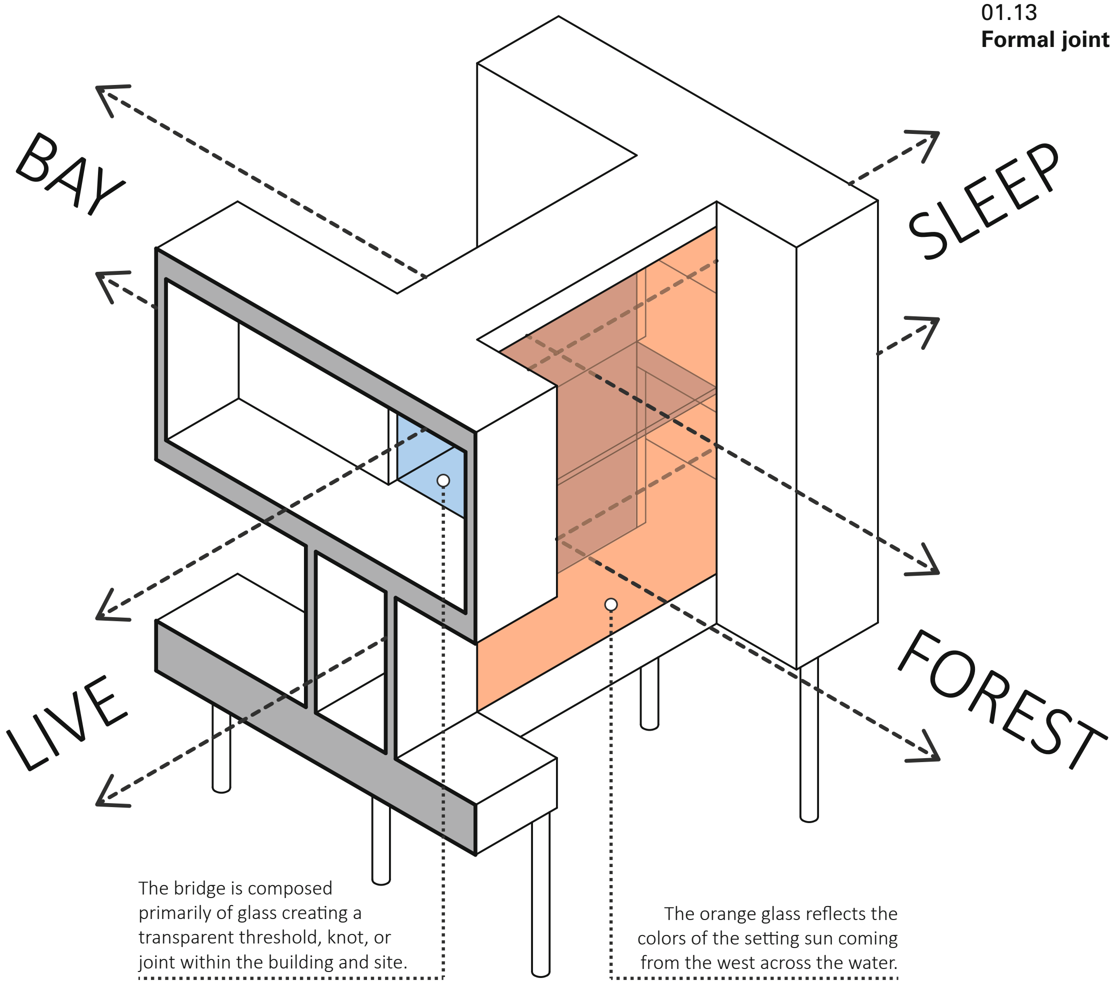
Place

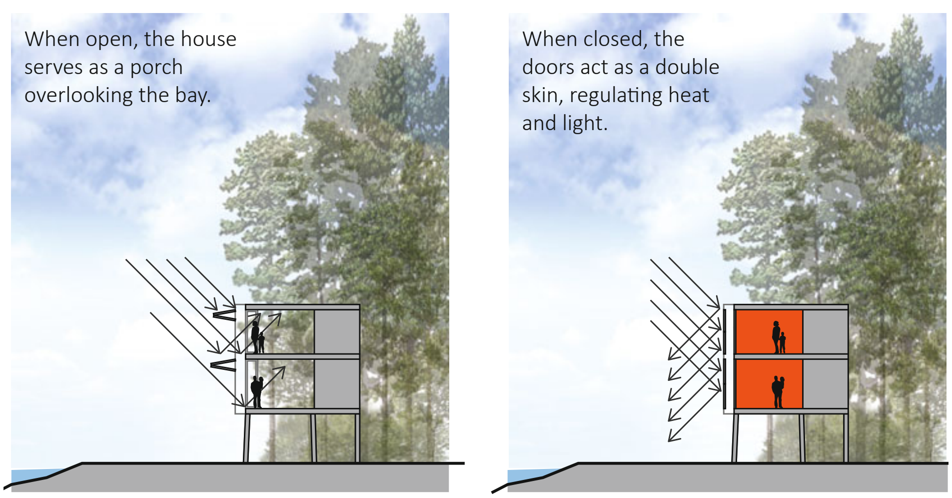
Loblolly House is constructed with respect to its environment. "The house intentionally seeks an empathic form of integration with the site."[13] Vertical strips of cedar clad the north, east, and south façades of the house, creating a blind that camouflages the building in the forest. Windows, hidden beneath the cladding, peak through and reflect the surrounding trees. The reflections intensify the illusion that the house is a small part of the larger forest.

The interior is designed around the environment as well. In particular, the bridge that connects the two parts of the house utilizes materiality to create a dialogue between the man-made and the natural (Figure 01.13). The back panels of the bridge are orange glass, amplifying the effect of the light from the sun setting across the bay. The transparency inherent in the glass walls and floor eliminates the separation between inside and outside; the walls become bamboo (which grows around the building) and the floor bleeds into the underbelly of the forest (Figure 01.15). The bridge is a crossroads in the Loblolly House, Frascari's *formal joint*. It is a threshold between the two wings of the building as well as between the worlds outside and inside the house.

The west façade of Loblolly connects the house and the bay. The wall is composed of a series of operable hangar and accordion doors that work in concert to provide a varied relationship between the living spaces and environment outside (Figure 01.14). The façade can be opened incrementally to regulate the penetration of elements (wind, sun, etc.) into the house. Or it can be closed for shelter and protection. When closed, the doors act as a double skin, regulating passive heat gain and tempering light infiltration. When fully open, the house serves as a porch overlooking the bay. Guided by the unique construction of the building, a relationship is developed in the Loblolly House between technology and the façade of the building. Although far less complex, this construct has similar traits to those found in the south façade of the Arab World Institute discussed earlier in this book (see page lv).

01.13
Formal joint at the bridge





01.14
Environmental considerations

01.15
View through the bamboo at the bridge

Additional Resources

Projects

Cellophane House™, The Museum of Modern Art, New York, New York, United States, 2008

Houghton Chapel and Multifaith Center, Wellesley, Massachusetts, United States, 2008 (42°17›29»N, 71°18›16»W)

Center City Building at University of North Carolina at Charlotte, Charlotte, North Carolina, United States, 2011 (35°13›42»N, 80°50›06»W)

Quaker Meeting House and Arts Center, Washington, DC, United States, 2011 (38°56›24»N, 77°04›26»W)

Morse and Ezra Stiles Residential Colleges, New Haven, Connecticut, United States, 2011 (41°18›45»N, 72°55›51»W)

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Kieran, Stephen, and James Timberlake. *Cellophane House*. Philadelphia: ORO Editions, 2011.

Kieran, Stephen, and James Timberlake. *Loblolly House: Elements of a New Architecture*. New York: Princeton Architectural Press, 2008.

Kieran, Stephen, and James Timberlake. *Refabricating Architecture: How Manufacturing Methodologies Are Poised to Transform Building Construction*. New York: McGraw-Hill, 2004.

Kieran, Stephen, James Timberlake, and Karl Wallick. *Kieran Timberlake: Inquiry*. New York: Rizzoli International Publications, 2012.

Lind, Diana. "On a Wooded Site on Taylors Island, Maryland, Kieran Timberlake Tested a New Way of Building with the Loblolly House." *Architectural Record* 195, no. 4 (2007), 140–46, 48.

Notes

1 Adapted from information found on KieranTimberlake's website: http://kierantimberlake.com/pages/view/33/about-front-page.

2 "Kierantimberlake: Loblolly House," http://kierantimberlake.com/pages/view/20/loblolly-house/parent, 3.

3 Stephen Kieran and James Timberlake, *Loblolly House: Elements of a New Architecture* (New York: Princeton Architectural Press, 2008), 18.

4 "Kierantimberlake: Loblolly House."

5 Stephen Kieran and James Timberlake, *Refabricating Architecture: How Manufacturing Methodologies Are Poised to Transform Building Construction* (New York: McGraw-Hill, 2004), 93–95.

6 Kieran and Timberlake, *Loblolly House: Elements of a New Architecture*, 67.

7 Ibid., 80.

8 Jean Labatut as cited in Marco Frascari, "The Tell-the-Tale Detail," in *Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory 1965–1995*, ed. Kate Nesbitt (New York: Princeton Architectural Press, 1996), 501. (Originally published in *VIA 7: The Building of Architecture* (1984), 23–37.)

9 Kieran and Timberlake, *Loblolly House: Elements of a New Architecture*, 67.

10 Ibid., 57.

11 Ibid.

12 Ibid.

13 "Casa Per Vacanza a Taylor Island, Maryland = Loblolly House, Taylor Island, Maryland," *Industria Delle Costruzioni* 42, no. 400 (March/April 2008), 64.

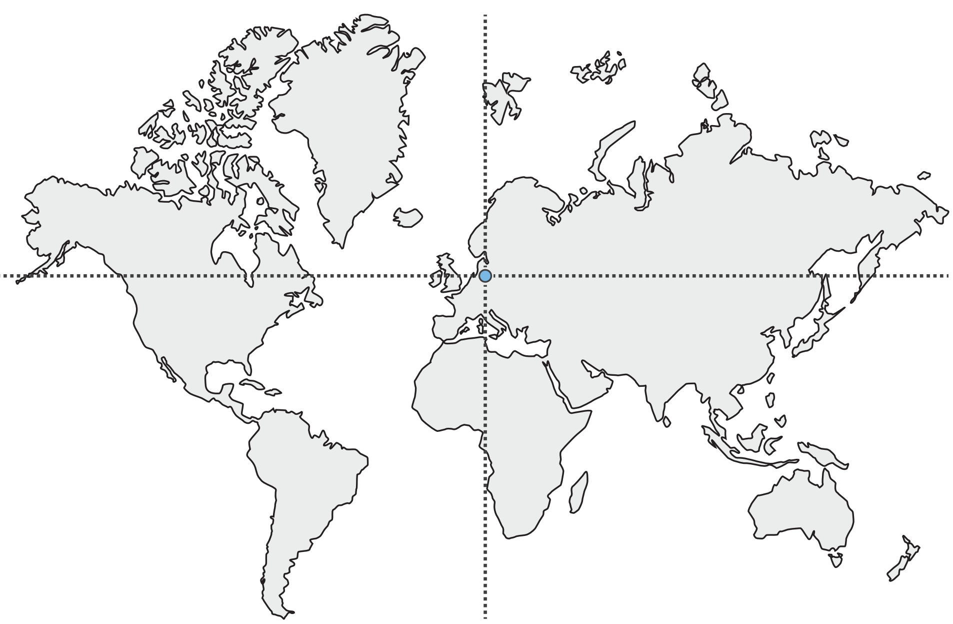
02
Swiss Sound Box
Peter Zumthor

Architect Brief

As the son of a cabinetmaker, Peter Zumthor spent his youth surrounded by the crafting of materials. Later, he formally studied furniture design at the University of Art and Design in Basel. These studies expanded to the architectural environment, and in 1967, Zumthor began his architectural career working for the Swiss government. In 1978, Zumthor opened his private practice in Haldenstein, Switzerland, which continues to produce highly regarded work around the world to this day. In 2009, Zumthor was selected as the recipient of the Pritzker Architecture Prize, followed by the RIBA Royal Gold Medal in 2013. Both awards are amongst the most significant of the profession and honor Zumthor's lifetime of substantial achievement.

Zumthor's work centers on materiality, the activation of the senses, the quality of details, and the creation of atmosphere within space. His two architectural manifestos – *Thinking Architecture* (1998) and *Atmospheres* (2006) – outline his philosophy on the making of space.

hannover, germany
gps | 52°19'5"N, 9°49'5"E - former locat
program | exhibition pavilion
completed | 2000
area | 2,774 m2 [29,860 ft2]



02.1
Vicinity map

> Architecture is always concrete matter. Architecture is not abstract, but concrete. A plan, a project drawn on paper is not architecture but merely a more or less inadequate representation of architecture, comparable to sheet music. Music needs to be performed. Architecture needs to be executed. Then its body can come into being. And this body is always sensuous.[1]

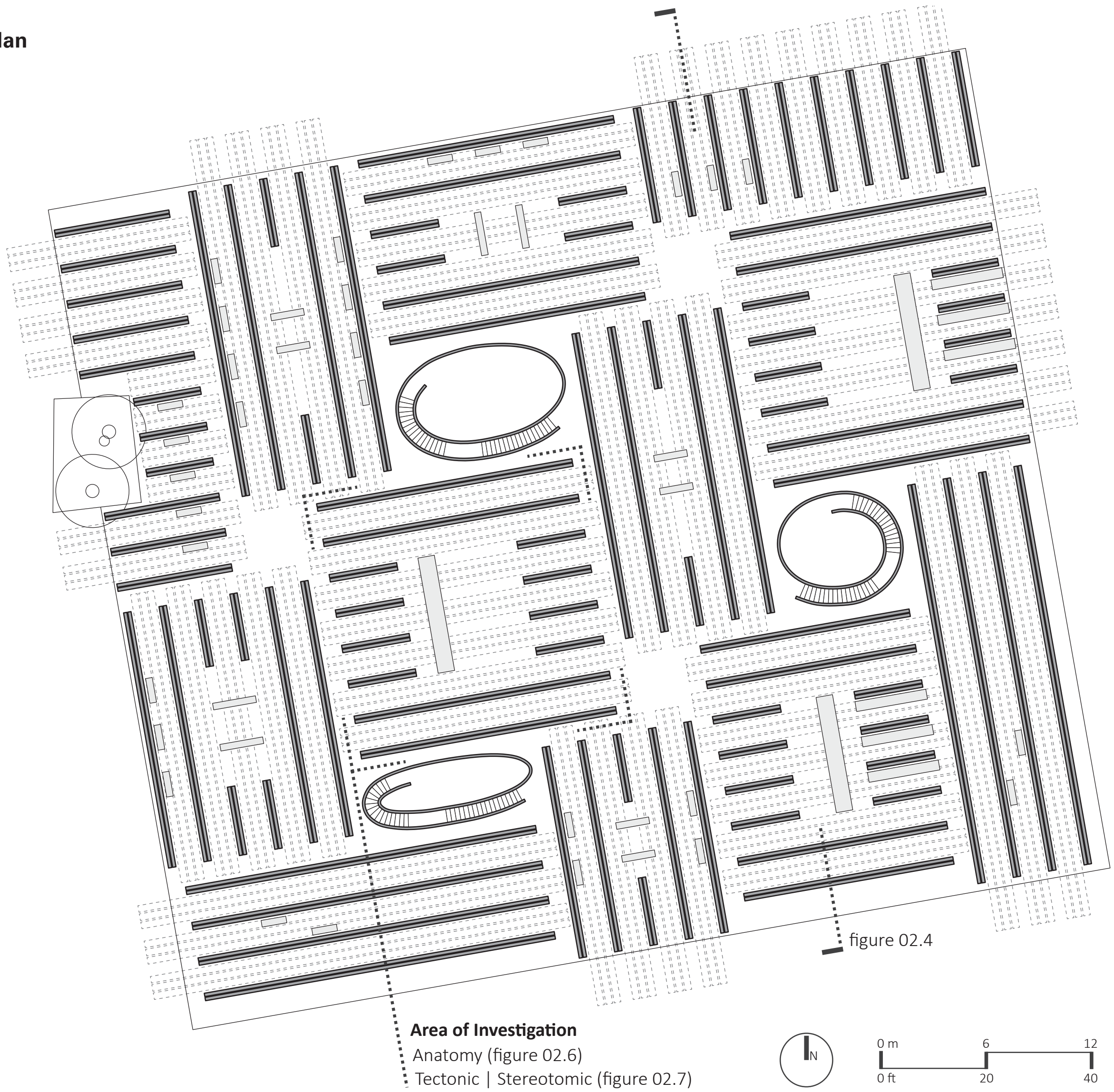
Project Brief

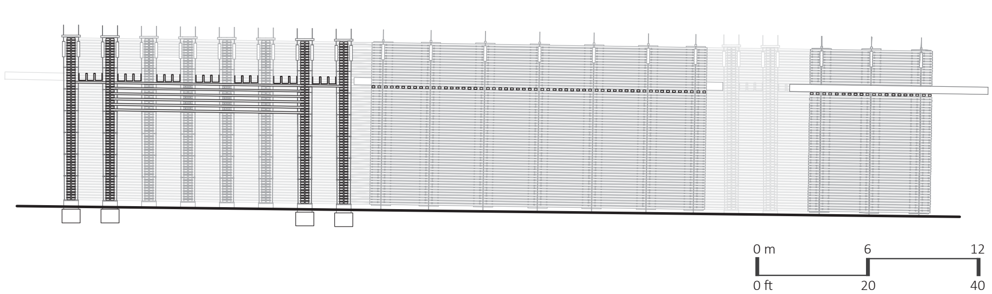
> The Sound Box is first and foremost a refuge for visitors saturated by the stimuli of the exhibition who are looking for a place to get away from it all. The Sound Box is a place to relax, stroll, enjoy, and discover.[2] (Figure 02.2)
>
> "Peter Zumthor: The Swiss Pavilion," 2000

The Swiss Sound Box was built for the Hannover World Exposition held in 2000 and was deconstructed soon after the event's completion. The building felt labyrinthian, but the basic structure was a pinwheel: four stacks of parallel wood walls grouped around a central square. The floor plan of the Sound Box was generated by "extending this basic arrangement into a regular fabric-like pattern"[3] (Figure 02.3). The arrangement included 12 separate stack areas – each alternating direction 90 degrees from those adjacent – and a total of 99 walls (Figure 02.4). The organization created a vague separation between interior and exterior with 50 different openings in the structure that allowed movement in and out of the pavilion.

02.2
Swiss Sound Box from the adjacent plaza

02.3
Floor plan





02.4
Building section

In plan, the building read like the warp and weft of a textile with knots at various meeting places and activity nodes. Visitors strolled through this wood tapestry and *came upon* places of activity that activated the senses (Figure 02.5). Three stand-up bars served food and drink reflecting the Swiss culture. These service elements were housed in spiral-shaped multistory units that also contained the back of house functions of the pavilion. Other voids in the stacks hosted musicians whose melodies reverberated through the Sound Box. In addition to food and music, woven into this project was the written word. Quotations about Switzerland and the Swiss people, taken from a wide range of sources, were projected in light onto the slatted wooden walls.

02.5
Interior court

Tectonic Principles

Anatomy

tarmac = a paving material that consists of crushed stone rolled and bound with a mixture of tar and bitumen

The earthwork of the Swiss Sound Box was divided into two components. The asphalt **tarmac**, which was constantly underfoot, provided a finished walking surface but did not bear the weight of the walls above (Figure 02.6). Instead, supports pierced through this surface and delivered its load to a series of concrete footings below. The framework of the building – the stacks – carried the roof above, providing a cohesive structure for the space. The stacked wood walls also served as the primary expression for the pavilion.

The activity spaces were seemingly carved out of the stack system; they read either as open courtyards between the stacks or as voids within them. These negative spaces – the *watering holes* for Exposition visitors – were the centers of activity, the hearths of the Sound Box. The cladding was physically present in the gutters overhead as well as in the walls themselves. Equally important, however, was the cultural cladding of the building. The text projected onto the walls told as much of the story of the Sound Box as any physical component of the architecture ever could. According to Semper, this cladding created the character of the space while also revealing its true nature and intent.[4]

Stereotomic

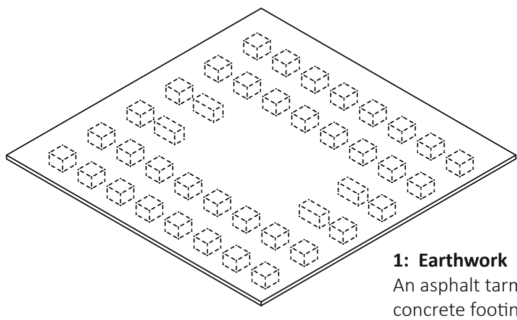
hardcore bed = aggregate base course = a layer of crushed rock

The Swiss Sound Box used few traditional stereotomic materials, and what was present had no extension above the ground plane (Figure 02.7). This strategy was logical; a primary goal of the Exposition was for each building to be easily dismantled after the event had concluded. Stereotomic materials rarely disassemble quickly, and the material used is typically unsalvageable when taken apart. The visible stereotomic component was the tarmac ground surface, which followed the existing topography. As the pavilion was not weathertight, Zumthor elected to cut grooves into this surface to help control the flow of water through the site. Below the tarmac, 396 prefabricated concrete foundation blocks were laid on a continuous **hardcore bed**. These blocks provided full support for the building above.

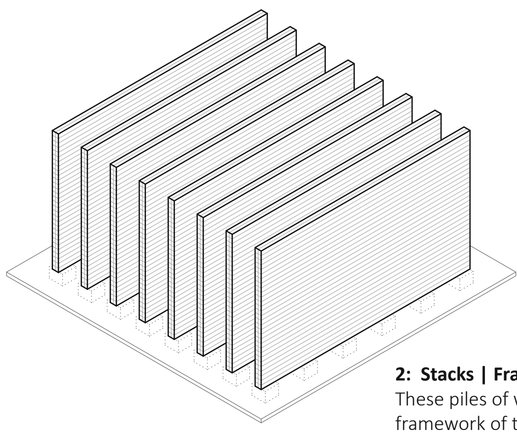
Nontraditionally, the entire Swiss Sound Box could be viewed as a stereotomic construction. The walls and roof of the structure were wood – a typically tectonic material – that was stacked with no direct mechanical fastening – a stereotomic process. The voids created between the timbers, however, alleviate this reading somewhat. Critic Peter Davey stated, “The walls are both opaque and permeable: as you walk down the paths of the maze, they seem almost solid, and directive. But turn straight onto the walls, and you can see through the slits.”[5]

Tectonic

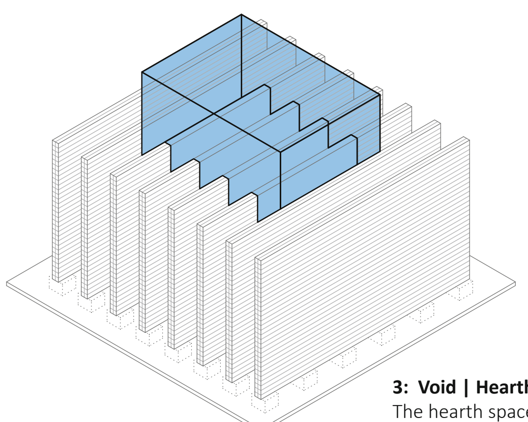
> In the case of the Sound Box, the structure and rhythm of the building from the smallest forms to the largest lines are derived from the method of construction itself: stacking, layering, the tensioning and compressing of the walls, the spanning of rooms, the jointing, lining up, and notching of beams, or the stacking of timbers.[6]
>
> Hönig, *Swiss Sound Box*, 2000



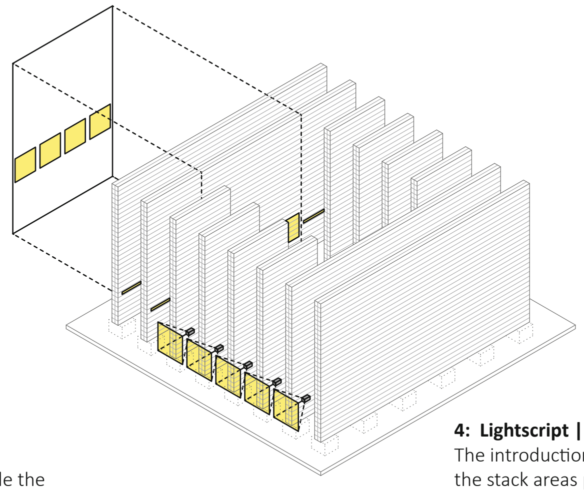
1: Earthwork
An asphalt tarmac and concrete footings provide the anchor to the earth.



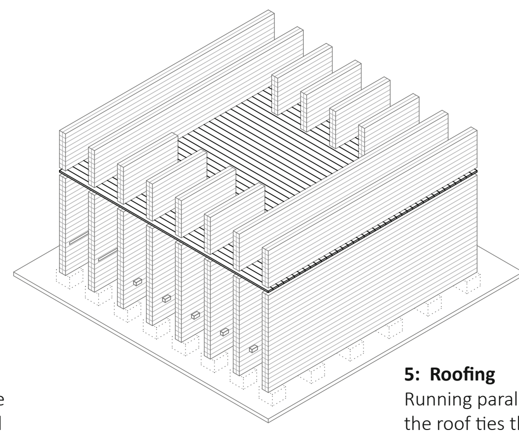
2: Stacks | Framework
These piles of wood create the framework of the building and the physical cladding.



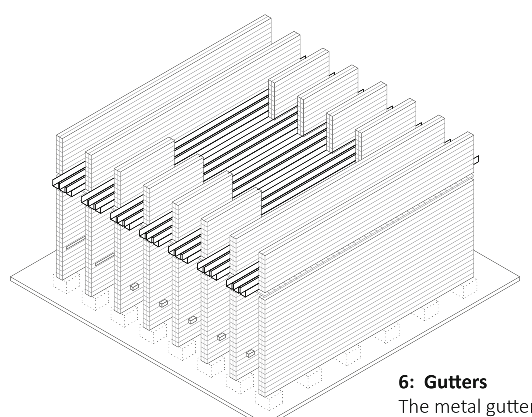
3: Void | Hearth
The hearth spaces- the places of rest- are seemingly carved out of the stacks as negative space.



4: Lightscript | Cladding
The introduction of light into the stack areas provides a layer of cultural cladding for the space.

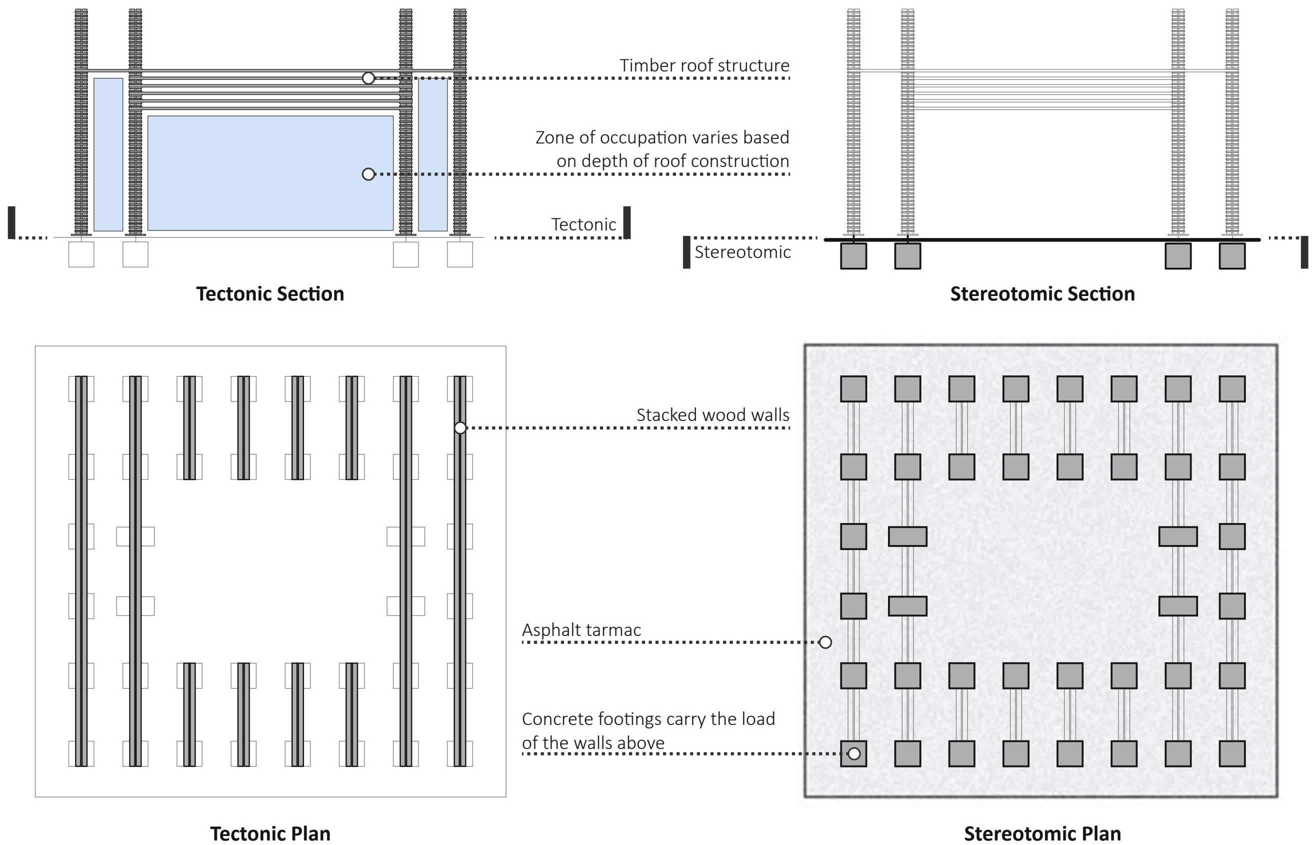


5: Roofing
Running parallel to the stacks, the roof ties the walls together into an integrated structure.



6: Gutters
The metal gutters provide a layer of protection from the elements for the interior spaces.

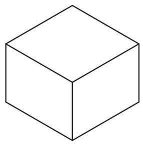
02.6
Anatomy



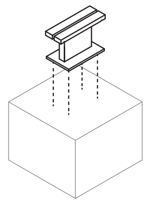
02.7
Tectonic | Stereotomic

The Swiss Sound Box was composed of over 40,000 timbers. All of the walls running east to west were made from douglas fir, while those running north to south were larch. Each timber used was cut immediately before being shipped to the construction site in a green state. The primary wall component had a 100 × 200 millimeter [3.9 × 7.9 inch] rectangular section. These timbers were stacked in alternating layers with smaller blocks of wood running perpendicular to the wall (Figure 02.8). These small blocks were 45 × 45 × 544 millimeters [1.8 × 1.8 × 21.4 inches] and allowed air to circulate around the larger timbers (Figure 02.9).

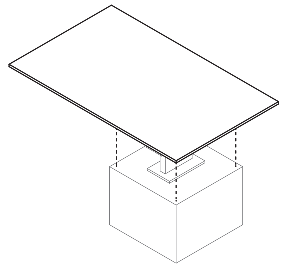
Every timber used in the Swiss Sound Box was unscathed by the construction process; the timbers were not screwed, nailed, or adhered. Instead, the stacks were held together through friction resistance. The timbers were placed precisely in stacks using templates and scaffolding for alignment and temporary support. After placement, the stacks were compressed using a system of stainless steel tension rods and steel springs. The tension systems were placed every 3 meters [9.8 feet] along the stacks; they were anchored at the bottom to steel plates and at the top to a cap element that spanned across the wall. The springs were integral to the system as they allowed the compression system to maintain constant pressure despite the fact that the wood was constantly changing shape (see “Precedent” below).



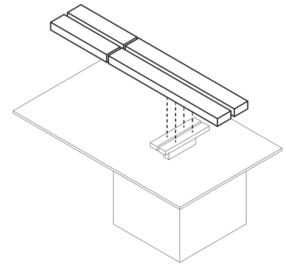
1: Concrete Footing



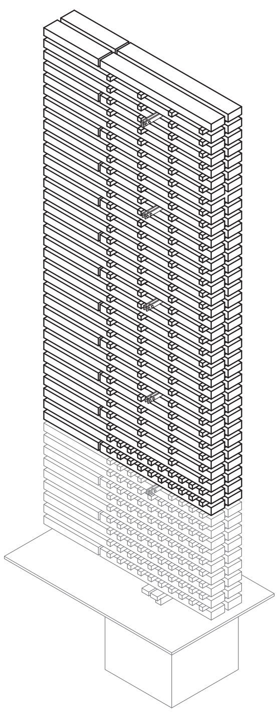
2: Steel Base Plate
Anchored to the top of each concrete footing.



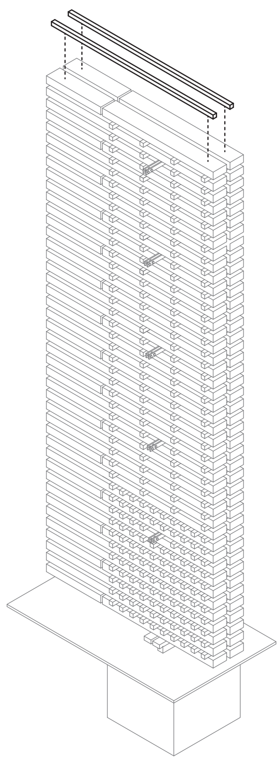
3: Asphalt Tarmac
The tarmac provides the finished ground surface of the Sound Box.



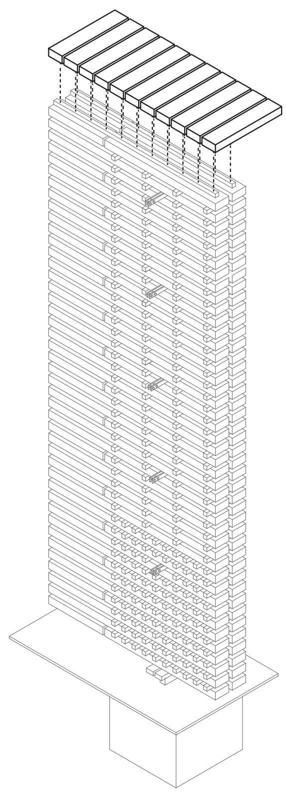
4: Stacked Wood I
The primary timbers are supported by the steel elements below.



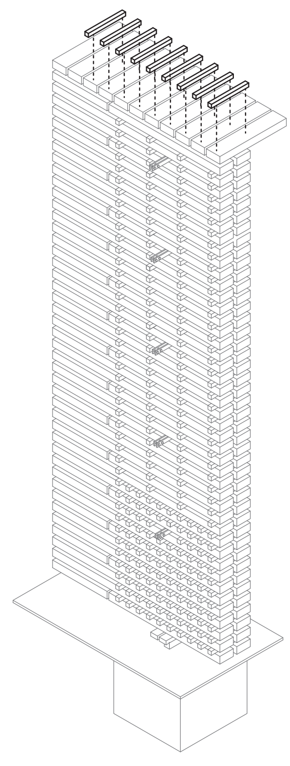
8: Lower Wall
This system of stacking is utilized to build the wall up to the roof level.



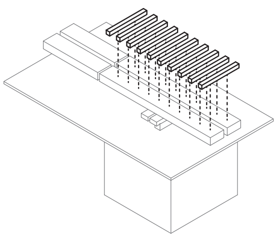
9: Parallel spacers
At the roof level, spacers are placed parallel to the wall to receive the roof structure.



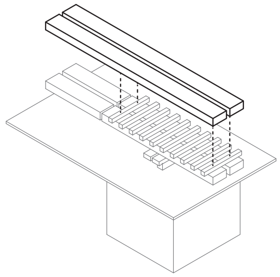
10: Roof Structure
The same timbers are used to create the roof structure that spans from wall to wall.



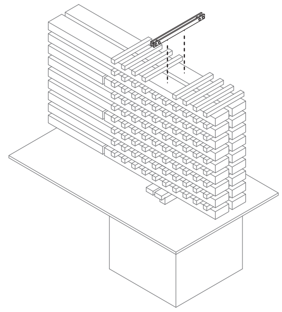
11: Roof Spacers
Blocks are placed on top of the roof construction to receive the upper portion of the wall.



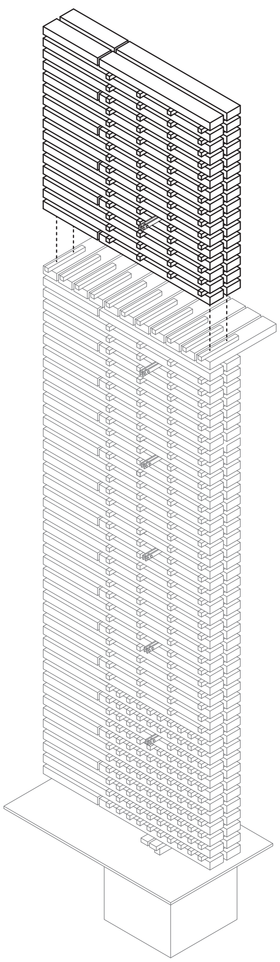
5: Wood Blocks
Smaller wood elements running perpendicular to the primary stacked lumber create spaces between the timbers.



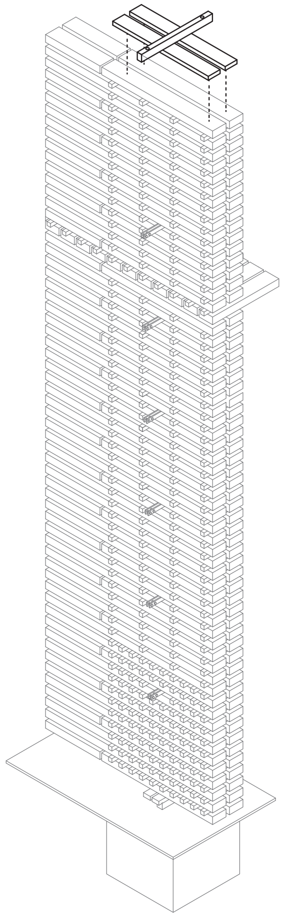
6: Stacked Wood II
The next layer of timbers is then laid directly over the blocks.



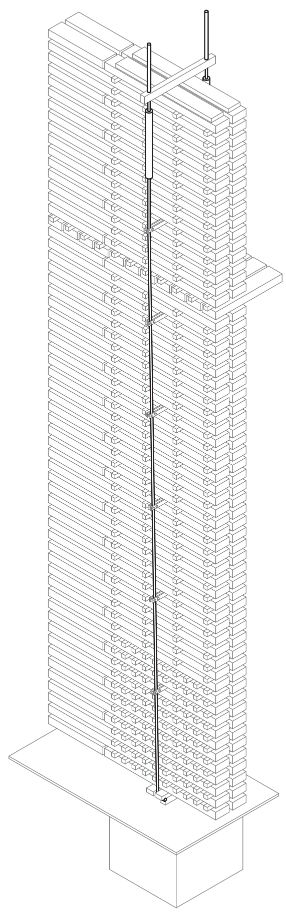
7: Rod supports
At each main tension support, guides are placed in the spacer system that the tension rods feed through.



12: Upper Wall
Above the roof, the wall construction continues.

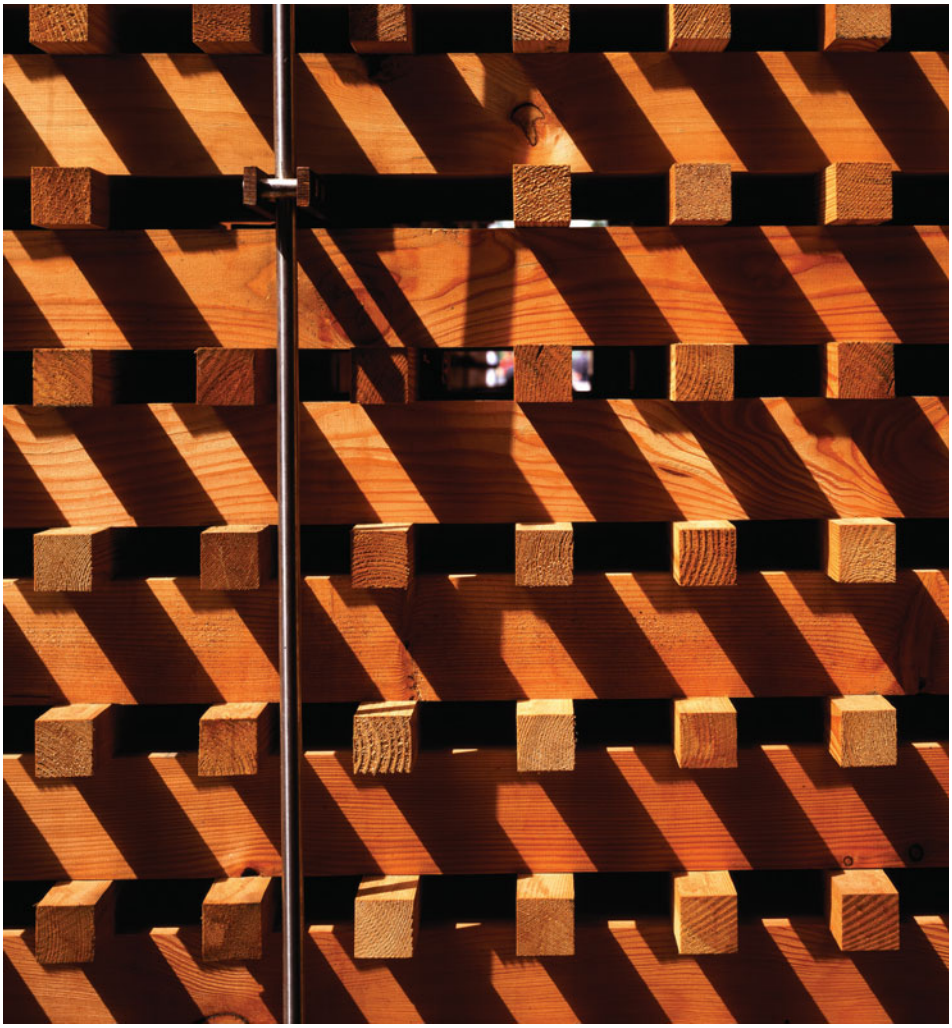


13: Tension Cap
At the top of the wall, a special construction is inserted to receive the tension structure.



14: Tension Rods
Steel rods and spring systems are utilized to clamp the wall construction together and ensure its continued stability.

02.8
Assembly sequence



02.9
Detail of the timber stacking

The roof structure – made from the same timbers – was integrated into the wall system. This structure sat about 6.3 meters [20.5 feet] above the tarmac surface. In addition to supporting the roof, these timbers provided rigidity and lateral resistance for the structure. The roof timbers bound a set of walls into what is referred to as a "stack area."

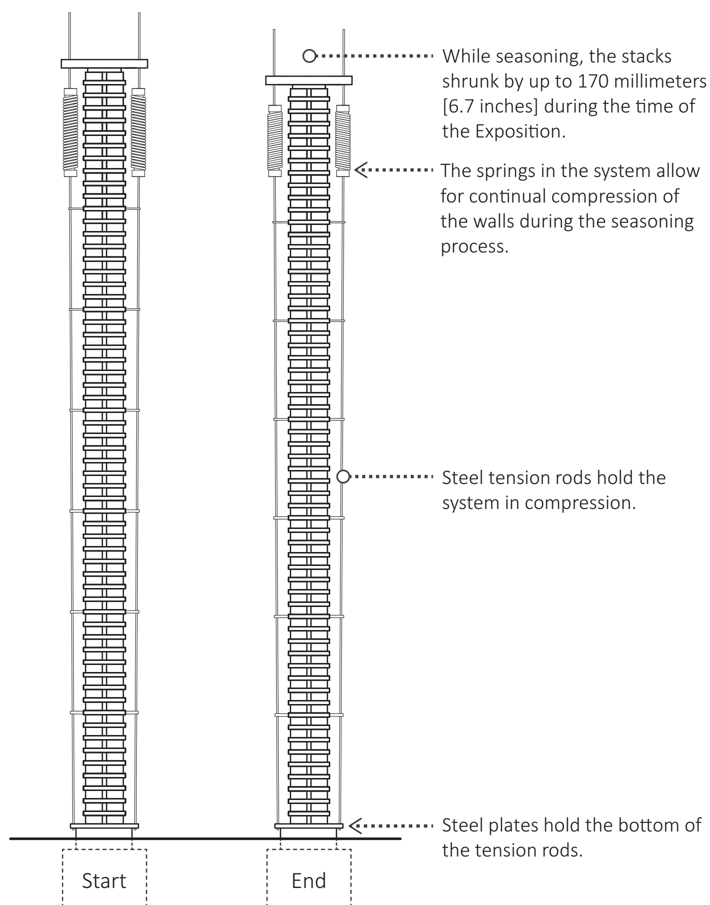
Precedent

As previously mentioned, the Exposition guidelines stipulated that each pavilion must be easily dismantled. The majority of the material from each pavilion was also required to be recycled and reused. In response to this challenge, Zumthor conceived of the Sound Box as a lumberyard.[7] The Swiss Sound Box did not just use stacked lumber, but also seasoned it. Cut just prior to the start of construction, the lumber dried over the course of the five-month Exposition and resulted in useable product. After being dismantled, the 3,000 cubic meters [105,944 cubic feet] of lumber was sold for use as "park benches, flooring, wall paneling, furniture, doors, houses, and for the dome at CERN in Geneva."[8]

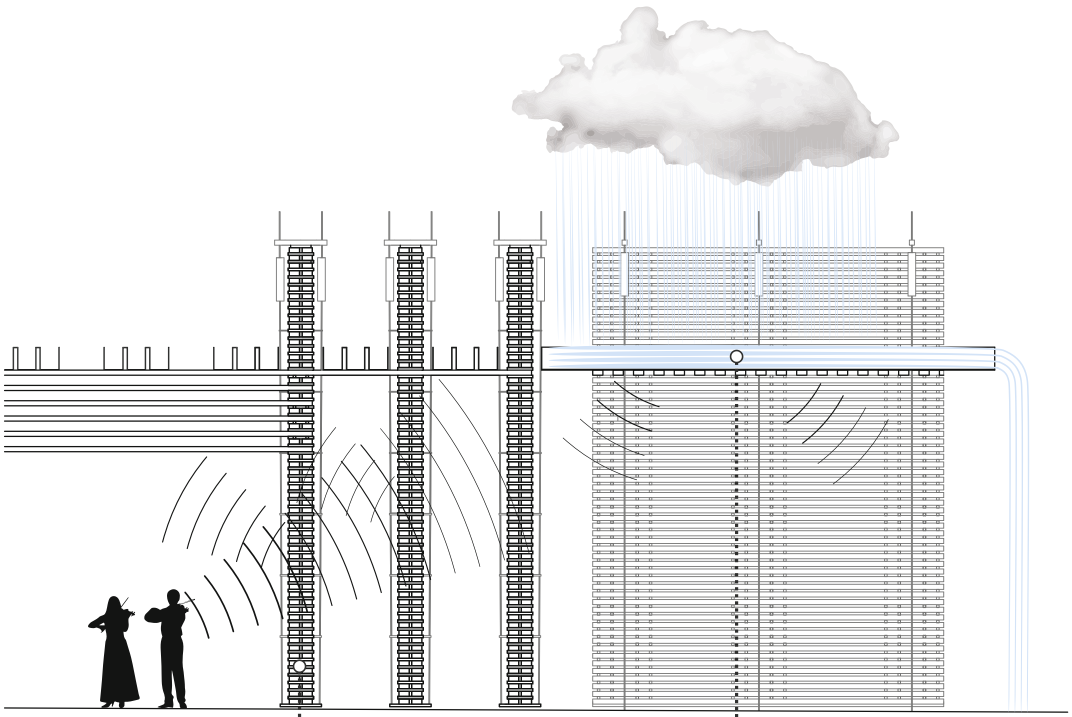
Integrating this process into the construction was complex. It was anticipated that the building's overall height would decrease by 170 millimeters [6.7 inches] over the course of the Exposition (Figure 02.10). The spring compression system allowed for consistent compressive force while the wood mass was shrinking in volume and also allowed for the springs to be retightened periodically as necessary. Additionally, "Zumthor [was] prepared for the possibility that during the pavilion's life, whole walls may deform and buckle. He [wanted] them to move. They [would] add to the organic resonance of the place."[9]

Place

The Swiss Sound Box was a temporary structure as well as a hub for the Exposition that allowed entry from all sides. As such, it was relatively divorced from any particular elements of the physical context. It was still strongly connected, however, to its environment (Figure 02.11). The open weave construction of the stacks allowed the elements to penetrate the building in "a physical, sensual event."[10] Water channeled along the tarmac, keeping certain spaces dry and others not while raindrops fell through gaps in the canopy above. The gutter system not only channeled water away from the building, but the exaggerated extensions turned the rain into a performance of sight and sound. Rain hitting the gutters



02.10
Seasoning process



02.11
Environmental influences

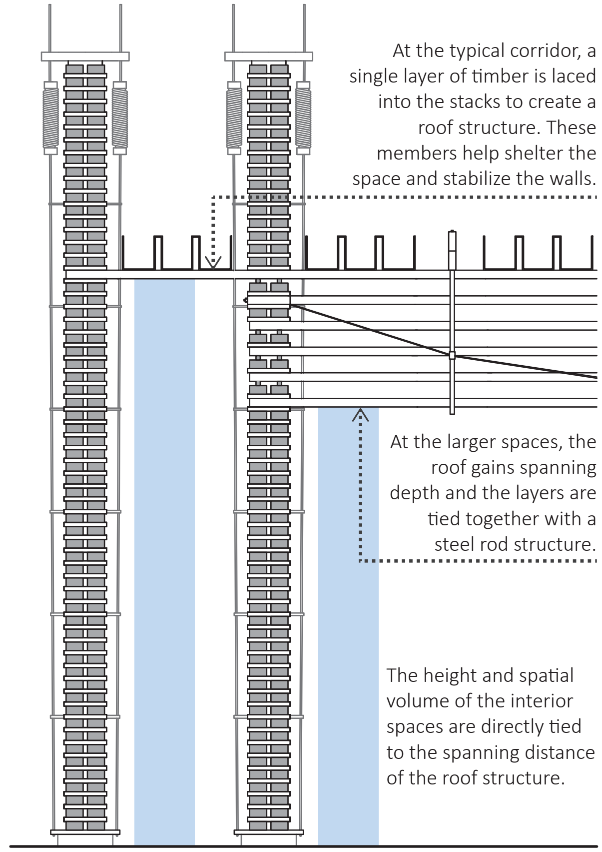
echoed melodically through the space, mixing with the contributions of the hired musicians to create a constant symphony of sound reverberating off the wood slats.

Like a tree canopy, light filtered down through openings in the Sound Box's roofing system, providing drama to the space. And the wood itself, along with a constantly changing selection of food and drink, laced the pavilion with smells reflective of Switzerland. Although not directly derived from an immediate physical context, the Swiss Sound Box is constructed to enhance the effects of the environment – both natural and artificial. Rather than the building just responding to environmental conditions, this pavilion was charged with amplifying them.

Space

The primary program spaces of the Swiss Sound Box were housed in voids in the stack system. These program spaces have roof constructions, which vary based on the structural spanning condition at each location. The large bar areas have a roof span of up to 11.25 meters [36.9 feet], while the smaller sound spaces have shorter roof spans of up to 6.74 meters [22.1 feet] (Figure 02.12). The longer the span, the deeper the structure became (Figure 02.13). In this construction typology, depth translated to more layers of timber and a

02.12
Sound space



02.13
Roof construction

lower ceiling height. Where multiple timber layers are used, they are tensioned together like a suspension bridge, using tie rods that function like the bridge's cables. As with Bötticher's notions of spatial tectonics, the program determines the size of the space, which in turn determines the structural condition and the final spatial height.

Representation | Ornamentation

The projected light texts used throughout the Sound Box were called Lightscripts (Figure 02.15). They were engineered to match the spacing of the slatted structure and to clad the building with the underlying character and essence of the Swiss people. Although a significant departure from the traditional tectonic notions of art-form and core-form, this variation is potentially more meaningful. The positioning of the light projectors follows a series of specific rules that are tied directly to the construction of the space. "[These] rules are based on the architecture, but lead to results that appear to be independent of the regularity of the design. To put it differently, they project the deep structure of the architecture onto its own surface."[11] This art-form is not only reflective of the construction of the place, but also of the construction of the culture that conceived it.

- Rule 1: If you are standing in a small courtyard space and can look through a stack and your view lands on the face of a stack wall, 50-centimeter [19.7-inch] text is projected onto that surface. This text is experienced vertically – looking straight at it on approach (Figure 02.14).
- Rule 2: The corridor viewed down in rule one has a single line of 2.5-centimeter [1-inch] text running continuously down its full length. This text is experienced horizontally – reading it while walking along it.
- Rule 3: Where the corridor in rule 2 intersects a bar or sound space void, the text that was supposed to fall on the wall of the corridor will, instead, be projected in 5-centimeter [2-inch] text on the opposite wall across the space.
- Rule 4: The text described in rule 3 is multi-line text that is center justified. Together, the texts in these rooms form double, triple, or quadruple sets depending on the size of the room.
- Rule 5: A view down any corridor that terminates in the face of a stack, outside those already accounted for in rule 1, will have medium, 5-centimeter [2-inch] text projected onto it. This text could be experienced horizontally or vertically depending on its location.

Additional Resources

Projects

Shelter for Roman Ruins, Chur, Switzerland, 1986 (46°50′48″N, 9°31′36″E)

Saint Benedict Chapel, Sumvitg, Switzerland, 1989 (46°44′5″N, 8°56′20″E)

Thermal Baths, Vals, Switzerland, 1996 (46°37′19″N, 9°10′52″E)

Kolumba Museum, Cologne, Germany, 2007 (50°56′19″N, 6°57′15″E)

Bruder Klaus Field Chapel, Wachendorf, Eifel, Germany, 2007 (50°35′32″N, 6°43′39″E) (also featured in this book, see Chapter 19)

References

Davey, Peter. "Moral Maze: Swiss Pavilion Expo 2000." *Architectural Review* 208, no. 1243 (2000), 50–53.

Durisch, Thomas, ed. *Peter Zumthor: Buildings and Projects*. Vols. 1–5. Zurich, Switzerland: Verlag Scheidegger & Spiess AG, 2014.

Hönig, Roderick, ed. *Swiss Sound Box: A Handbook for the Pavilion of the Swiss Confederation at Expo 2000 in Hanover*. Boston: Birkhauser, 2000.

Zumthor, Peter. *Atmospheres*. Boston: Birkhauser, 2006.

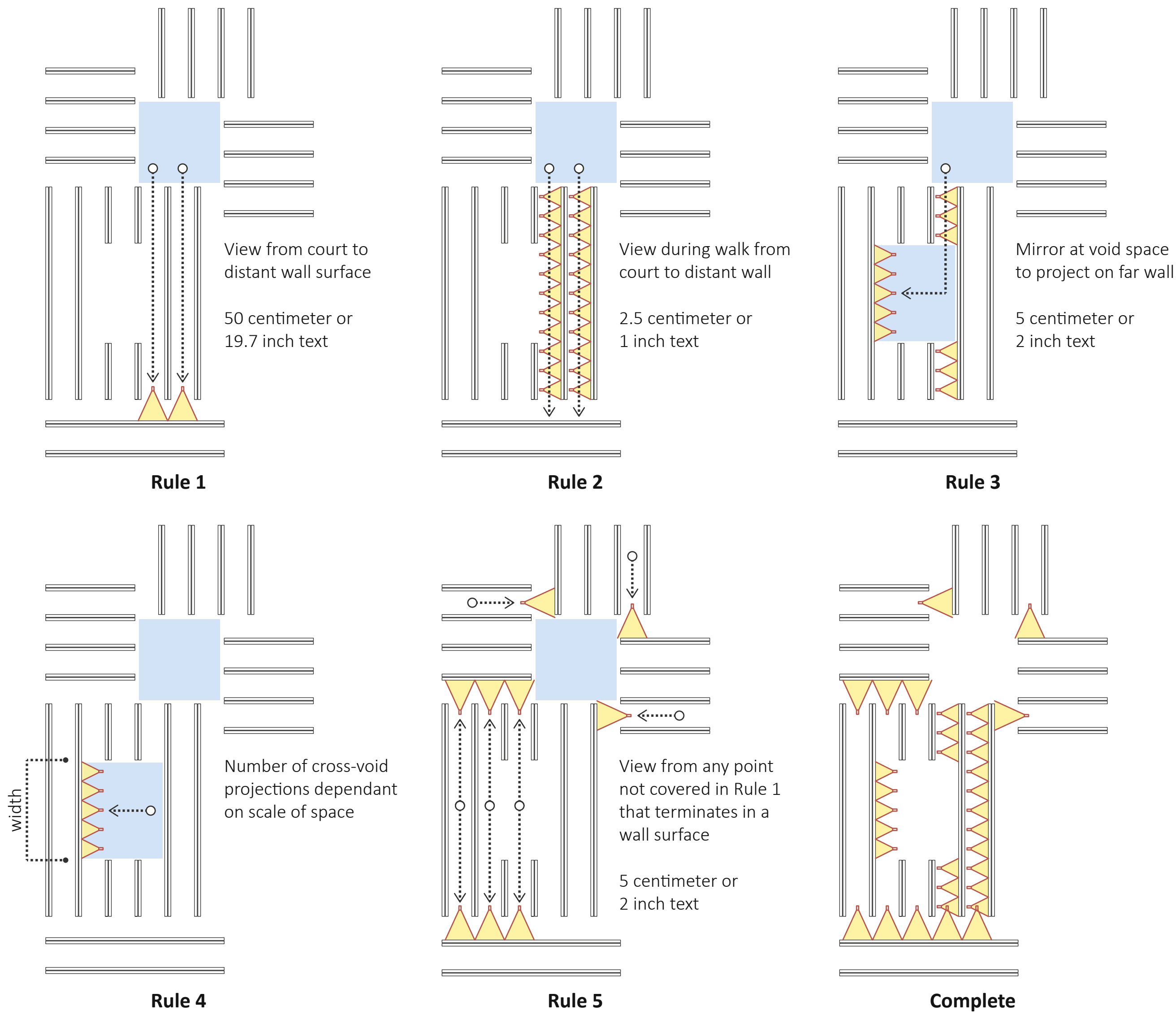
Zumthor, Peter. 2006. *Thinking Architecture*, 2nd ed. Boston: Birkhauser.

Notes

1 Peter Zumthor, *Thinking Architecture*, 2nd ed. (Boston: Birkhauser, 2006), 66.

2 "Peter Zumthor: The Swiss Pavilion," *A+U: Architecture and Urbanism* 9, no. 360 (2000), 30.

3 Roderick Hönig, ed. *Swiss Sound Box: A Handbook for the Pavilion of the Swiss Confederation at Expo 2000 in Hanover* (Boston: Birkhauser, 2000), 24. This publication was a guidebook available for visitors coming to the Swiss Sound Box during the Exposition. It presents as a glossary of terms and describes in detail every aspect of the Swiss contribution to the 2000 Expo.



02.14
Lightscript rules

4 Hönig's *Swiss Sound Box* was used as a reference for this section of the chapter.

5 Peter Davey, "Moral Maze: Swiss Pavilion Expo 2000," *Architectural Review* 208, no. 1243 (2000), 52.

6 Hönig, *Swiss Sound Box*, 178.

7 The idea of the lumberyard is discussed both in Hönig's guidebook and in Peter Zumthor and Helene Binet, *Peter Zumthor Works: Buildings and Projects 1979–1997* (Basel: Birkhauser, 1999).

8 Thomas Durisch, ed. *Peter Zumthor 1985–2013: Buildings and Projects. Vol. 2: 1990–1997* (Zurich: Verlag Scheidegger & Spiess AG, 2014), 110.

9 Davey, "Moral Maze," 50.

10 Hönig, *Swiss Sound Box*, 5.

11 Ibid., 182. The following rules are also taken from this source.

02.15
Projected Lightscript text on the stacked timber

03
Thorncrown Chapel
E. Fay Jones

Architect Brief

E. Fay Jones' childhood dreams of building and making led him to the School of Architecture at the University of Arkansas where he was a part of the school's first graduating class in 1950. Later in his career, he returned to teach at the school and eventually took over the role of Dean. Along with his mentors in Arkansas, Jones cited two individuals critical to his architectural development. The first was Bruce Goff who chaired the School of Architecture at the University of Oklahoma while Jones taught there from 1951 to 1953. The second was Frank Lloyd Wright who, after several encounters, extended an invitation to Jones in 1953 to study with him at Taliesin.

The ideals of **organic architecture** and **total design**, which permeate the work of both Goff and Wright, influenced Jones' architecture significantly. In addition, Jones is noted for his

organic architecture = an architectural philosophy that promotes harmony between the man-made and natural worlds

total design = the act of designing not only the building, but the entire living environment around a central philosophy

eureka springs, arkansas, united states
gps | 36°25'2"N, 93°46'18"W
program | chapel
completed | 1980
area | 134 m2 [1,440 ft2]

03.1
Vicinity map

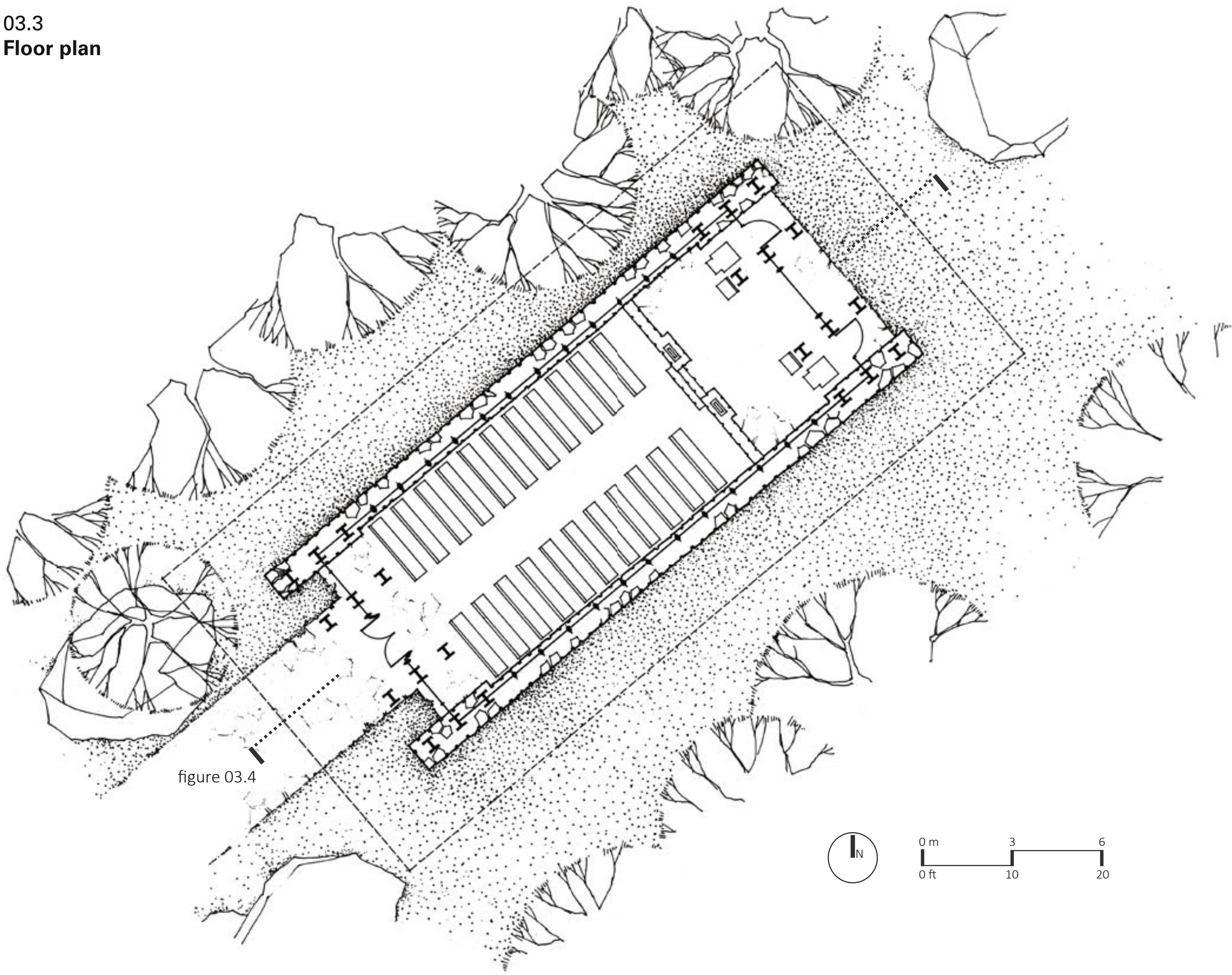
thoughtful consideration of place, his attentiveness to materials and their intrinsic properties, and his mastery of the medium of wood.[1]

Project Brief

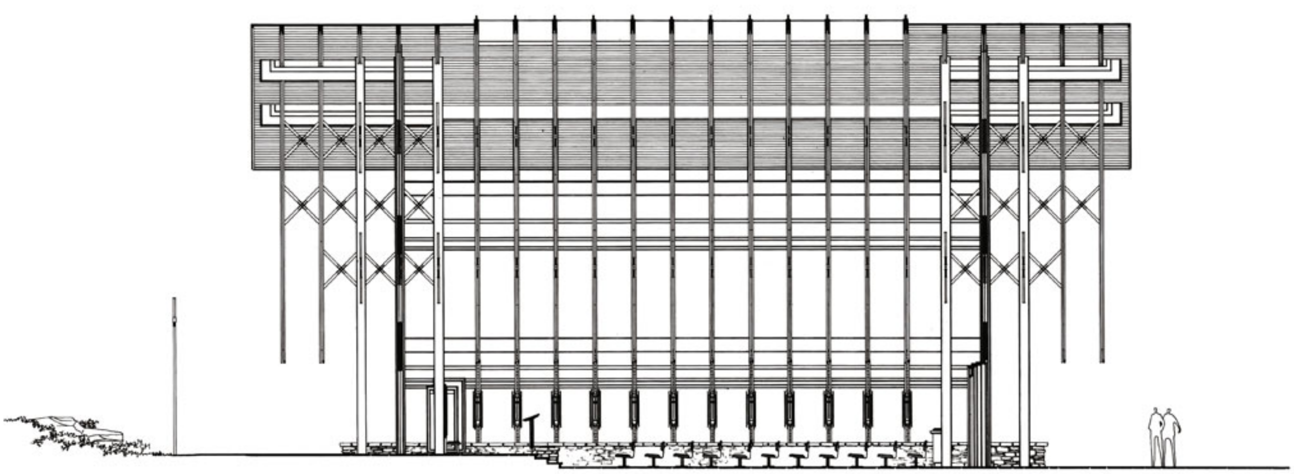
Nestled amongst the trees, Thorncrown Chapel sits on a sloped site in the Ozark Mountains of Arkansas. Its 3.2-hectare [8-acre] site of pristine woodland is just a few minutes drive from nearby Eureka Springs (Figure 03.2). Founder Jim Reed cherished this land and wanted to extend its accessibility for visitors. As such, Thorncrown was conceived as a place for pilgrimage, a meditative space in the landscape. Reed had a limited budget, however, and required an architect who could work within the constraints of the project. Fay Jones embraced the restrictions and created an American masterpiece – its strength derived "through the discipline of wood construction."[2]

Thorncrown Chapel is a deceptively simple building. Despite its complex assembly, the chapel is a single room: 7.3 meters [24 feet] wide by 18.3 meters [60 feet] long (Figure 03.3). The chapel is tall for its size, rising 14.6 meters [48 feet] above the forest floor, matching the verticality of the surrounding trees (Figure 03.4). Jones limited the building's material palate to the essentials: stone, wood, and clear glass with accents of blue cloth and metal. Opposite the entry door, a dais serves as the platform for officiating services and events, and while Thorncrown does not contain a traditional altar, the glazed end wall frames a cross in the foreground and the forest in the background (Figure 03.5).

03.2
Thorncrown Chapel from the main entry path

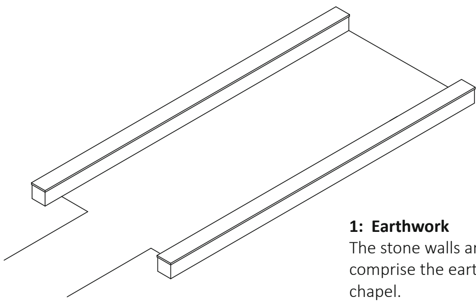


03.3
Floor plan

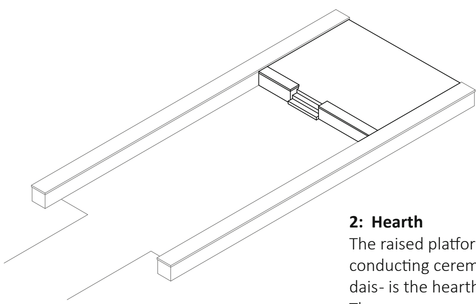


03.4
Building section

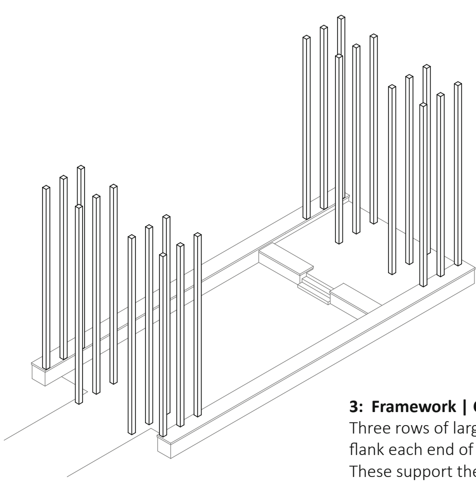
03.5
Interior from the main entry



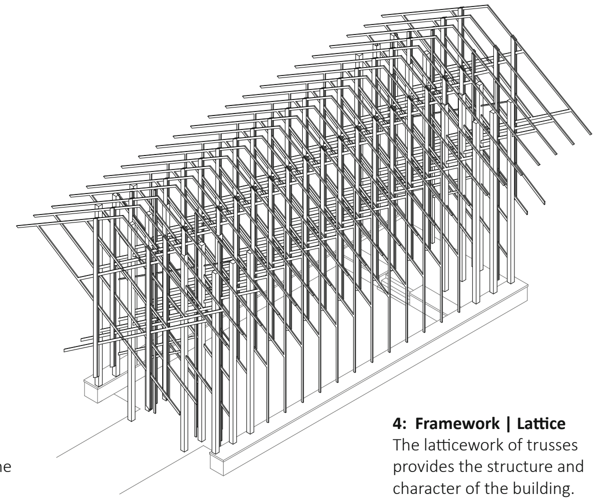
1: Earthwork
The stone walls and floor comprise the earthwork of the chapel.



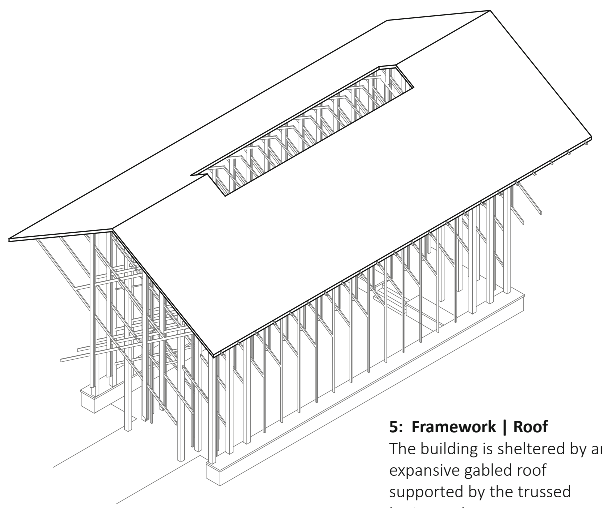
2: Hearth
The raised platform used for conducting ceremonies- the dais- is the hearth of Thorncrown.



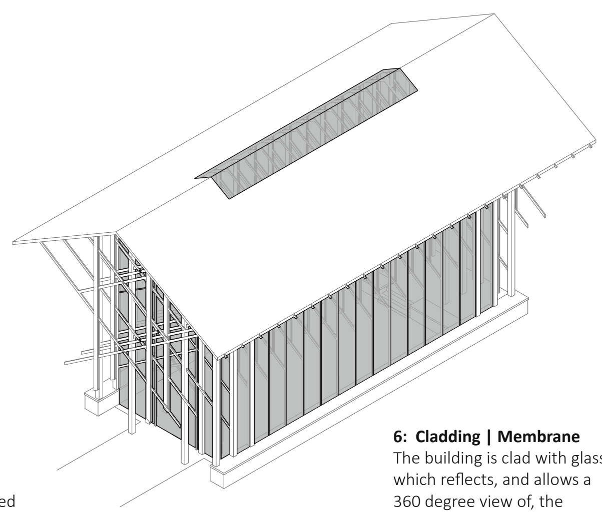
3: Framework | Columns
Three rows of large columns flank each end of the chapel. These support the cantilevered ends of the roof.



4: Framework | Lattice
The latticework of trusses provides the structure and character of the building.



5: Framework | Roof
The building is sheltered by an expansive gabled roof supported by the trussed latticework.



6: Cladding | Membrane
The building is clad with glass which reflects, and allows a 360 degree view of, the surrounding forest.

03.6
Anatomy

American Arts and Crafts movement = period of art and architecture between the 1860s and the early 1900s characterized by a rejection of familiar historical styles and a push for handcraftsmanship over machine work

Thorncrown's design draws inspiration from Frank Lloyd Wright, the **American Arts and Crafts movement**, and Japanese traditions. Jones devised every detail in the chapel, from the structure to the furniture to the door hardware. The resultant design ignited Jones' firm, inspiring a series of commissions for projects that integrated similar themes, construction styles, tectonic makeup, and experiential atmospheres.

Tectonic Principles

Anatomy

Two low stone walls mark the forest floor at the base of Thorncrown Chapel (Figure 03.6). This manipulation of the site claims a space for the chapel on the Ozark hillside. Within that earthwork sits the dais – the hearth of Thorncrown. Despite the absence of an altar, it is the spiritual center of the building during ceremonies. However, based on the ideas of Semper and Frampton, the chapel itself could also be seen as a hearth – a spiritual and social center of the forest.

The primary expression of Thorncrown is its framework. The repetitve wooden frames provide structure for the building, rhythm and order for the space, and the formal expression of the architecture. The framework mimics the canopy of the surrounding forest, sheltering the space with a latticework of small members and an expansive roof. The chapel's primary cladding is the glass enclosure. The nearly invisible envelope allows the character of the space to be defined by the forest, which is visible through and reflected in this exterior surface of the building.

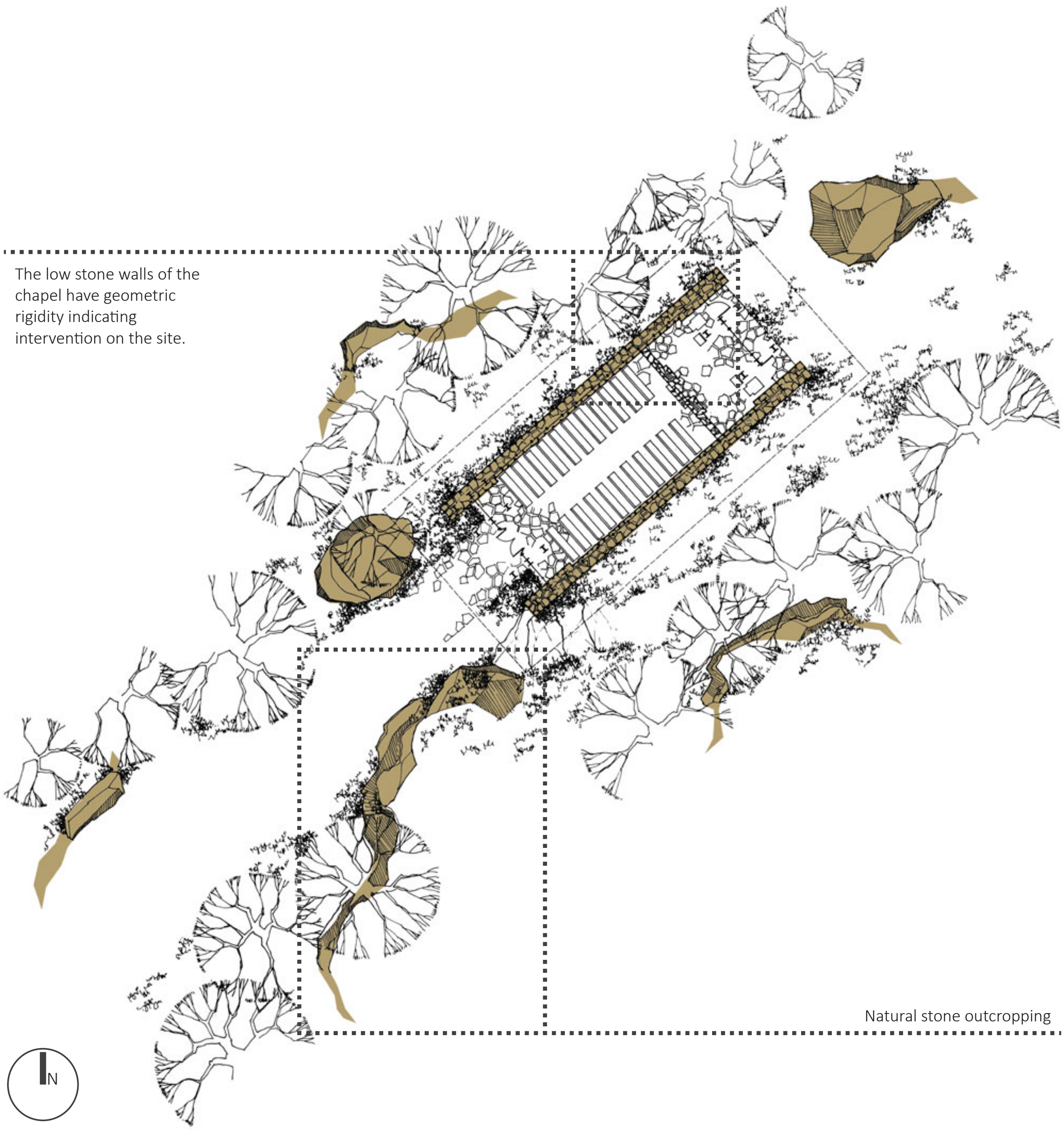
Stereotomic

Rocky outcroppings lace Thorncrown's site, following the contours of the hillside. On approach, the chapel's stereotomic base reads as an extension of these elements (Figure 03.7). The parallel stone walls of the chapel rise from the earth and define the chapel's interior space. They loosely align with their natural counterparts but provide a geometric rigidity indicating intervention by man. Reminiscent of unearthed foundations of a relic structure, they are metaphorically reclaimed from the forest and used to support the new enclosure above. In contrast to the tectonic structure, the stone walls provide a defined separation between the sanctuary and the forest. These walls, built of local stone, root the building to the earth (Figure 03.8).

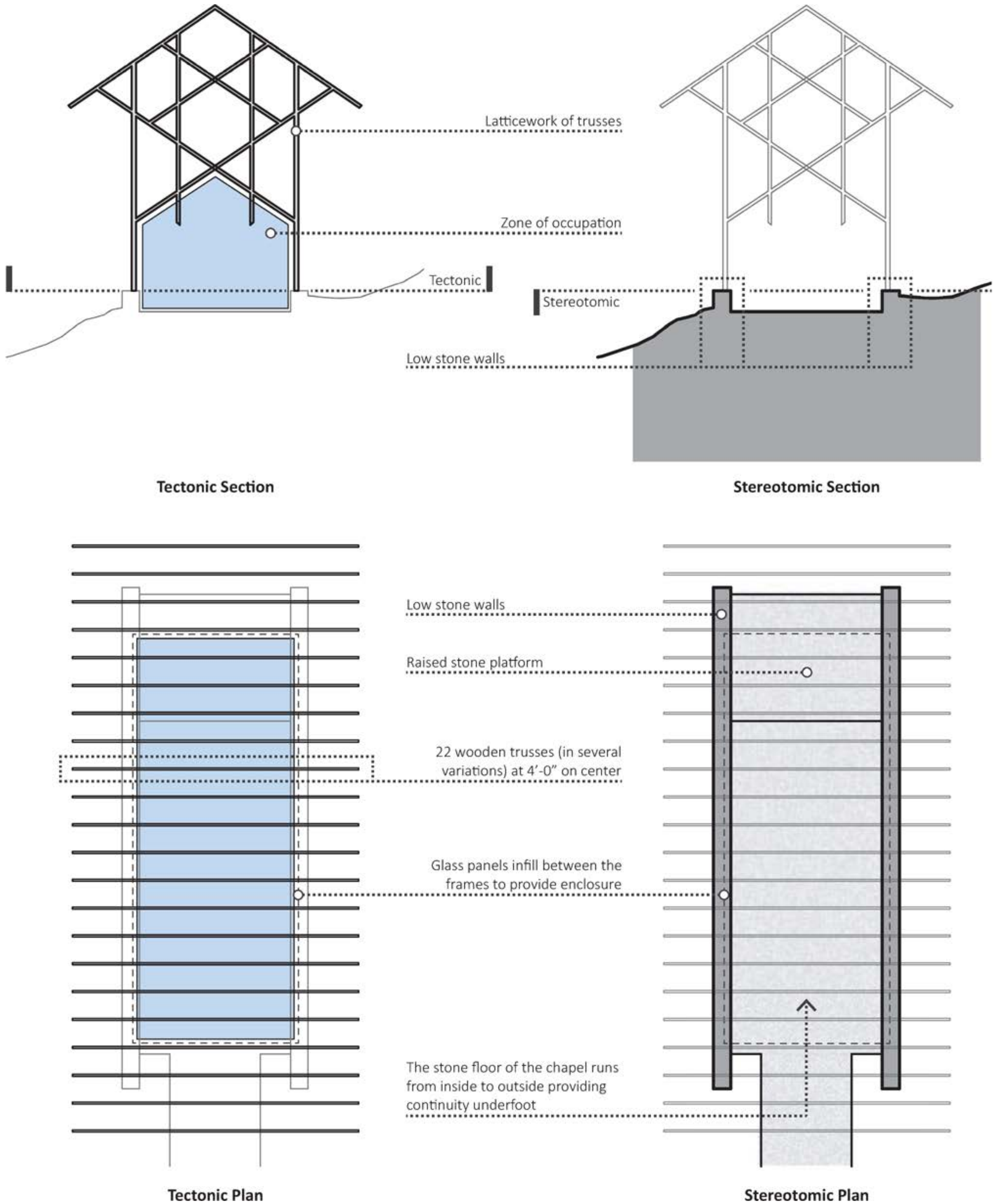
Local stone also composes Thorncrown's floor. The flagstone moves unimpeded from the front walk, under the glass entry wall, and through the building. Variation comes only from the polished finish found inside the chapel. Opposite the entry, the stone runs up onto the dais – marking the sacred space on the earth – before returning out to the forest. The resulting effect of the stereotomic base of Thorncrown Chapel is the forest floor; the building simply shelters a small piece of it.

***Tectonic*[3]**

Thorncrown Chapel is a predominantly tectonic construction, built using typical stock lumber, but assembled in nontraditional ways. A regiment of trusses forms the sanctuary – supported by slender columns – and establishes the gabled profile. The use of wood



03.7
Site stereotomics



03.8
Tectonic | Stereotomic

signifies a departure from most historic religious construction: "The chapel rephrases the aisled, masonry, compression structure of a medieval church as a light wooden structure built of two-by-fours layered over one another in some places and jointed end to end with metal fittings in others, resulting in a frame that works in tension."[4] The assembly of wood forms a latticework that shapes your experience while visiting Thorncrown.

In addition to wood, glass dominates the tectonic expression of the chapel. Panes of glass infill between the framing components and a skylight slices along the ridge of the roof. Both glazing conditions provide transparency and dematerialize the building; they permit you to view from the forest, through the building, and back out to the forest (or up to the sky). The glazing also blurs the boundary between the inside and the outside of Thorncrown Chapel. In short, the tectonic construction allows the building to develop a relationship with its environment while instilling a "unified simplicity" through an array of "interlocked, individual pieces."[5]

Detail | Atectonic[6]

At Thorncrown Chapel, Jones establishes two significant generative themes. These ideas manifest throughout the chapel, from the structure to the furnishings. The first theme is that of the cross.

> [A] cross motif appears in the metal bar stock supporting the pews, in lanterns lining the walls, in a metal column supporting the moveable lectern, and in the chapel's cross – a slender metal stake positioned outside the transparent altar wall, symbolically connecting man to the universe.[7]

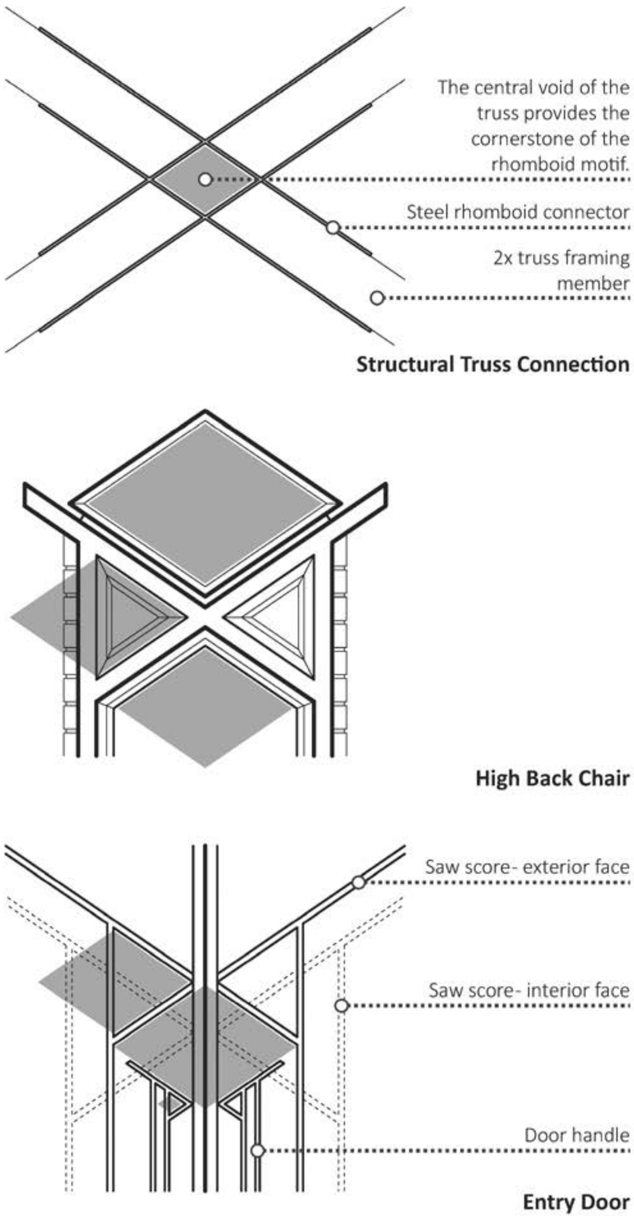
The second generative theme – the rhomboid – is more essential to the space (Figure 03.9). In *The Architectural Detail*, Edward Ford states:

> The pattern of flat rhomboids of the door handle of the Thorncrown replicates almost exactly the design of the interior wood truss, and the rhomboid occurs in both the window mullions and in the high-backed chairs behind the altar. More critically it is the primary joint of the building, as a steel rhomboid connector [is] used at the intersection of the truss chords.[8]

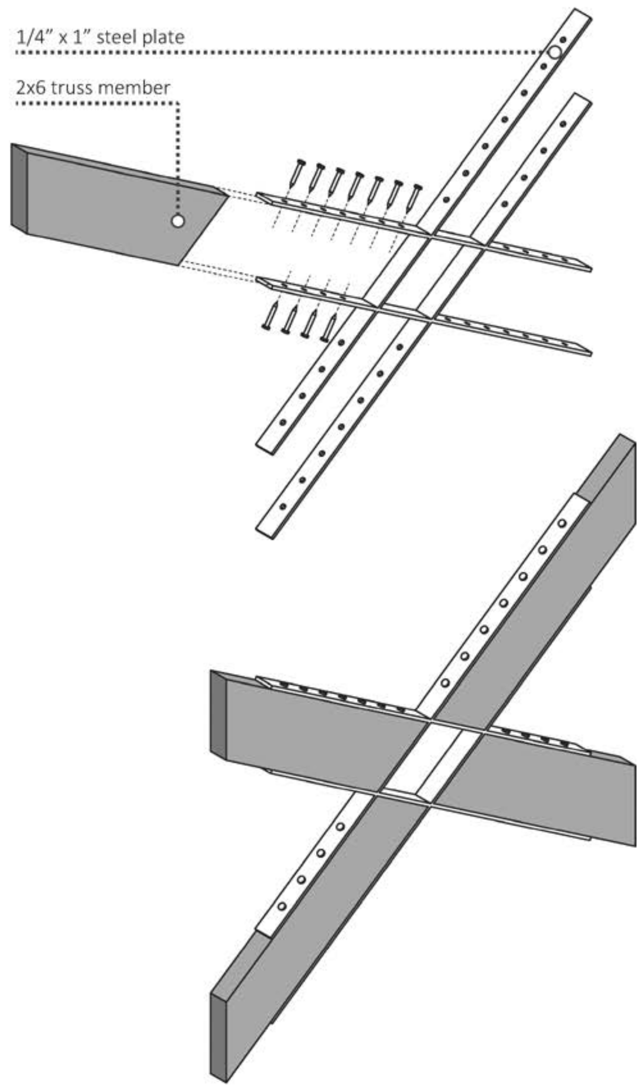
Thorncrown Chapel is, quite literally, constructed from this motif. Thorncrown's defining detail is the steel rhomboid truss connector. The joint allows for a hollow at the intersection of the truss chords – a principle point of load transfer in the structure – and distorts the perception of the stability of the structure while assisting in the perception of the floating of the building's roof (Figure 03.10). The rhomboid expresses the core characteristic of the architecture; it permeates the chapel and binds its discrete elements.

Representation | Ornamentation

At Thorncrown Chapel, the cladding, which in tectonic theory typically conceals the ontological structure beneath, is transparent. The transparency allows the surrounding forest

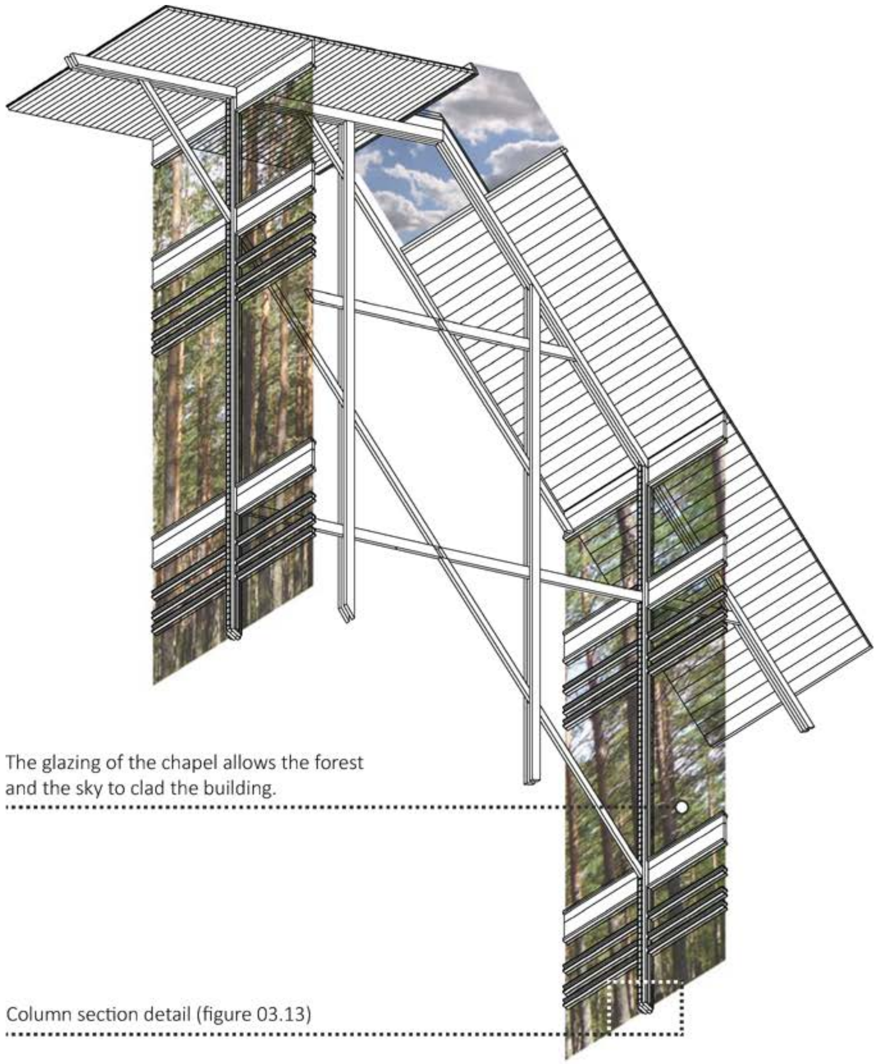


03.9
Rhomboid comparison



03.10
Truss connection detail

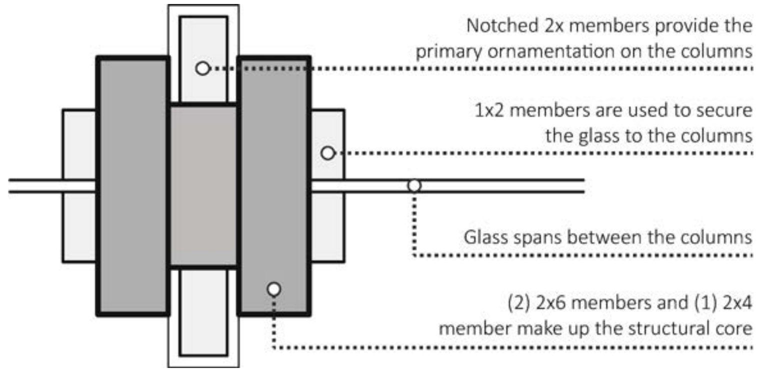
to be superimposed on the chapel, cladding the building with the natural environment (Figure 03.11). The structure is a representation of the forest and the reflected "cladding" of trees illustrates the latticed construction within the building. Here, the representation is not just derived from nature; it is a literal reflection of nature in the cladding of the building. The glass veils the chapel in the forest itself, camoflaging it into the surroundings (Figure 03.12).



03.11
Building cladding[9]

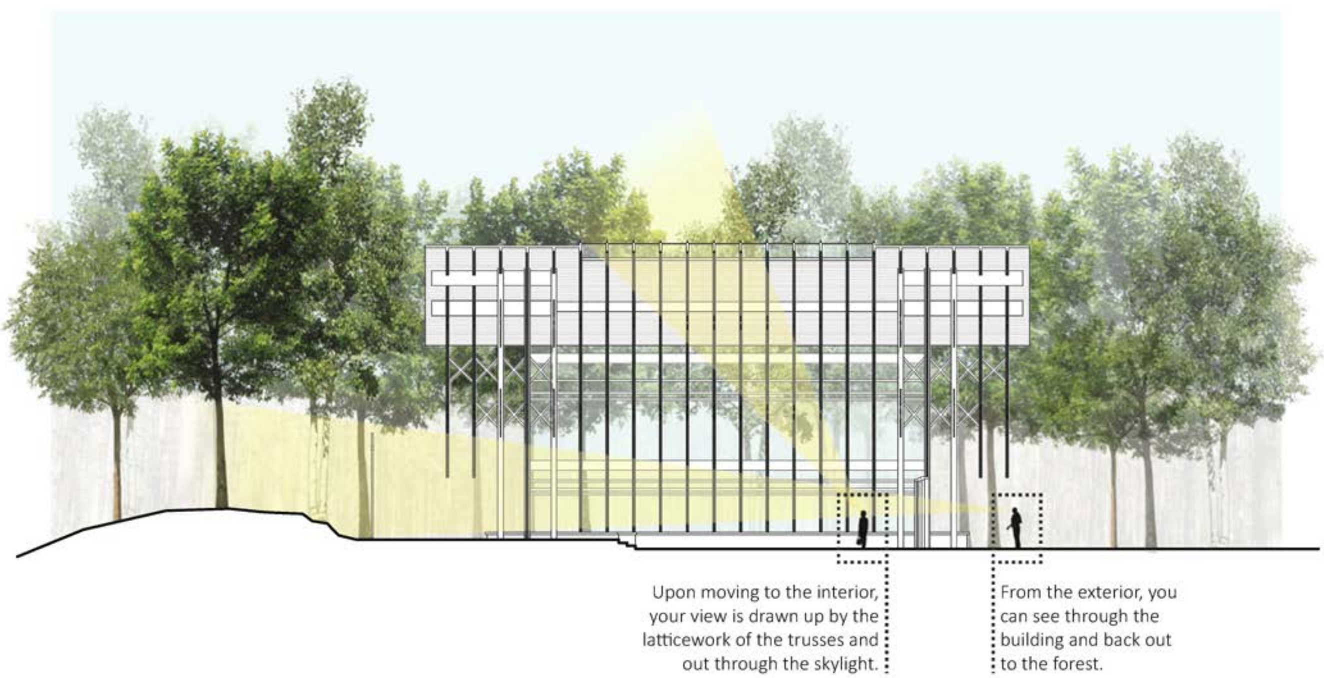
03.12
Reflections in the chapel's glazing

03.13
Column section



Contrary to Botticher's philosophy, Thorncrown Chapel visibly expresses its *Kernform*. All of the members of the wooden trusswork, however, are not necessary for the transferring of loads. Jones has integrated both structural and ornamental elements in these components (Figure 03.13). The ornamentation, such as the notches ascending the interior of the building's columns, is simple but effective in enhancing the verticality of the space and motifically tying the structure to the other components of the building.

03.14
Primary views



Space

The transparency of Thorncrown Chapel draws your eyes first through the building and then out to the forest. But upon entering the structure, your gaze turns upwards towards the sky and the heavens, caught by the latticework of wood (Figure 03.14). Professor Richard Kieckhefer stated:

> the repetitive complexity of the beams replicates the complexity of a vaulted Gothic church. The emphasis on the roof calls attention not only to the upper portions of the structure but to the interaction between this patterned structure and the sky that serves as its background. And the complexity of the framework combined with the expanse of window space makes for a constantly shifting play of light and shadows that makes emphatically clear the relationship between interior and exterior sacred space.[10]

Or as Daniel Willis has claimed, "Not since the roof vaults of the Gothic cathedrals had an interior architecture so willfully drawn our imaginations skyward."[11] As a nondenominational way station in the forest, the construction of Thorncrown allows you to find your own spiritual connection within this meditative natural environment. The spiritual qualities embedded in the space and the empathy it evokes in the viewer are rooted in the construction of the building, a tectonic manipulation of the environment.

Place

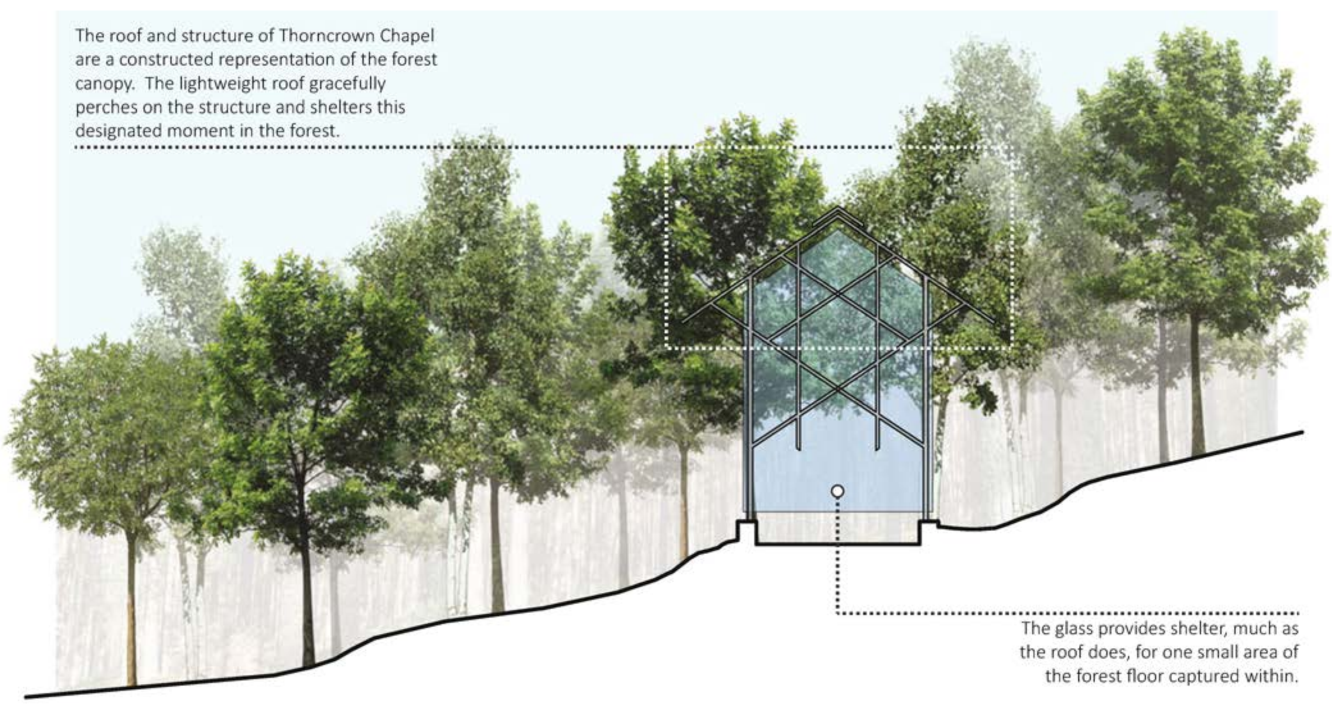
The preservation of the existing environmental state of the site drove the design of Thorncrown Chapel (Figure 03.15). To minimize damage to the forest, Jones devised a construction strategy that limited access to vehicles. The materials needed to construct the building were carried to the site by hand. The construction was conceived as portable, with all components sized to not overburden a two-man crew. Most critically, Jones envisioned the larger structural components as jointed assemblies comprised of numerous members. These tectonic constructions – built out of 2×4s, 2×6s, and 2×12s – were assembled on site and raised into place. The preservation of the forest not only provided a self-imposed limitation but also contributed to the architectural language of the building.

In addition to assembly processes, the forest provided the inspiration for the conceptual design of Thorncrown. The building places its occupants at "an undecidable boundary between shelter and exposure, artifice and nature."[12] The chapel is aligned with the place; it captures a small piece of the forest and encases it in glass (Figure 03.16). Nestled under the tree canopy, the chapel disappears in the forest, camouflaged in the distance as you approach from the parking lot.

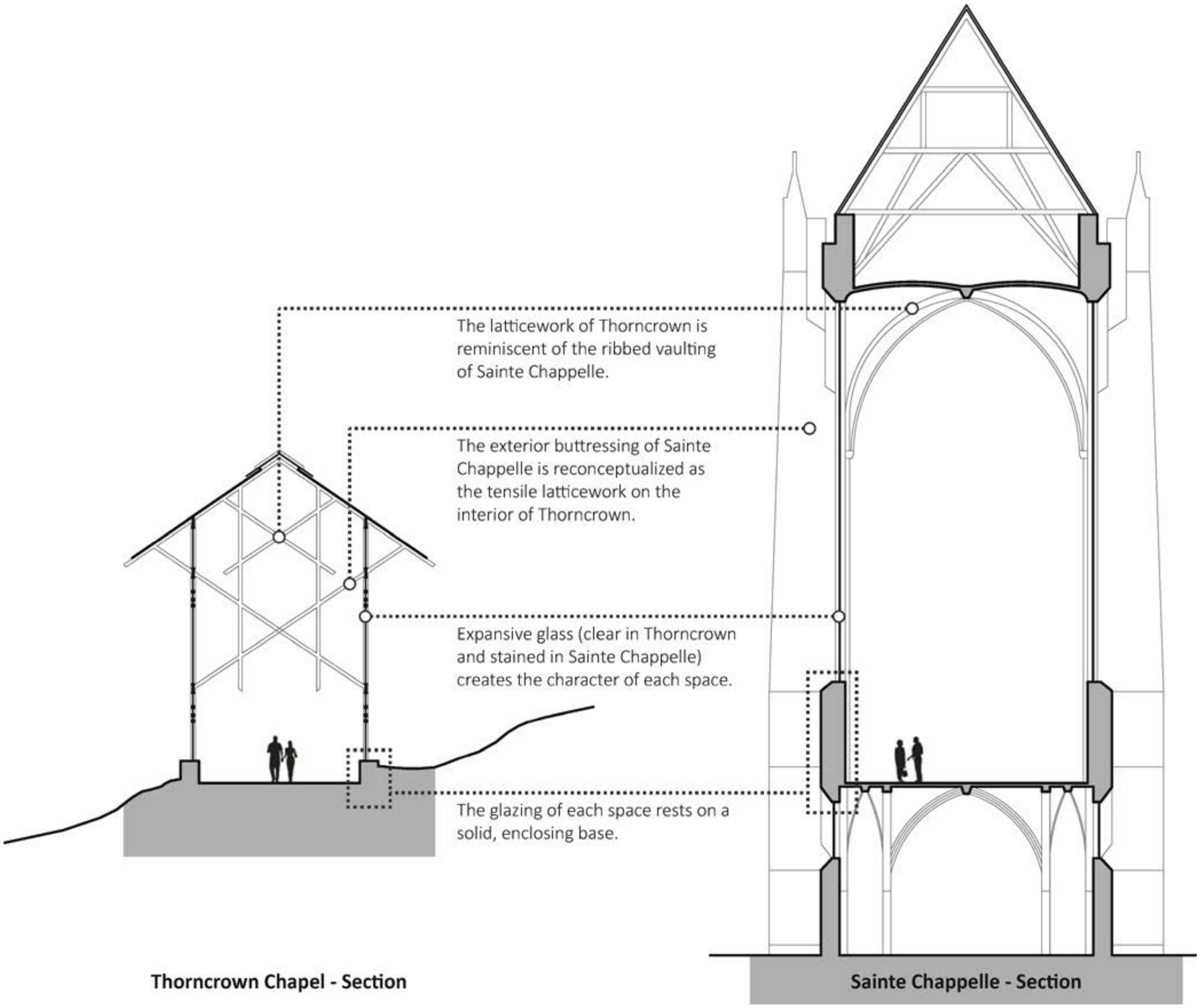
Precedent

Fay Jones has cited the Parisian Gothic sanctuary of Sainte Chappelle (48°51′19″N, 2°20′42″E) as inspiration for Thorncrown Chapel (Figure 00.21, p. lxi). Sainte Chappelle was built as a reliquary to house the Crown of Thorns. In its honor, this small chapel was named Thorncrown. The proportion of the two chapels is similar – Thorncrown is 7.3 × 18.3 meters [24 × 60 feet], and Sainte Chappelle is 9.8 × 30.2 meters [32 × 99 feet] – and both are single rooms (Figure 03.17).

03.15
Thorncrown from the forest



03.16
The capture of the forest



03.17
Comparison of Sainte Chappelle and Thorncrown Chapel

The buttressed structure of Sainte Chappelle is typical of most Gothic structures. In the translation to Thorncrown, Jones institutes what he refers to as the "operative opposite."[13] Instead of buttressing the exterior of the chapel to allow for a clear interior, Jones integrates a tensioned array of wood trusses into its sanctuary. These trusses are reflective of the ribbed vaulting of the ceiling of Sainte Chappelle.

The other critical contribution of Sainte Chappelle to the design of Thorncrown is its awe-inspiring character. This character is derived from the ornate stained glass that decorates the chapel. To accommodate the preeminent display of glass, the stonework of Sainte Chappelle is reduced to a delicate framework, leaving the majority of the surface for the glazing. The stained glass of Sainte Chappelle is translated in Thorncrown as clear glass; the forest, the earth, and the sky provide the expression, the character, and the artwork.

Additional Resources

Projects

Reed Residence, Hogeye, Arkansas, United States, 1980

Davenport Residence, Evergreen, Colorado, United States, 1986

Mildred B. Cooper Memorial Chapel, Bella Vista, Arkansas, United States, 1987 (36°28′40″N, 94°14′44″W)

Pinecote Pavilion, Picayune, Mississippi, United States, 1988 (30°30′6″N, 89°40′0″W)

Thorncrown Worship Center, Eureka Springs, Arkansas, United States, 1989 (36°24′59″N, 93°46′23″W)

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Ivy, Robert. "Special Feature: Fay Jones." *Architecture and Urbanism* 2, no. 245 (February 1991), 57–120.

Stegers, Rudolf. *Sacred Buildings: A Design Manual*. Basel, Switzerland: Birkhauser, 2008.

University of Arkansas Libraries Special Collections: Fay Jones Collection [website] http://libinfo.uark.edu/specialcollections/manuscripts/fayjones/default.asp

Notes

1 The Architect and Project Briefs both draw from: Robert Ivy, *The Architecture of Fay Jones* (New York: The American Institute of Architects Press, 1992). Please consult this for a thorough investigation into the life and work of E. Fay Jones.

2 Ibid., 32.

3 The two paragraphs in this section were originally published in Chad Schwartz, "Investigating the Tectonic: Grounding Theory in the Study of Precedents," *The International Journal of Architectonic, Spatial, and Environmental Design* 10, no.1 (2015), 1–15.

4 Dell Upton, *Architecture of the United States* (New York: Oxford University Press, 1998), 127.

5 Ivy, *The Architecture of Fay Jones*, 35.

6 The two pargraphs in this section were originally published in Schwartz, "Investigating the Tectonic."

7 Ivy, *The Architecture of Fay Jones*, 35.

8 Edward Ford, *The Architectural Detail* (New York: Princeton Architectural Press, 2011), 112.

9 Drawing inspired by Figure 25 on page 111 of Ford's *The Architectural Detail*.

10 Richard Kieckhefer, *Theology in Stone: Church Architecture from Byzantium to Berkeley* (New York: Oxford University Press, 2004), 132.

11 Daniel Willis, *The Emerald City and Other Essays on the Architectural Imagination* (New York: Princeton Architectural Press, 1999), 211.

12 Ibid., 210.

13 Kieckhefer, *Theology in Stone*, 133.

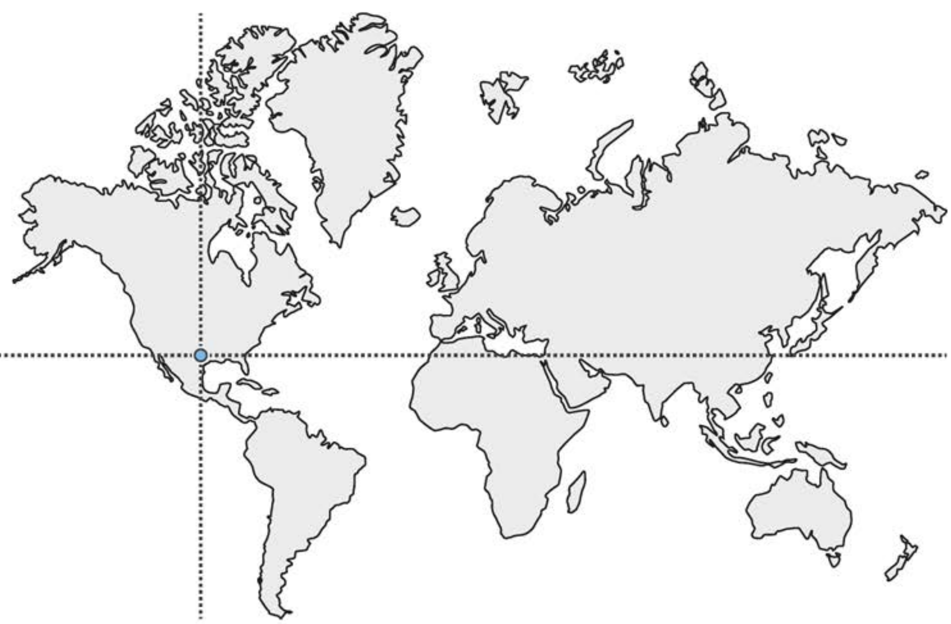
04
Government Canyon Visitor Center
Lake|Flato

Chapter co-written with Suzanne Abell

Firm Brief[1]

Established in 1984, Lake|Flato has gained a national reputation for designing architecture that is rooted to its place, responds to the natural environment, and merges with the landscape. A passionate advocate for environmental stewardship through their focus in sustainable design, the firm seeks to create architecture that is tactile, modern, and well crafted.

The firm began over 30 years ago when founding partners Ted Flato and David Lake met under the tutelage of their mentor O'Neill Ford at the firm of Ford Powell Carson in San Antonio, Texas. Lake and Flato were inspired by Ford's ability to blend Texas regionalism with modernism to create a unique southwestern style of his own. These architectural philosophies are present in Lake|Flato's work, which shows appreciation for the pragmatic solutions of vernacular architecture, the honesty of modernism, and the context of a rich and varied landscape.



san antonio, texas, united states
gps | 29°32'57"N, 98°45'54"W
program | educational visitor center
completed | 2005
area | 394 m2 [4,224 ft2]

04.1
Vicinity map

Utilizing contextually authentic sustainable strategies in a wide variety of project types and scales, Lake|Flato produces architecture that conserves energy and natural resources while also fostering healthy environments that enrich communities. The firm has been honored with over 200 design awards, including the American Institute of Architects' Firm of the Year Award in 2004. For their efforts in progressing sustainable design, Lake|Flato has also won ten Committee on the Environment Top Ten Green Project Awards and received the Global Award for Sustainable Architecture in 2013.

Project Brief

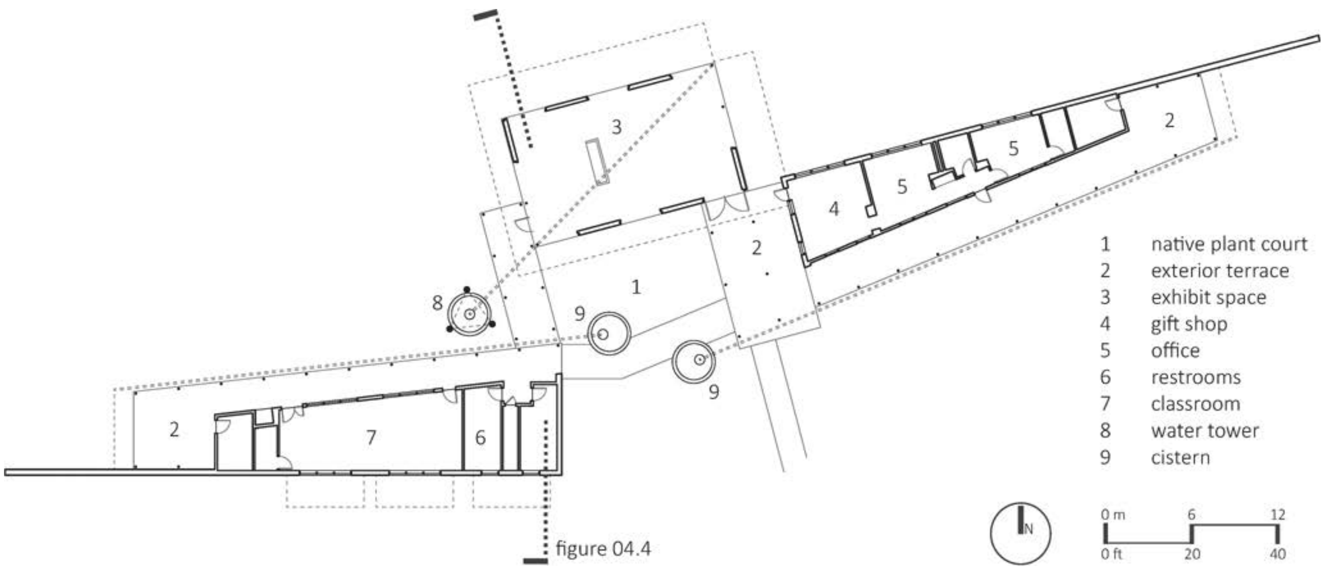
> The design for the Government Canyon Visitor Center strives to foster a harmonious relationship between people and the natural environment. The design considers the ecosystem, landform, and climate to create a place that unites humans with the landscape in simple and elegant ways. Creating these experiences that heal and restore the ecosystem while fostering environmental stewardship – this is the basis of the design thinking.[2]
>
> Bob Harris, FAIA

The Visitor Center serves as a gateway to the Government Canyon State Natural Area about 40 kilometers [25 miles] northwest of downtown San Antonio, Texas (Figure 04.2). It is perched at the mouth of a canyon on the Balcones Escarpment, a geological fault zone consisting of many deep canyons. This escarpment defines the eastern boundary of the Edwards Plateau, which makes up a large portion of western Texas. The Visitor Center provides a threshold between the suburban neighborhoods of San Antonio and the natural beauty of the Edwards Aquifer, located on the eastern edge of the Plateau. About 88 percent of the Natural Area overlaps with the aquifer's recharge zone. This aquifer is the only source of drinking water for the approximately two million inhabitants of south central Texas, playing a vital role in the health of the surrounding communities.

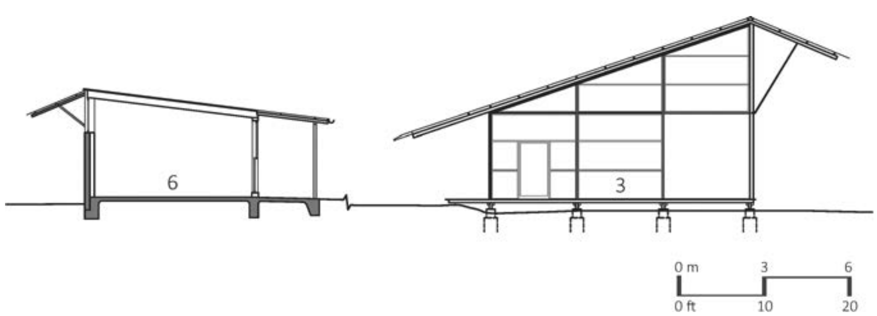
Guests approach the Visitor Center from a parking lot south of the facility. The complex consists of three primary buildings built for use by the Texas Parks and Wildlife Department. One functions as office space for park officials, another as classroom and meeting space for educating the community about water conservation. The third is an open-air exhibition space (Figures 04.3 and 04.4). The buildings are entered through a central garden on the south, while the aquifer lies to the north of the project.

Lake|Flato's design intent was to protect and restore the natural landscape of the site while simultaneously designing a low-maintenance, durable, sustainable, and functional public education center (Figure 04.5). To accomplish this goal, many sustainable strategies were employed; the Visitor Center was meaningfully situated within its landscape and only local materials were used in the construction. These traits exemplify Lake|Flato's work. The success of the Visitor Center led to a Top Ten Green Project Award by the American Institute of Architects' Committee on the Environment in 2007.

04.2
Government Canyon Visitor Center from the main entry path



04.3
Floor plan



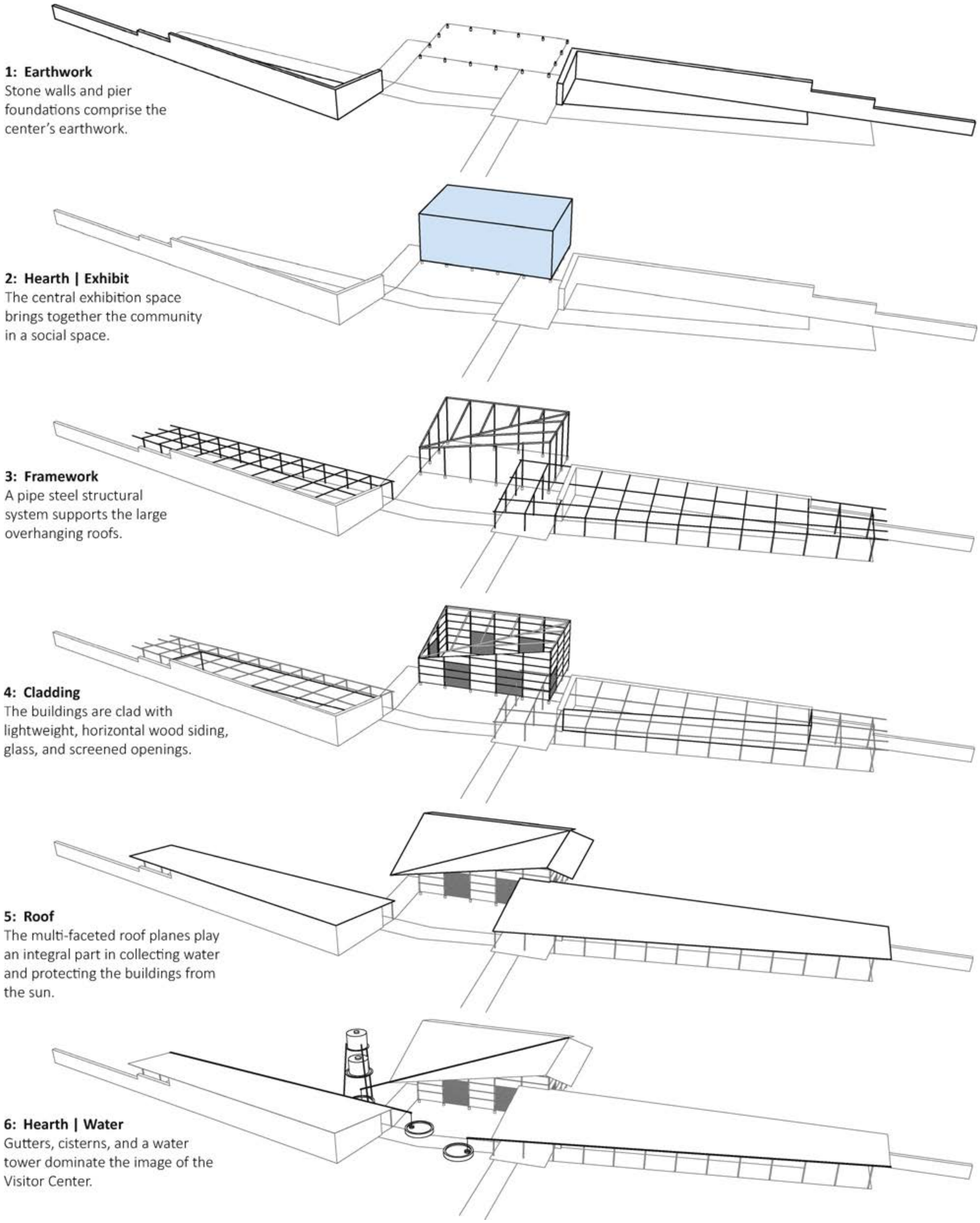
04.4
Building section

04.5
View out of the central pavilion

Tectonic Principles

Anatomy

The two wing buildings of the Government Canyon Visitor Center sit on concrete slabs raised about 30 centimeters [12 inches] off the natural grade on mounded earth (Figure 04.6). The surrounding terrain is configured to slope away from the structures to ensure positive drainage on the site. Long limestone walls reach out from the platforms and help define the edges of the buildings as well as the boundary of the Natural Area. They are man-made marks on the earth. Unlike the wing buildings, the central building is set up on pier foundations, creating a disconnect from the ground plane and allowing natural systems to run unimpeded below. A framework of steel pipe forms the primary structure of all three buildings, while horizontal wood slats and large screened windows comprise the cladding. Above, the deep overhangs of metal roofs shelter the spaces below. These elements, in true tectonic fashion, all serve to protect and serve the hearth.


1: Earthwork
Stone walls and pier foundations comprise the center's earthwork.
2: Hearth | Exhibit
The central exhibition space brings together the community in a social space.
3: Framework
A pipe steel structural system supports the large overhanging roofs.
4: Cladding
The buildings are clad with lightweight, horizontal wood siding, glass, and screened openings.
5: Roof
The multi-faceted roof planes play an integral part in collecting water and protecting the buildings from the sun.
6: Hearth | Water
Gutters, cisterns, and a water tower dominate the image of the Visitor Center.

04.6
Anatomy

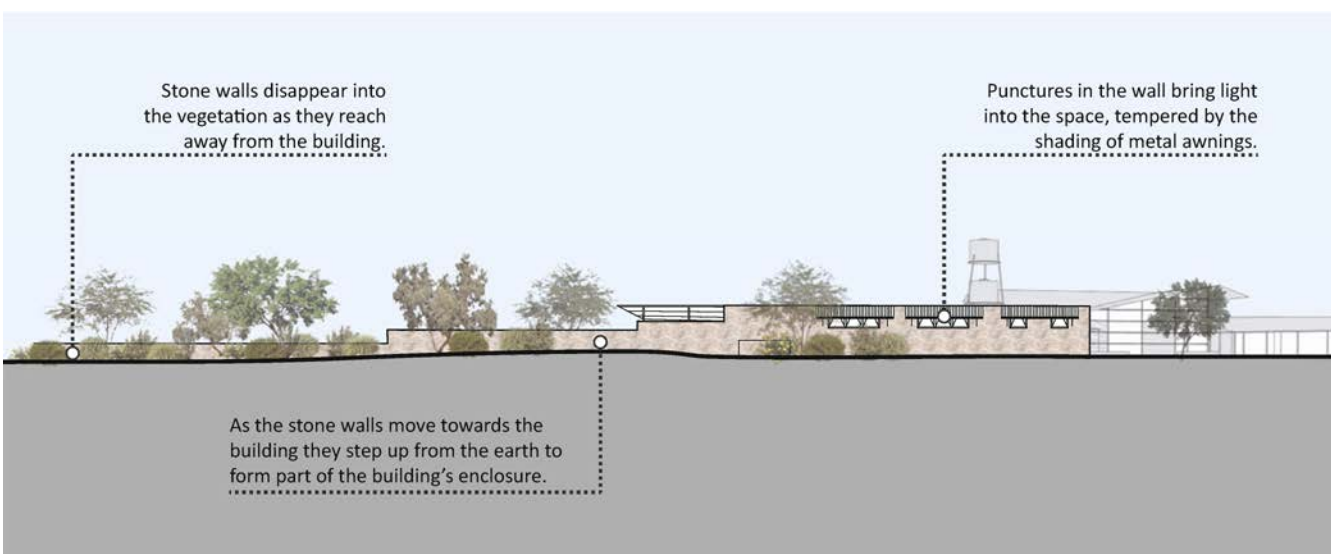
Semper believed "the hearth formed that sacred focus around which the whole took order and shape."[3] The Visitor Center has two primary focal points: water conservation and public education. The social center of the facility – the open-air pavilion – supports public education. This exhibit and gathering space embodies the design intent to foster community around the concept of water conservation; it links the community to the natural environment. The structure also connects the two wing buildings, providing a contemplative space between office and classroom from which to enjoy the beauty of the aquifer beyond. The other embodiment of the hearth is through the cisterns. Three underground units and a water tower hold the precious liquid around which the entire project is developed. These chalices are truly sacred to this place and reflect the protection of the environment that the facility pursues. Whereas Semper's conceptualization of the hearth began with the life-giving warmth of the fire, here that essential element is its elemental opposite – water.

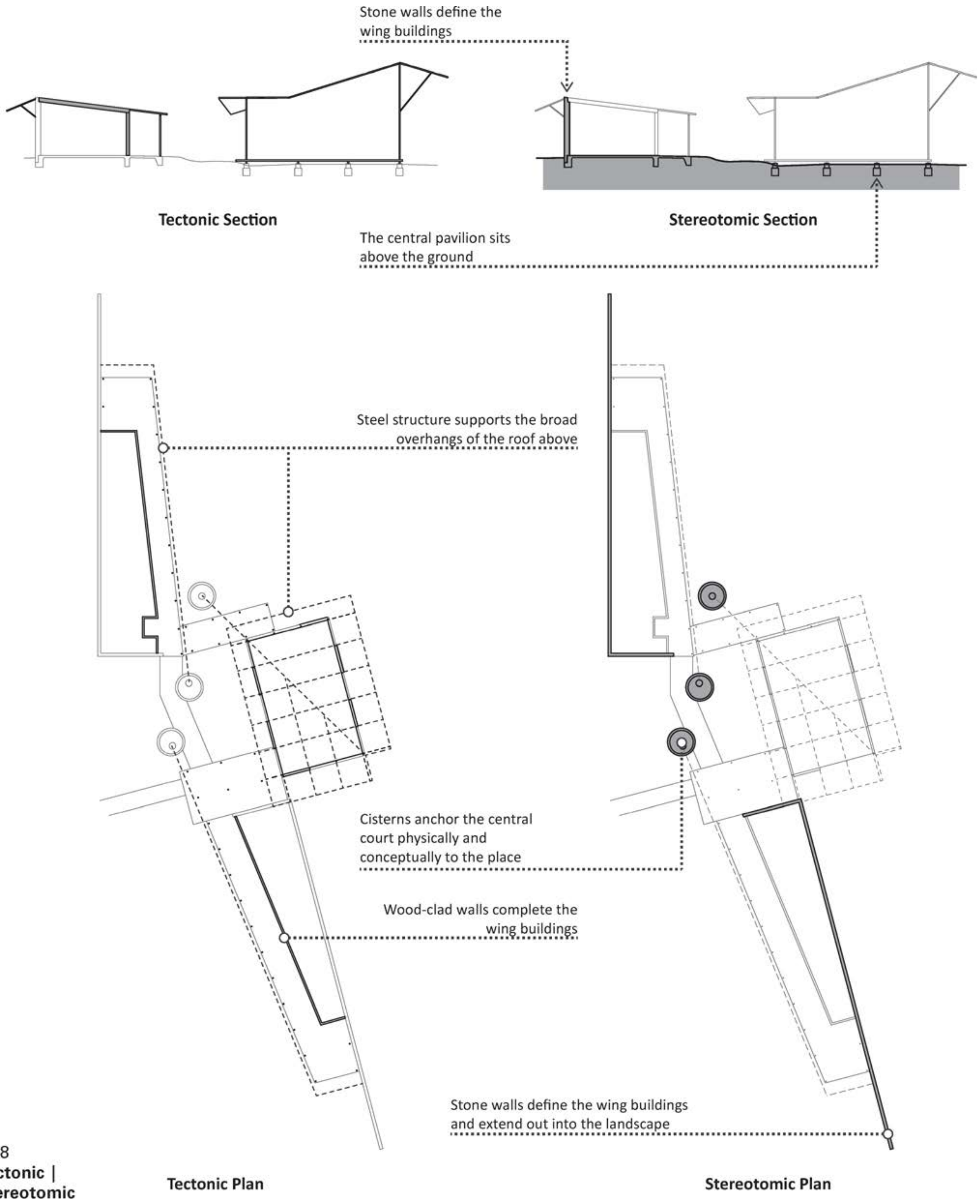
Stereotomic

Constructed of limestone quarried within 80.5 kilometers [50 miles] of the site, the long stone walls clearly define the edge of the recharge zone and anchor the project to the earth (Figure 04.7). Their composition is reminiscent of historic stone fences that can be found around the site.[4] As they stretch towards the buildings from either side, they extrude up from the earth, eventually forming full-height walls that partially enclose the Visitor Center's wing buildings (Figures 04.8 and 04.9). The outer ends of the walls disappear into the native vegetation, returning to the earth. A break between the walls provides a conceptual joint or threshold in the middle of the project site leading to the facility and through it to the aquifer.

The cisterns at Government Canyon hold a combined 67,380 liters [17,800 gallons] of water. Reflective of the natural retention of the aquifer, they serve as stereotomic anchors to the earth and its systems. As the project is shaped around water, these cisterns also tether the project to that primary goal. Two of the underground cisterns are found in the entry

04.7
Wall elevation analysis





04.8
Tectonic | Stereotomic

04.9
View along the stone wall towards the Visitor Center

04.10
Water tower and wing building

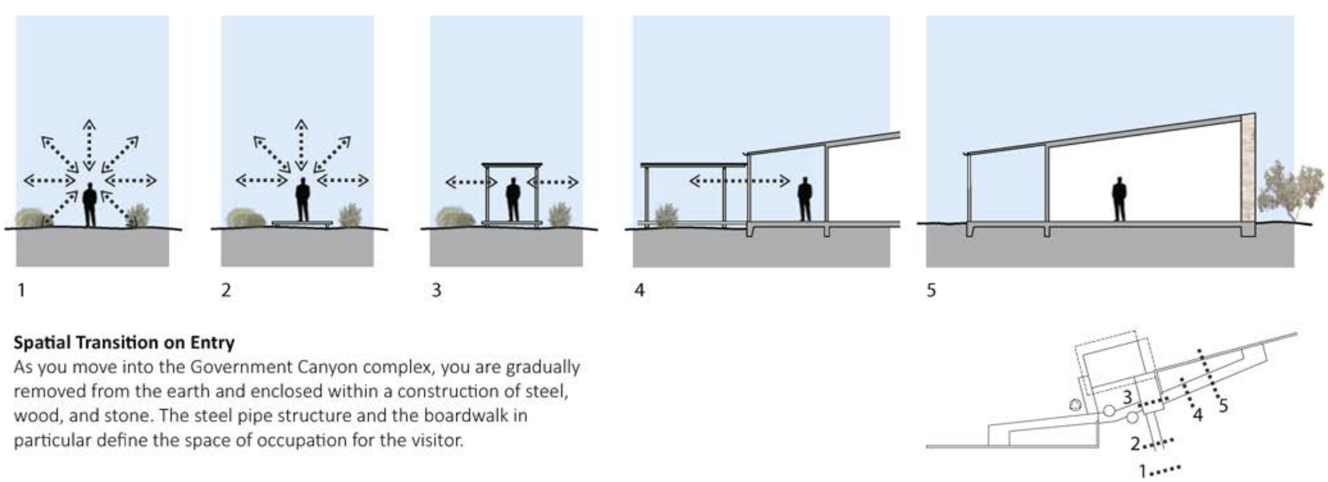
court, and these are topped with concrete planters that hold native vegetation. Conversely, the water tower dominates the site, looming over the project and serving as a beacon for its message (Figure 04.10).

Tectonic | Space

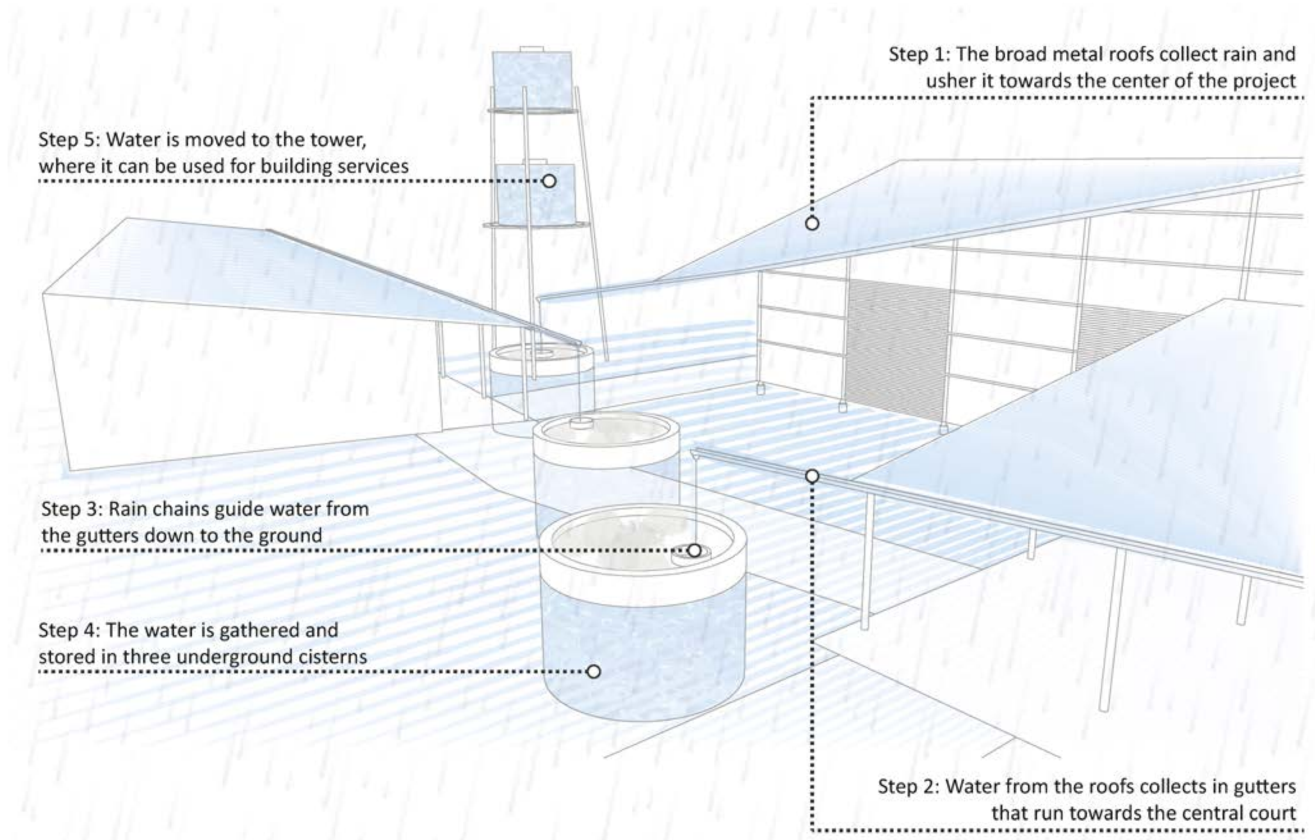
The primary tectonic components of Government Canyon Visitor Center are the lightweight steel structure, the sloped roofs, and the slatted wood walls. The steel frame originated from the region's oil pumping facilities and cattle ranch fence suppliers and was reworked with new purpose at Government Canyon. The lightweight walls are clad with eastern red cedar siding that is naturally resistant to decay and was left untreated to patina to a dull silver. The frame and wood-clad walls read as thin and delicate in contrast to the heavy stone walls. Whereas the stone elements anchor, the tectonic components enclose and define space. That definition is variable; the transition between indoor and outdoor is gradual due to the use of screens, large ceiling-to-floor double-hung windows, and deep porches (Figure 04.11). This gradual transition assists in the development of a relationship between natural and man-made space.

The roof planes are covered with corrugated, galvanized metal roofing, which provides a reflective surface to mitigate heat gain while reducing the need for roof decking and substructure. The long sloped roofs – in addition to sheltering the spaces from the elements – have a primary role in the collecting of rainwater. Each roof is asymmetric and guides rainwater to a system of gutters and rain chains that leads to the cisterns (Figure 04.12). Echoing Porphyrios' statement that "a tool as the product of craft fulfills its purpose only when used,"[5] this project was created as a utensil for collecting water and its goal is to comprehensively fulfill that purpose. Because of its prominence in the design, water can be considered to be primary to the Visitor Center's material palate. The path of water defines the shape of the buildings while its underlying meaning provides the reasoning for the development of the program. Although it is impossible for water to serve alone in this capacity, it helps define both space and expression for the project.

04.11
Spatial transition



Spatial Transition on Entry
As you move into the Government Canyon complex, you are gradually removed from the earth and enclosed within a construction of steel, wood, and stone. The steel pipe structure and the boardwalk in particular define the space of occupation for the visitor.



04.12
The path of water

Representation

Water can also be viewed as the ornamentation of the Government Canyon Visitor Center. Bötticher states:

> the principle of . . . tectonics is identical to the principle of nature as creator: that is, to express the *concept* of every entity in its *form*.
>
> [. . .]
>
> The *tectonic's* active hand forms each member as a part of a corporeal *schema*. Thus, while creating a spatial entity, the member accommodates not only its own function but also its static *interplay* with *all other members* most *completely*.[6]

At Government Canyon, the components of this assembled structure are interlinked as part of the master plan for ushering water. The central schema of the project unites its members in a tectonic assembly of parts.

Although perhaps not expressing a physical underlying structure, this schema visibly depicts the natural forces at work on the building and the underlying foundation of its conception. Every component of the structure – the roof, the gutters, the chains, the cisterns – expresses the concept of water conservation. The water becomes a "skin" that endows these elements with higher purpose. Here, ornamentation is tasked with conveying an understanding of the conservation of water and creating an abstract reflection of the natural processes at work below in the aquifer.

Semper states that

> [a]rchitecture, like its great teacher, nature, should choose and apply its material according to the laws conditioned by nature, yet should it not also make the form and character of its creations dependent on the ideas embodied in them, and not on the material?[7]

Similar to the ideas of Schelling, Semper believed that the principles of nature, rather than its form, should guide the creation of the built environment. The principles of ecology, environmental systemic relationships, and the laws of gravity create the blueprint for the development of the Visitor Center. These systems clad the buildings with an art-form of water. Even the simplest elements, such as gutters, are exaggerated to highlight the passage of water from the sky to the earth. In a world that must become hyper aware of environmental issues, this small project is clad with the art-form of contemporary times.

Place

The design of the Government Canyon Visitor Center is based on vast accumulated knowledge of the unique needs of this place. Much of this information was gathered with the assistance of the Texas Parks and Wildlife Department. This knowledge was then utilized to design a facility that not only showcases the beauty of the landscape, but also centers on and teaches about conservation and the preservation of the aquifer (Figure 04.13).

A number of strategies were utilized in the creation of this sustainable center. The spaces are oriented to optimize the solar potential of the building, while the roof overhangs are designed to regulate the solar impact on the interior spaces. The central pavilion can be manipulated, through the use of rolling doors and screens, to block winds when cool or to allow them through for natural ventilation when it is warm. Sustainable materials with recycled content like fly ash concrete and steel with 75 percent recycled content were used throughout the project. Lake|Flato also reduced the conditioned program space proposed initially by 35 percent to further lower energy costs.

The central pavilion floats about 46 centimeters [18 inches] above the ground, allowing water and cooling breezes to move unobstructed beneath the structure. To reach this elevation, a boardwalk extends from the parking lot – where it is at grade – and slowly rises to the height of the pavilion. This design minimizes the impact of the man-made structures on the movement of water through the site, but it also accounts for periodic flooding in the region during heavy rains. This design exemplifies the coordination of building construction for site- and project-specific reasons. The structure, construction, and art-forms of the project use the theme of conservation to tie the project to its place in the Texas savanna.

04.13
Front court space

Additional Resources

Projects

Agudas Achim Synagogue, Austin, Texas, United States, 2001 (30°21’34”N, 97°45’29”W)

Shangri La Nature Center, Orange, Texas, United States, 2008 (30°6’6”N, 93°45’3”W)

Brown Residence, Scottsdale, Arizona, United States, 2010

ASU Health Services Building, Tempe, Arizona, United States, 2012 (33°25’17”N, 111°55’59”W)

Briscoe Western Art Museum, San Antonio, Texas, United States, 2013 (29°25’23”N, 98°29’21”W)

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Novak, Celeste Allen, G. Edward Van Giesan, and Kathy M. DeBusk. *Designing Rainwater Harvesting Systems: Integrating Rainwater into Building Systems*. Hoboken: John Wiley & Sons, Inc., 2014.

Notes

1 The firm brief was provided by Lake|Flato.

2 This quote by Lake|Flato partner Bob Harris was provided by the firm.

3 Gottfried Semper, “The Four Elements of Architecture: A Contribution to the Comparative Study of Architecture,” in *The Four Elements and Other Writings*, ed. Harry Francis Mallgrave and Wolfgang Herrmann (New York: Cambridge University Press, 2010), 102. (Originally Published in 1851.)

4 “Top Ten Projects: Government Canyon Visitor Center,” The American Institute of Architects, accessed October 15, 2014, www.aiatopten.org/node/143.

5 Demetri Porphyrios, “From Techne to Tectonics,” in *What Is Architecture?*, ed. Andrew Ballantyne (New York: Routledge, 2002), 132.

6 Karl Bötticher, “Excerpts from *Die Tektonik Der Hellenen*,” in *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, ed. Werner Oechslin (New York: Cambridge University Press, 2002), 188. (Originally published as Bötticher, Carl Gottlieb Wilhelm. *Die Tektonik Der Hellenen*, Potsdam, 1844.)

7 Semper, “The Four Elements of Architecture,” 102.

05

Peninsula House

Sean Godsell Architects

Architect Brief

> Sean Godsell says he can never shake away the inbuilt belief that architecture begins with a site, crystallises around a richly described set of abiding events, and is solved by the hard work of seeking the level and testing the puzzle until everything fits together as in a dream.[1]
>
> Leon van Schaik, "Sean Godsell: Enigma vs. Extravagance," 2004

After graduating from the University of Melbourne in 1984, Sean Godsell began an architectural tour of Japan, Western Europe, Scandinavia, and Italy, seeking out the works he had studied in school. He hoped to find a more complete understanding through first-hand exploration. In 1994, Godsell returned to Melbourne and founded his own firm, which he

mornington peninsula, victoria, australia
gps | not provided for residence
program | summer residence
completed | 2002
area | 280 m2 [3,014 ft2]

05.1
Vicinity map

05.2
View of the Peninsula House from the northeast

continues to run today with associate Hayley Franklin. The firm focuses on distinct regional work that is designed with the belief that "[a]rchitectural space must be confronting. Cryptic. Cause double takes. It must need to be learned. But not quirky. Calmness, not content is the key."[2] Godsell has received numerous regional and international awards for his design work including a Citation from the American Institute of Architects in 2003.

Leon van Schaik, Godsell's close friend, has written: "Few other architects today practise in a way that is so unmediated between themselves and the production processes of architecture."[3] The office produces most of their work with pencil on trace, allowing the hand to be the mediating device between thought and drawing, a tactile process of making and thinking. Thinking is "etched into paper and re-etched into construct."[4]

Project Brief

The Peninsula house is located south of Melbourne on the Australian coast. The 30 × 7.2 meter [98 × 24 foot] box is embedded into the side of a large sand dune and is composed of a core wrapped with two layers of cladding: one of glass and one of wood (Figure 05.2). It is a box within a box; a space sheltered with a dual skin that is both permeable and protective. The program for this summer retreat is simple: a living space, a kitchen and dining space, a sleeping space, a study space or library, and a verandah or open, covered porch, which is an essential component to the Australian outdoor lifestyle. The Peninsula House is part of a continuum of ongoing research in Godsell's office into the design and construction of architecture situated within the multicultural environment of southern Australia.

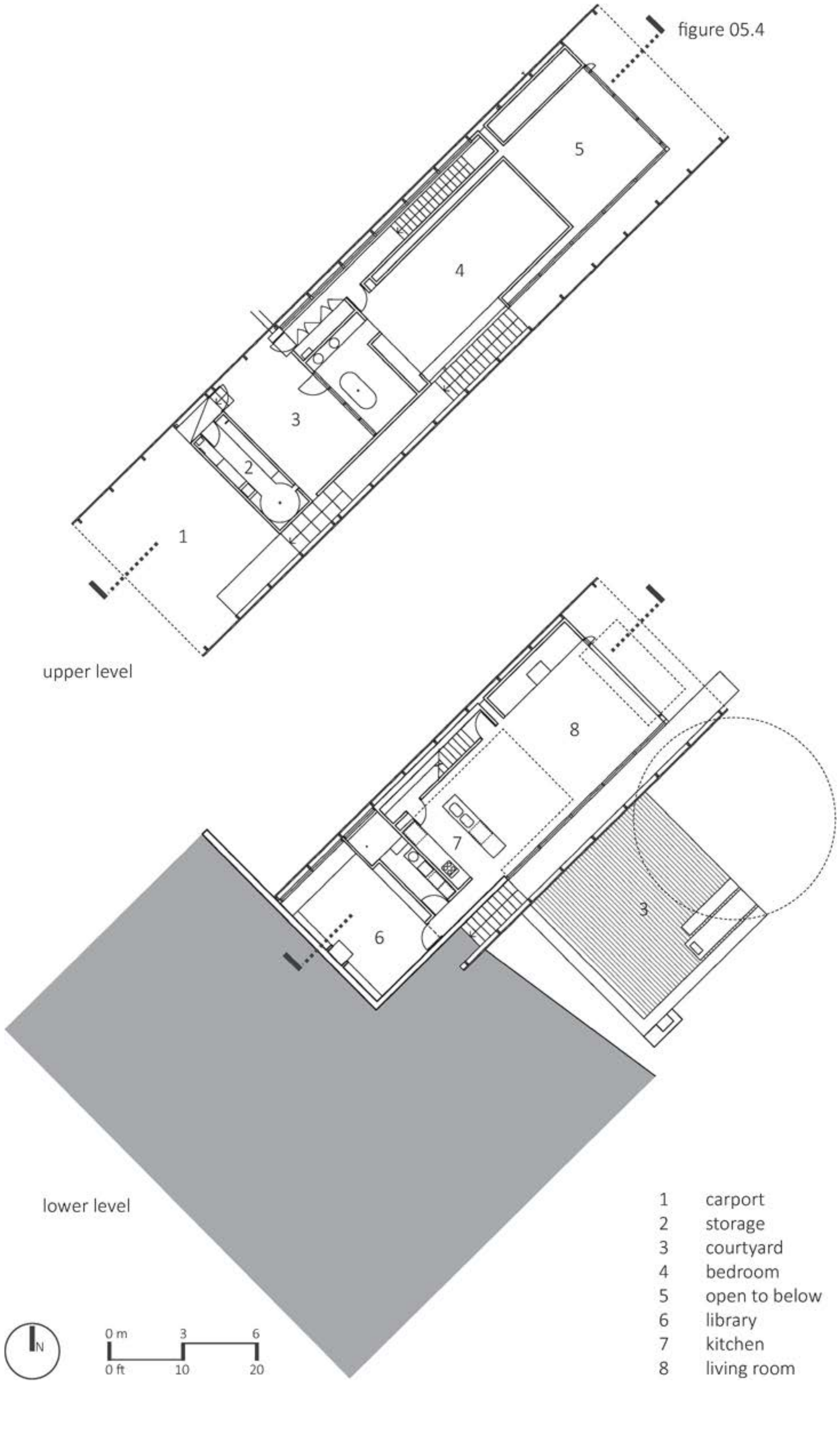
You arrive at the house via a narrow road at the top of the dune and immediately encounter a carport. To enter the home, you descend a staircase on the southeast side of the residence to the living space on the lower floor (Figure 05.3). The large, open social space occupies the north end of the house. Behind it (back towards the dune) is the kitchen, which is open to the living space, followed by a bathroom. The library sits at the rear of the main floor, nestled into the dune; it is a quiet space for reflection. Cantilevered above the kitchen and dining areas is the sleeping space (Figure 05.4). This private upper level is accessed by a separate stair on the northwest side of the building. Behind the bedroom is a second bath that is adjacent to a private courtyard (Figure 05.5). On the opposite side of the courtyard, a storeroom and private entry separate the carport from the rest of the house. The storeroom also serves as a shower and changing space before and after venturing to the nearby beach.

Tectonic Principles

Precedent

This particular thread of Godsell's exploration of regional typology began to coalesce in the design of the Carter/Tucker house. Here in particular, the ideas of an inner room and enclosed verandah that permeate his work were explored for their multicultural relevance. Godsell says:

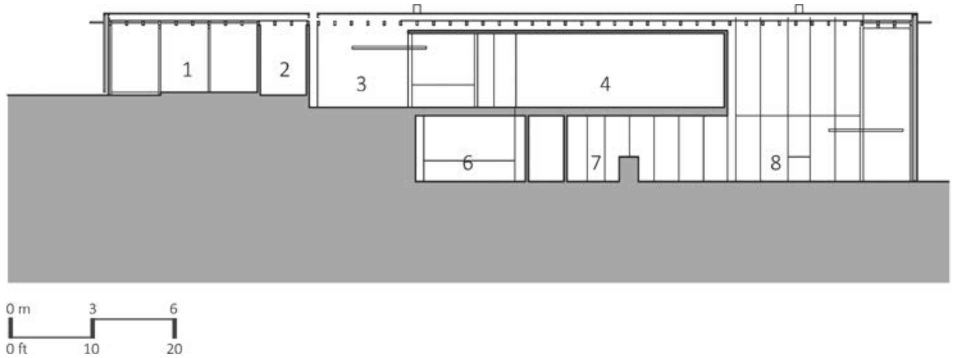
> In traditional Chinese architecture the aisle is a fluid outer building continuous around the perimeter of the inner building. In traditional Japanese architecture the aisle (*gejin*) is not continuous when added to a structure (*hisashi*) but is fluid space when an inner



05.3
Floor plans

05.4
Building section

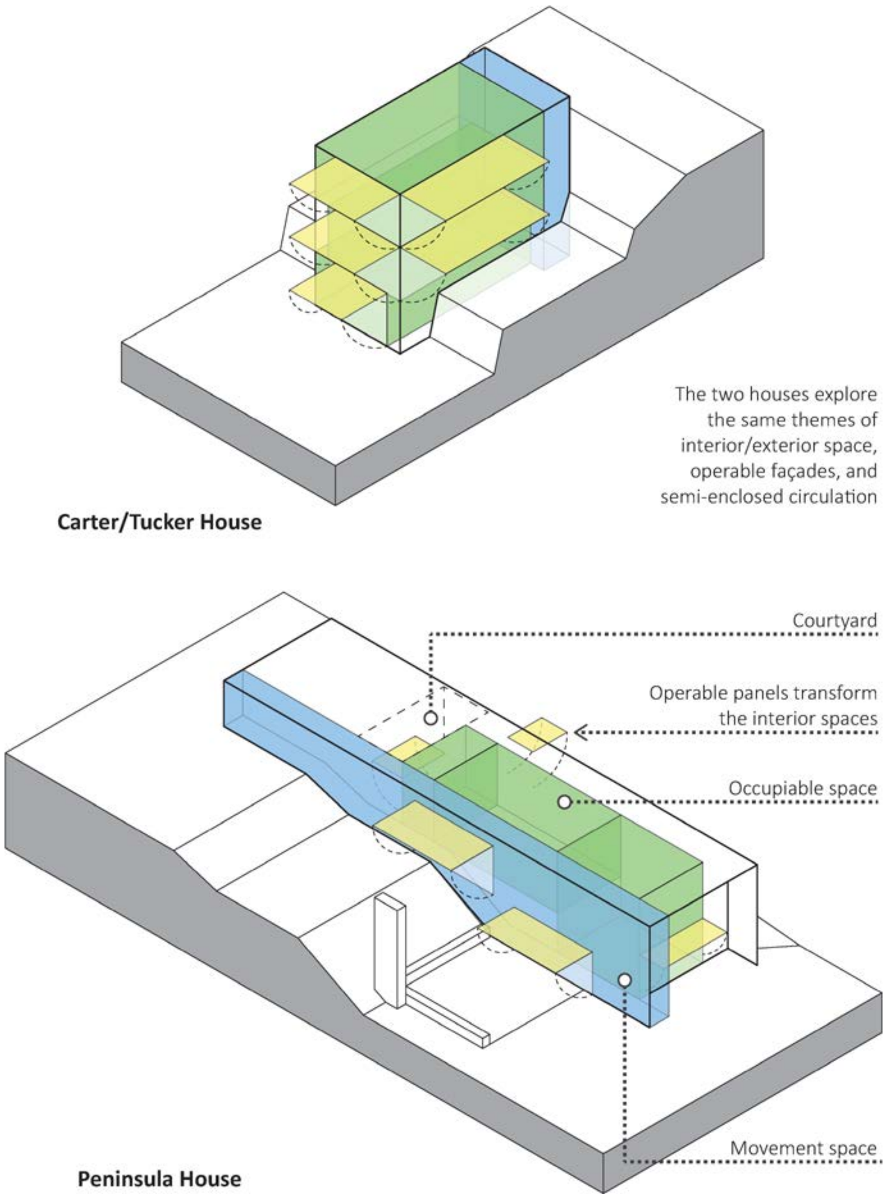
1 carport
2 storage
3 courtyard
4 bedroom
5 open to below
6 library
7 kitchen
8 living room



05.5
Courtyard and bath

> building is partitioned (*hedate*) to cause an aisle to be formed. The traditional outback Australian homestead is also surrounded by fluid space (verandah) which is sometimes partly enclosed by flywire or glass to form an indoor/outdoor space (sunroom).[5]

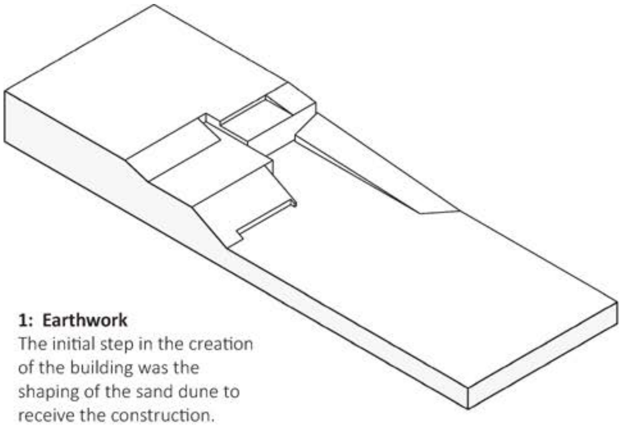
This fusion of cultural constructs was further abstracted in the Peninsula House (Figure 05.6). The verandah became a protective outer shell that can be occupied and manipulated. The building can be closed down or opened to alter the living space and its relationship to the surrounding environment.



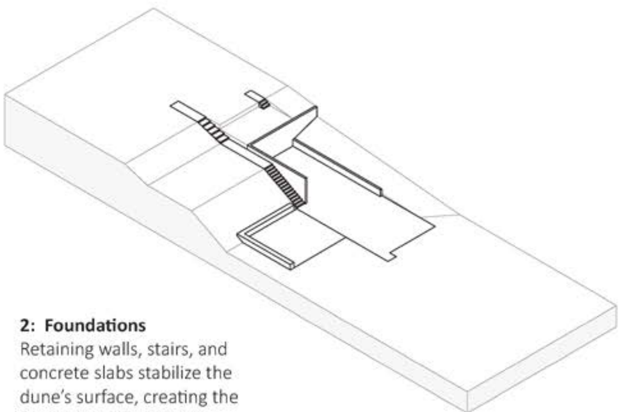
05.6
Comparison of the Carter/ Tucker House and the Peninsula House

Anatomy

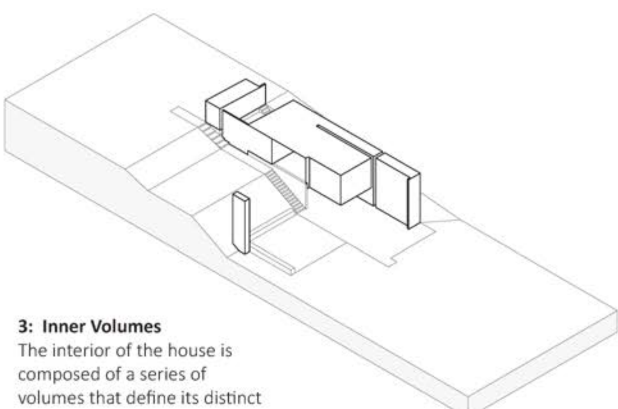
The earthwork of the Peninsula House consists primarily of the dune itself. This mound of earth hosts the south end of the home, opening a dialogue between building and environment (Figure 05.7). A concrete platform emerges from the excavated hillside along with two primary foundation walls that retain the earth and support the building above. The house's structure is a rectangular volume composed of a series of steel frames. The frames support a timber screen that occupies both the long walls and the roof of the building. Within this



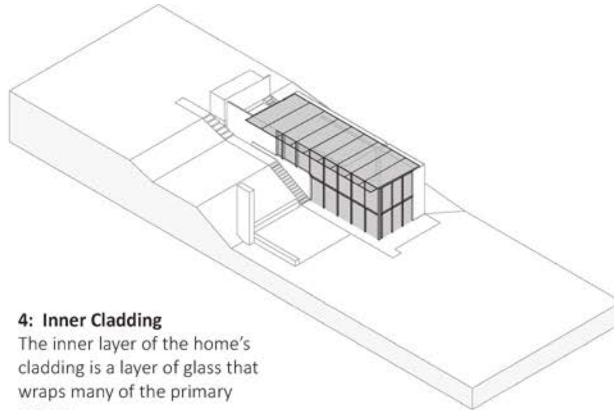
1: Earthwork
The initial step in the creation of the building was the shaping of the sand dune to receive the construction.



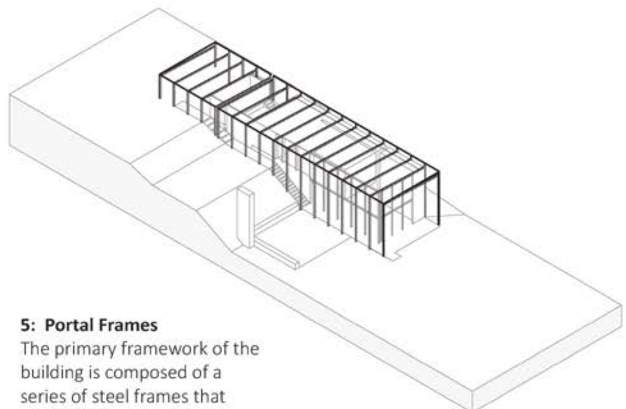
2: Foundations
Retaining walls, stairs, and concrete slabs stabilize the dune's surface, creating the foundation of the home.



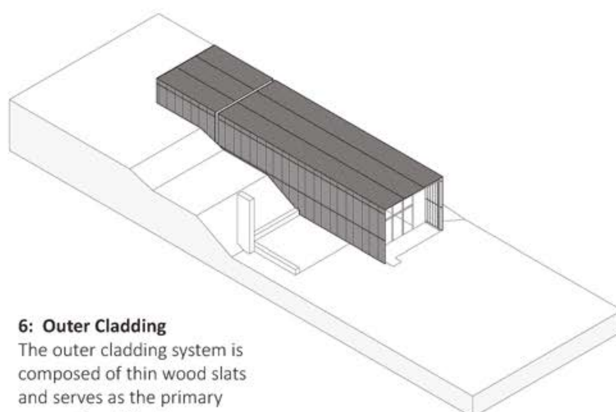
3: Inner Volumes
The interior of the house is composed of a series of volumes that define its distinct spaces.



4: Inner Cladding
The inner layer of the home's cladding is a layer of glass that wraps many of the primary spaces.

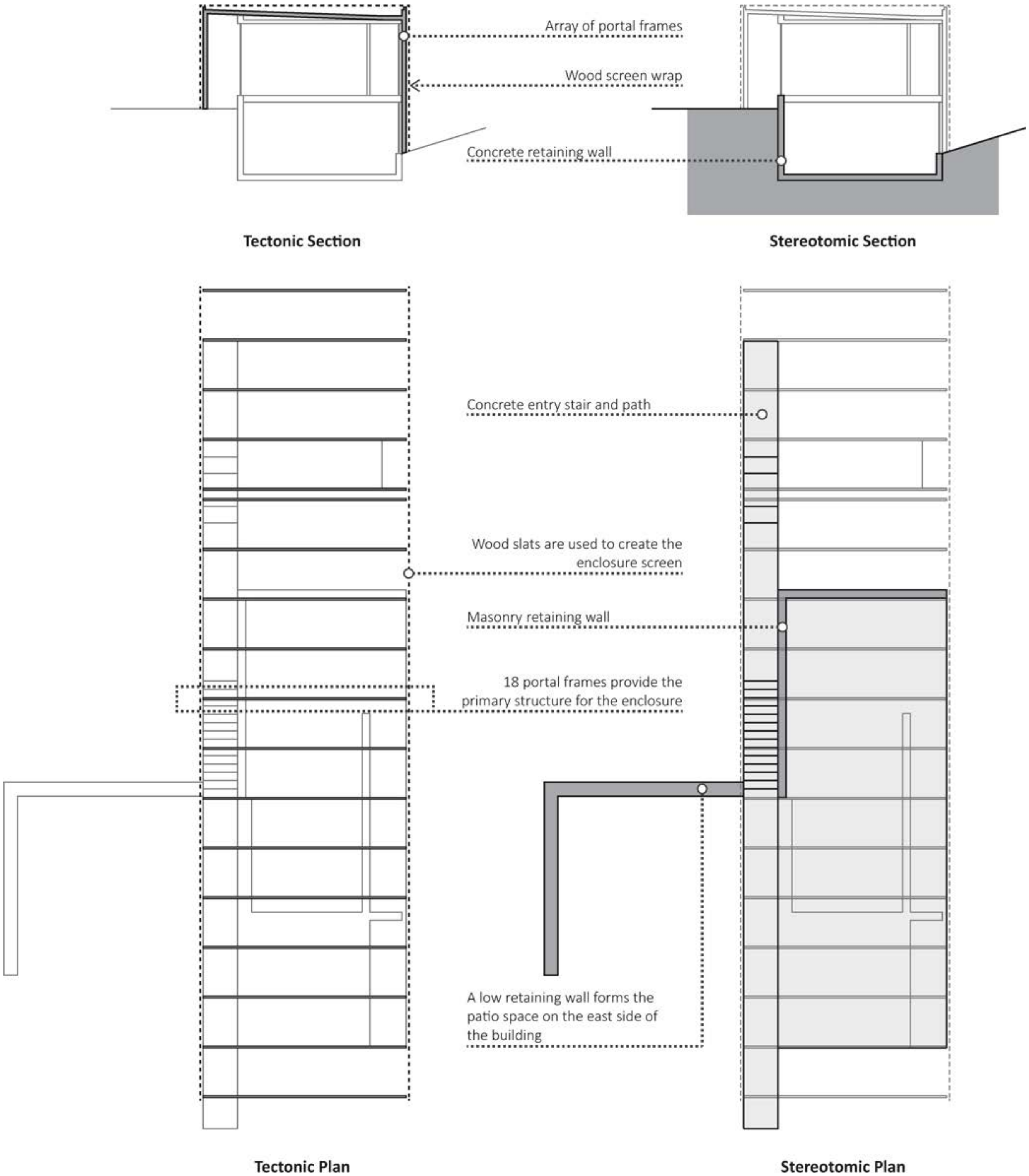


5: Portal Frames
The primary framework of the building is composed of a series of steel frames that support the exterior cladding.



6: Outer Cladding
The outer cladding system is composed of thin wood slats and serves as the primary expression of the home.

05.7
Anatomy



05.8
Tectonic | Stereotomic

screen, a second cladding of glass encloses a large portion of the building to provide a sealed interior environment.

The roof and the façade share the same structural and material basis and, therefore, merge into a single sheltering element. "There is no distinction . . . between the function of the roof and the function of the walls. The house itself is the nurturing inner room, protected from the elements by a coarse outer hide."[6] The earth and cladding protect the sanctuary within – the hearth. This arrangement is also tied to Godsell's cultural studies. The inner sanctum is akin to the Japanese ***moya*** being protected by the previously mentioned ***hisashi***; ". . . the house evokes all the archetypal qualities of dwelling: cave, hut, hearth enclosure, expansion, and conquest of but respect for nature."[7]

moya = central area of a residence or sacred central area of a temple

hisashi = the aisles that surround the moya

Tectonic

The structural diagram of the Peninsula House reads as a series of parallel lines realized as oxidized steel portal frames (Figure 05.8). The frames are rhythmic in their arrangement and provide an ordering system for the space. The walls and roof are categorically *die Wand* in nature. Glass wraps much of the public space including the northeast end of the building, which is fully glazed and provides a prominent view out to the surrounding landscape.

The roof, southeast wall, and northwest wall are further protected by the timber wrap (Figure 05.9). The wood used for this construction – all of which was reclaimed – is a native

05.9
Timber battens on southeast façade

species of eucalyptus commonly called jarrah. Jarrah is very hard and dense, allowing the battens or slats to be cut into extremely slender strips – 10 × 35 millimeters [3/8 × 1 3/8 inches) – while still maintaining strength and durability. The wood is so hard that when seasoned, it is impossible to cut with typical woodworking tools. It also has a high oil content, making it resistant to termites and rot.

Stereotomic

The two ends of the rectangular volume reveal very different characteristics of the building. The north end is open, defined by light, and has the tectonic connotations outlined above. The south end, however, sits within the earth, rooted into the sand dune. When LeCuyer talks about the "radical tectonic" growing out of the earth itself, intimately linking the construction to place, time, and culture,[8] she is referencing a project such as the Peninsula House.

Two L-shaped walls are used to retain the dune and solidify the excavation. The first is a masonry wall that delineates the rear section of the lower floor of the house; the second is a bench-height concrete wall that forms the verandah patio on the southeast side of the house. These two elements hold back the earth and define the space of the home.

Place

The Peninsula House is a hybrid of Semper's roof-hut and courtyard constructs. As in the roof-hut, the roof is the dominant element, sheltering the space beneath. But here, the roof wraps down onto the wall surfaces. This enclosure creates an internal sanctuary that is both open to the surrounding environment and hidden away from it. The cladding reinforces this duality. Viewed at an angle, the skin appears opaque; but when viewed straight on, the slenderness of the slats allows them to disappear and transparency is achieved.

Art critic Adrian Stokes has written:

> Used, carved stone, exposed to the weather, records on its concrete shape in spatial, immediate, simultaneous form . . . the winding passages of days and nights, the opening and shutting skies of warmth and wet.[9]

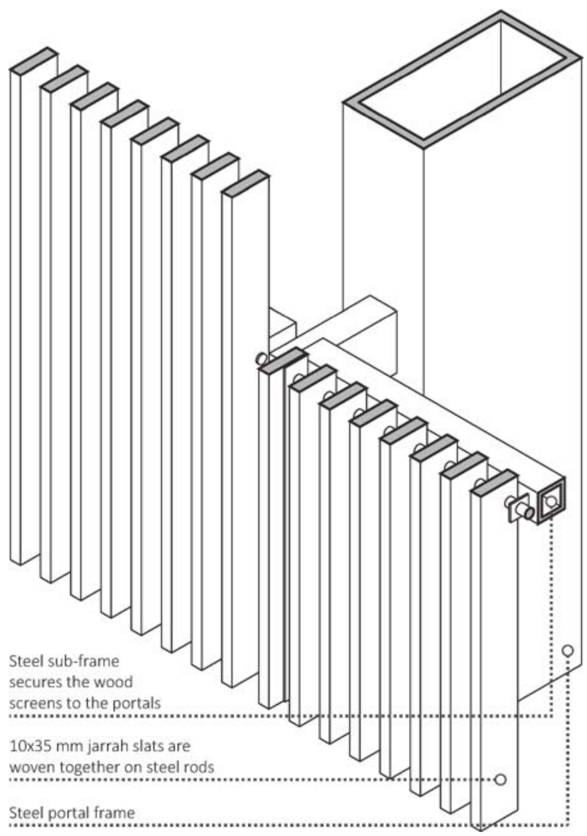
Although primarily discussing the impact of human touch on the material, Stokes clearly outlines the impact of the environment on materiality and, in turn, space and experience. In the Peninsula House, Godsell created a "sundial that records the passage of time by the patterns of shadows thrown by the screens."[10] Over the course of a day and over the course of a year, the construction manipulates light to create a constantly changing environment. Godsell also used light to define the three primary spaces of the home; the living space has the most light, the bedroom has a mid range, and the library is relatively dark and secluded. In addition, the slender timber battens will weather and likely warp with exposure to sunlight and the sea air, marking the passage of time. This evolution of material creates an ever-changing finish for the home, a tectonic link to place and environment.

Representation | Ornamentation | Detail

The battens are also representative of the underlying steel portal. The verticality and wrapping action of the slatting matches the structural action of the frames as well as their formal positioning, orientation, and proportioning. Although not a true core-form/art-form condition, the ornamentation is a clear reflection of the forces at work beneath in the structural frame.

The cladding system also has ties to the performance of the surrounding natural environment: "a glass roof floats below a lath screen. The effect is that of being sheltered by a leafy tree."[11] The cladding, in this respect, serves as an abstraction of the tree canopy. This relationship to nature falls on the lowest level of Shelling's hierarchy but is more responsive to Bötticher's ideas about imitation of natural form. The timber screens also reveal Schelling's higher principles of nature, however, through the depiction of time previously described. Although Schelling refers to this relationship as the creation of "solidified music," in the Peninsula house, the process is decidedly active; it is an ever-changing symphony of light and shadow.

Building on Semper's theory of dressing, the cladding is a textile woven of wood and galvanized steel. The vertical timber battens feed on to horizontal steel members and are separated with spacers (Figure 05.10). This fabric is then draped over open scaffolding, reflecting Semper's beliefs about the origin of architecture. As a performative structure similar to that in Semper's narrative, the Peninsula House evokes the most primitive and the most primary essences of his theory of human shelter.



05.10
Exterior screen detail

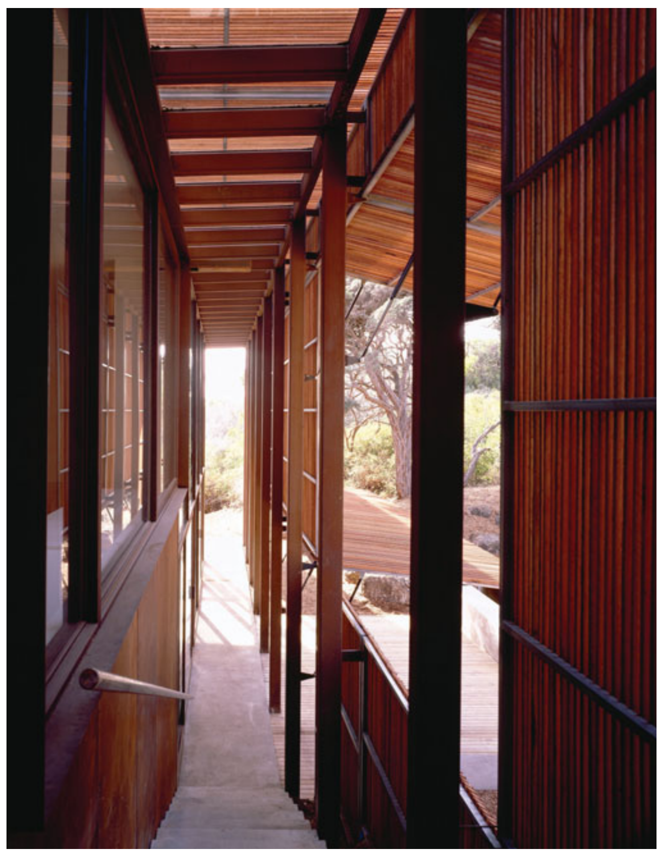
05.11
Manipulation of the timber screens

Space

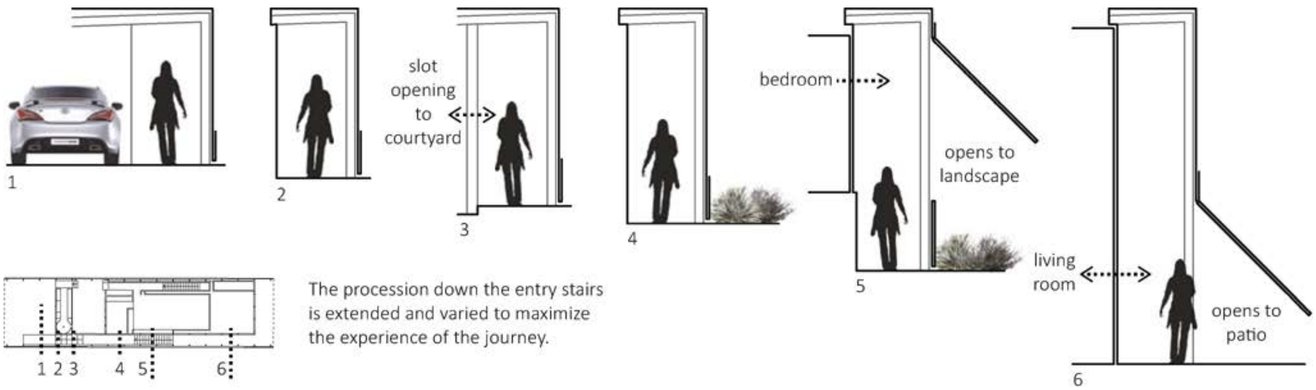
The occupant plays the role of mediator in this project, controlling the level of exposure between interior and exterior environments. This mediation is accomplished through the manipulation of the façade, making the space an organic construct that shifts according to the needs of the occupant. This strategy recalls Bötticher's theory of spatial tectonics, which calls for construction that is formed around the needs of the user.

In the Peninsula House, the cladding on the east façade can be opened (both glass and screen). When the screens at the lower level are open, they transform into a roof plane defining the outdoor patio space (Figure 05.11). Similarly, the lower half of the northeast glass wall rotates up on a counterweighted hinge to an open position, extending the living space to the exterior. The southwest wall of the master bathroom also operates on a similar system, allowing the bathroom to open to the private courtyard. The building shifts based on user need, a feat made possible by the flexibility provided by the building's structure.

In *Studies in Tectonic Culture*, Frampton describes the work of Dimitris Pikionis as one where "the surface of the ground is kinetically experienced through the gait, that is to say through the locomotion of the body and the sensuous impact of this movement on the nervous system as a whole."[12] Building on this thought, Godsell explores the idea of moving through space throughout the project.



05.12
Views down entry stair



05.13
Revealing and concealing of the entry route

In the Peninsula House, there are two separate paths of movement through the building: public and private. They "intersect at the kitchen table."[13] The public path is critical to the home's spatial design. The double skin is pulled apart and extended to create the verandah. Visitors occupy this interstitial space while walking down to the main entry of the building. This path is purposefully long; you must walk the entire length of the building on the entry approach, gradually descending with the contours of the dune to the main entry (Figure 05.12). The path is an exercise in revealing and concealing of both the house and the landscape. As the path ends, the verandah opens to a larger patio space: the social center of the Australian home (Figure 05.13).

Additional Resources

Projects

Kew House, Kew, Victoria, Australia, 1997
Carter/Tucker House, Breamlea, Victoria, Australia, 2000
St. Andrews Beach House, St. Andrews Beach, Victoria, Australia, 2006
Glenburn House, Glenburn, Victoria, Australia, 2007
RMIT Design Hub, Melbourne, Australia, 2012 (37°48′23″S, 144°57′45″E)

References

Crespi, Giovanna, ed. *Sean Godsell: Works and Projects*. Milan, Italy: Electa Architecture, 2004.

Godsell, Sean, Leon van Schaik, and Juhani Pallasmaa. "Sean Godsell 1997–2013." *El Croquis*, no. 165 (2013).

Helsel, Sand. "Sean Godsell Transforms a Seemingly Simple Box, Wrapping His Peninsula House in a Veil of Slender Wood Battens." *Architectural Record* 191, no. 4 (2003): 134–39.

"Light Filter: Melbourne, Australia." 2002. *Architectural Review* 212, no. 1270 (2002): 38–41.

"Sean Godsell: Peninsula House, Victoria, Australia." *GA Houses* 75 (2003): 58–69.

Notes

1 Leon van Schaik, “Sean Godsell: Enigma vs. Extravagance,” in *Sean Godsell: Works and Projects*, ed. Giovanna Crespi (Milan: Electa Architecture, 2004), 12.

2 Sean Godsell, as quoted in van Schaik, “Sean Godsell: Enigma vs. Extravagance,” 25.

3 Leon van Schaik, *Mastering Architecture: Becoming a Creative Innovator in Practice* (Chichester: John Wiley & Sons, Inc., 2005), 140.

4 Ibid., 141.

5 From a written statement provided by the architect.

6 From a written statement provided by the architect.

7 “Light Filter: Melbourne, Australia,” *Architectural Review* 212, no. 1270 (2002), 38.

8 Annette LeCuyer, *Radical Tectonics* (London: Thames & Hudson, 2001), 16.

9 Adrian Stokes, “Stones of Rimini,” in *The Critical Writings of Adrian Stokes Volume 1*, ed. L. Gowing (London: Thames & Hudson, 1978), 183.

10 “Light Filter: Melbourne, Australia,” 39.

11 van Schaik, *Mastering Architecture: Becoming a Creative Innovator in Practice*, 140.

12 Kenneth Frampton, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture* (Cambridge: MIT Press, 2001), 9.

13 Leon van Schaik, “A Conversation with Sean Godsell,” *El Croquis*, no. 165 (2013), 15.

06

Prayer Pavilion of Light

DeBartolo Architects

Firm Brief[1]

DeBartolo Architects was founded in 1996 by the father and son team of Jack DeBartolo Jr. and Jack DeBartolo III. The two partners have always been drawn to "significance" over success and have honored that commitment while producing high-quality architecture primarily in and around Phoenix, Arizona. The firm aspires to shape spaces that evoke quality and beauty, that integrate successfully into the landscape, and that create experiences that are memorable and profound. DeBartolo Architects' commitment to architectural excellence is paralleled by their commitment to creating relevant and functional environments for their clients.

The studio has distinguished itself with numerous award-winning projects that have transformed their environments – typically making much out of little. DeBartolo Architects cites seven key points of architecture that they use to create space: site, form, structure, material, light, space, and soul.[2] Through creativity, innovation, and careful listening, the firm

06.1
Vicinity map

has become one of the leading regional studios in creating well-tuned environments that respond equally to client, context, culture, and community.

Project Brief

> By day, the chapel looks like a frosty ice cube sitting on the mountainside. By night, it softly glows a rainbow of colors, producing an effect that is at once soothing and mesmerizing.[3]
>
> Jenna McKnight, "Prayer Pavilion of Light, Phoenix, Arizona," 2010

The Prayer Pavilion of Light is an addition to Phoenix First Assembly of God, a Pentecostal megachurch that has been a fixture in the Phoenix area for over 75 years. After providing First Assembly with a new master plan in the 1990s for their 26.3-hectare [65-acre] campus, DeBartolo Architects began making architectural interventions including an early childhood education center, a youth pavilion, a children's pavilion, a sanctuary renovation, and the Prayer Pavilion.

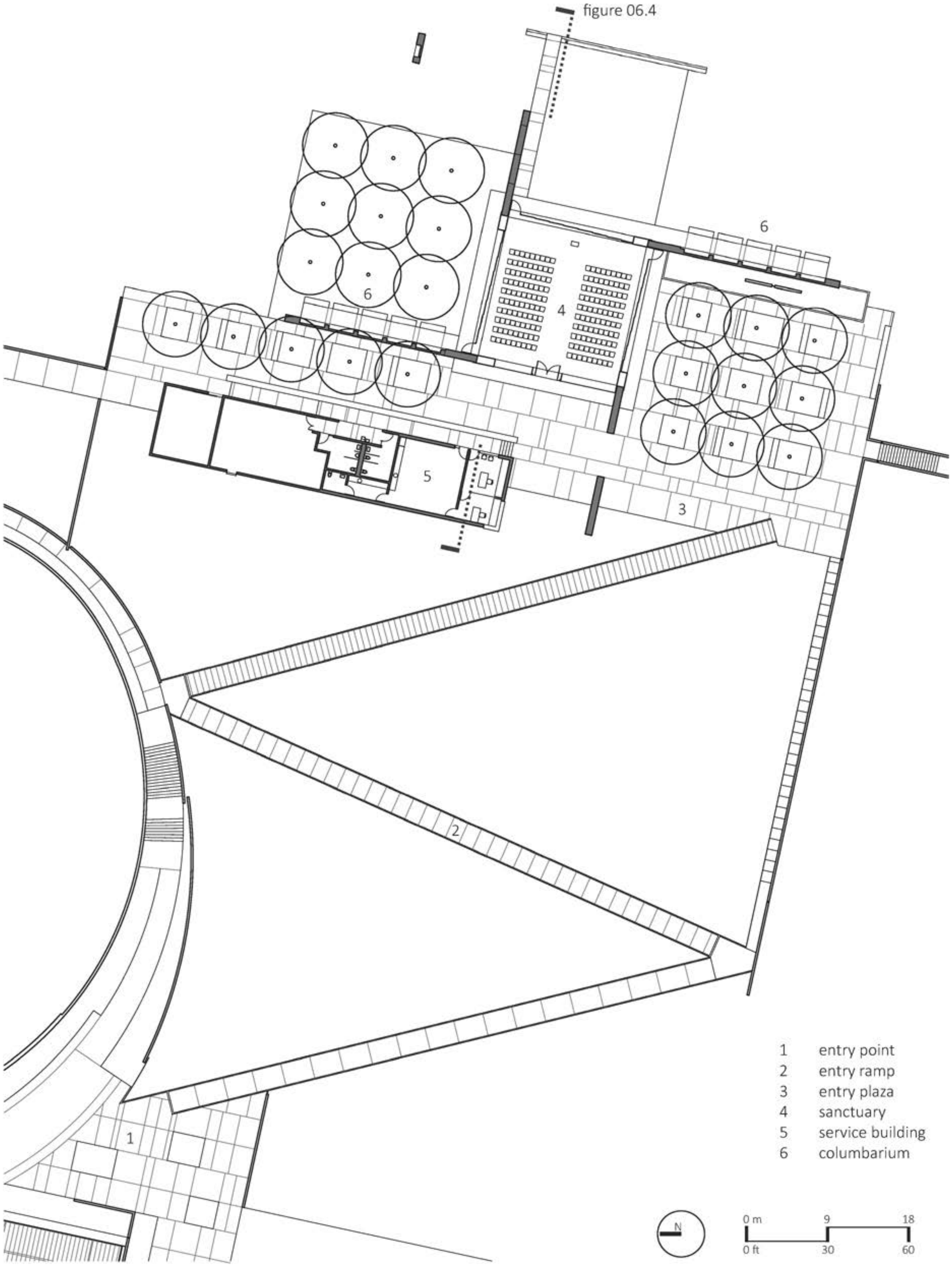
The project is situated on the highest section of the property, adjacent to Stoney Mountain. A significant component of the Prayer Pavilion is the journey up to it. From the parking area, the hillside rises about 8.5 meters [28 feet] to the building. A path 183 meters [600 feet] long zigzags up the hill, patiently moving you towards the ultimate goal. This extended threshold creates a significant separation between the normative condition of your life awaiting your return below and the contemplative sanctuary of the Prayer Pavilion above. The walkway is flanked with weathered steel plates on both sides that complement the surrounding desert landscape.

Although the materials of the walkway are similar to those used by many contemporary southwest architects, the building offers a distinctly different feel.[4] The Prayer Pavilion is a glass box, perched on concrete walls that extend out into the landscape (Figure 06.2). Placed high on the hillside, the box serves as a lantern and is highly visible from the surrounding area.

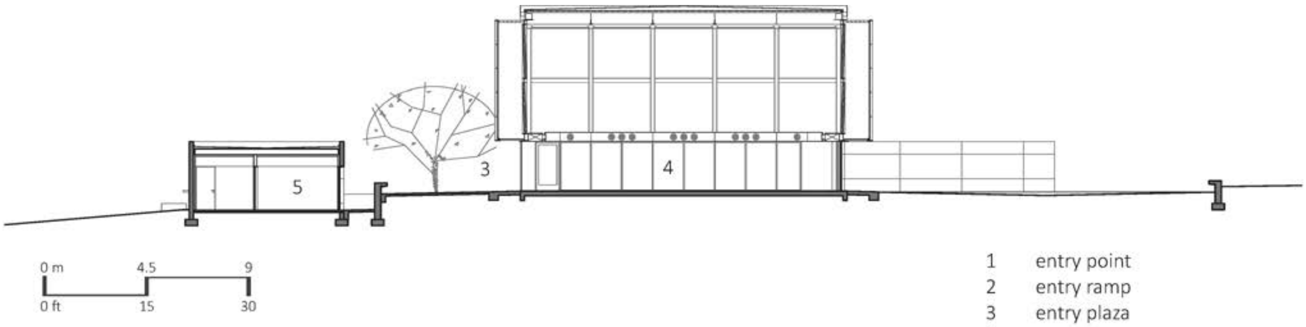
Arriving at the top of the hill, you are deposited in one of the plazas that flank the building (Figure 06.3). The space is serene, sheltered by a grid of maturing paloverde trees. The plaza is highlighted by the composition of a long reflecting pool, a torch, and a steel cross 15 meters [50 feet] tall. An opening in the nearest concrete wall leads to the building's main entry. Next to the Prayer Pavilion – on the west side – is a low concrete building that houses all of the service functions for the project including restrooms, storage space, offices, and mechanical systems. This building is situated 75 centimeters [30 inches] lower than the main building, enhancing the pavilion's prominence on the site (Figure 06.4).

While the entry façade is primarily fixed glass, the Prayer Pavilion is entered through a pair of handcrafted bronze doors. The other three sides of the pavilion consist of sliding glass walls that, when open, expose the chapel to the surrounding environment (Figure 06.5). The pavilion is used for weddings, funerals, and other events, but it is most prominently a place for reflection, a respite from the day-to-day, a quiet moment in the suburban metropolis.

06.2
View of the Prayer Pavilion from the entry plaza



06.3
Floor plan



1 entry point
2 entry ramp
3 entry plaza
4 sanctuary
5 service building
6 columbarium

06.4
Building section

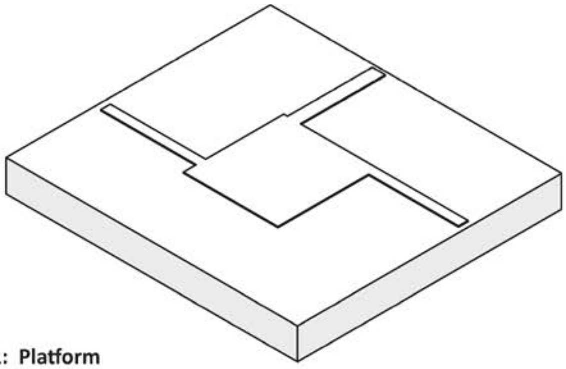
06.5
View through the Prayer Pavilion to the surrounding landscape

Tectonic Principles

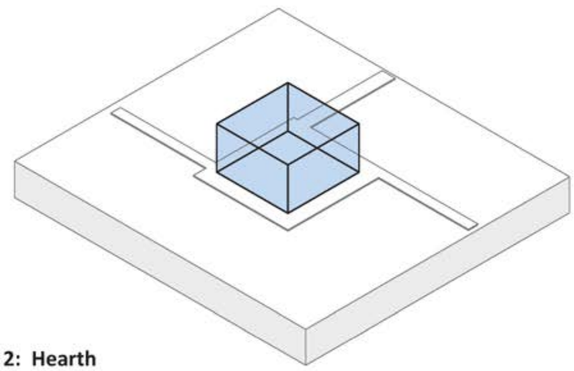
Anatomy

The Prayer Pavilion of Light sits on a concrete slab-on-grade (Figure 06.6). On the interior of the building, this surface is tiled. The tile extends out past the exterior walls to the edge of the overhanging construction above, marking the earth and creating a material juxtaposition between it and the adjacent decomposed granite and grass surfaces. Experientially, however, a different story is conveyed. Approaching from below, the building's platform feels like the mountain itself; the building, in this way, serves as a ceremonial cap to the monolithic hillside.

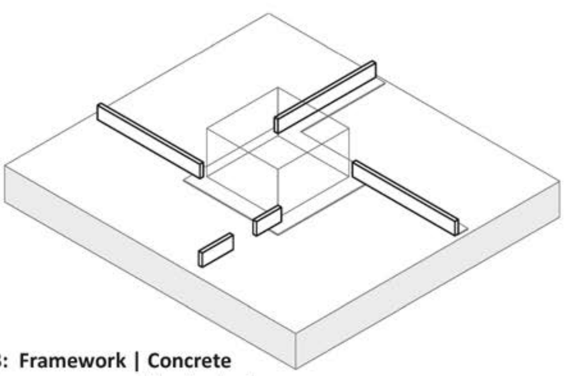
Four massive concrete walls rise from this base. The *die Mauer* nature of the concrete walls is complemented by the *die Wand* quality of the lightweight structure they support. This framework is comprised of a steel truss frame that forms the upper walls and a network



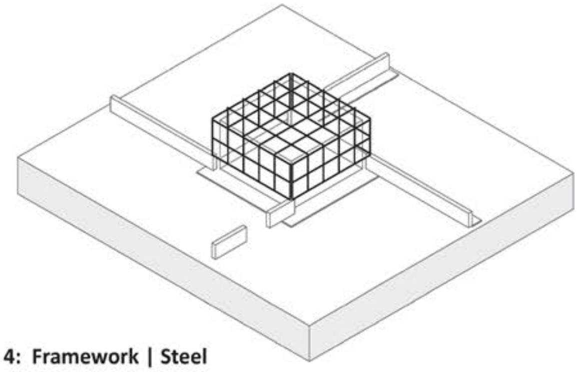
1: Platform
The Prayer Pavilion sits on a tiled concrete slab on grade.



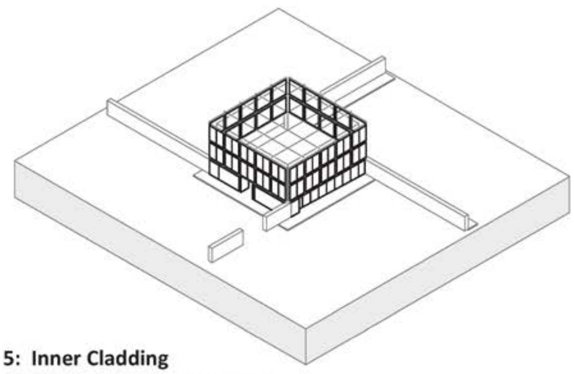
2: Hearth
The single room of the chapel serves as either an inwardly reflective or outwardly social space for visitors.



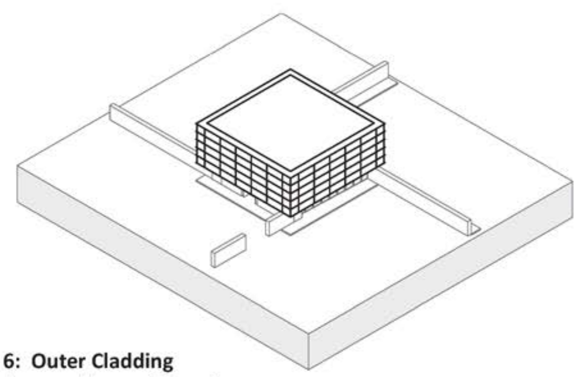
3: Framework | Concrete
Four concrete walls pinwheel out from the building, providing support and defining space.



4: Framework | Steel
A steel framework perches on top of the concrete walls below.

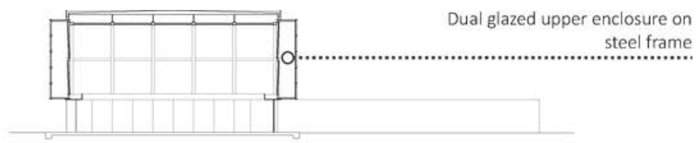


5: Inner Cladding
An inner layer of glass is fixed to the steel frame. Glass also infills between the concrete walls below.

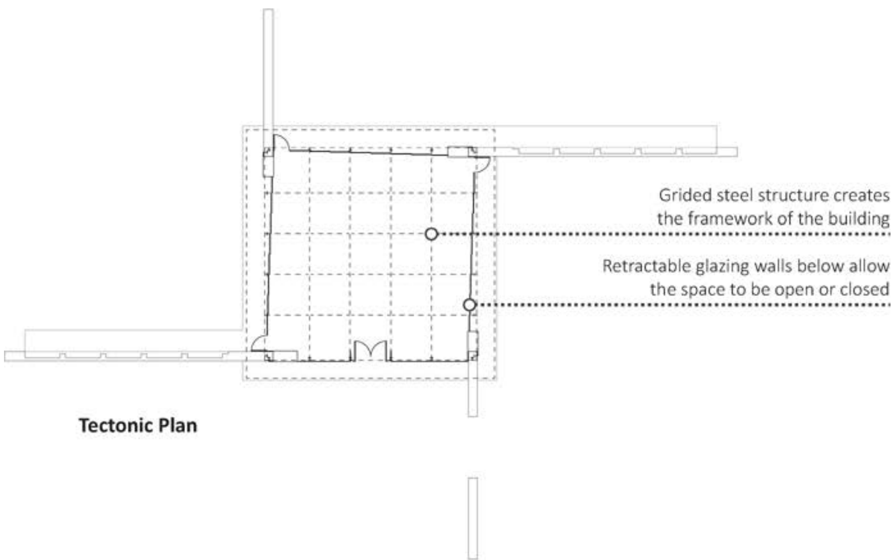


6: Outer Cladding
A second layer of glass is cantilevered out from the inner layer, creating the outward expression of the building.

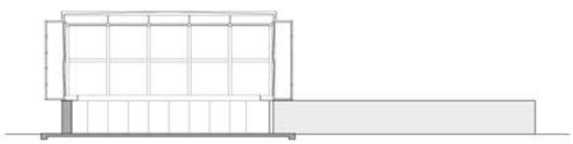
06.6
Anatomy



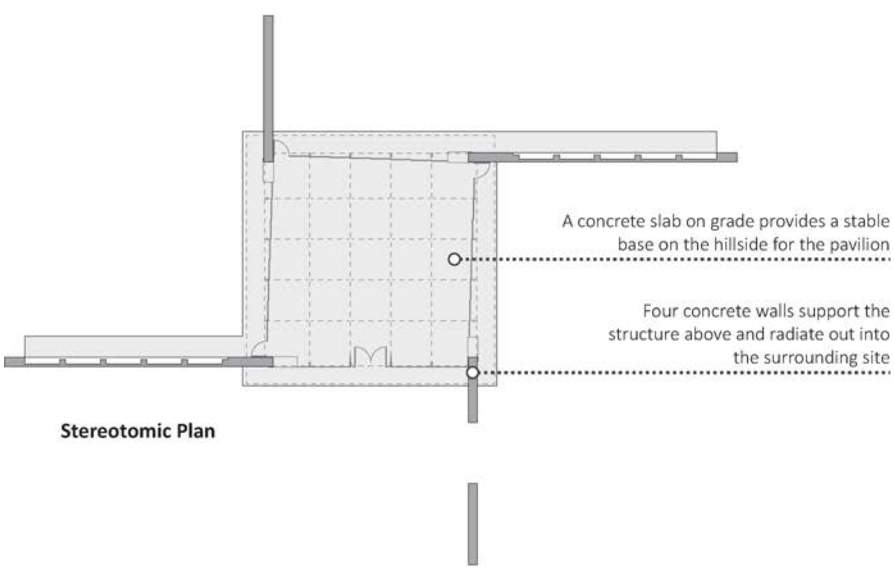
Tectonic Section



Tectonic Plan



Stereotomic Section



Stereotomic Plan

06.7
Tectonic | Stereotomic

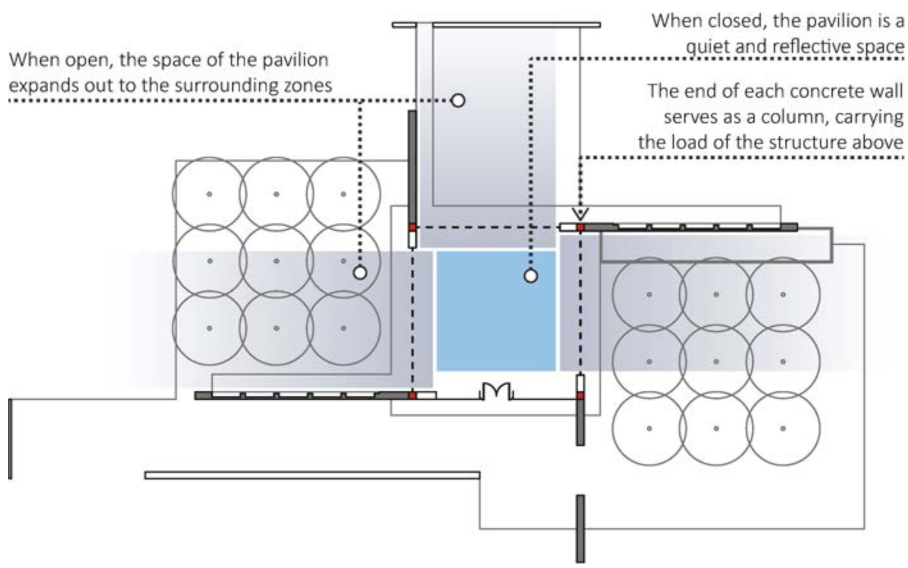
of steel beams that forms the roof. A double layer of glass clads the structure, creating the character of the Pavilion inside and out. Glass walls also infill between the concrete walls below, creating a comprehensive scheme for the building's cladding system.

All of the elements serve to protect and enhance the qualities of the simple inner space – a single room that provides a forum for both ceremony and reflection, social activity and spiritual contemplation. This hearth space can be closed and inwardly focused or it can be opened and connected to the surrounding desert landscape, some of which is finely manicured and some of which is decidedly raw and natural.

Stereotomic | Space

Four black concrete walls provide the stereotomic construct of the Prayer Pavilion (Figure 06.7). Each wall is 690 millimeters [27 inches] thick and stands 2.4 meters [8 feet] tall. Despite their mass, very little of the walls' bulk is responsible for carrying vertical load. The pinwheeling walls converge at the glass box, each carrying the weight of one corner of the construction above. Structurally, these elements act more as columns than bearing walls, occupying a middle ground between Semper's need for mass bearing conditions and Bötticher's embracing of the dematerialization of that mass in favor of a more delicate, open structure.

As the walls radiate out from the building, they separate the surrounding space into distinct zones of occupation, each having different qualities and potential for occupation (Figure 06.8). Although the concrete walls have almost no impact on the definition of the interior space when the building is closed, they do define the corners and proportions of the building and serve as sentinels marking the threshold between inside and outside. The impact of the concrete walls is only clearly felt when the building is open and the interior space – now a central connective hub – is allowed to bleed out into the carefully defined exterior zones.



06.8
Spatial plan

06.9
Prayer Pavilion from the mountainside on the east

This transition also marks a significant change in the spatial perception of the Prayer Pavilion. When closed, the building functions as chapel; but when open, its character as a pavilion in the landscape is revealed.

The concrete walls also define space in an entirely different manner; those that move out north and south from the building serve as columbariums, housing the deceased within their mass. They are the final resting place for these individuals and an extension of the earth below.

Tectonic

The tectonic frame of the Prayer Pavilion is perched on top of the concrete walls, hovering 2.4 meters [8 feet] above the heads of visitors. The primary structure is a set of four **Vierendeel trusses** that span between the walls below. These trusses support the interior glass panels and a simple roof structure of steel beams. Cantilevered off this structure, on the exterior of the building, is a lightweight steel armature. The outer structure holds the second layer of glass. Similar to other projects in this book, the Prayer Pavilion serves as a reflection of Semper's simple, primitive framework, clad this time in a glass fabric.

Vierendeel trusses = a structural truss using a rectangular arrangement rather than the traditional triangular arrangement of members

The Prayer Pavilion also demonstrated Frampton's qualitative definition of the tectonic being dematerialized and of the sky. Although the pavilion's glass box has the quality of floating upwards towards the heavens during the day, the effect is more pronounced at night. At dusk, the black concrete walls below dissolve into the dark landscape beyond (Figure 06.9). The building becomes a glowing box, floating up the mountainside.

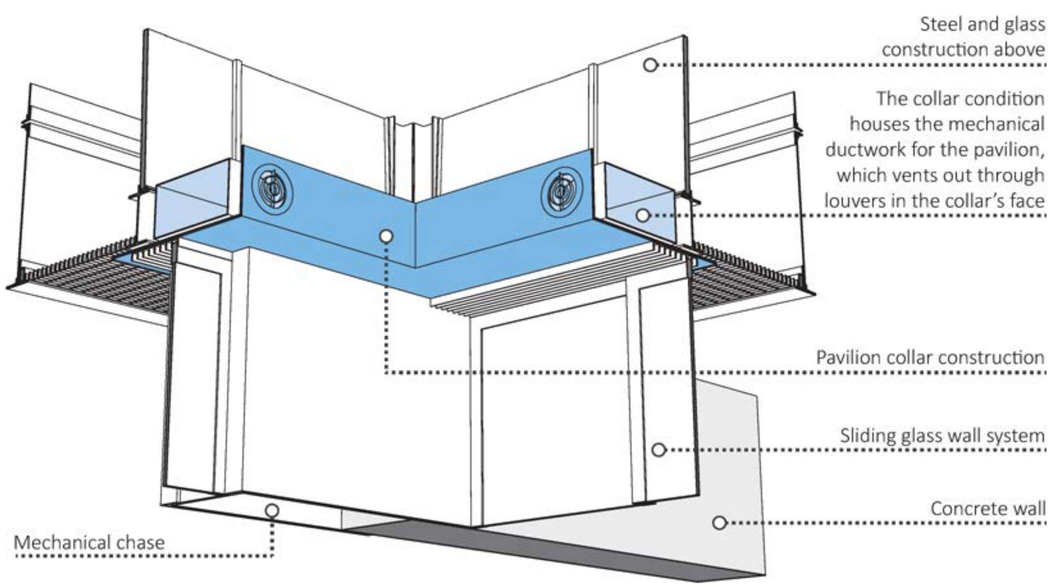
Intersection | Atectonic

The intersection point of the glass box and the concrete walls creates a datum that rings the building. At this point, DeBartolo Architects created a collar element that serves as both a transition between the two constructions aesthetically and a means of screening some of the building's services (Figure 06.10). On the inside of the building, this element conceals the mechanical ductwork along with other elements. On the outside, it screens the chase within the dual glazed skin.

Perceptibly, the collar condition also creates an atectonic impression in the Pavilion. It is at this point that the upper portion of the building is visually separated from its supporting structure below (Figure 06.11). The cantilevered second skin sits 50 millimeters [2 inches] above the top of the concrete walls. The collar conceals the connection between this cantilever and the main structure, allowing the glass box to appear to be hovering above the walls. This point of connection between the heavy and the lightweight, the dark and the light, is a tether. Like the string on a balloon, this joint prevents the glass box from floating away.

Place | Detail

The Prayer Pavilion of Light boldly denounces Semper's taxonomy of vernacular building. In this desert climate, the courtyard building is traditional. DeBartolo Architects started with a different premise, however: how do you create a glass box in the desert? After many trials, the best solution was to use glass to screen glass, creating a double façade that allows for transmission of light but not heat (Figure 06.12). The inner layer of glass is triple insulated and translucent to provide ample resistance to the desert sun. These glass panels are also



06.10
Detail of the collar zone

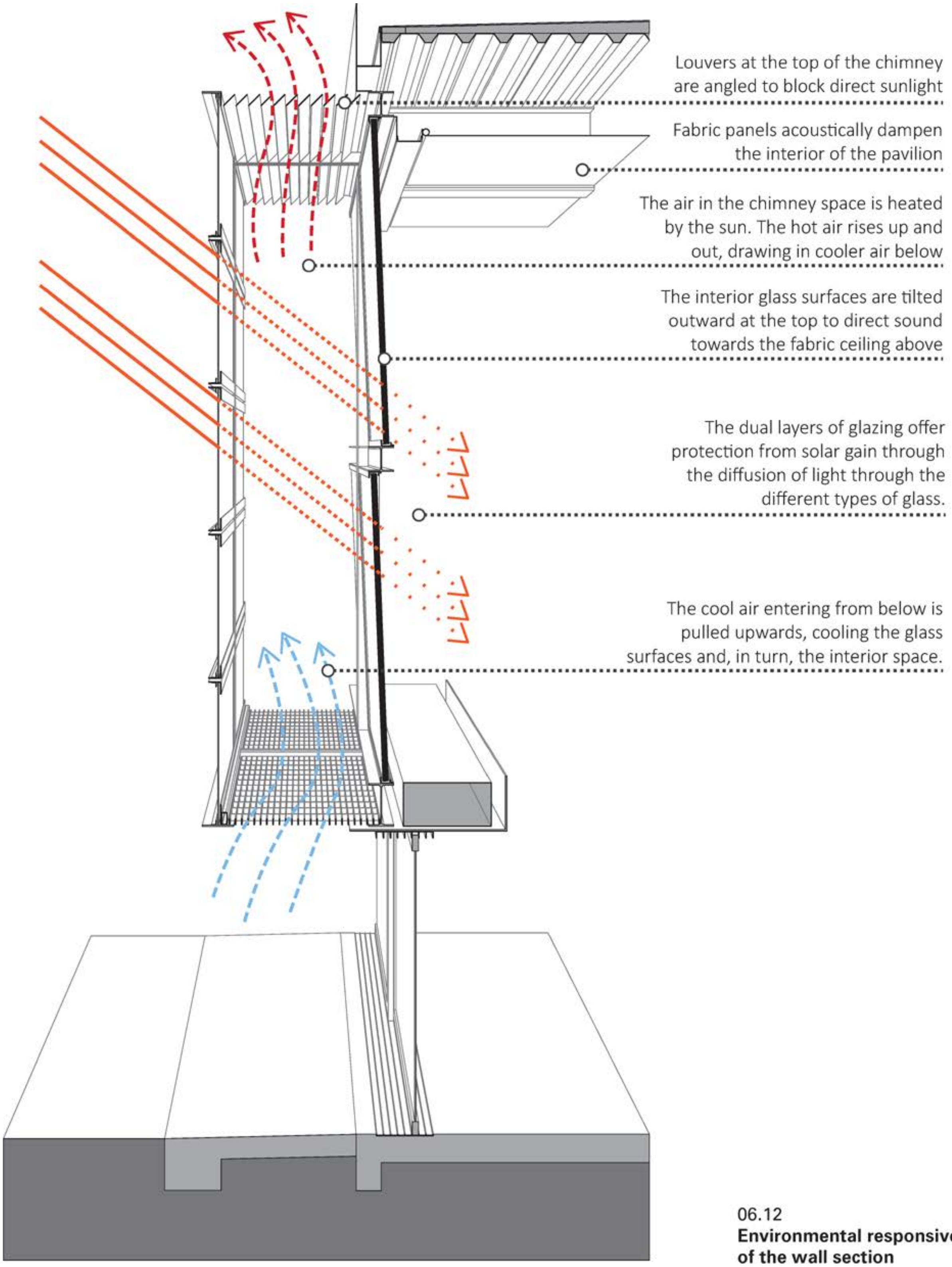
06.11
Floating corner above a concrete wall

designed to optimize the Pavilion's acoustics; they tilt outward, reflecting sound up towards the fabric panels that line the ceiling.

The second glass skin sits 1.5 meters [5 feet] out from the interior surface. The channel of space between the two skins "serves as a natural convection chimney, channeling hot air to louvers up top."[5] As the air in between the layers heats up during the day, it rises and draws in cooler air from below. The movement of air through this double skin dissipates the heat and cools the surfaces. The outer layer of glass is laminated for safety and is both fritted and translucent, providing more deterrent to heat gain. Schinkel stated that "every perfect construction in a specific material has its own very distinct character, and cannot be rationally carried out in the same way in another material,"[6] while Schopenhauer believed that "architecture is destined to reveal not only gravity and rigidity, but at the same time the nature of light, which is their very opposite."[7] The quality of the desert light experienced in the Pavilion is diffuse but ever-changing. The structure is a celebration of both glass and light and could not exist in any other construct besides this one.

Representation

Kant believed that architecture must aspire to achieve a purposiveness to elevate itself to a fine art. The Prayer Pavilion of Light seeks this higher purpose. Although the double skin of the building serves as a technical system to create a comfortable interior environment (both environmentally and spiritually), it also allows for the building to become an art-form, separate from its defined programmatic function. The building is a lantern, a beacon for the church. Situated high on the mountainside, it commands a presence for some distance over northern suburban Phoenix. DeBartolo Architects embedded in this dual skin a series of LED fixtures that allow the building to glow in a slowly shifting series of colors throughout the

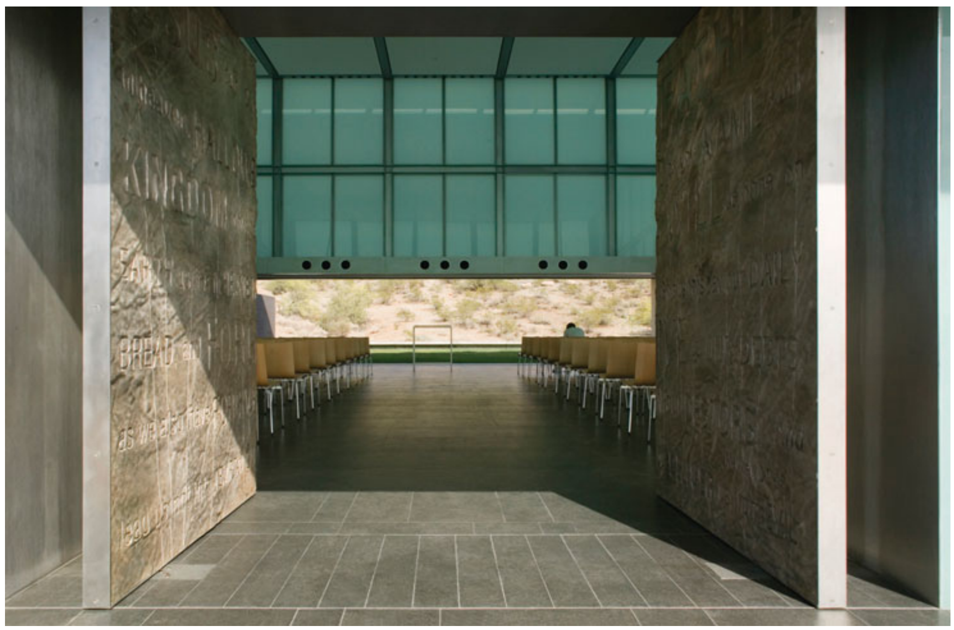


06.12
Environmental responsiveness of the wall section

06.13
Changing colors of the Prayer Pavilion

night (Figure 06.13). The building is a sculpture, a contemporary work of art created with the mediums of light and steel – the same mediums that define the space during the day. In this pavilion, purposiveness is explored through contemporary art and architecture.

A second piece of artwork in the building is the entry doors, which are heavily textured cast bronze (Figure 06.14). This addition of sculpture is particularly appropriate at the one point in the building where you *must* touch the structure. As you enter the building, not only do you see the Lord's Prayer which is inscribed into the door but you also bodily "meet the mass of the cathedral door."[8] Once again, the integration of art-form into architectural space has a profound effect not on the practicality of the building, but in the visitor's emotive reaction to and interaction with space.



06.14
Entry doors

Additional Resources

Projects

Storms Research Center, Phoenixville, Pennsylvania, United States, 2000 (40°7′14″N, 75°32′57″W)

Mariposa Residence, Phoenix, Arizona, United States, 2002 (33°30′30″N, 112°4′15″W)

Richmond Community Church, Glen Allen, Virginia, United States, 2003 (37°41′28″N, 77°36′25″W)

Scottsdale First Assembly Phase I, Scottsdale, Arizona, United States, 2006 (33°44′46″N, 111°53′35″W)

Power Parasol at Lot 59, Tempe, Arizona, United States, 2011 (33°25′40″N, 111°55′46″W)

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Galindo, Michelle. *Desert Architecture*. Germany: Braun, 2009.

McKnight, Jenna M. “Prayer Pavilion of Light, Phoenix, Arizona.” *Architectural Record* 198, no. 6 (2010): 169–73.

Notes

1 This firm brief was adapted from the firm profile on DeBartolo Architects’ website: http://debartolo-architects.com/#info/philosophy

2 For more information on these seven points, please see http://debartoloarchitects.com/#inspiration.

3 Jenna M. McKnight, “Prayer Pavilion of Light, Phoenix, Arizona,” *Architectural Record* 198, no. 6 (2010), 173.

4 Ibid.

5 McKnight, “Prayer Pavilion of Light, Phoenix, Arizona,” 173.

6 Karl Friedrich Schinkel, “Excerpts from Notes for a Textbook on Architecture (c. 1835),” in *Architectural Theory Review. Volume I: An Anthology from Vitruvius to 1870*, ed. Harry Francis Mallgrave (Malden, MA: Blackwell Publishing, 2011), 413. (Originally published as Goerd Peschken, ed., *Das Architeckonische Lehrbuch* (Berlin: Deutscher Kunstverlag, 1979, 149–50.)

7 Arthur Schopenhauer, *The World as Will and Representation*, Vol. I, trans. E. F. J. Payne, (New York: Dover Publications, Inc., 1969), 216.

8 Juhani Pallasmaa, *The Eyes of the Skin: Architecture and the Senses* (Hoboken: John Wiley & Sons Inc., 2007), 40.

07
GC Prostho Museum Research Center
Kengo Kuma & Associates

Chapter co-written with Aaron Neal

Architect Brief

After graduating from the University of Tokyo in 1979 with his architecture degree, Japanese architect Kengo Kuma moved to the United States to further his studies at Columbia University. In 1990, after returning to Tokyo, Kuma founded Kengo Kuma & Associates. The firm's work, which has progressively moved out from Japan to an international stage, has been honored with a number of major awards and prizes. Kuma has won several international awards as well for his overall contribution to the field of architecture. In addition to his practice, Kuma has been active in academia, having served as a professor at Columbia University, Keio University, and the University of Illinois at Urbana-Champaign. He currently teaches at the University of Tokyo.

Along with his professional practice, Kuma is an active writer; his most notable publication is *Anti-Object: The Dissolution and Disintegration of Architecture*. In his writings, as well as in his architectural work, Kuma conceives of architecture as a series of particles:

kasugai, aichi, japan
gps | 35°14'25"N, 136°58'11"E
program | research facility and museum
completed | 2010
area | 626.5 m2 [6,744 ft2]

07.1
Vicinity map

> I am interested in systems in which the possibility of an endless combination of small particles produces total freedom in the overall design – a similar concept to organic systems, in which small cells combine to form the whole.[1]

This theory of a "principle of particalization" is at least partially derived from his understanding of the Ise Shrine in Japan (34°27′18″N, 136°43′32″E)[2] and is widely deployed in his work. It can be seen in his use of repetitive elements in a wide range of materials that are carefully stitched together with precise joints.

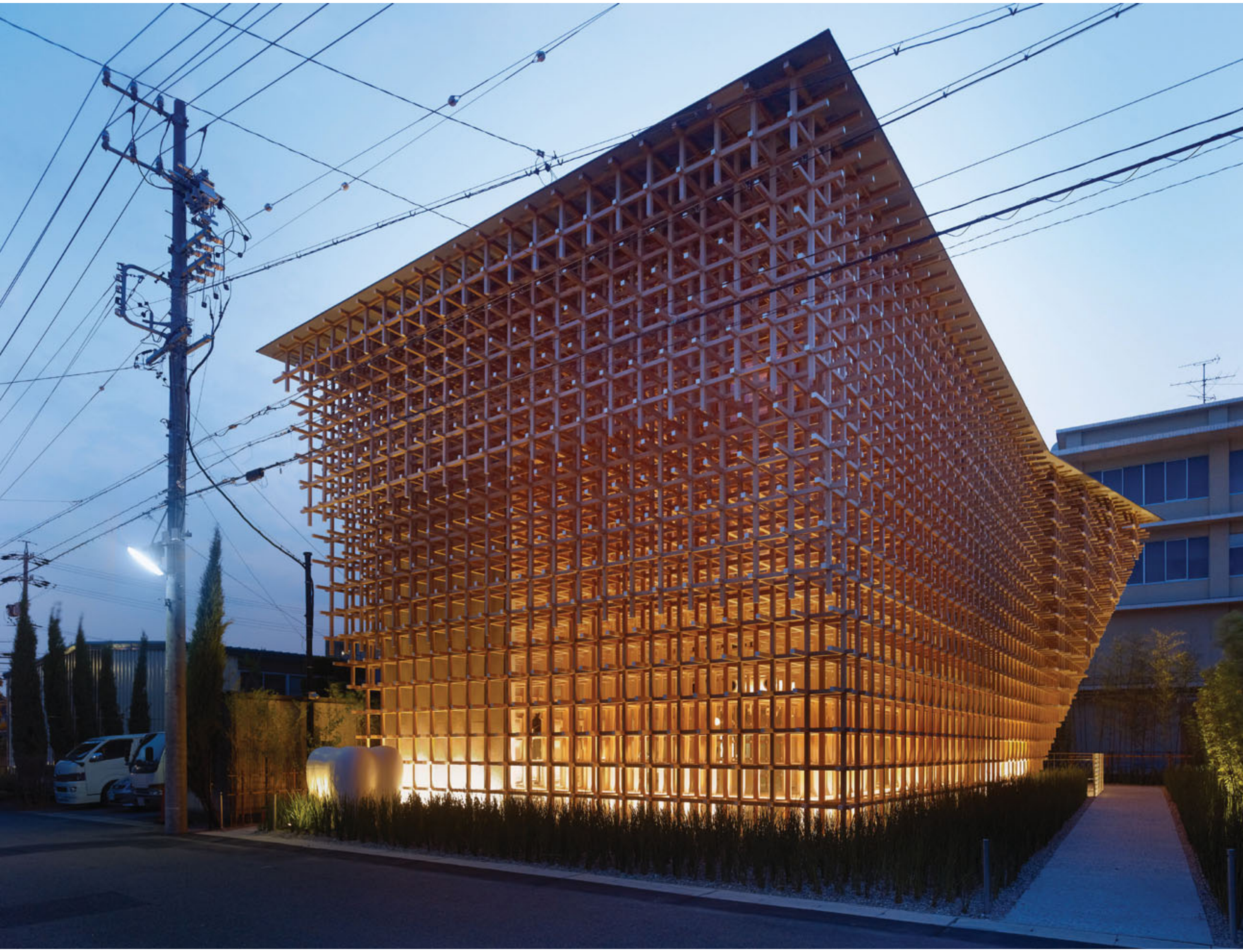
Materiality is also a common theme in Kuma's work. He believes that "materials only begin to show their true nature when you challenge them at the limits of their capabilities."[3] As such, the work of Kengo Kuma & Associates is an investigation into the latent potential housed within the materials of our built environment. The firm combines this exploration of materiality with thoughtful consideration of its relationship to the site and to the inhabitant.[4]

Project Brief

> The façade, wrapped in a cubic latticework of aromatic, tactile Japanese cypress and red-tinged zelkova, seems enigmatic, even impenetrable, when compared to the neighborhood's traditional two-story houses. Nevertheless, the delicate forms conjure up pleasantly familiar associations – from jungle gyms to the intricately carved wooden brackets found on Japanese Buddhist temples. Curiously inviting, the building has great refinement and grace.[5] (Figure 07.2)
>
> Azby Brown, "Something to Sink Your Teeth Into," 2011

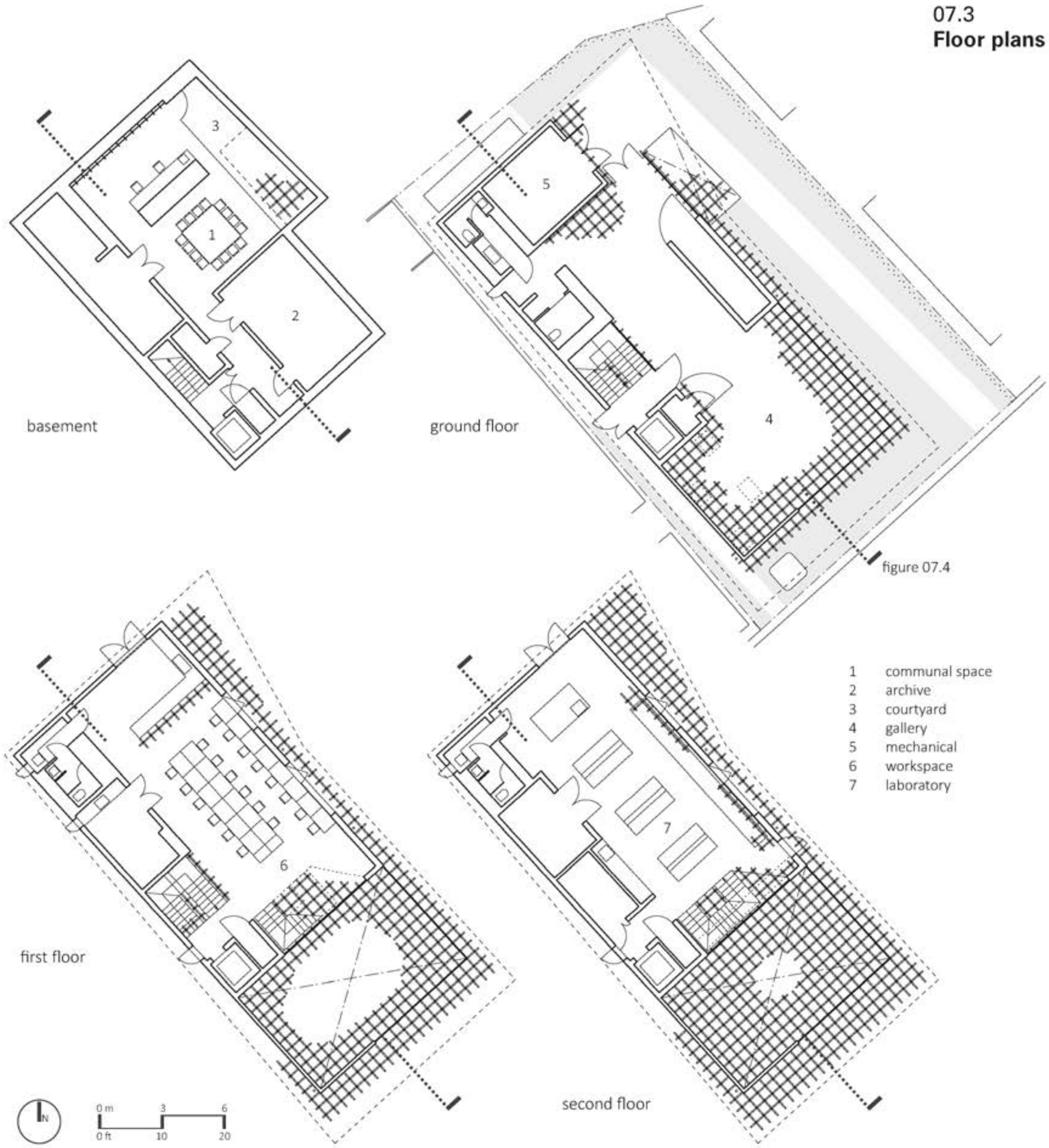
The GC Prostho Museum Research Center is a research space devoted to the development of dentures and other dental prostheses by GC, a prominent dental care company in Japan. This facility – a satellite branch of their main offices – serves as a laboratory and office for 40 employees but also contains an exhibition space commemorating the company's fiftieth anniversary. The building's core, a three-story concrete structure, houses offices and labs. The ground level of the building provides entry to the research facility through a main lobby, while the two upper floors contain the primary workspaces (Figure 07.3). In addition, a basement level serves as communal space for the employees (Figure 07.4). The museum – the public face of the GC facility – is located on the ground level (Figure 07.5). It is housed in a lightweight wood structure that wraps the concrete building on its northeast and southeast sides. This matrix of wood permeates into the concrete structure, creeping up stairs, into rooms, and down into the lower level by means of a light well.

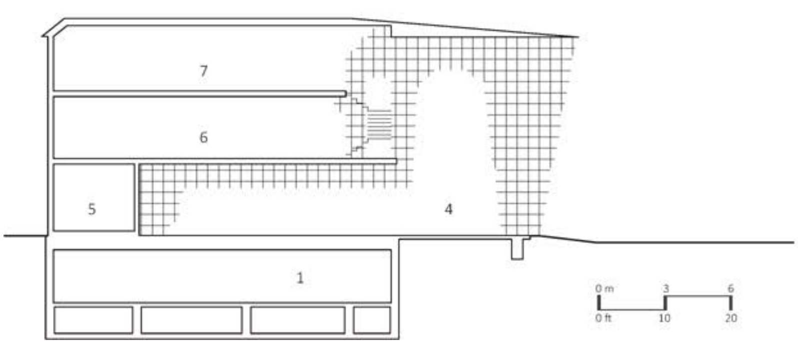
Scale is important to Kuma. He states that he prefers "a scale that is close to the human body's, that possesses the delicacy and strength of arms and legs."[6] In GC Prostho, each strand of wood used in the museum was kept as slender as possible. The delicacy of the wooden structure allows for the multistory gallery to feel lightweight and familiar to the user. This assembly of sticks reflects Kuma's theory of particulate design. The long, thin particles, repeated in three dimensions, create a gridded field and bring human scale to the forefront of our understanding of the space.



07.2
View of GC Prostho from the street

07.3
Floor plans





07.4
Building section

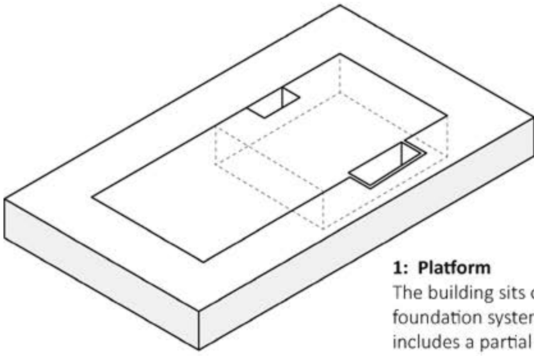
07.5
Interior of main gallery

Tectonic Principles

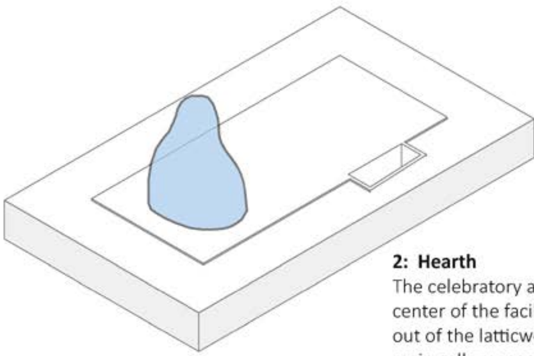
Anatomy

GC Prostho rests on a concrete platform foundation that anchors the project to the earth (Figure 07.6). On top of this base sit two distinctly different structures. The core of the building, a three-story concrete construction, is an extension of the foundation system. In contrast, the lightweight matrix of wood springs from a slab-on-grade at the front of the building, rising up to the roofline above. A common roof plane connects the two opposing constructions, composed of a simple structure finished with painted mineral board on the exposed lower surfaces and galvanized sheet metal on the upper ones. Hidden within the wooden framework, panes of glass are used to create a line of enclosure. The glass, which is seamlessly woven into the structure, is nearly invisible, disrupting the perception of a sealed space.

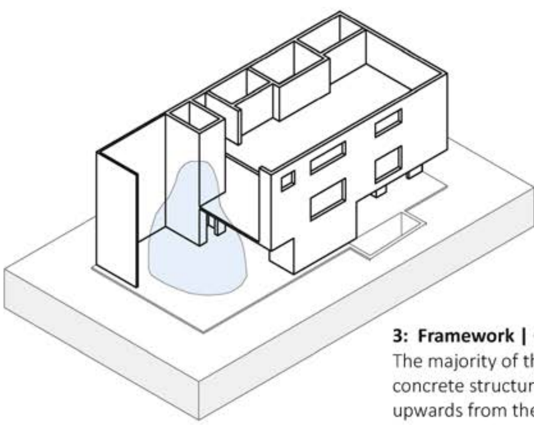
In most advanced research facilities, the focal space of the building would likely be the laboratory. In GC Prostho, however, the cultural and celebratory heart of the facility is the main gallery. In this space, which is dedicated to 50 years of success for the company, the three-story space creates an effect similar to the sanctuaries of many religious structures. Your eyes move upwards, through the lattice, to the light beyond (Figure 07.7). This gallery is the heart of the building and a clear expression of GC's vision for its business, employees, and clients.



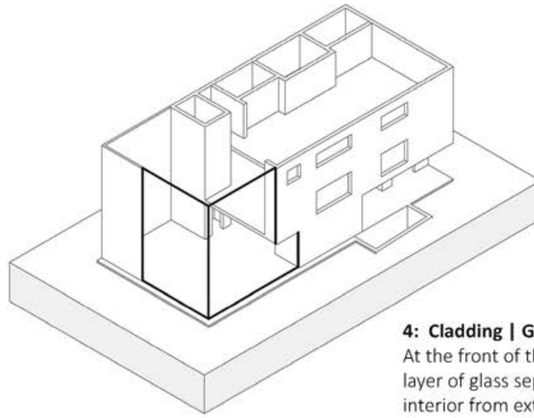
1: Platform
The building sits on a concrete foundation system that includes a partial basement.



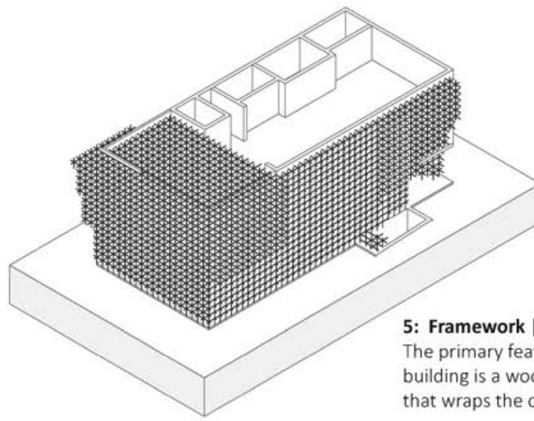
2: Hearth
The celebratory and cultural center of the facility is carved out of the latticwork of the main gallery space.



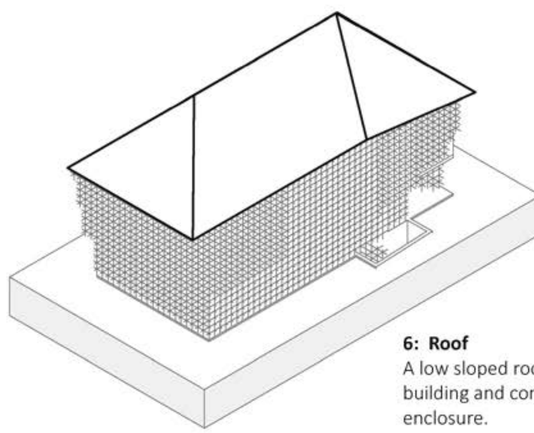
3: Framework | Concrete
The majority of the building is a concrete structure that extends upwards from the foundations below.



4: Cladding | Glass
At the front of the building, a layer of glass separates interior from exterior. This glass is set within the wooden framework.



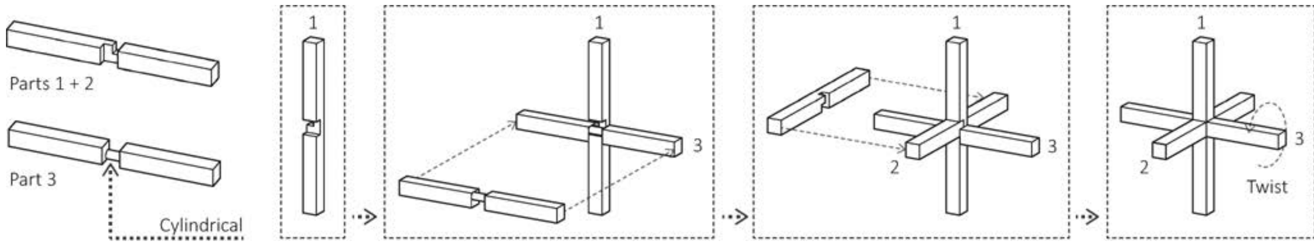
5: Framework | Wood
The primary feature of the building is a wooden lattice that wraps the concrete core.



6: Roof
A low sloped roof caps the building and completes the enclosure.

07.6
Anatomy

07.7
View upwards in main gallery



07.8
Assembly of a joint

Precedent* | *Detail

The wooden structure of the GC Prostho Museum was developed through the study of a children's toy called a *chidori* that originated centuries ago in the city of Hida-Takayama, Japan (36°9′30″N, 137°14′41″E). The toy is a three-dimensional puzzle composed of notched sticks of wood that join together without the use of adhesives or mechanical fasteners (Figure 07.8). This type of joinery is seen often in traditional Japanese woodworking at all scales, from small furniture and accessories to temples and other prominent structures. Central to these traditional tenets of building is the practice of handcrafting. In GC Prostho, Kuma explored a return to the practice of making by hand to help revive a tactile understanding of the practice of architecture lost in a building culture relying more and more heavily on machine-made materials and components. All of the wood components of GC Prostho, like the toy that preceded it, were fashioned by the hands of a master craftsman instead of by industrial equipment.

The *chidori* system used in the GC Prostho Museum required modifications to work at such a large scale. The cross section of the members had to be proportionally increased to ensure structural soundness. Structural testing was performed throughout the process, resulting in a final member cross section of 60 × 60 millimeters [2.4 × 2.4 inches]. The increase in scale also required an attention to precision not necessarily required in the fabrication of the toy. Each handmade piece had to be fashioned precisely to ensure that the structural quality of the joints would be satisfied.

Since working on the GC Prostho Museum, Kengo Kuma & Associates have developed a series of other works that utilize wood joinery systems of increasing complexity. These include a Starbucks Coffee at Dazaifutenmangu Omotesando (2011) in which a diagonal lattice of four members was used, the United Nations University Wisdom Tea House (2012) in which a diagonal lattice of three members was used, and Sunny Hills Japan (2013) which served as a building-scale adaptation of these diagonal lattice structures.[7] The firm has also developed a line of modular furniture that utilizes the *chidori* joining system.

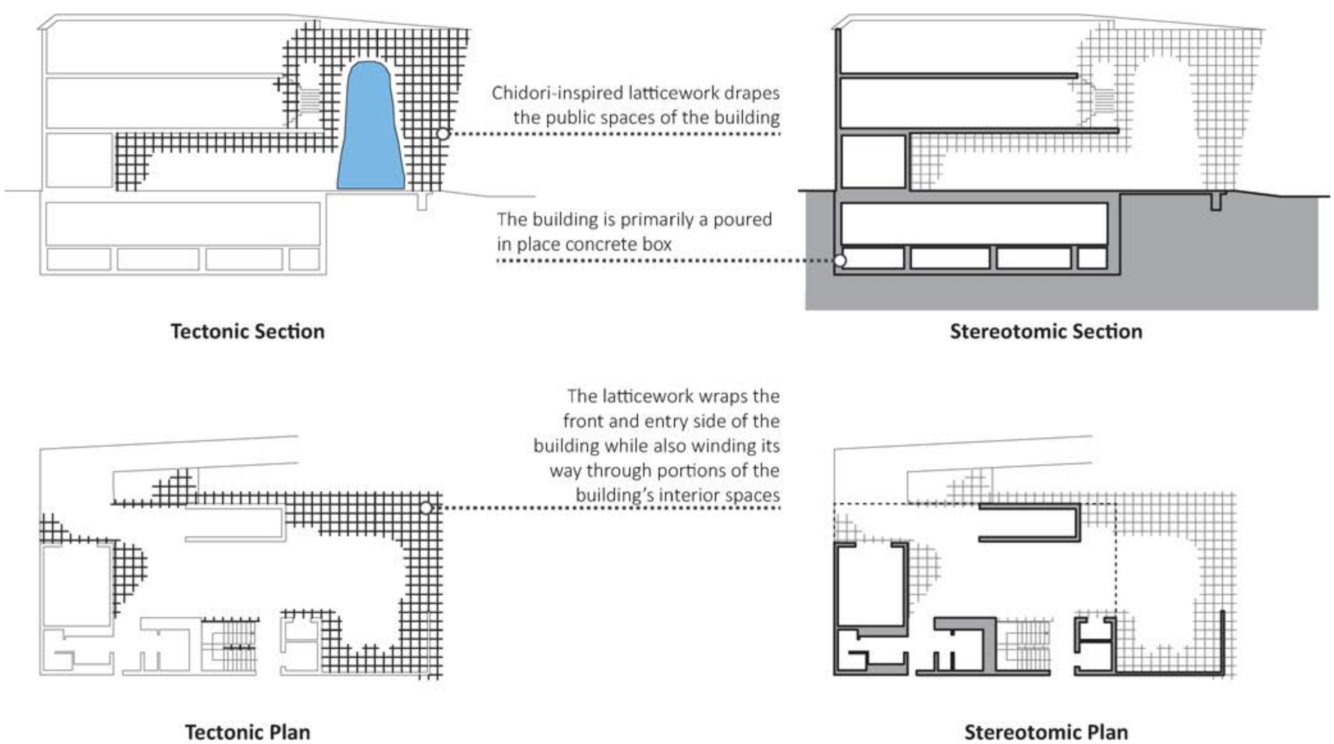
Tectonic

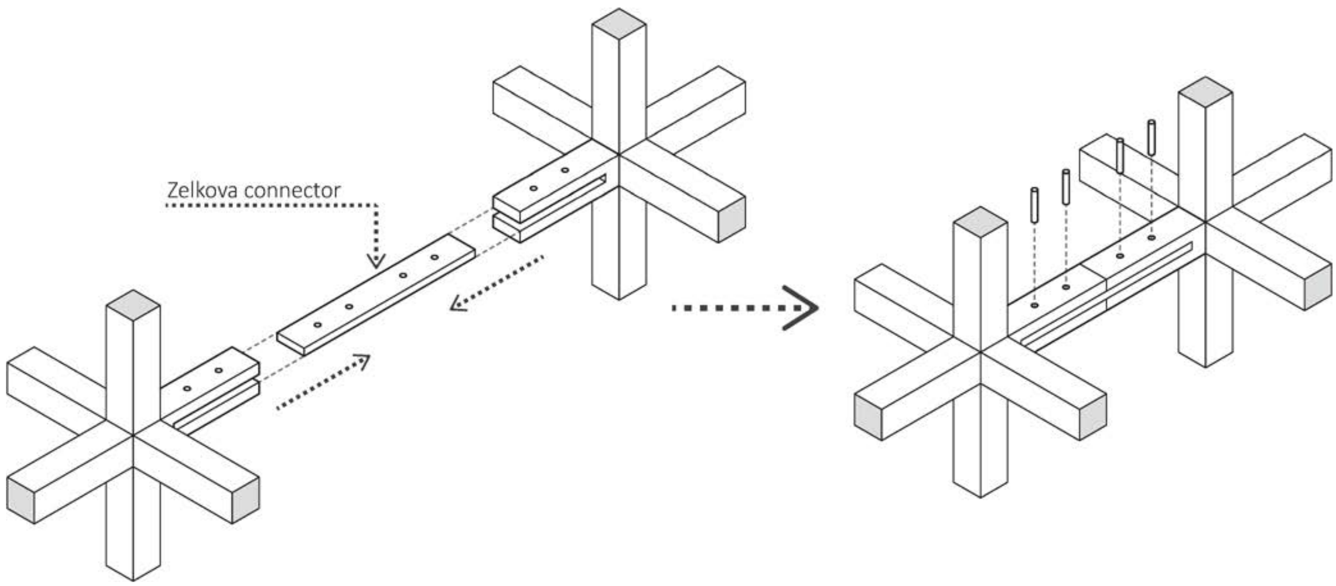
Six thousand sticks of cypress were used to create the tectonic wood matrix of the GC Prostho Museum. These components were woven together to create an enclosure 9 meters [29.5 feet] high (Figure 07.9). This matrix serves as structure, spatial catalyst, and host for the museum's exhibition of the history of dentures. The wooden rods are spaced 500 millimeters [19.7 inches] on center in each direction to create a uniform grid. Prior to full assembly, these elements were fabricated into 2,000 × 2,000 × 3,000 millimeter [6.5 × 6.5 × 9.8 foot] sections off site and then shipped to the site for final placement within the structure. Each section was formed through the interweaving and rotating of the wooden rods previously discussed. The sectional frames were then fastened together with thin wood connectors that slip into slots on the ends of the wooden rods (Figure 07.10). These fasteners, made of zelkova – a deciduous tree in the elm family native to eastern Asia – are 10 millimeters [about 3/8 inch] thick and are pinned to the frame with 10-millimeter [about 3/8-inch] hot-dipped galvanized steel pins.[8]

Cypress and zelkova were chosen for their ideal material qualities. Cypress, in particular, is fairly lightweight but strong, allowing the framework to be built both taller and out of slimmer members. This species also has the ability to withstand the frequent rainfall and high humidity of this region of Japan, making it ideally suited for this environment. Other wood choices would not have been as successful; and other materials, like steel, would be susceptible to rust.[9]

Steel, however, was necessary to strengthen the frame at one location: the museum's stair. Due to seismic requirements, Kuma was forced to increase the load-bearing potential of this area of the framework in order to properly support the stair. He elected to do so through the creation of a system of steel members that match the proportion and scale of the wood structure exactly.

07.9
Tectonic | Stereotomic



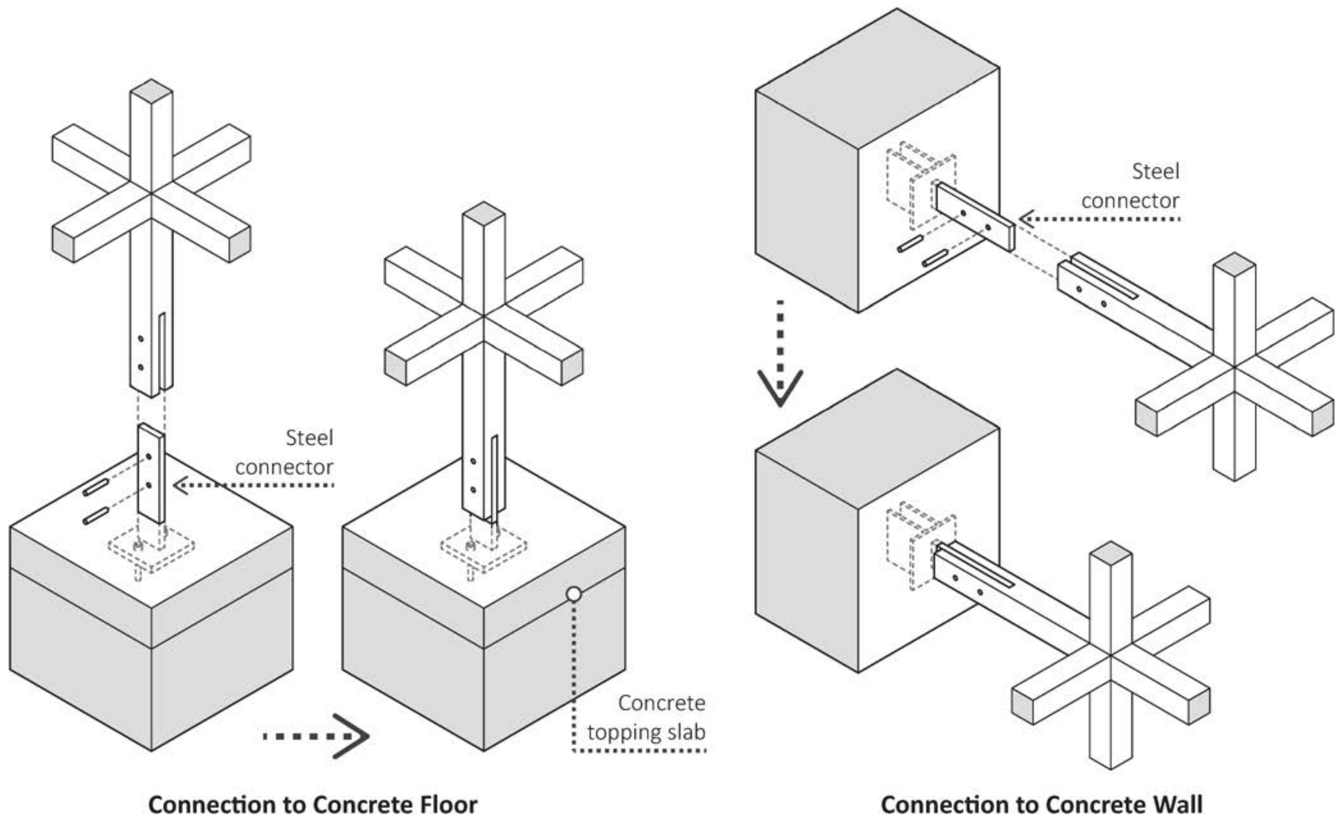


07.10
Assembly of the framework

Stereotomic

A concrete core is hidden behind the tectonic façade of Kuma's building. The exterior walls of the structure are poured-in-place concrete, clad with cement excelsior (wood wool) board – a composite cement board product using wood fibers and cement – with a polished finish. The floors are also poured-in-place concrete with a similar polished finish. Most of the building's program is housed within this heavy concrete structure but little of it is revealed on the exterior, especially along the building's public front. The distinct separation of building construction technologies coincides with the separation of public and private spaces within the facility. The tectonic frame is airy and welcoming, serving as an introduction to the company for visitors, while the stereotomic structure is closed off, concealing, and protective of the advanced scientific work underway in the labs.

There is also a distinct difference in the permanence of the two systems employed in the GC Prostho Museum. Concrete is a permanent material; after forming, it is unable to be modified or disassembled without complete destruction. The wood framework, conversely, is able to be disassembled without damaging the materials. It is rare to find architecture that can be undone so freely; unlike concrete or even steel, the *chidori* system is vastly easier to manipulate because, "after all, [it is] based on something that children can put together and take apart."[10]



07.11
Detail at the intersection of concrete and wood constructions

Intersection

The primary intersection in the GC Prostho Museum is between the tectonic frame and the stereotomic base. The wood framework does not actually touch the concrete floor on which it sits. Instead, T-shaped steel components, which are anchored to the concrete slab, receive the wood rods; the joints are fastened in an identical manner to those utilizing zelkova components (Figure 07.11). This process of assembly heightens the delicacy with which the frame touches the ground, insinuating that it floats above the surface. A similar system is used to attach the lattice to the concrete walls, but here the steel fasteners are concealed, allowing the intersection joints to become invisible.

The relationship between tectonic and stereotomic also involves a spatial intersection of the two systems. Although the lattice is the dominant feature of the public spaces of the building, it also creeps into other areas of the building. This sense of *growth* springs from the particulate nature of the construction and gives the impression of a symbiotic or parasitic entity (in only the best way possible) growing on the core beneath. The ever-expanding structure weaves through the building, creating moments of dialogue with the structure and the visitors (Figure 07.12).

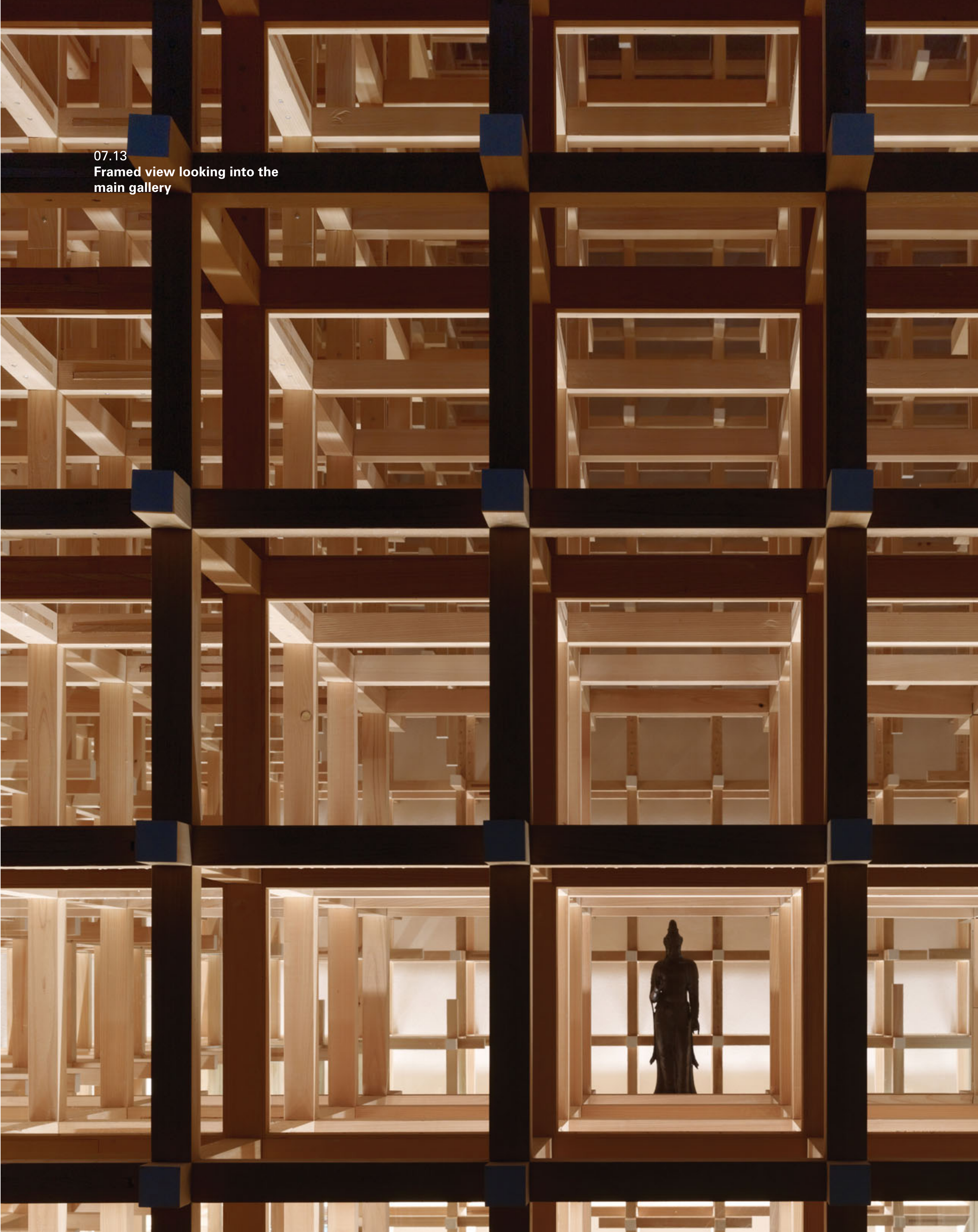
Space

Despite its process of assembly, the spatial quality of the exhibition gallery in the GC Prostho Museum is reminiscent of a carved space. The even rhythm of the gridded structure is

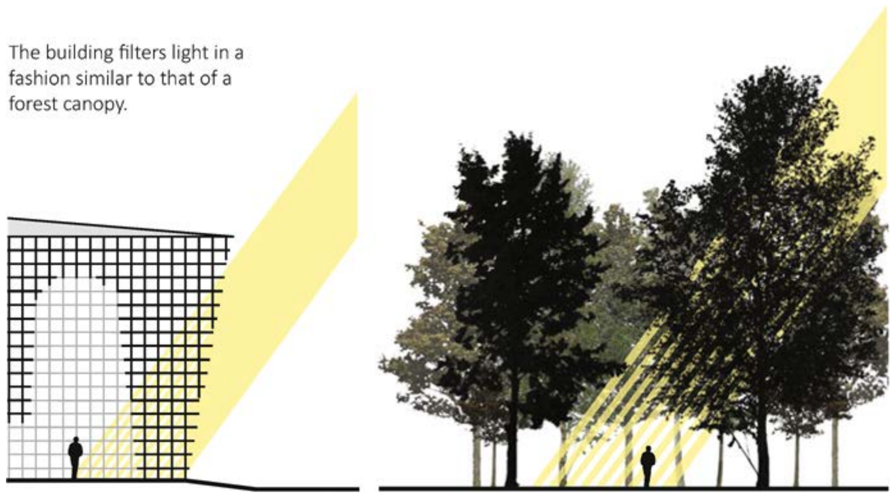
07.12
Weaving of lattice and structure: stair, entry, light well

juxtaposed by the very irregular volume of space it forms: an eroded cavity in the overall structure. This quality is enhanced by the gridded wall growing "thicker as it extends upwards, lending a cave-like ambience to the space."[11] The visible end of every wooden rod is painted white, reminiscent of a hatch pattern indicating a cut element in a drawing set. This treatment highlights the fictional process of the carving alluded to within this inner space; what remains is the structure necessary to define the volume and, with respect to Bötticher's theories of spatial tectonics, what is necessary to support the roof above.

The spatial qualities are compounded by the integration of light and shadow from the east-facing glazing. Sunlight filters through the lattice, creating an ever-changing pattern of shadows. As one critic put it: "Sharply defined shadows, mesmerizing in their complexity, shift across the concrete floor. As you gaze upward, into the lattice vault, your eyes easily get lost among the plethora of patterns that present themselves from different angles."[12] These complex light patterns can also be likened to those created by the forest canopy (Figure



07.13
Framed view looking into the main gallery



07.14
Shadow study

07.14). Kuma himself refers to the structure as “a forest of deciduous trees, where you can enjoy sunshine filtering through.”[13] This filtering of light only adds to the spiritual nature of the space, with the quality of the light constantly changing throughout the day.

Additional Resources

Projects

Chockkura Plaza, Takanezawa, Shioya, Tochigi, Japan, 2006 (36°37′50″N, 139°59′49″E)
Yusuhara Town Hall, Yusuhara, Takaoka, Kochi, Japan, 2006 (33°23′32″N, 132°55′37″E)
Yusuhara Wooden Bridge Museum, Yusuhara, Takaoka, Kochi, Japan, 2010 (33°23′14″N, 132°56′38″E)
Museum of Wisdom, Chengdu, China, 2011 (30°23′49″N, 103°48′03″E)
Tienda Sunny Hills, Sunny Hills, Japan, 2013 (35°39′56.5″N, 139°42′58.5″E)

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Liotta, Salvator-John A., and Matteo Belfiore, eds. *Patterns and Layering: Japanese Spatial Culture, Nature and Architecture*. Berlin: Gestalten, 2012.

Notes

1 Kenneth Frampton, *Kengo Kuma: Complete Works* (London: Thames & Hudson, 2012), 185.

2 Ibid., 13.

3 Kengo Kuma, "Introduction," in *Material Immaterial: The New Work of Kengo Kuma*, by Botond Bognar (New York: Princeton Architectural Press, 2009), 10–11.

4 For more information on Kuma's ideas regarding this relationship, please see Kengo Kuma, "Preface," in *Kengo Kuma: Complete Works*, by Kenneth Frampton (London: Thames & Hudson, 2012), 9.

5 Azby Brown, "Something to Sink Your Teeth Into," *Interior Design* 82, no. 1 (2011), 59.

6 Kuma as cited in Brown, "Something to Sink Your Teeth Into," 60.

7 For more information on these other structures, please see Kengo Kuma, "Interlocking Wood Joinery: From Small Buildings to Large," *JA: Japan Architect*, no. 89 (Spring 2013), 24–25.

8 This information was ascertained through drawings provided by the architect.

9 Frampton, *Kengo Kuma: Complete Works*, 185.

10 Kengo Kuma, "GC Prostho Research Center, Aichi, Japan, 2010," *JA: Japan Architect*, no. 83 (Autumn 2011), 49.

11 Frampton, *Kengo Kuma: Complete Works*, 192.

12 Brown, "Something to Sink Your Teeth Into," 60.

13 Kuma as cited in Cathelijne Nuijsink, "Forest Fantasy," *Frame*, no. 78 (January/February 2011), 156.

08
Parrish Art Museum
Herzog & de Meuron

Firm Brief

Swiss architects Jacques Herzog and Pierre de Meuron studied together at the Federal Institute of Technology Zurich (ETH Zurich) – a school noted in the context of this study for having had Gottfried Semper as its founding dean. Their mutual architectural interests inspired them to establish Herzog & de Meuron in 1978 in Basel, Switzerland. Over the past decades, the firm has developed from the small office it once was into an international powerhouse.

Despite a wide range of project types, Herzog & de Meuron have found their greatest success in public projects, including many notable museums. Regardless of location, scope, or size, however, the firm's work is shaped by a fundamental spirit of collaboration. No single voice is responsible for any project. Instead, collaboration leads to a broad variety of perspectives on each and every design problem, strengthening the quality of the resulting

water mill, new york, united states
gps | 40°54'16"N, 72°21'56"W
program | art museum
completed | 2012
area | 3,195 m2 [34,400 ft2]

08.1
Vicinity map

architecture. This philosophy has helped the firm garner global acclaim, winning such honors as the Pritzker Architecture Prize in 2001 and the RIBA Gold Medal and the Praemium Imperiale in 2007.

Herzog & de Meuron seeks to "create forms that make the material speak"[1] and to push the boundaries of conventional material use. In addition, their work has been compared to the tectonic framework developed by Semper. Semper's theory of dressing is evident in the firm's exploration of woven surfaces and the relationship between cladding and frame. The similarities extend to the understanding of ornament's role in the creation of space: "By resituating ornament in its rightful place on the border, they are able to bring the complex relation between surface and space to the fore."[2]

Project Brief

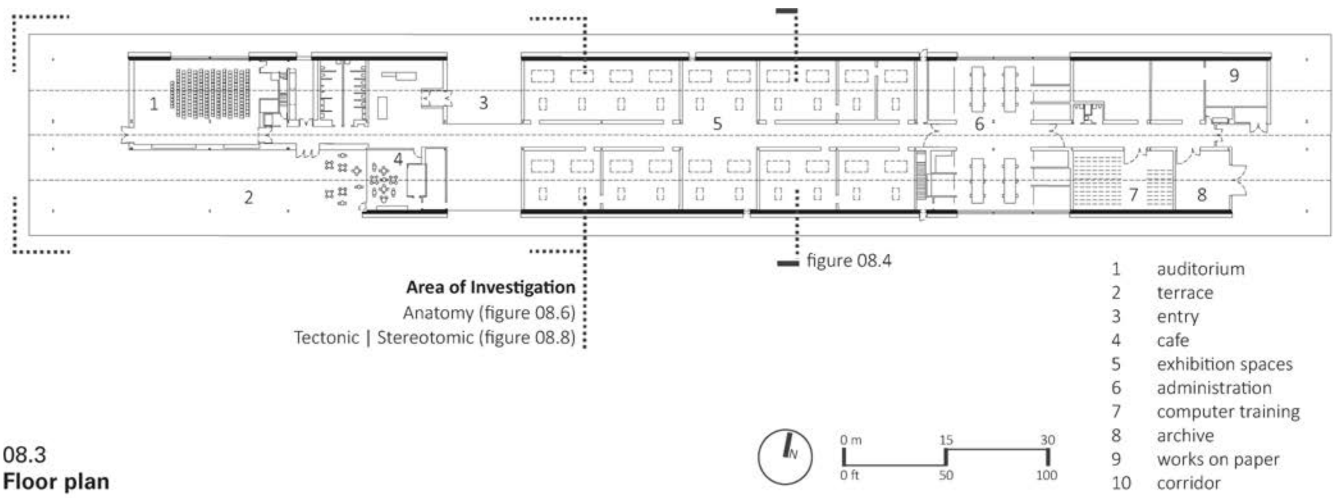
> Standing in front of the building, you immediately grasp the phenomenological intention. The long roof reflects and merges with the bright and luminous sky, the cast concrete sidewalls are rooted and terrestrial. Architecture is seen as a meeting point between sky and earth; a sort of horizon in its own right, or at least an expressive interpretation of this notion.[3] (Figure 08.2)

The Parrish Art Museum was founded in 1898 by Samuel Longstreth Parrish to house his personal collection of artwork, much of which was created by artists who lived and worked in this area of New York. In recent years, however, the collection outgrew its home, an Italianate building located in nearby Southampton. This historic structure was too small to house the growing collection and outdated in its approach to museum design. The original intent was to upgrade the existing building, but issues during the review process forced a shift to new construction on a 5.7-hectare [14-acre] property adjacent to a busy local highway.

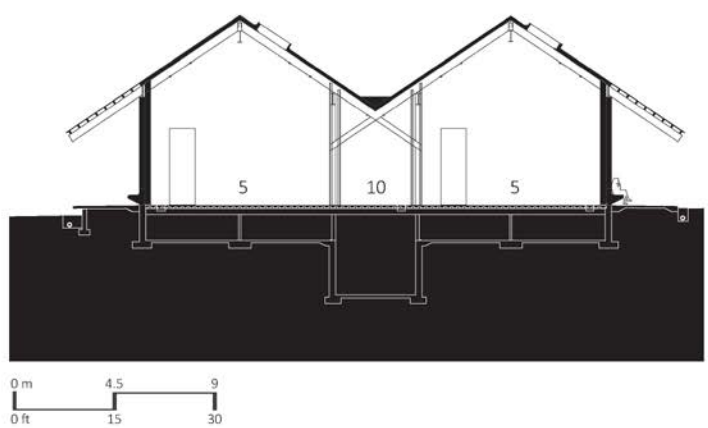
After an economic recession forced a significant reduction in the budget, the original design of the museum – a cluster of pavilions – was abandoned in favor of a single, double-gabled form resembling a pair of conjoined barns. The long, narrow building – approximately 29 × 187.5 meters [95 × 615 feet] – nearly tripled the museum's display space (Figure 08.3). In the center of the building, five galleries sit under each roofline, separated by a corridor space running the length of the museum (Figure 08.4). At the east end of the building sit the administrative spaces along with storage, workshops, and loading docks. The west end of the building houses the public functions: the entry lobby, a café, an auditorium, and a gift shop.

The Parrish is a deceptively simple project that appears to be somewhat of a departure from Herzog & de Meuron's other lauded work. However, the project is, in many ways, "representative of how to produce architecture in a new economic reality."[4] This simple extrusion is thoughtfully crafted both physically and in its approach to museum design. While it "is an extremely skilled and artful essay on the tectonics of timber-and-concrete construction," it also is practical in how it draws visitors to and through its exhibit spaces[5] (Figure 08.5).

08.2
Parrish Art Museum at dusk



08.3
Floor plan



08.4
Building section

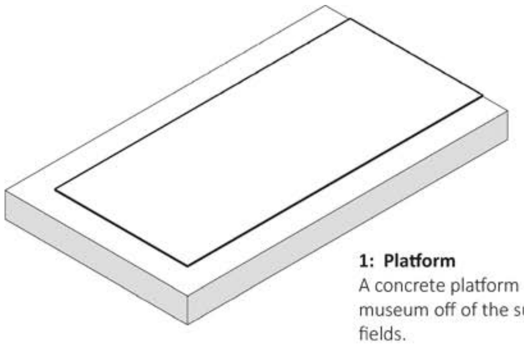
08.5
Typical gallery space

Tectonic Principles

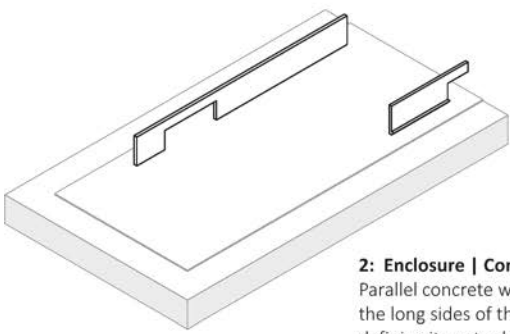
Anatomy

The Parrish Art Museum floats above the surrounding fields on a concrete platform (Figure 08.6). Rising from this platform are a pair of concrete walls that flank the elongated space of the building. These walls are paired with a steel structure of columns and beams that form a grid and establish a rhythm of organization for the building. The framework channels the load of the expansive wooden roof above to the ground. At the building's ends, wood-clad walls enclose the space while lightweight, demountable partitions infill and subdivide the interior as a backdrop for the artwork.

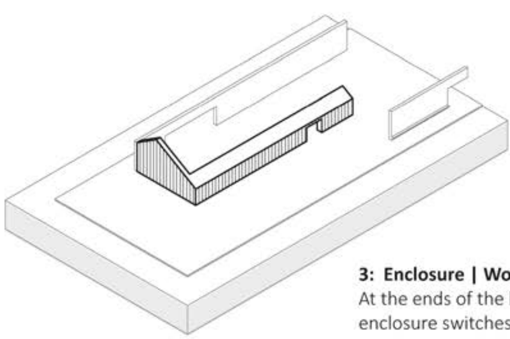
While the Parrish has clear links to Semper's four elements, it also conceptually ties to Laugier's earlier classification system. "Let us never lose sight of our little rustic hut. I can



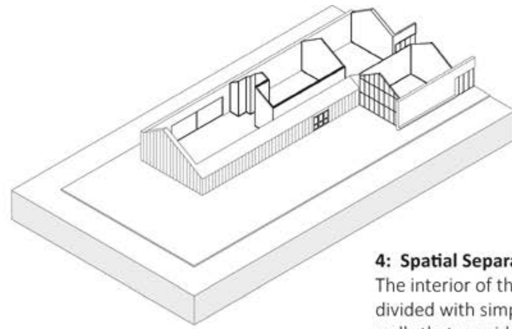
1: Platform
A concrete platform raises the museum off of the surrounding fields.



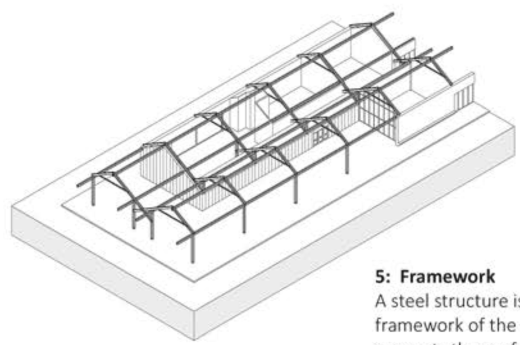
2: Enclosure | Concrete
Parallel concrete walls flank the long sides of the museum, defining its outer boundaries.



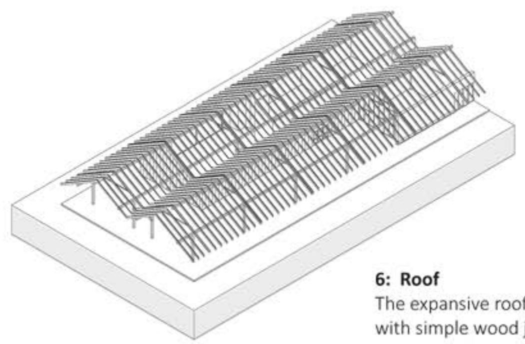
3: Enclosure | Wood
At the ends of the building, the enclosure switches to wood, which is treated through dyeing its exterior surface.



4: Spatial Separation
The interior of the museum is divided with simple white clad walls that provide the backdrop for the artwork. Glass infills the openings in the enclosure.

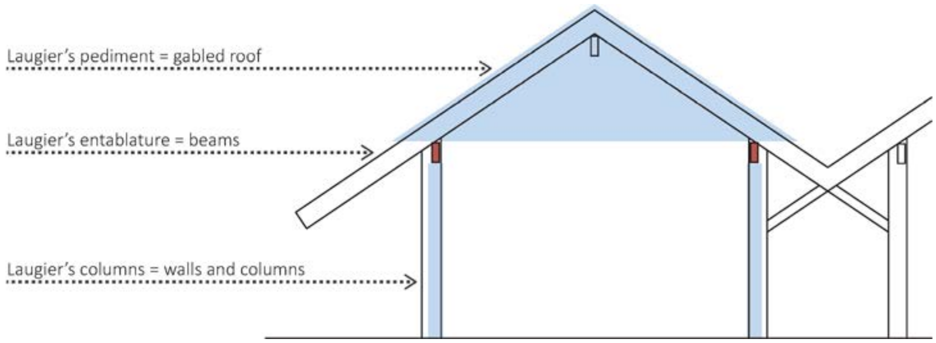


5: Framework
A steel structure is the framework of the museum. It supports the roof and defines its distinctive profile.



6: Roof
The expansive roof is framed with simple wood joists topped with metal roofing.

08.6
Anatomy



08.7
Comparison to Laugier's anatomy

only see columns, a ceiling or entablature and a pointed roof forming at both ends what is called a pediment"[6] (Figure 08.7). The simplicity of the structure of the Parrish emulates Laugier's system, especially in section where the pointed roof and simple column/wall structure is clear. The dominant horizontal beams that carry the roof serve as the entablature, evident as they leave the building and reach out towards the horizon.

Stereotomic

The hovering concrete plinth serves as the stereotomic base of the Parrish Art Museum (Figure 08.8). The shadow line created by the recessed condition at the edge of the slab creates the sense that the building has uprooted itself from its earthly constraints – an atectonic experience – and is floating on the sea of surrounding field grasses.

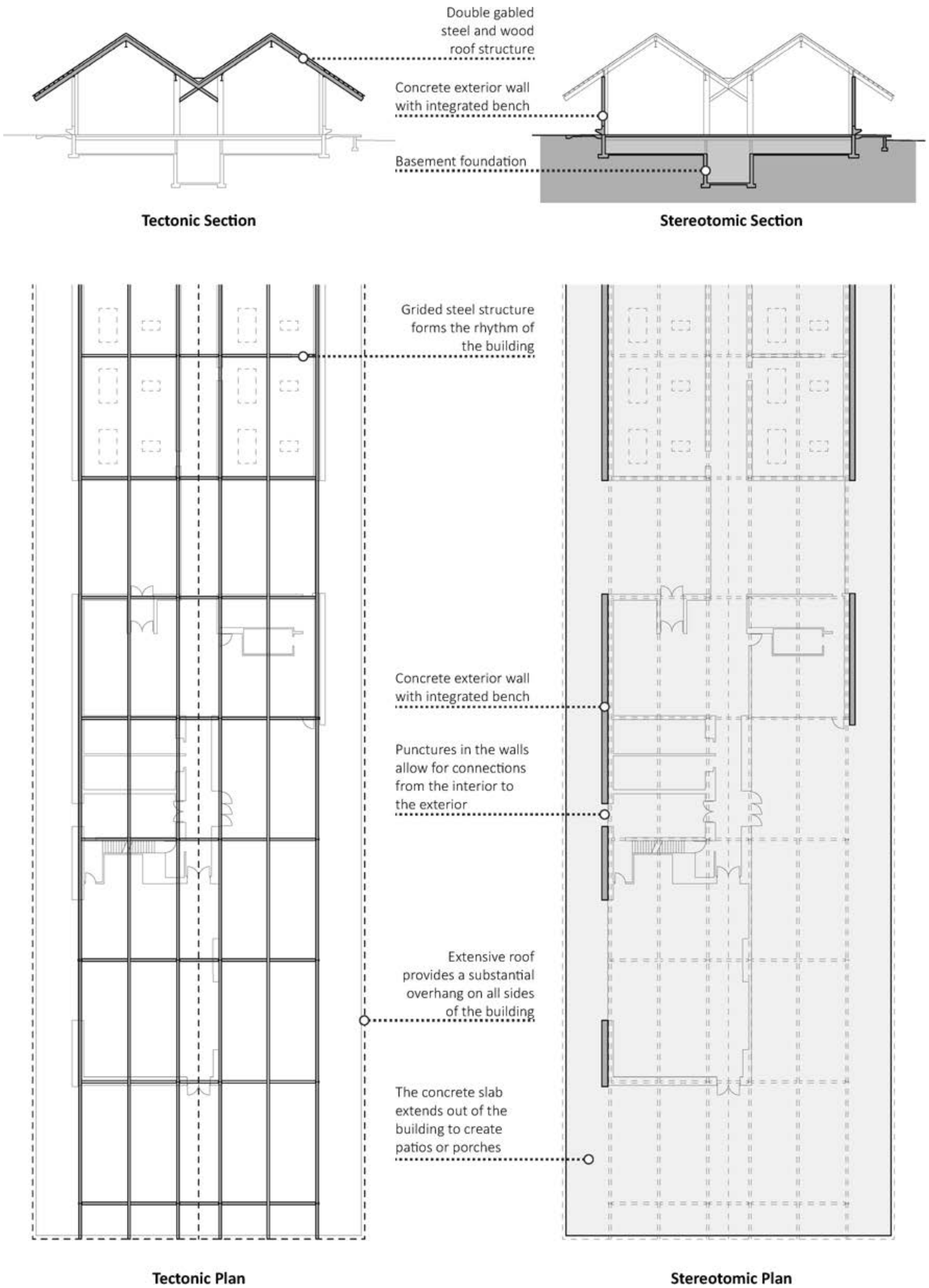
Rising from the base, the concrete walls – lightly textured by their cribbing or formwork – serve as a backdrop for patrons of the museum who have found respite on the walls' integrated benches (Figure 08.9). Throughout the day, the walls receive the ever-changing play of light and shadow from the overhanging roof structure. They are also punctured at key moments. The breaks allow the exterior environment to encroach on the pristine gallery spaces within, while also allowing glimpses into the protected interior environment from the surrounding porch space.

Tectonic

The dominant feature of the Parrish Art Museum is the twin pitched roof, supported by the building's tectonic steel skeleton. Corrugated metal roofing finishes a relatively straightforward wooden roof structure, comprised of plywood and rafters that are exposed throughout much of the building's interior. The roof extends past the exterior walls of the buildings on all sides. On the north and south (the long sides of the building) this takes the form of an extended eave, sheltering the seating spaces below. On the east and west ends of the building, the extended roof creates substantial exterior porch spaces (Figure 08.10).

Precedent

Many precedents influenced the development of the Parrish Art Museum. First, and probably most obviously, is the relationship of the building to the area's vernacular construction typologies. The form of the double barn and the simple material palate of exposed wood,



08.8
Tectonic | Stereotomic

08.9
View into the museum from the porch space

08.10
Double gable profile

concrete, and corrugated sheet steel are reflective of the agricultural past (and, to a lesser extent, present) of the surrounding landscape. In addition, the "long, low building of the Parrish Art Museum references the repurposed storage units from the Second World War that were embraced by the [area's] artistic community."[7]

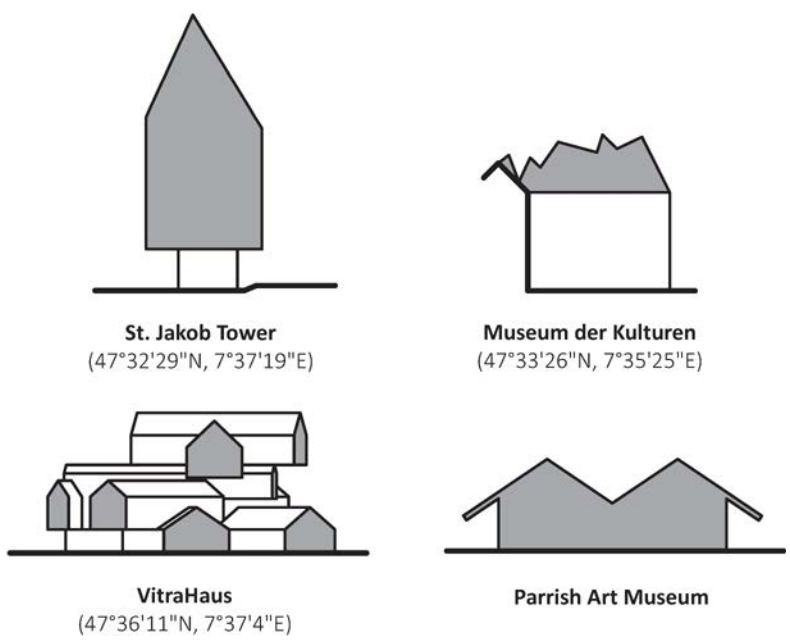
Local artists were also inspirational in other ways. The original design for the project called for a series of small buildings modeled after the studios of the preeminent artists of the area. Although that strategy was not ultimately pursued, the proportions of those studio spaces, along with many other artists' workspaces on the neighboring East End of Long Island, New York, were studied and used to create the spatial proportions of the gallery spaces in the Parrish.[8]

Herzog & de Meuron also looked to their own work for inspiration, as they often do while developing ideas for a project. The Parrish Art Museum, as seen prominently in the pitched roof, "is a reinterpretation of a very genuine Herzog & de Meuron typology, the traditional house form. What we like about this typology," states Herzog, "is that it is open for many different functions, places and cultures. Each time this simple, almost banal form has become something very specific, precise and also fresh"[9] (Figure 08.11). This iconic form, born out of structural and environmental logic, is examined in this museum for its symbolic and cultural potential.

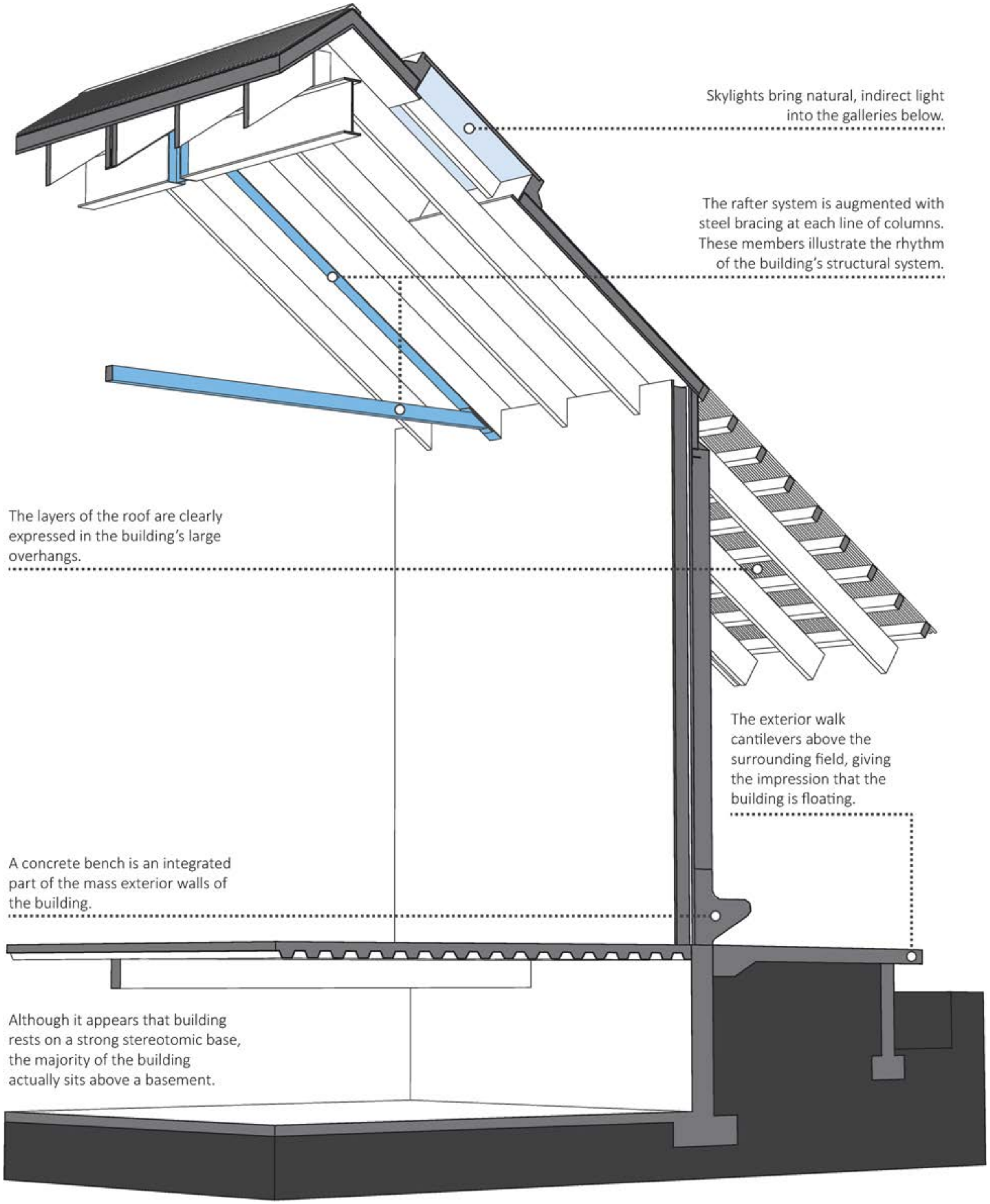
Place

With the constrained budget, the Parrish Art Museum had to be designed economically. Herzog & de Meuron utilized local materials whenever possible and even local techniques such as the dyeing of the exterior red cedar siding. The building is a shining example of simple, local materials being used in extraordinary ways through precision in detailing and finishing.

In addition to materiality, light ties this building to its place, primarily through its role in the development of the gallery spaces. Although there are moments where visitors have framed



08.11
Comparison of the iconic house form in Herzog & de Meuron's projects



08.12
Sectional perspective through gallery and porch

views of the landscape through carefully placed openings in the exterior walls, the primary source of natural light for the galleries are large skylights. Most of these openings face north to capture the best-quality sunlight for the artwork. This orientation helped to set the overall orientation of the building. What is distinctly different in the Parrish though is that unlike many contemporary museums where only filtered natural light is allowed inside, in this museum, unfiltered, indirect light is allowed to enter the galleries and interact with the artwork (Figure 08.12). The use of clear, north-facing skylights and windows allows the museum visitor to feel a direct relationship to the surrounding environment.[10] This approach is reflective of that found in the loft workspaces of the local artists discussed earlier in "Precedent." For particularly sensitive exhibits, the architects designed scrims on wooden frames that can be manually inserted into the skylights for protection against the harmful effects of sunlight.

The use of local light ties directly to Frampton's notions of regional tectonics. He states, in reference to contemporary museum practices, that the

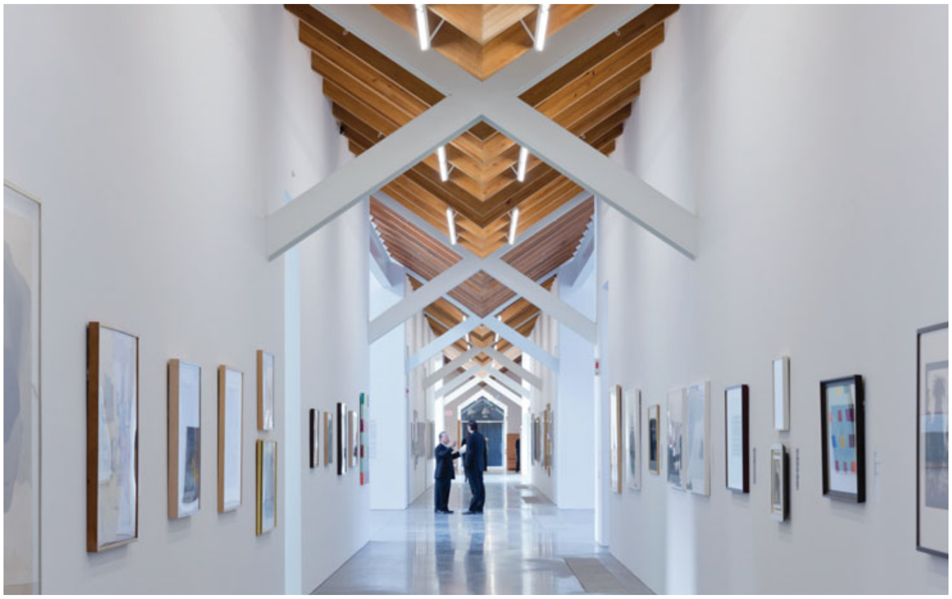
> converse of . . . "placeless" practice would be to provide that art galleries be top-lit through carefully contrived monitors so that, while the injurious effects of direct sunlight are avoided, the ambient light of the exhibition volume changes under the impact of time, season, humidity, etc.[11]

This concept is embraced in the Parrish, where the qualities of light utilized in the creation of art are also deployed for the viewing of that same art. Here, light connects making with viewing, artist with patron.

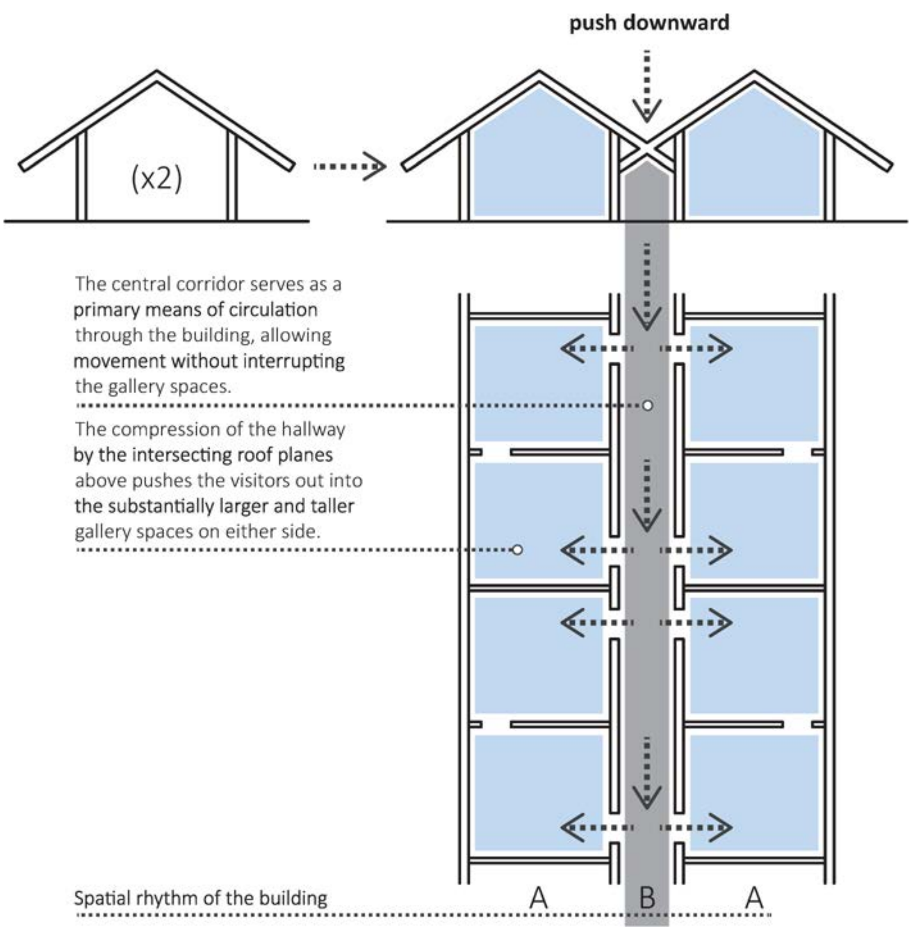
Space

In *The Principles of the Hellenic and Germanic Ways of Building*, Karl Bötticher outlines his theory of spatial tectonics. The primary element of Bötticher's theory is the roof, which is also the dominant component in the development of the space of the Parrish Art Museum. The two pitched roofs define two sets of galleries that run along the north and south sides of the building. The intersection of the roofs in the middle of the building, however, creates a low internal corridor that provides the primary circulation spine through the building (Figures 08.13 and 08.14). This A-B-A organization is driven by the roof construction and structural scheme and allows the museum to be highly functional with respect to visitor movement through the space.[12] As mentioned earlier, the roof also reaches out past the exterior walls of the building, claiming space around its perimeter as walks and porches.

The roof strategy also creates interesting scale relationships in the building. The central hall is low and perceptively pushes downward, urging guests out into the vaulted, almost monumental gallery spaces to either side. The galleries are also subject to an abstract interpretation of Semper's wall-hung carpets. In this project, the concrete of the exterior (the protective surround) is not expressed on the interior. Instead, the interior is clad in a traditional wash of *gallery* white, the museum's neutral backdrop on which the artwork becomes the textile. As in Semper's theory (see page lviii), the creation of spatial character in the museum (white walls) is divorced from the development of enclosure and protection (concrete and wood).



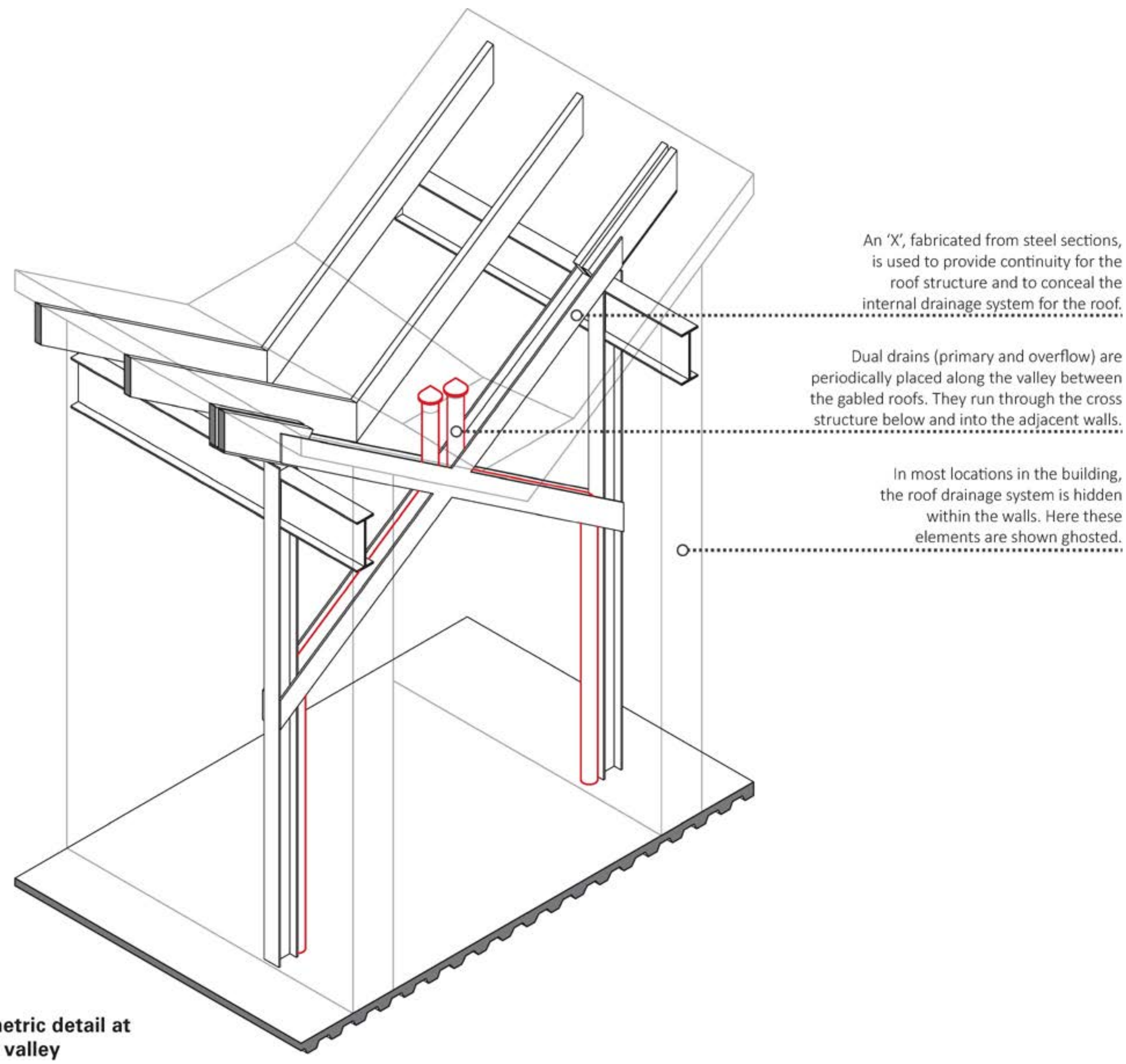
08.13
Central corridor



08.14
Spatial organization

Detail

Similar to Thorncrown Chapel (see Project 03), the Parrish Art Museum has a significant motific detail, driven by the gabled form of the intersecting roof planes. It defines the central spine of the building where the structural members overlap and reads "as an inverted roof, which compresses the space inside the building."[13] Critic Florian Idenburg also notes that the integration of this detail nullifies the role of the roof in the vernacular sense of its inspirations: "where a typical pitch roof sheds water and snow to either side, the duplication of the gable undoes this main function."[14] Therefore, this detail is not only space defining and structural, but also has integrated within it the functional task of removing water from the roof (Figure 08.15).



08.15
Axonometric detail at the roof valley

Additional Resources

Projects

Dominus Winery, Yountville, Napa Valley, California, United States, 1998 (38°24′19″N, 122°22′27″W)

de Young Museum, San Francisco, California, United States, 2005 (37°46′17″N, 122°28′8″W)

Caixaforum Madrid, Madrid, Spain, 2008 (40°24′40″N, 3°41′37″W)

National Stadium (2008 Olympic Stadium), Beijing, China, 2008 (39°59′29″N, 116°23′24″E)

1111 Lincoln Road, Miami Beach, Florida, United States, 2010 (25°47′27″N, 80° 8′27″W)

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Allen, Matthew. "Parrish Art Museum, Herzog & de Meuron." *Domus*, no. 965 (January 2013): 44–51.

Idenburg, Florian. "Ducks and Sheds – Herzog & de Meuron: Parrish Art Museum, Water Mill, New York." *Archithese* 43, no. 1 (2013): 10–15.

Petit, Emmanuel. "Horizon Line." *Architectural Review* 233, no. 1391 (2013): 35–43.

Rajagopal, Avinash. "Austere Charm: Despite a Rocky Start, Or Perhaps Because Of It, the Parrish Art Museum has a Refined New Home." *Metropolis* 32, no. 7 (2013): 31–32, 34.

Ursprung, Philip, ed. *Herzog & de Meuron: Natural History*. Montreal, Canada: Lars Muller Publishers, 2005.

Webber, Gwen. "Parrish Counsellors." *Blueprint*, no. 311 (2012): 48–52.

Notes

1 Philip Ursprung, "Exhibiting Herzog & de Meuron," in *Herzog & de Meuron: Natural History*, ed. Philip Ursprung (Montreal: Lars Muller Publishers, 2005), 33.

2 Carrie Asman, "Ornament and Motion: Science and Art in Gottfried Semper's Theory of Adornment," in *Herzog & de Meuron: Natural History*, ed. Philip Ursprung (Montreal: Lars Muller Publishers, 2005), 397.

3 Emmanuel Petit, "Horizon Line," *Architectural Review* 233, no. 1391 (2013), 37.

4 Florian Idenburg, "Ducks and Sheds – Herzog & de Meuron: Parrish Art Museum, Water Mill, New York," *Archithese* 43, no. 1 (2013), 10.

5 Petit, "Horizon Line," 41.

6 Marc-Antoine Laugier, *An Essay on Architecture*, trans. Wolfgang Herrmann and Anni Herrmann (Los Angeles: Hennessey + Ingalls, 2009), 12. (Originally published in 1753.)

7 Gwen Webber, "Parrish Counsellors," *Blueprint*, no. 311 (2012), 50.

8 This idea is discussed in both Avinash Rajagopal, "Austere Charm: Despite a Rocky Start, or Perhaps Because of It, the Parrish Art Museum has a Refined New Home," *Metropolis* 32, no. 7 (2013), 31–32, 34 and Idenburg, "Ducks and Sheds."

9 Jacques Herzog as cited in Idenburg, "Ducks and Sheds," 12.

10 Information provided by the architect.

11 Kenneth Frampton, "Towards a Critical Regionalism: Six Points for an Architecture of Resistance," in *Essays on Postmodern Culture*, ed. Hal Foster (New York: The New Press, 1998), 30.

12 Matthew Allen, "Parrish Art Museum, Herzog & de Meuron," *Domus*, no. 965 (January 2013), 51. For a more detailed analysis of this spatial strategy, please see Allen's well-developed critique.

13 Petit, "Horizon Line," 41.

14 Idenburg, "Ducks and Sheds," 12.

09

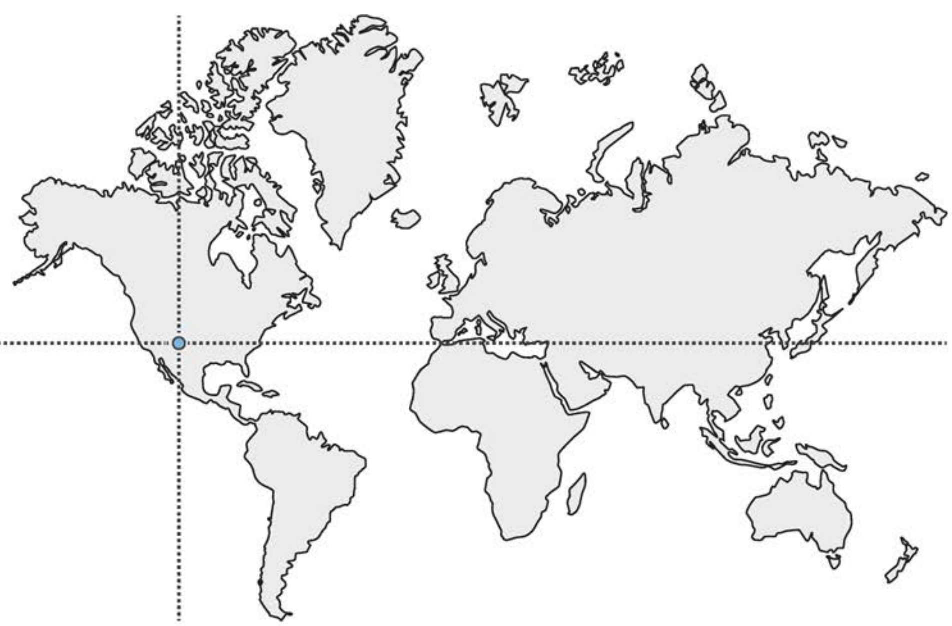
Center of Gravity Foundation Hall

Predock_Frane Architects

Firm Brief[1]

In 2000, Hadrian Predock and John Frane established Predock_Frane Architects in Santa Monica, California as a collaborative research and development design studio. They offered a collaborative working relationship with prospective clients that aimed to elicit deep thinking about design problems and to produce atmospheric architecture. Initial explorations with clients included a significant effort to explore ideas outside of the conventional boundaries.

The architecture of Predock_Frane ranged from small-scale art projects to infrastructure and large public venues. Their research-driven work sought to extract and transfer non-disciplinary logic into the architectural terrain while encouraging site and context to become active and vital agents in shaping material and spatial development. The partners sought out the challenge of building rich atmospheres out of limited and constrained material sets; thus their work had a strong multisensory and experiential bias. Sustainable thinking had



jemez springs, new mexico, united stat
gps | 35°46'21"N, 106°41'23"W
program | zen buddhist teaching hall
completed | 2004
area | 279 m2 [3,000 ft2]

09.1
Vicinity map

also been a driving force in Predock_Frane's design practice since its inception; a thorough integration of intelligent environmental strategies underpinned all of their work.

Predock and Frane won many awards, lectured widely, and presented or exhibited at venues around the world, including the 2012 Venice Biennale and the 2006 Cooper Hewitt Design Triennial. Both partners have also taught extensively, including appointments at the University of California, Los Angles (UCLA), University of California, Berkeley, the University of Southern California (USC), and Tulane University.

In 2015, the firm was amicably disbanded by the partners in order for them to pursue independent interests. Predock is currently serving as the Director of Undergraduate Programs at the USC School of Architecture, while Frane is a Design Director in the Los Angeles office of HGA.

Project Brief

> Dawn is breaking. A glow, and then direct sun, hit the westerly flank of the canyon, giving acid life to its cliffs of travertine and ruddy sandstone. The fast-brightening daylight translates into another glow inside the hall, in part from its glass clerestory and open front door, but mostly for the full-height polycarbonate walls on laminated-strand lumber enclosing its western half. . . . A sweet incense burns on the altar.[2] (Figure 09.2)

The Center of Gravity Foundation Hall is the main teaching and meditation space for the Bodhi Mandala Zen Center, located in a mountain river valley in northern New Mexico. The building is one in a series of structures that house the Zen Center. Unlike the Foundation Hall, many of the other buildings on the campus have graced the site for some time, including a century-old church. Predock_Frane designed their addition to the campus to reflect the character of these sentinels, which have watched over this corner of the lush valley as it has evolved.

The Foundation Hall is a study in duality. It is composed of two boxes that cradle the meditation space within. The first box is composed of rammed earth, while the second box, which slips inside the first, is wood light frame construction, clad with polycarbonate sheets (Figure 09.3). Carved out of the rammed earth box is a large southeast-facing opening. A series of sliding wood panels sit in this 11-meter-wide [36-foot] opening, allowing the space to open to the garden beyond. Perched on top of the pair of wall systems is a folded metal roof supported by a wood structure. The extensive roof, which floats out beyond the walls of the building, is designed to capture rainwater, which is used to irrigate the surrounding gardens (Figure 09.4).

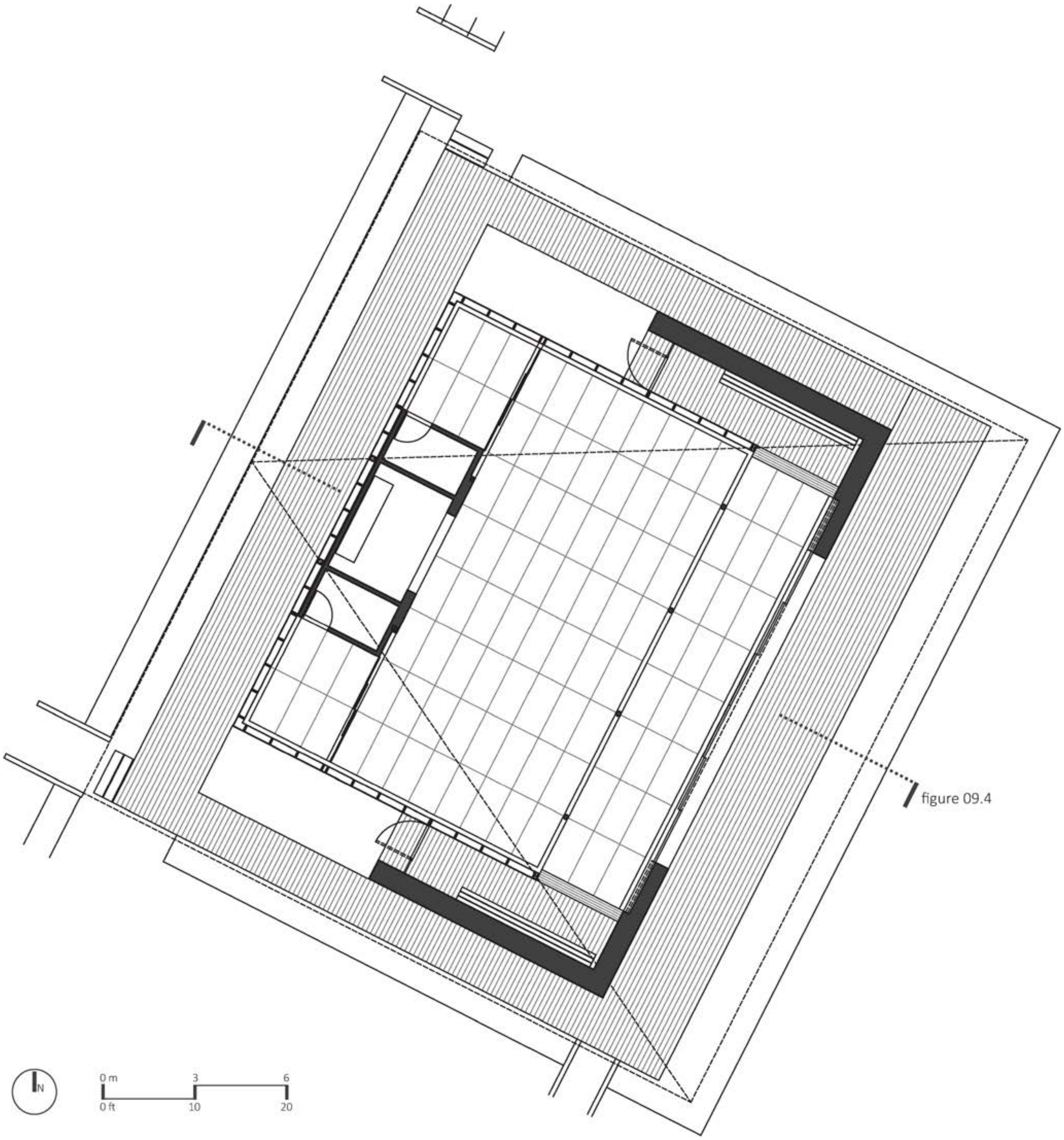
Programmatically, the space is used first and foremost for the teaching of Zen Buddhism. The ***Roshi*** enters from the east and sits facing the Buddha located in the Hall's ***budsudon*** to the west (Figure 09.5). The monks and students in training sit on **tatami mats**, which line the floor of the space. The monks occupy the north side of the space, while students occupy the south side.[3] In addition to training, the Foundation Hall is used for weddings, funerals, and other ceremonies for both Buddhist and non-Buddhist faiths.

Roshi = the religious leader of the Zen Buddhists

budsudon = a shrine in a Buddhist temple that houses a religious icon

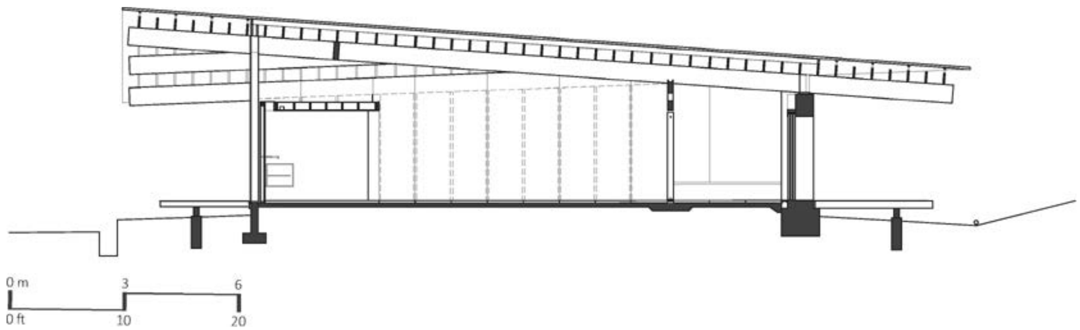
tatami mat = a traditional Japanese flooring made of rice straw

09.2
Foundation Hall from the entry path

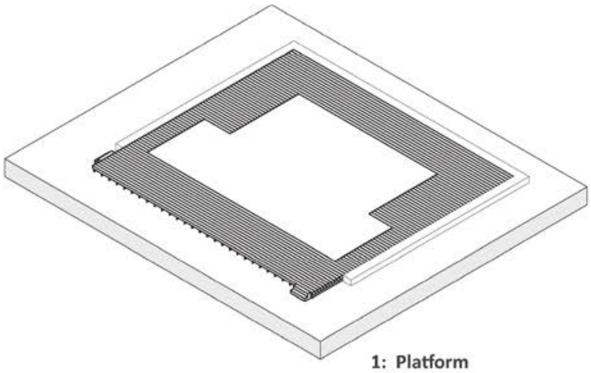


09.3
Floor plan

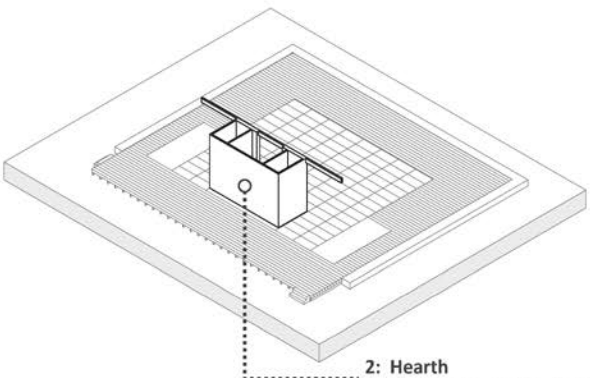
09.4
Building section



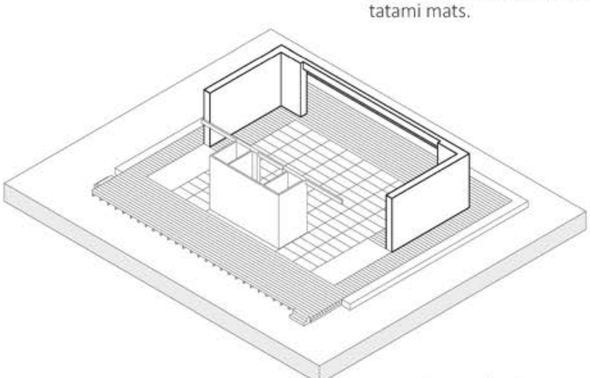
09.5
View through the hall's interior



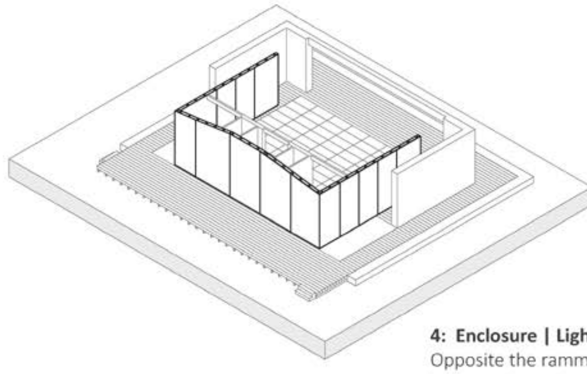
1: Platform
The building sits on a concrete pad, surrounded by a wooden deck on all sides that floats above the landscape.



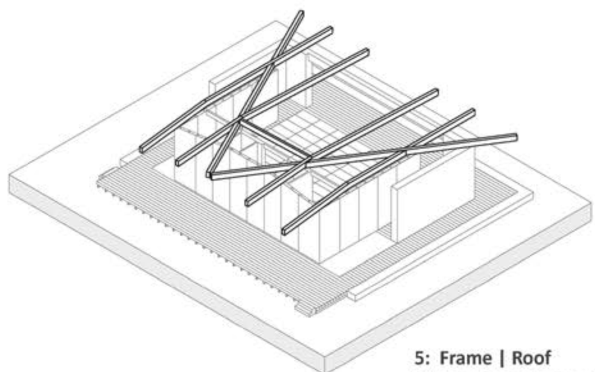
2: Hearth
The foundation hall centers on the butsudan. Additionally, the flooring of the ceremonial space consists of traditional tatami mats.



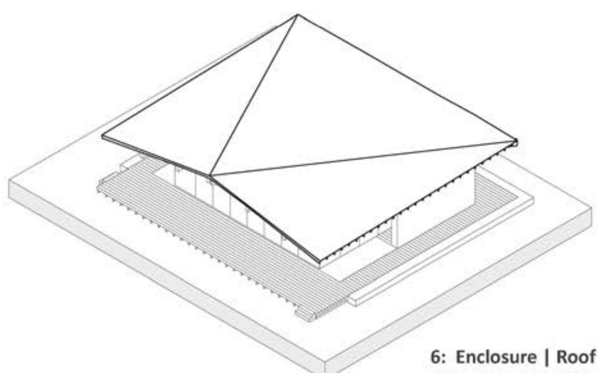
3: Enclosure | Solid
The east side of the building is wrapped with a heavy, rammed earth wall. A large opening in the wall allows for a connection to the landscape.



4: Enclosure | Lightweight
Opposite the rammed earth, a lightweight enclosure of wood and polycarbonate wraps the west side of the building.



5: Frame | Roof
Glulam beams hover above the space, supported by the rammed earth and steel columns hidden in the polycarbonate walls.



6: Enclosure | Roof
An expansive roof extends out over the surrounding deck, floating above the building and sheltering the sacred space.

09.6
Anatomy

Tectonic Principles

Anatomy

The Foundation Hall's earthwork is composed of two parts: a concrete slab, which is only exposed outside the two main entrances to the hall, and the rammed earth wall that forms the east side of the structure's enclosure (Figure 09.6). These elements are contrasted by the U-shaped wood light frame wall system that slips inside its rammed earth counterpart. The framework and earthwork perform a balancing act and define the interior space. The framework is clad with polycarbonate sheets on both the inside and outside of the building, while the large opening cut into the east wall is filled with an operable screen composed of wood and glass. The building is capped by a gracefully sloping roof. It is framed in wood, clad in corrugated metal, and supported by steel columns that are hidden inside the walls.

On the west wall of the building, a dark-stained wood enclosure serves as the Hall's *butsudon* (Figure 09.7). It is sheltered by the roof and the two wall systems – heavy and light, *die Mauer* and *die Wand* – and is the principle hearth of the building. At a larger scale, though, the entire enclosed volume also serves as the social and spiritual center of the Bodhi Mandala Zen Center.

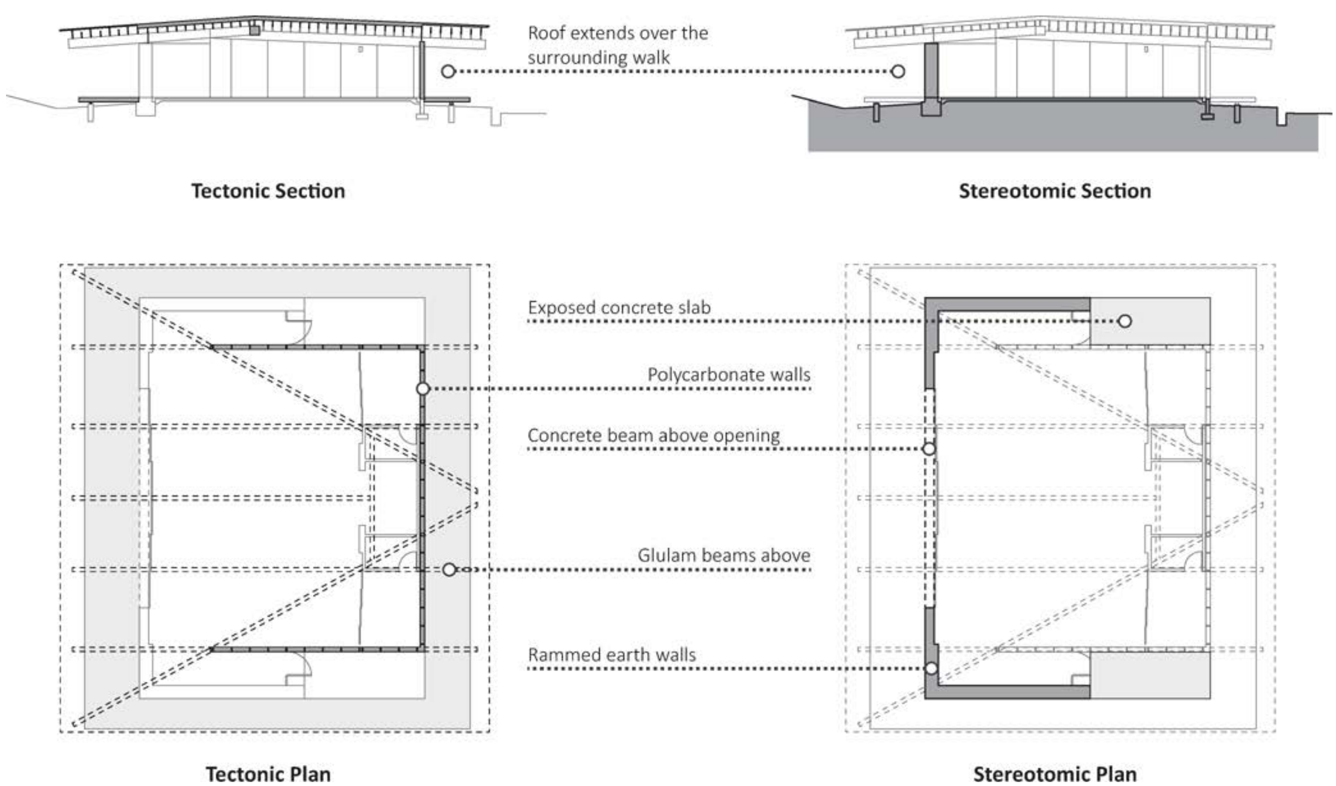
09.7
View of the *butsudon*

Tectonic

The first tectonic component of the Foundation Hall is the **timberstrand**-framed enclosure that Predock describes as "a layered, component based system of sticks (wood framing), surface/envelope (polycarbonate), and fasteners"[4] (Figure 09.8). The multilayered construction of the system allows the air pocket trapped between the polycarbonate skins to provide insulation for the space. This west-facing wall glows throughout the day allowing the space to be filled with ambient light that serves as the primary illumination for the space. In the late afternoon, the setting sun bathes the space in the rich, warm colors of the sunset, while at night the reverse occurs and the building, now lit from the interior, becomes a lantern that lights the walks between the collection of buildings on the property. The construction allows for "a sense of lightness, translucency, and a plasticity of light."[5]

timberstrand = a brand of engineered lumber made from laminated strands of wood

The second tectonic system is the roof, composed of a glulam timber structure, recycled two-by-twelve roof joists, and a corrugated metal roofing system. The roof floats above the enclosing wall systems, supported by a hidden steel structure embedded in the walls. On the exterior, a third system – a wood deck surrounding the project – is elevated slightly above the surrounding landscape, detaching the Foundation Hall from the ground plane.



09.8
Tectonic | Stereotomic

Stereotomic

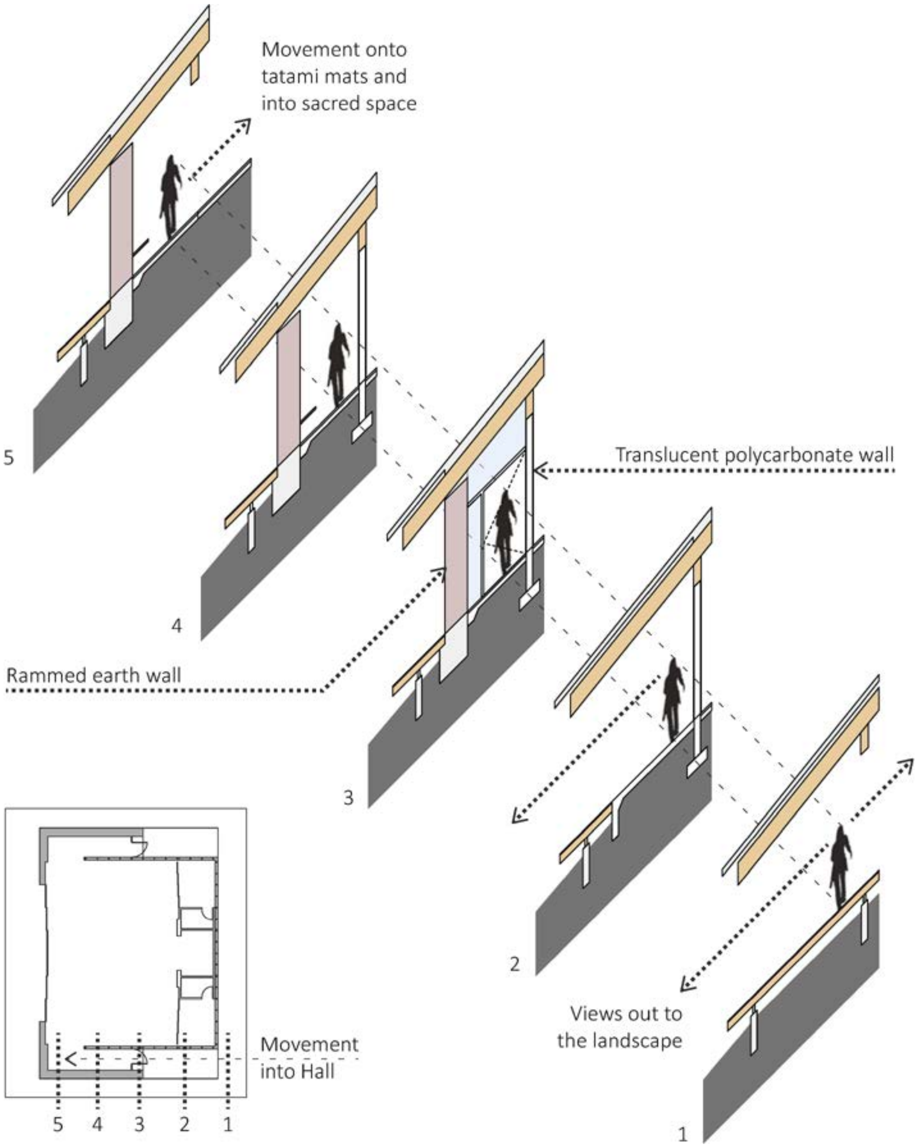
As opposed to the deck, the rammed earth walls provide an anchor for the Foundation Hall. These walls cradle the east side of the building and were built with materials taken from excavations at a local construction site. Predock describes the walls, however, as “more monolithic than stereotomic,” believing them to be characterized by a “stratified monolithicity.”[6] This phrase accurately describes the process of making rammed earth through the piling and packing of layers of material, while also illustrating the final product of that process: a single, uniform construction.

The rammed earth walls vary between 460 and 660 millimeters [18 and 26 inches] thick. This thickness allows the earthen walls to act as thermal masses, helping to passively heat the space in the cool months and keep the space cooler in the warmer months. In the high altitude of this region of New Mexico, the diurnal temperature swing is substantial and the rammed earth walls help to balance the internal temperature of the space.

Intersection

Although not directly connected, the tectonic and stereotomic wall systems of the Foundation Hall meet at the two entries to the building (Figures 09.9 and 09.10). As you transition from the outside to the inside of the building (and vice versa), you slip between these overlapping layers. This moment is a significant threshold for the project and serves as what Frascari would call a “formal joint” or spatial intersection. From the outside, you walk along the deck next to the smooth polycarbonate wall. The first transition is in the flooring, which shifts from wood to a finished concrete slab. You then slip between the polycarbonate and rammed earth walls, eventually stepping through the door. Once inside, your feet are again on wood, but your body is still positioned between the two walls. A bench emerges, attached to the rammed earth wall, which allows you to sit and remove and store your footwear. Finally, prior to entering the main hall, the polycarbonate wall stops and the space opens opposite the rammed earth enclosure into the Hall. This journey is brief but meaningful, both spiritually and experientially, and is driven by the material makeup of the space.

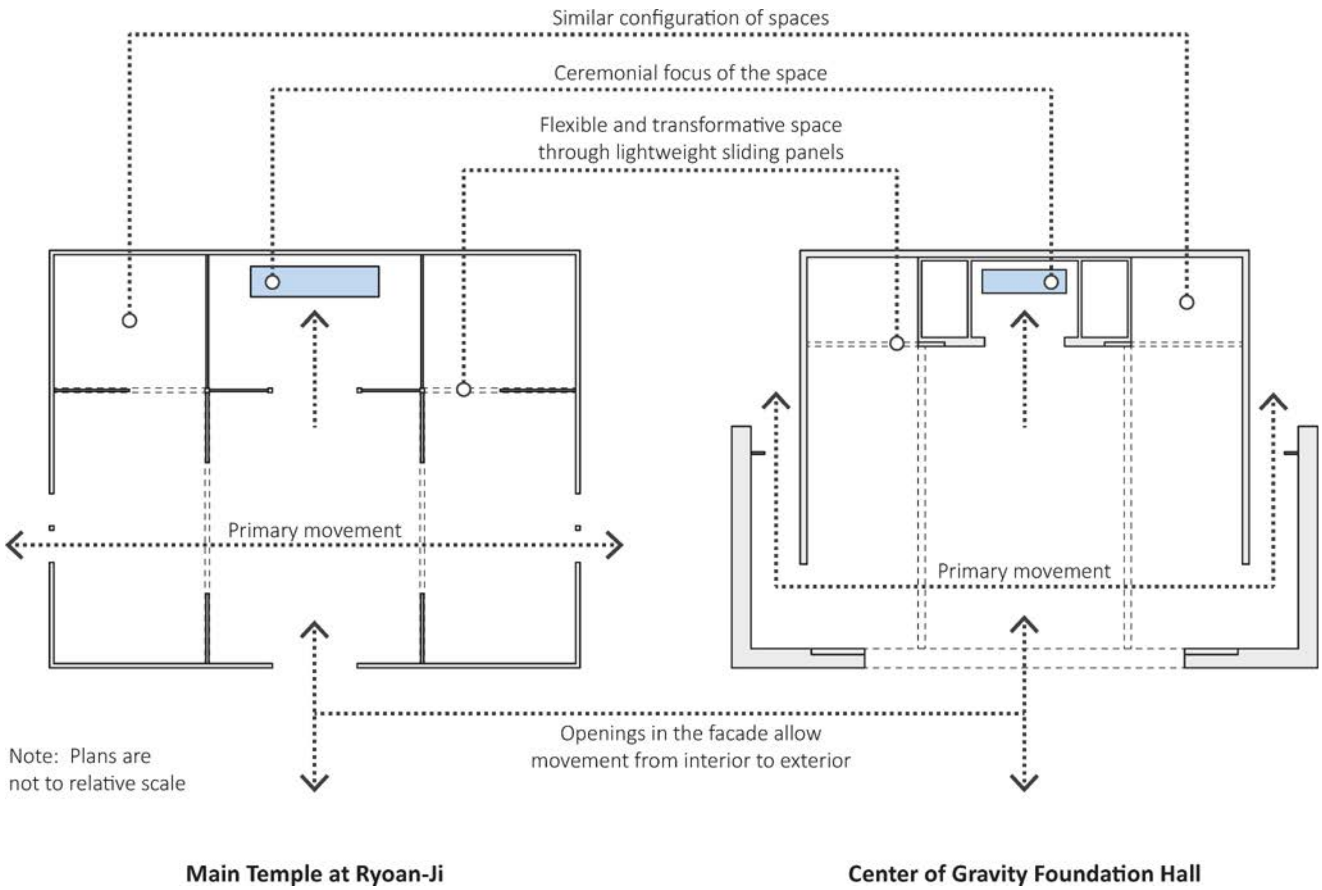
09.9
One of the building’s primary entries



09.10
Entry sequence

Precedent

The most critical precedent for the Center of Gravity Foundation Hall was historic Zen Buddhist architecture. Predock_Frane examined "the antecedent temple projects in Kyoto . . . such as Ryōan-Ji,"[7] (35°2′4″N, 135°43′6″E) from which the lineage of the Zen Buddhism practiced by their client originated (Figure 09.11). Through this study, the Foundation Hall's orientation was aligned based on spiritual need, and the system of entry was derived from formal systems traditionally used in many Japanese Zen temples.[8] There are also other links to Japanese architecture embedded in the Hall, including the polycarbonate panels that are reminiscent of traditional Japanese rice-paper screens and the exposed roof structure that is reflective of historic temple construction. The project is distinctly contemporary, however; and although "the project emerges out of a several-thousand-year lineage of Japanese



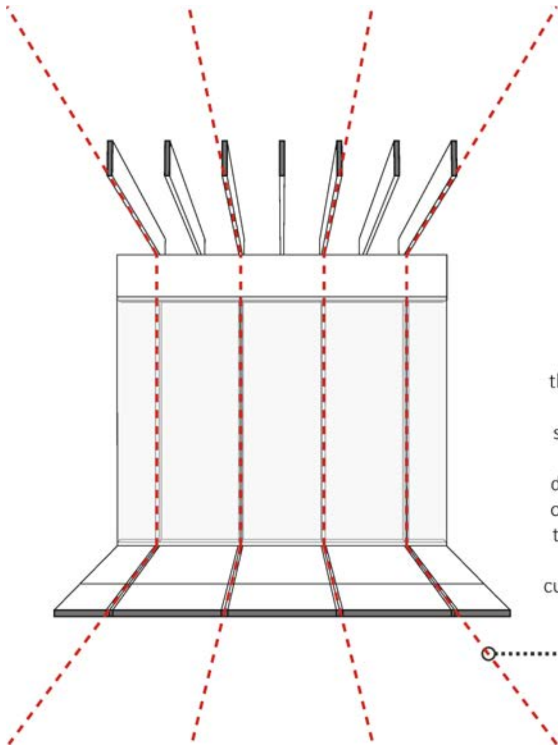
09.11
Temple comparison

Rinzai-Ji Zen practice," it is "one of a handful of projects that attempts to establish new modes of identity for the architecture of Zen practice."[9]

Space

According to Predock, when the client approached Predock_Frane to discuss the project, their desire was to explain the rituals that would take place in the building and for the firm to design a space to frame the rituals.[10] This approach to spatial design parallels Bötticher's ideas of the user and the culture of place determining the plan and, in turn, the construction of space. Space here is defined by ritual, not the other way around.

In the Center of Gravity Foundation Hall, there is a module that guides much of the primary construction (Figure 09.12). The spacing of the timberstrand-framed wall, the polycarbonate panels, and the roof purlins is based on a 0.91-meter [3-foot] module. This dimension is driven by the tatami mat flooring of the main hall. Tatami mats vary in size (including 0.91 by 1.82 meters) based on the region of Japan in which they are made, but always have a 2:1 ratio in proportion. Historically, the mats were organized based on a defined set of rules or principles drawn from how the room was to be organized and used by the inhabitants. The use of woven mats for organization also weighs heavily in Semper's understanding of



09.12
Tatami module

09.13
Light coming through the wooden screen

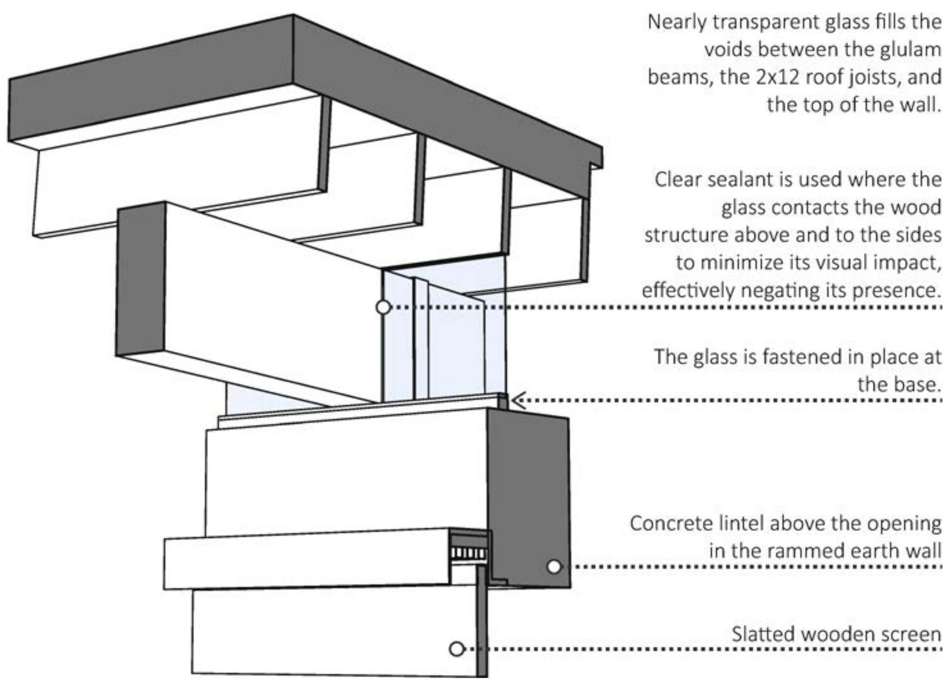
fabric's role in the defining of space. In the Foundation Hall, however, the fabric is not hung to separate space but is, instead, laid out in a specific pattern on the floor to clearly define ritual and its spatial relationships in the Hall.

Place

Although not heavily drawn from its immediate context, the Center of Gravity Foundation Hall ties "the daily ritual of the natural world – the rising and setting of the sun – to the rituals of transcendence."[11] The morning sun rises and shines through the wood slatted screen mounted in the opening in the rammed earth wall. The screen is embedded with vertical strips of plate glass that are mounted on edge. These glass elements catch the morning light and refract beams through the space (Figure 09.13). While this lighting quality defines the eastern edge of the building, the western façade is defined by the changing color of the glow of light through the polycarbonate wall. The space is inwardly focused, a space for spiritual contemplation, but it is still connected to the surrounding environment as it morphs dramatically throughout the day as the sun moves from east to west.

Detail | Atectonic

Predock cites one particularly critical detail in the design and construction of the Foundation Hall: the effect of the floating roof (Figure 09.14). This "magician's trick" is actually achieved through a series of moves. First, the significant extension of the roof plane; second, the concealing of the steel supports inside the polycarbonate wall; and third, the filling of the gap between the roof and walls with glass.[12] This last component is particularly important. The glass is fixed on top of the walls and then sealed to the roof components using structural



09.14
Detail of floating condition at roofline

silicone for an invisible joint. The effect is a strong continuity from interior to exterior above the building's walls that perceptibly "lifts" the roof off of its supports. Predock states that an effect is created that you may, at first, not notice, but eventually you will start to wonder why the space feels the way it does.[13]

Additional Resources

Projects

Family Room for the J. Paul Getty Museum, Los Angeles, California, United States, 2003 (34°4′39″N, 118°28′28″W)
Acqua Alta, Venice Biennale, Venice, Italy, 2004 (temporary installation)
Twin Houses, Pacific Palisades, California, United States, 2008
Habitat 15, Hollywood, California, United States, 2009 (34°5′42″N, 118°20′41″W)
Venice House, Venice, California, United States, 2012

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Crosbie, Michael J. *Houses of God: Religious Architecture for a New Millennium*. Mulgrave, Australia: Images Publishing Group, 2006.
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Sullivan, C. C. "Dharmic Dawn." *Architecture* 93, no. 10 (2004): 46–51.

Notes

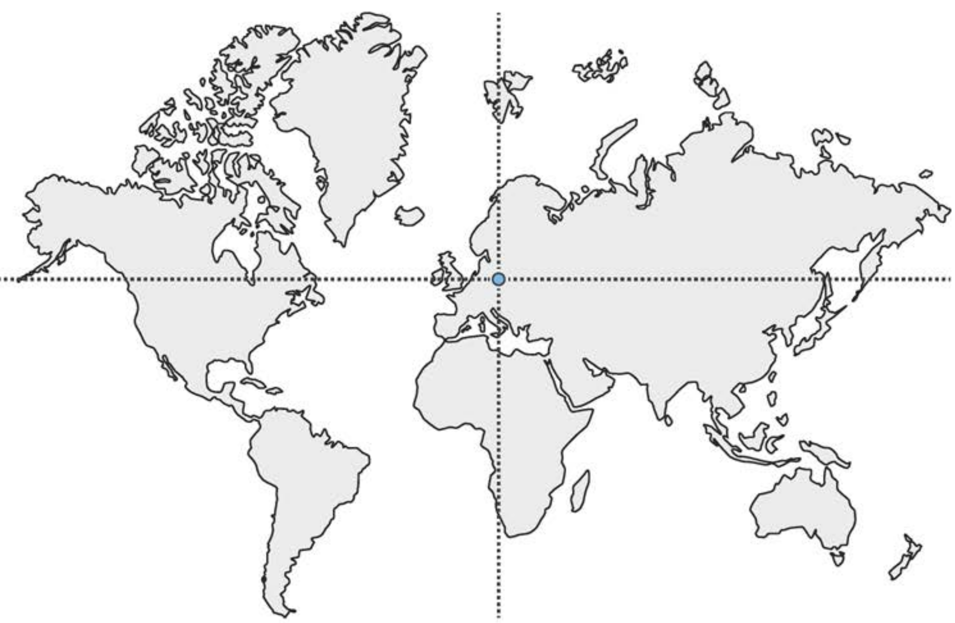
1 This firm brief is a modified version of the firm profile found on Predock_Frane's website: http://predockfrane.wordpress.com/category/profile/
2 C. C. Sullivan, "Dharmic Dawn," *Architecture* 93, no. 10 (2004), 48.
3 Michael J. Crosbie, *Houses of God: Religious Architecture for a New Millennium* (Mulgrave, Australia: Images Publishing Group, 2006), 74.
4 Information provided by Hadrian Predock through a digital interview, September 2014.
5 Ibid.
6 Ibid.
7 Ibid.
8 Ibid.
9 Ibid.
10 Sullivan, "Dharmic Dawn," 48.
11 Ibid., 45.
12 Hadrian Predock, digital interview.
13 Ibid.

10
Chapel of Reconciliation
reitermann/sassenroth architekten

Architect Brief

Rudolf Reitermann studied architecture at the University of Technology in Stuttgart and later received his advanced degree from the Berlin University of the Arts in 1990. Reitermann ran his own architectural studio in Berlin after graduation until 1996 when he partnered with Peter Sassenroth to form the firm reitermann/sassenroth architekten. Sassenroth spent his formative years studying architecture at the Technical University of Berlin. In 1986, he spent a year studying in the United Kingdom with Archigram founder David Greene before returning to Berlin to complete his studies at the Technical University in 1989. Along with his partnership with Reitermann, Sassenroth is an active academic who has taught at numerous universities including Dalhousie University in Halifax, Canada and Bielefeld University of Applied Sciences, Germany where he currently is serving as a full professor of construction and design.

berlin, germany
gps | 52°32'9"N, 13°23'31"E
program | chapel
completed | 2000
area | 398 m2 [4,284 ft2]



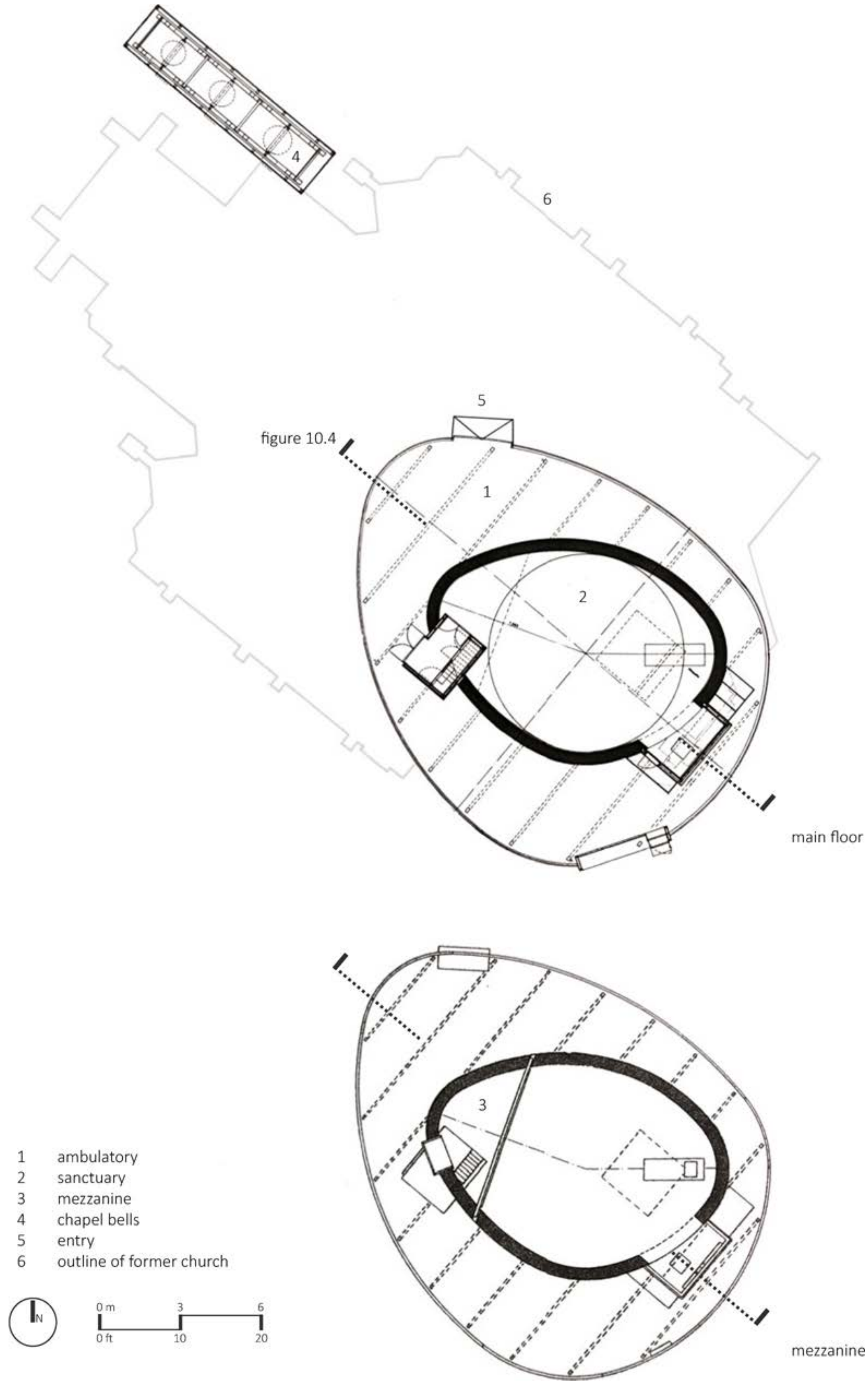
10.1
Vicinity map

Project Brief

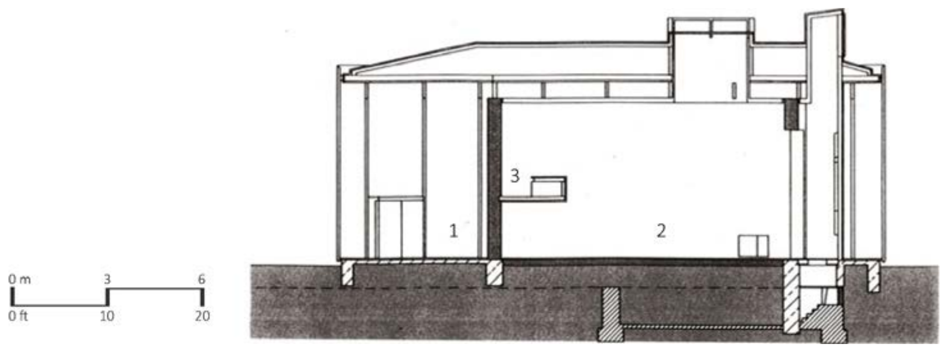
The Chapel of Reconciliation started as a design competition, won by Reitermann and Sassenroth. The chapel occupies precarious ground, situated over the foundations of the former Neo-Gothic Reconciliation Church and within the interstitial space formally flanked by the two sides of the Berlin Wall, known as "no man's land" or the "death strip." The Reconciliation Church was destroyed by the East German guard in 1985 because its bulk, situated within no man's land, caused line-of-sight issues for the patrol charged with ensuring the zone's impenetrability. The new chapel respects the memory of the former occupant of the site, but differs from it significantly in its formal composition, experiential quality, and material makeup (Figure 10.2).

The Chapel is "organised as two ovaloids in plan, one contained by the other, like a baby in the womb."[1] It is small in stature, standing only 9 meters [29.5 feet] high. At its widest, the chapel measures 18 meters [59 feet] across (Figures 10.3 and 10.4). Despite the curvilinear forms, each of the ovaloids has a distinct orientation based on their rotation around a common center point. The outer wooden shell is oriented to align with the axis of the site's historic church. The inner mass wall, however, aligns with the true east/west axis. Exaggerated thresholds penetrate both shells, guiding visitors from the outside environment into the chapel's inner sanctum.

10.2
View of the Chapel of Reconciliation from the plaza



10.3
Floor plans



1 ambulatory
2 sanctuary
3 mezzanine
4 chapel bells
5 entry
6 outline of former church

10.4
Building section

Moving from the exterior through the vestibule in the first shell, you find yourself in a sheltered, but open-air, **ambulatory** space (Figure 10.5). It is loosely programmed and serves as a middle ground between the outside world and the sacred center of the building. To access the inner space, you must walk around the curve of the outer space towards a large box that serves as a second threshold. The threshold components are finished with a special casein plastering technique, which utilizes a metal brush to polish the plaster.[2] Moving through this box, you are greeted with an altar that sits along the axis of the inner ovaliod (Figure 10.6). Off to the right, there is a large niche in the rammed earth wall (aligned with the second axis) that contains the salvaged **reredos** from the historic Reconciliation Church. Above the entrance to this inner sanctuary, there sits a mezzanine space that serves as an organ loft. It is reached through a small stairway contained in the threshold box. The last component of the project is a second structure set out towards the main road on the site. This small building houses the chapel's bells.

ambulatory = an outer aisle or covered walk in a religious building

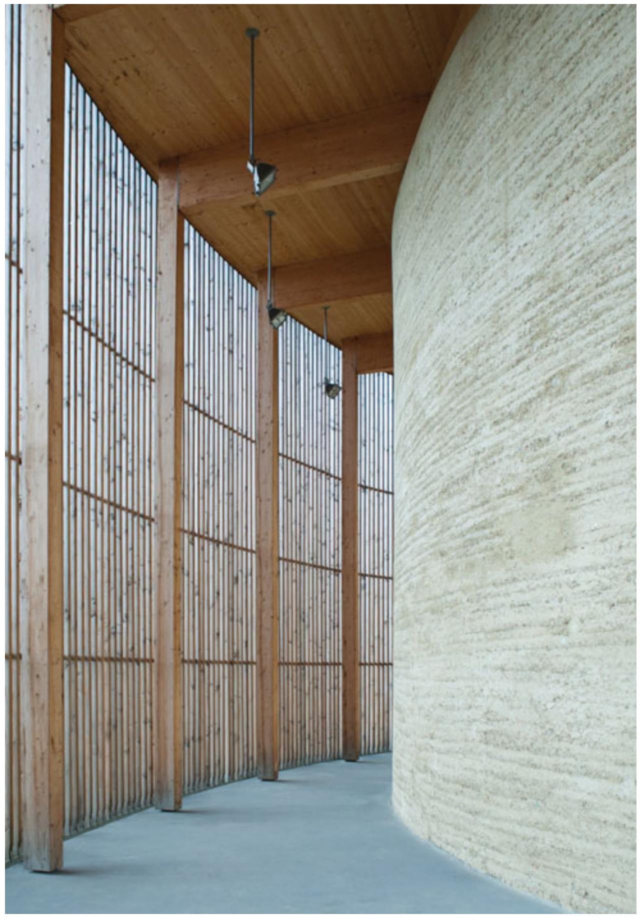
reredos = an ornamental screen or wall surface behind a church's altar

Light plays a critical role in the space. During the day, light streams through the outer shell – a wooden screen – while the inner sanctuary receives its light entirely from a large skylight above the altar. At night, the chapel is lit from the interior; light beams out through the screen and the building transforms into a beacon for the community (Figure 10.7).

Tectonic Principles

Anatomy

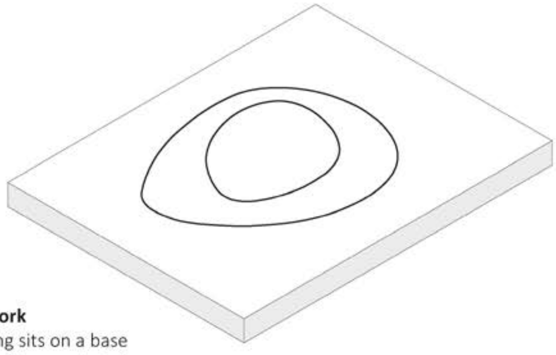
The Chapel of Reconciliation sits on a relatively flat site. While the building's platform is primarily a concrete slab finished with asphalt, the floor of the inner sanctuary is rammed earth, signifying a link between this space and the ground it sits on (Figure 10.8). From this platform rises the *die Mauer*-type inner ovaliod wall, also constructed of rammed earth. The outer shell of the chapel is supported by a heavy timber structure consisting of nine frames. The frames are clad with a wooden screen consisting of vertical strips mounted on horizontal steel straps. This cladding shelters the ambulatory space and protects the earthen core.



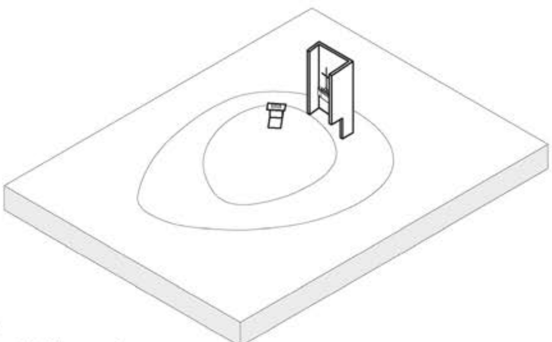
10.5
Ambulatory space

10.6
Sanctuary space

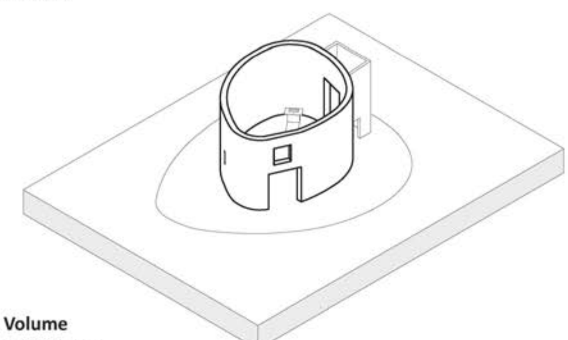
10.7
Chapel at dusk with bell enclosure



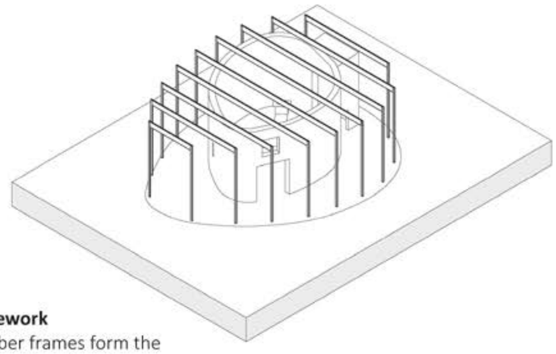
1: Earthwork
The building sits on a base consisting of two materials: concrete and earth. Below the chapel lies the remains of the former church.



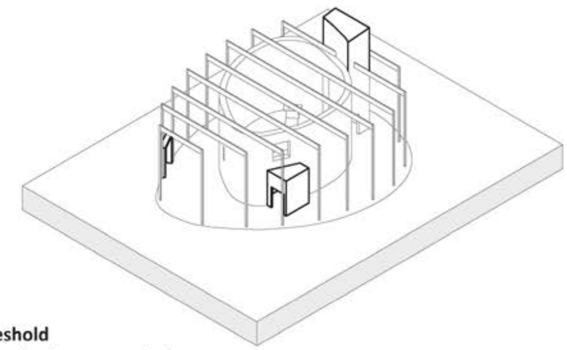
2: Hearth
Two elements in the sanctuary provide a spiritual center. Each aligns with one of the chapel's two primary axis.



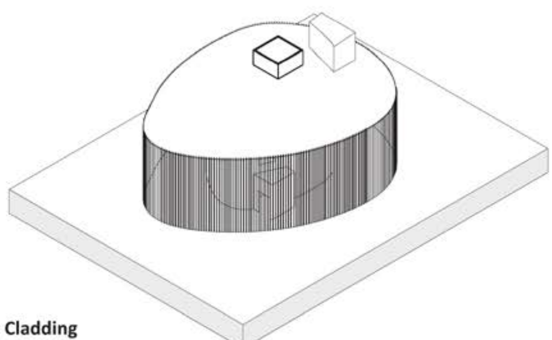
3: Inner Volume
A rammed earth wall, embedded with remains of the historic church, surrounds the sanctuary.



4: Framework
Nine timber frames form the structure of the chapel.



5: Threshold
A series of volumes penetrate the skins of the building, providing access to the chapel.



6: Outer Cladding
The outer cladding system and primary expression of the chapel is composed of vertical wood slats hung from the timber frame.

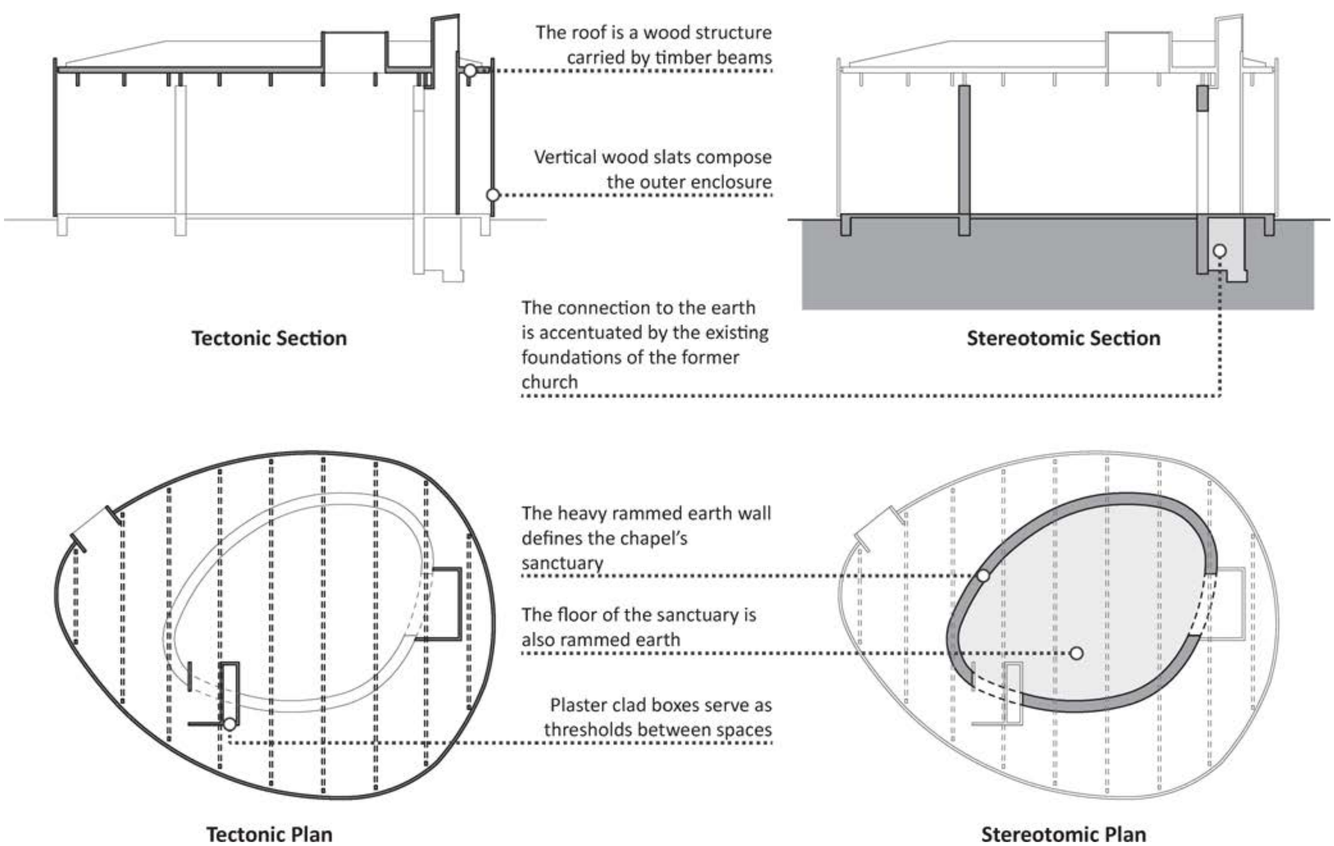
10.8
Anatomy

There are two hearths present in the Chapel of Reconciliation, each aligning with an axis of the building. In the typical church or chapel, the altar, sitting on a raised dais, would serve as the hearth of the building. Despite the lack of a raised dais, the altar of the Chapel of Reconciliation does serve that purpose. However, competing in the space for the primary spiritual nexus is the niche containing the reredos of the former church. This element dominates the interior sanctuary and serves as a second *center* for the small building. It not only connects the project spiritually to God, but historically to the intense and complex past this place has endured.

Stereotomic

The inner rammed earth wall – also referred to as compressed loam – consists primarily of clay and was built using a technique called *Lehmbau* (Figure 10.9). In addition to clay (or loam), the wall contains aggregate and flax fibers that were compressed under high pressure. This stereotomic mass is punctured at very few locations. The primary perforations are at the plastered box that serves as an entry (threshold) and at the niche holding the relics of the historic Reconciliation Church (point of sacred reflection). The heavy wall is sound absorbent, creating a very quiet interior space. It also provides valuable thermal insulation through its mass, helping to control thermal shifts in the building as the project does not contain a heating, ventilation, and air conditioning (HVAC) system.

10.9
Tectonic | Stereotomic



The Chapel of Reconciliation is also bound to the earth through its interaction with the remains of the Reconciliation Church. Small glazed punctures in the floor of the sanctuary allow a glimpse of foundations, a basement stair, and other relics from the past resting below. The altar, which is also a rammed earth structure, sits on a slab of polished stone set into the rammed earth floor. The dais-like structure is oriented directly above the **refectory** of the Reconciliation Church.[3] These elements help to root the project not only to the place physically but also to the palimpsest built up on the site over time.

refectory = a dining hall in a religious building

Tectonic

Set in opposition to the inner wall, the outer shell of the Chapel of Reconciliation is decidedly tectonic. The vertical slats of the screen are Canadian douglas fir and have weathered to a silver patina since their initial erection. The primary structural components – the nine timber frames – sit on the concrete foundation. In addition to the outer frame, the mezzanine is also a wood construction primarily supported by a heavy timber beam that sits in beam pockets in the rammed earth wall. These pockets cut through the entire thickness of the wall and are expressed in the cloister as niches in the earth construction.

Space | Intersection

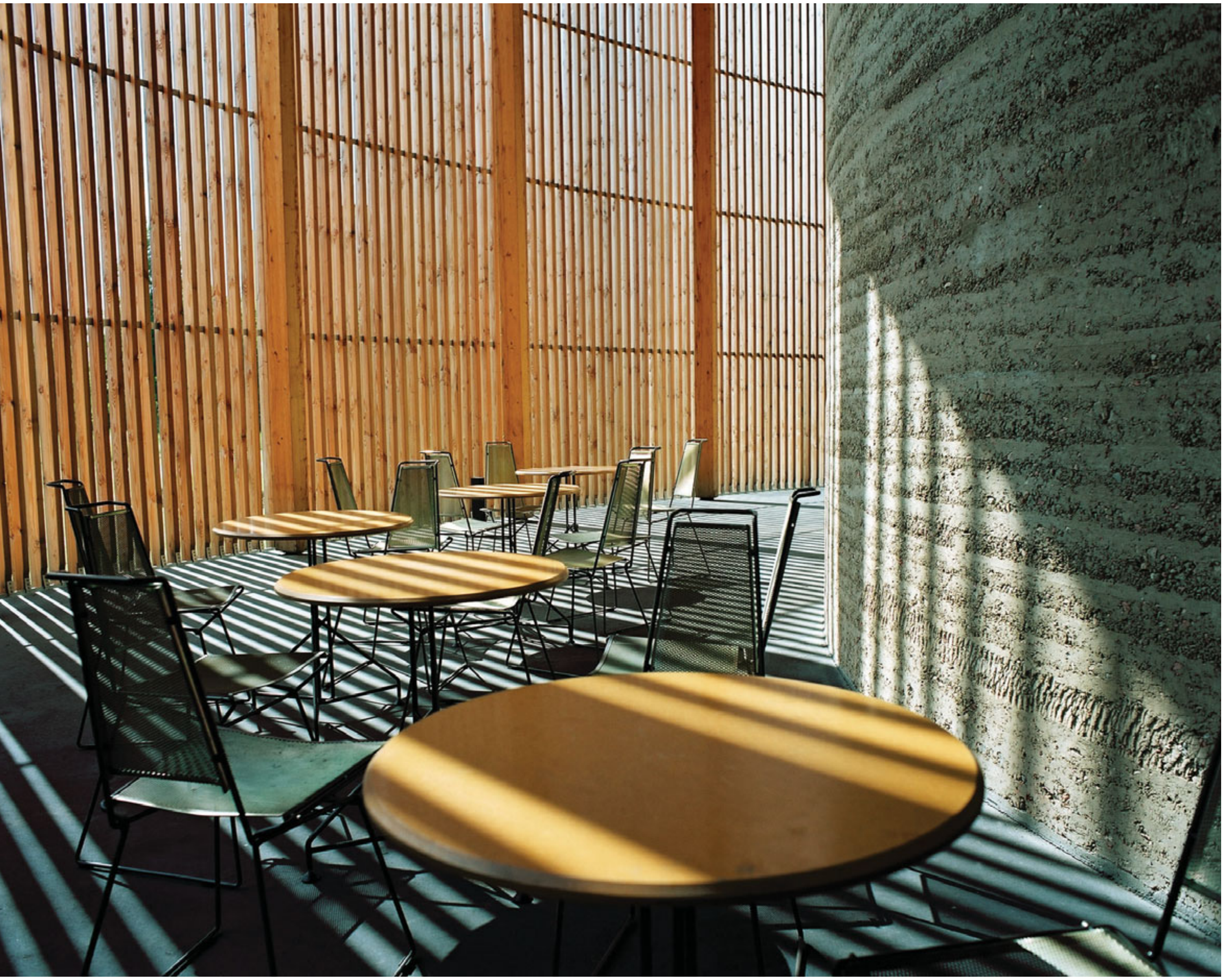
Similar to the Center of Gravity Foundation Hall (see Project 09), the intersection condition in the Chapel of Reconciliation is a spatial construct. The ambulatory space is a void between two walls, one of wood and one of earth. The unequal curvatures of the two walls create a space that is constantly curving, but also constantly shifting is size. Unlike Bötticher's notions of space being defined by user and societal needs, here the walls define a distinct space that then must be inhabited by the user. The space is flexible, but vague; it can be used, "but not in a particularly satisfactory manner. It is ambiguously colonnade, cloister and ambulatory; all of these at once and yet none of them"[4] (Figure 10.10).

The play of contrasting materiality and permeability also creates a space that differs from its traditional counterparts (Figure 10.11). The ambulatory can be seen as a "substitute for the arcaded or colonnaded side aisles of a conventional church. Yet unlike side aisles, it yields nothing of the interior of the nave or sanctuary for the visitor."[5] The chapel also has an absence of both the symmetry and dominant central axis that you find in a traditional Christian church.[6] On the other hand, the ambulatory could also be seen as a **cloister**; but unlike the cloister, which typically directs your view inward, this space directs your view outward to the death strip, a not-so-subtle reminder of the history of the place. By constructing the heavy wall on the interior and the lightweight screen on the exterior, the typical programming of spiritual space has been removed in favor of a spatial construct that embeds qualities of the past in the present, adding another layer to the palimpsest of the "no man's land."

cloister = a covered walk, typically in a courtyard of a religious building

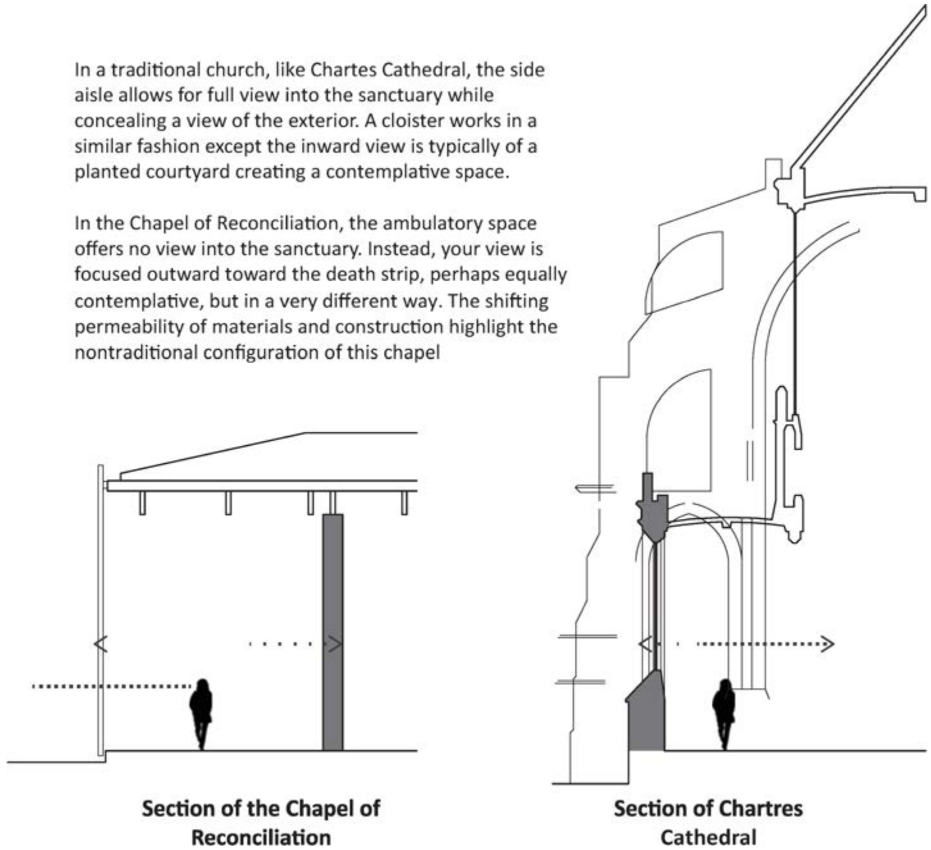
Place

The original design scheme for the Chapel of Reconciliation called for a building constructed of a concrete core and an outer screen of glass and steel. Although the church community appreciated the design, they considered the proposed material palate to be representative of the Berlin Wall, the East German regime, and the cold, stark history they wanted to escape.



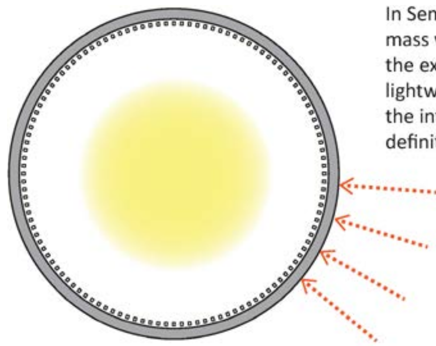
10.10
Ambulatory as a seating space

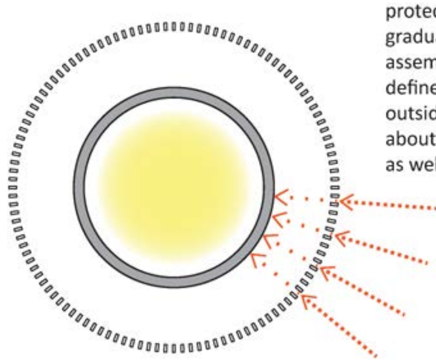
10.11
Comparison to a traditional church



While searching for the best alternative strategies, it was discovered that there had been a clay mine – long since abandoned – near the Reconciliation Church. This bit of history sparked the potential for the use of earth in the fabrication of the chapel, ultimately resulting in the pairing of rammed earth with wood as the primary material palate for the building. Although not taken from the nearby abandoned mine, the clay used for the project was local, brought in from the town of Herzfelde.

Environmentally, the building is not weathertight and the ambulatory is not a sealed space, so seasonal changes have a significant impact on the quality of the space inside the chapel. Frampton believes that "the main antagonist of rooted culture is the ubiquitous air conditioner, applied in all times and in all places, irrespective of the local climatic conditions which have a capacity to express the specific place and the seasonal variations of its climate."[7] The Chapel of Reconciliation embraces Frampton's point of view. As the seasons change, the temperature and humidity change in the building, an unusual event given our typical reliance on mechanical conditioning. Breezes are felt in the ambulatory and water from rain and snow can be found, at times, within the building as well. The chapel is affected by time through its connections to the past, but also with the changes of the season that are allowed to manipulate the space.





10.12
Protective layers of the building

The wooden screen protects the building from the elements, a role seemingly in contrast with the tectonic ideas of Semper (Figure 10.12). Semper saw hanging carpets as providing the character of a space, while the heavy mass walls behind provided protection and structure for the building. In the Chapel of Reconciliation, the rammed earth wall, despite its imposing mass and presence, is fabricated from a relatively brittle medium. The compressed earth crumbles easily and must be protected from rain, snow, and the other elements to prevent deterioration. Here, the heavy wall must be protected by the hanging screen, sheltered from the elements to prevent degradation of the structure.

Representation | Ornamentation

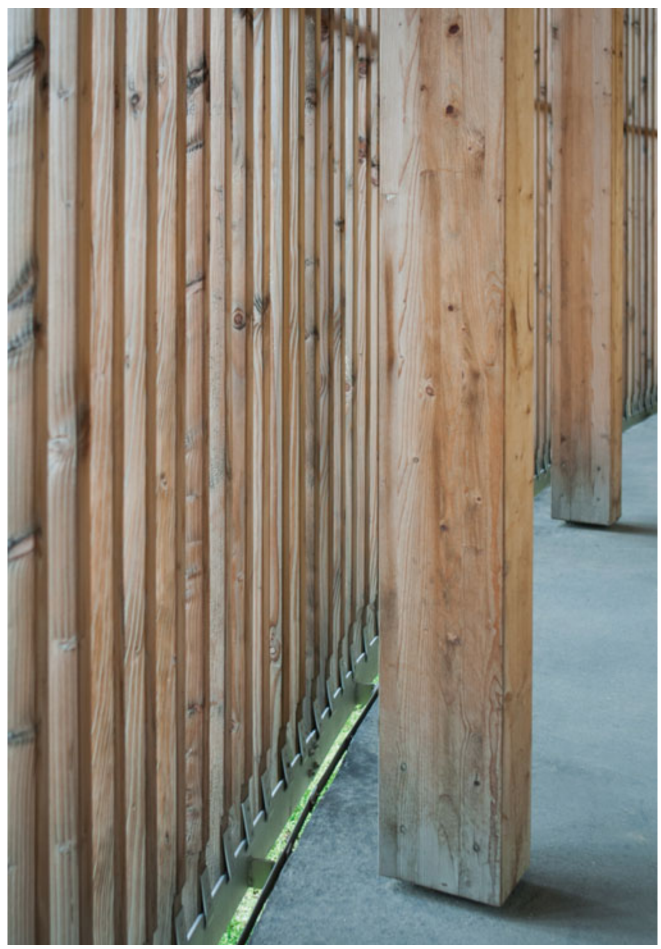
> Its strength is in its constructive re-aggregation of artefacts, making them new, making them structural, and, in the spirit of Benjamin's archaeology, making them ambivalent enough to allow for projections of memory.[8]
>
> Adam Sharr, "The Sedimentation of Memory," 2010

Although the rammed earth wall of the Chapel of Reconciliation may be brittle structurally, it is a powerful cultural and historical presence. Although the wall does not consist of a *Kernform* and *Kunstform* as Bötticher conceived of them, the rammed earth construction provides a reading of structure and representation. The ornamentation of the chapel can be found in the makeup of this wall, more specifically in the aggregate used to create the earth mixture (Figure 10.13). Bits of brick and tile, nails, and other remains salvaged from the excavation of the Reconciliation Church were reclaimed and integrated into the clay to form the rammed earth mixture. Looking at the wall, you can see the remains of the past; and although they do not tell the story of how structural loads move through the wall, their representative tale moves well beyond to the suffering and destructive history of the Berlin Wall, the death strip, and the oppression of society. This ornamentation reveals the weight of history bearing on the chapel, not gravity.

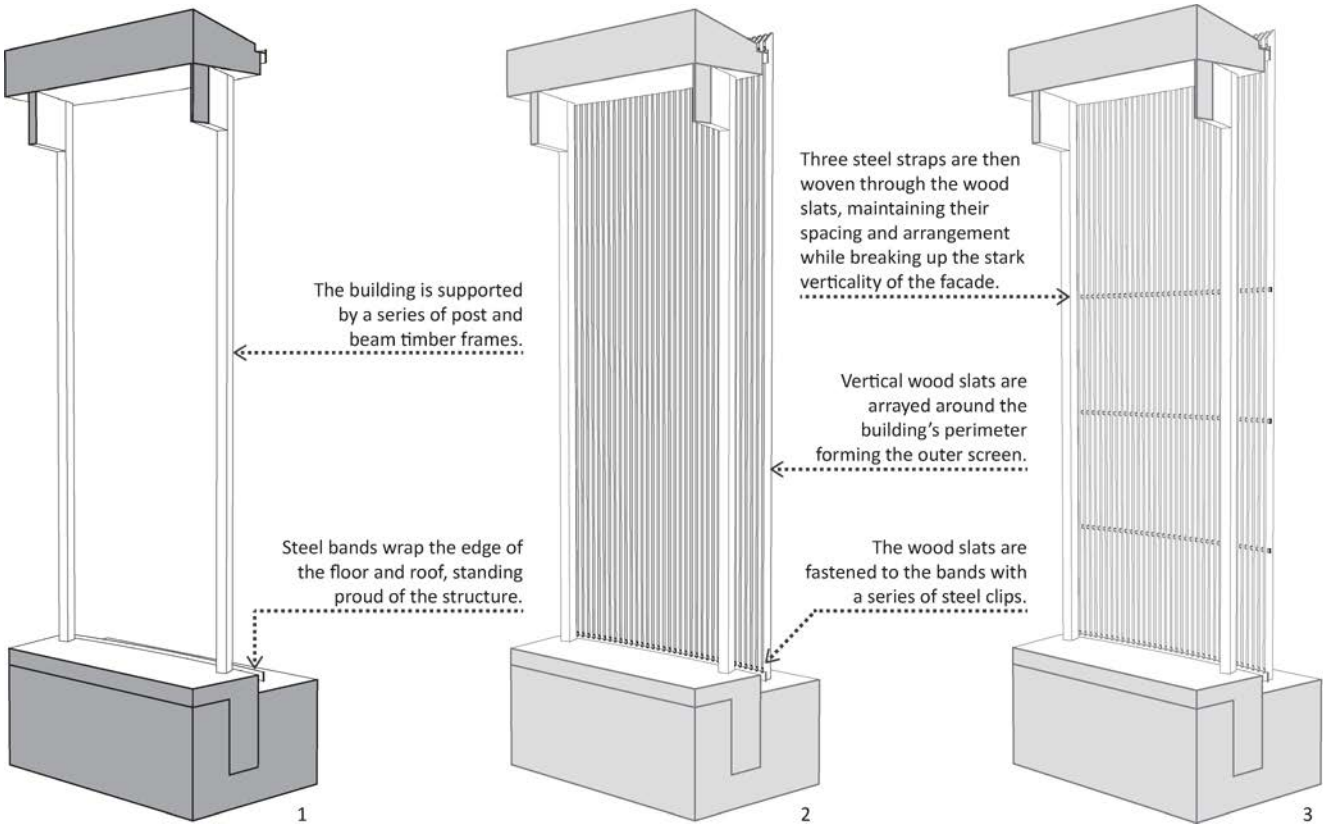
Detail

Outside of the aggregate inclusions in the rammed earth wall, many of the important details of the project can be found in the attachment of the wooden screen to the timber frames (Figures 10.14 and 10.15). The wood slats are each fitted with clips at the top and bottom, fastened with screws. The clips are used to attach the slats to steel bands running the full

10.13
Details of the chapel's rammed earth composition



10.14
Detail view of the chapel's wood screen



10.15
Screen construction sequence

circumference of the building at the floor and roof lines. Horizontal steel bands are then laced through slots in the slats to help maintain their spacing and arrangement. These bands also break up the stark verticality of the screen wall. Overall, the construction of the slatted screen is simple and clean, a distinct counterpoint to the composition of its rammed earth foil.

Additional Resources

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Notes

1 Adam Sharr, "The Sedimentation of Memory," *The Journal of Architecture* 15, no. 4 (2010), 502. Please see this source for a thoughtful and in-depth study of The Chapel of Reconciliation and its significant ties to the history of its place. This chapter draws from Sharr's essay at several points.
2 Information provided by the architects.
3 Ronald Rael, *Earth Architecture* (New York: Princeton Architectural Press, 2009), 46.
4 Sharr, "The Sedimentation of Memory," 502.
5 Ibid., 505.
6 Rael, *Earth Architecture*, 46.
7 Kenneth Frampton, "Towards a Critical Regionalism: Six Points for an Architecture of Resistance," in *Essays on Postmodern Culture*, ed. Hal Foster (New York: The New Press, 1998), 30.
8 Sharr, "The Sedimentation of Memory," 512.

11
Porciúncula La Milagrosa Chapel

Daniel Bonilla Arquitectos

Architect Brief[1]

After studying architecture at Universidad de los Andes in Bogotá, Daniel Bonilla traveled to London and received his Masters in Urban Design from Oxford Brookes University in 1990. While in London, he worked with Llewelyn Davies developing large-scale urban projects. Upon his return to Colombia in 1993, Bonilla's interest in urban themes inspired a partnership with Bogota's city government on several public projects. After serving as the Director of Design at one of the top real estate development companies in the country, Bonilla elected to establish his own firm in 1997.

Bonilla's firm, currently in operation, specializes in work at a variety of scales: urban, architectural, and industrial. Many of their projects have been well received in national and international design competitions and publications. Among their most prominent accolades

la calera, cundinamarca, colombia
gps | 4°39'29"N, 73°58'32"W
program | chapel
completed | 2004
area | 205 m2 [2,200 ft2]

11.1
Vicinity map

are the firm's inclusion in the XVII, XVIII and XIX Colombian Architecture Biennales, *Proyecto Diseño Magazine*'s Blue Steel Pen Award, and the Emerging World Architecture Award organized by *Architectural Review Magazine* and *Designers Line Magazine*.

Bonilla is a noted lecturer and has been invited to speak at many distinguished universities, institutions, and conferences including those of The Royal Institute of British Architects, The Danish Royal Academy, and the GSD Latin Association at Harvard University. Bonilla and his staff have also spent a considerable amount of time in academia conducting design workshops, teaching seminars, and lecturing on their perspective of the built environment.

Project Brief

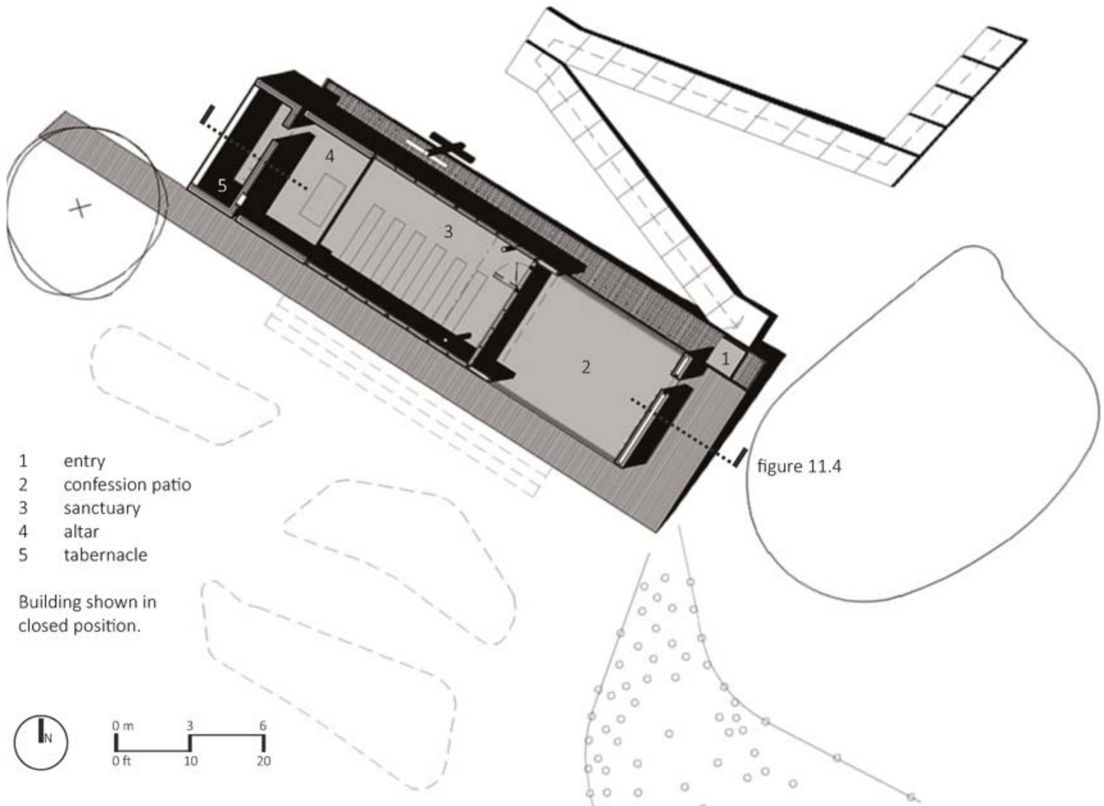
> The purity of the volume suggests harmony, the essential; its simplicity is sheltered by an austere presence that values silence, the wind and the light.[2]
>
> Daniel Bonilla digital interview, 2014

The Porciúncula La Milagrosa Chapel is located in a meadow on a hillside outside of La Calera, Colombia. The chapel is approached from below along a winding entrance path that snakes through a hillside garden. You are greeted at the top by a reflecting pool that runs the length of the east side of the structure (Figures 11.2 and 11.3). From the pool rises a slender steel cross. Bonilla describes this pool as a "serene water mirror" that "dilutes the mass of the landscape while reiterating and distorting the volume and finally making its density vanish."[3] In order to proceed, you must cross the pool using a single stepping stone – the first threshold. After crossing, you encounter a second threshold, a tall wall made of dark stone. A full-height slot in the wall allows passage to a courtyard beyond called the confession patio. The slot also serves as a bell tower as a brass chapel bell is suspended at the top of the slot between the two sides of the stone wall (Figure 11.4).

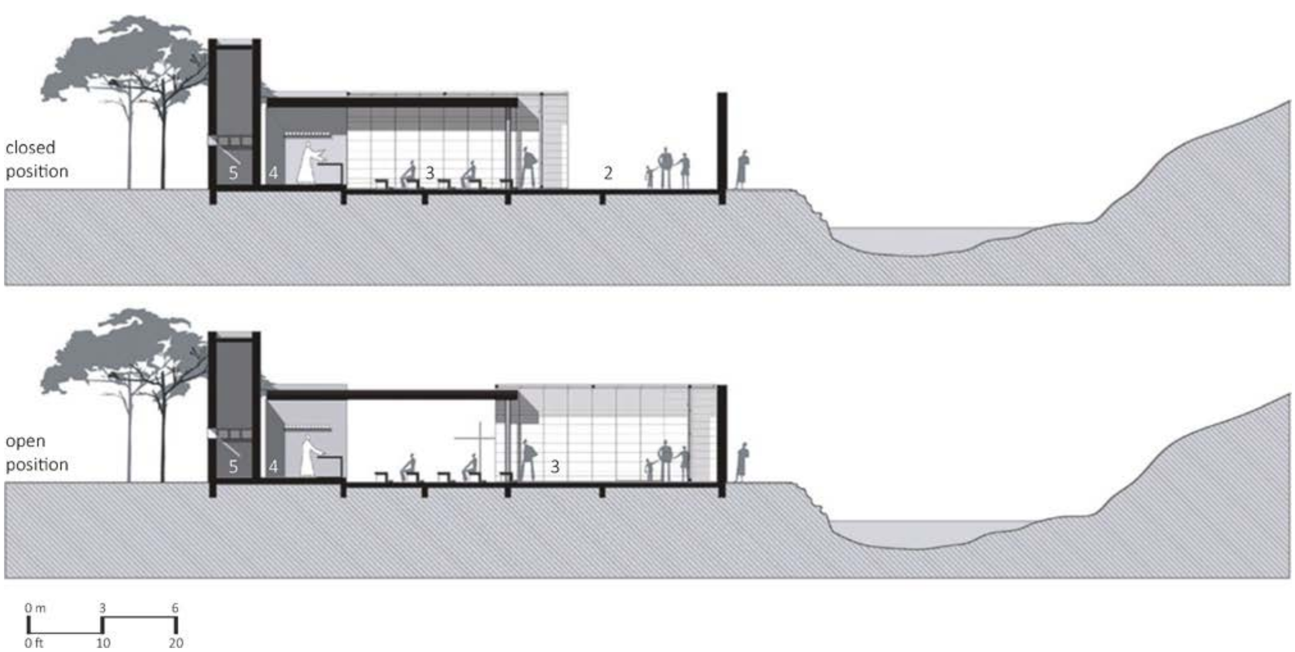
The eastern wall of the church, located on the other side of this patio, conceals the chapel's entry door, which blends into the wall's slatted cladding. The interior of the chapel is a seemingly simple space (Figure 11.5). At the far side of the single volume is the altar. While the nave is flanked by slatted walls similar to the entry wall, the altar is cradled by stone walls on the north and south (sides) and a taller stone volume on the west (behind). The taller volume is the chapel's tabernacle and is accessed through a slot in the west wall of the altar space. Between the altar and the tabernacle, a slot of glass cuts through the building, creating another threshold – this time of light. The tabernacle has stone on all four sides, relieved only by a small skylight in the ceiling and a horizontal window running the length of the space on the west wall. A significant alignment occurs within this stone volume. The vertical slot in the west wall of the altar space and the horizontal slot in the west wall of the tabernacle create a rectangle that crops a singular view of the landscape beyond (Figure 11.6). Here, "God's creation is brought right into the middle of humanity's."[4]

11.2
View of La Milagrosa and the pool from the entry walk

11.3
Floor plan

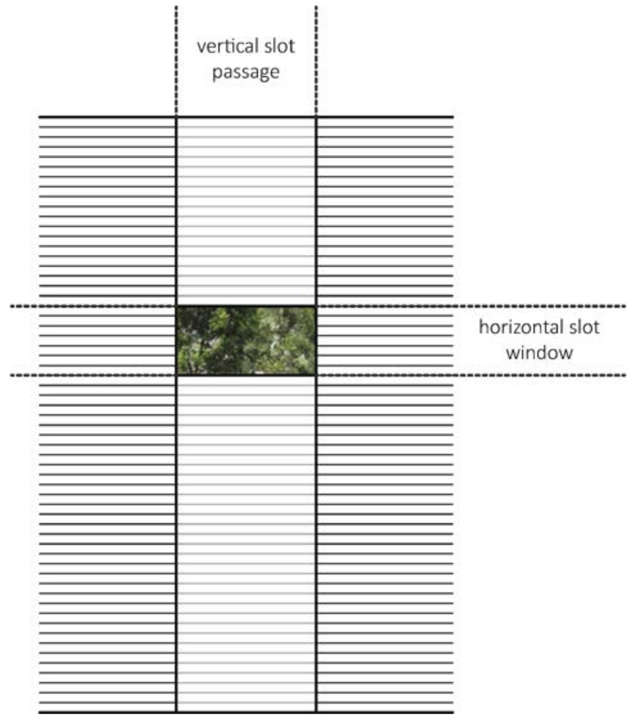


11.4
Building sections



11.5
Interior of the chapel from the entry door (closed position)

11.6
Alignment of the openings



Tectonic Principles

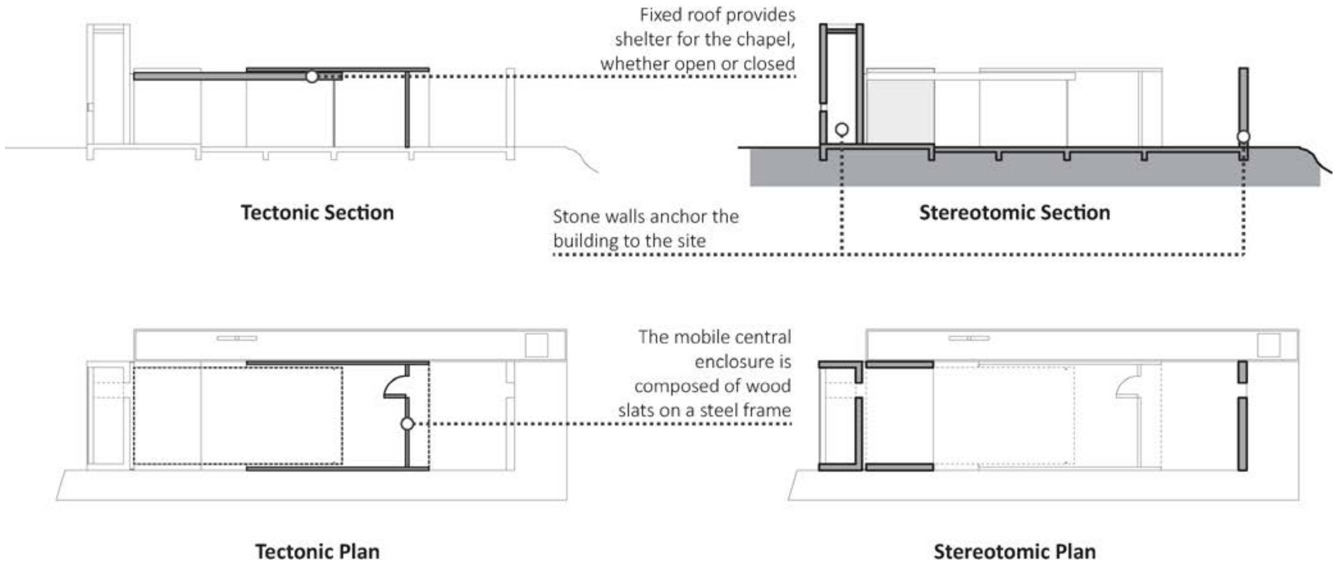
Stereotomic

The stereotomic qualities of La Milagrosa Chapel are found in the stone walls (Figure 11.7). These walls are dark, heavy, and remarkably earthbound. The stone is rough and set in very thin horizontal bands; both characteristics reflect the qualities of the earth and its strata (Figure 11.8). The walls are also a stark contrast to the white stone used to pave the floor of the chapel. These two mass elements are set in opposition but fill atypical roles – the dark mass rises from the ground, while the light mass runs horizontally along it (as opposed to the opposite condition of light rising and dark sinking). The walls define the east and west ends of the building, bookends anchoring La Milagrosa in place. On the east, the stone entry wall serves as a threshold. On the west, they enclose the altar, creating contrast with the airiness of the rest of the building.

The reflecting pool also plays a stereotomic role in the understanding of the chapel. It sits in the concrete platform on which the building is erected and it is filled with local stone. Like the stone walls, it provides a static tether for the chapel, keeping it in place despite its transformative qualities. You must rise above and step across this earthbound sentry to reach the chapel's main entrance.

Tectonic

The transformative qualities of La Milagrosa Chapel are found in its tectonic components. The nave is surrounded by a multilayered construction of steel, glass, and wood and is composed of two primary systems. The first is a roof that covers the altar and extends out



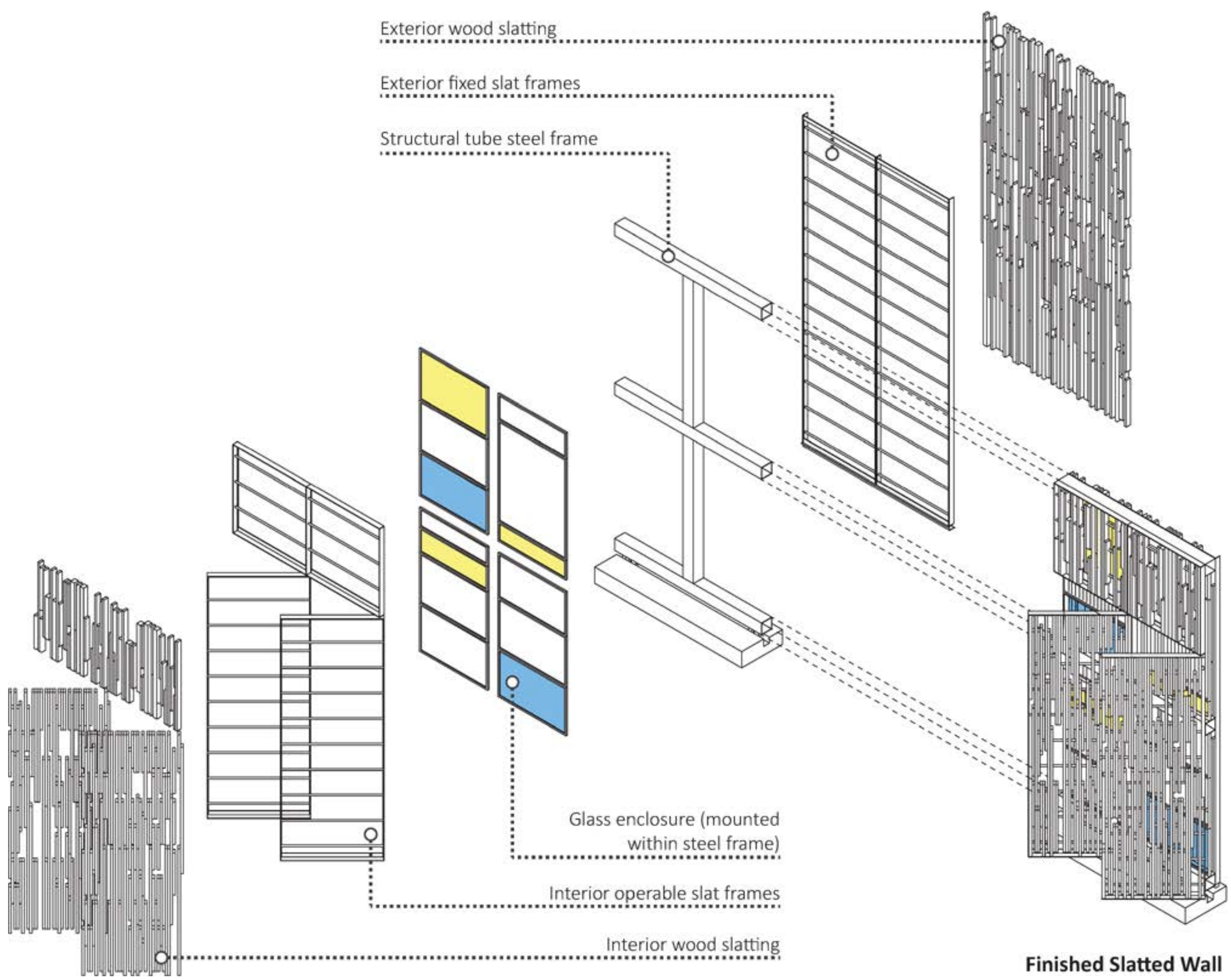
11.7
Tectonic | Stereotomic

11.8
Interior of the tabernacle

into the nave. This plane consists of a steel frame, clad with wood strips on the interior and flat deck roofing on the exterior. It is supported by the stone walls flanking the altar on the west and by two slender steel columns on the east.

The second element is a three-sided enclosure that wraps up and over the roof. It has three distinct layers: an outer layer of wood slats, a layer of glass, and an inner layer of wood slats (Figure 11.9). Its construction is modular, built as a series of 1-meter [3.3-foot] panels, each with a lightweight steel frame. A heavier tube steel frame provides the primary structure for the enclosure.

The cladding consists of slender wood slats fed onto steel rods. The slats are cut to different lengths and arranged to give variety to the pattern of each panel. The interior and exterior screens are identical except that while the exterior screens are fixed, the interior screens are hinged and can swing open like shutters, transforming the nave. The middle layer of the enclosure consists of glass panes set into the steel frame. Although most are clear glass, some panes are colored, further augmenting the quality of light entering the space.



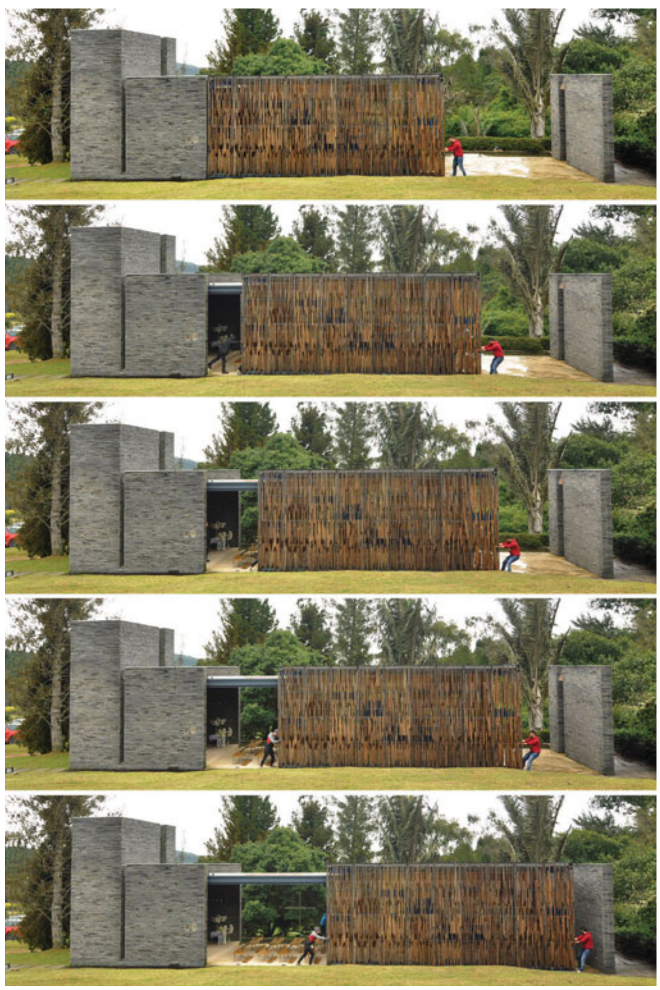
11.9
Slatted wall composition

> Light is filtered and striated and, as the sun moves, it transforms the whole space with slowly changing streaks and sheets of luminance, sometimes stained by the panels of blue and yellow glass incorporated in the skin.[5]
>
> "Moving Moment: Chapel, La Calera, Colombia,"

This sophisticated multilayered system wraps the sanctuary space, but the most significant part of the tectonic construct is that the entire 9-meter [29.5-foot] volume can move.

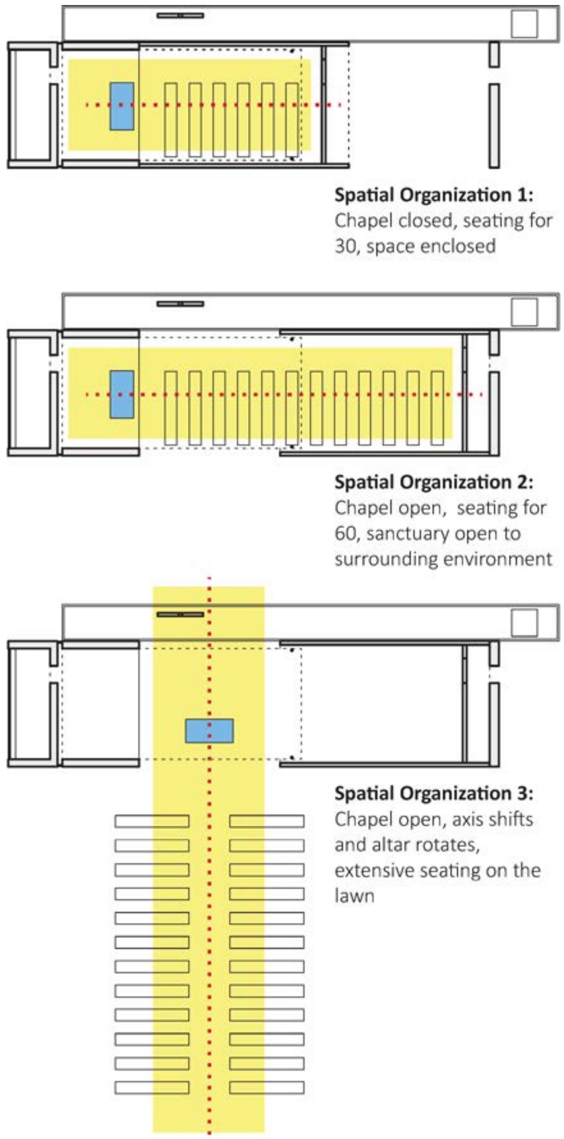
Space | Precedent

The tectonic enclosure of Porciúncula La Milagrosa Chapel can be shifted back over the entry courtyard to the east all the way to the stone wall holding the chapel bell (Figure 11.10). This transformation allows the nave to, first, double in capacity; second, the movement opens the sanctuary to the north towards the forest and to the south towards the open meadow; and third, the shifting pulls the higher roof plane out from above the solid lower plane (which does not transmit light), allowing light to filter into the space from above.



11.10
Opening sequence

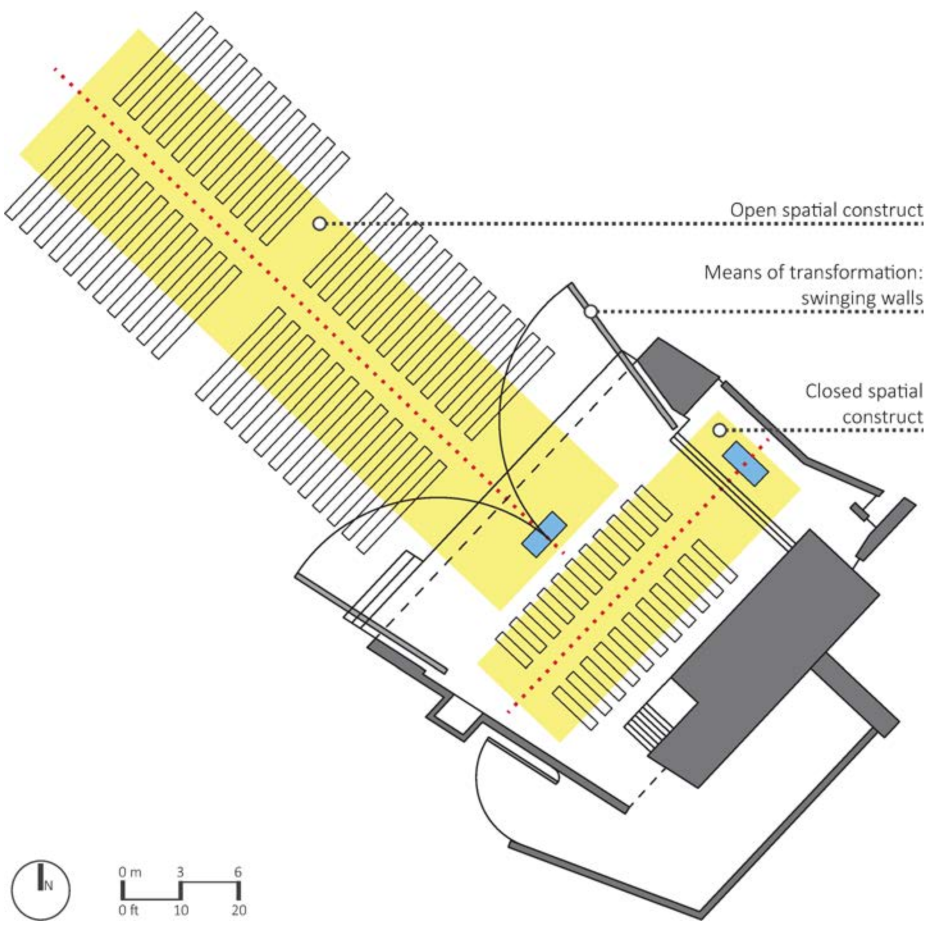
11.11
Transforming states



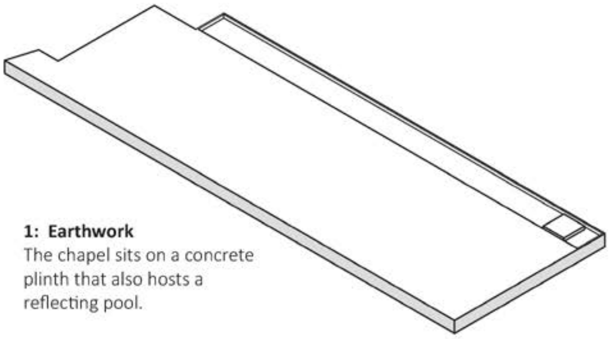
This flexible space allows for three primary configurations (Figure 11.11). With the volume closed, a small, intimate ceremony or service can be held with about 30 people. With the volume open, larger events can be held in the chapel – with up to about 60 people – while also allowing the event to better connect to the natural environment. However, a third configuration exists for more substantial events. The entire spatial construct rotates to a north/south alignment with the opening in the volume. In this configuration, the altar moves to the center of the nave, facing south, and the congregation moves to the terraced grassy meadow, which is ideal for seating large crowds.

In La Milagrosa, the transformation of constructed parts is intricately tied to the redefining of sacred space. The relationship between construction and space ties the project to Bötticher's understanding of spatial tectonics. Instead of the roof's structure permanently defining space, however, the ability for the enclosure of the space to shift its volume and support allows the space to also reconfigure around the needs of the occupant and the religious and cultural conventions of the program. The shift in scale and in axis, not surprisingly, forms a cross that has a close relationship to the axial plan of a traditional Catholic church. But, more importantly, the shift also leads to a change in the symbolic meaning of particular elements: the altar becomes a choir, the main nave becomes a transept, the grassy slope becomes the nave, and the tabernacle becomes part of the landscape.[6]

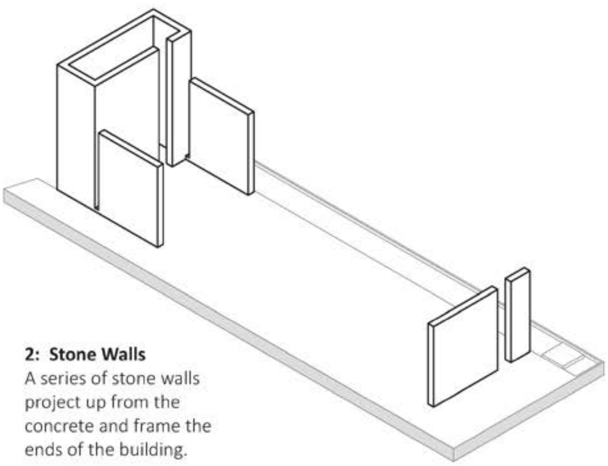
This project is not the first in which Bonilla has explored flexible, transformative space. La Milagrosa Chapel followed the development of a chapel space for Los Nogales School in Bogotá (4°46′53″N, 74°3′14″W) (Figure 11.12). In both projects, heavy materials (stone) were used for the static components and lighter materials (wood and glass) were used for the mobile elements. In the first generation, instead of a sliding movement, the walls of the chapel swing out to open the nave to a large lawn. As with La Milagrosa, the intent is the same: to significantly expand the assembly space and to connect the sacred interior space to the natural environment.



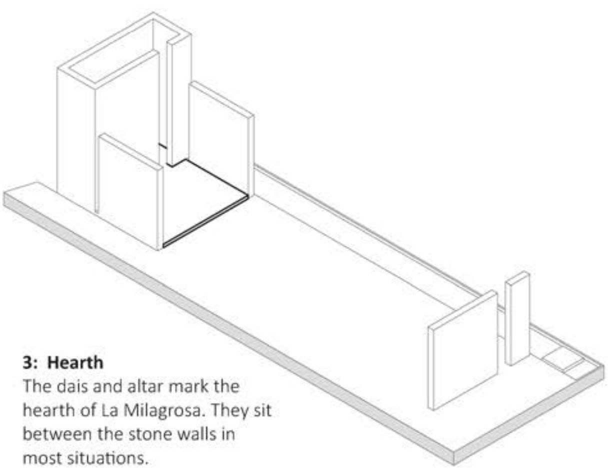
11.12
Transformation of the chapel at Los Nogales



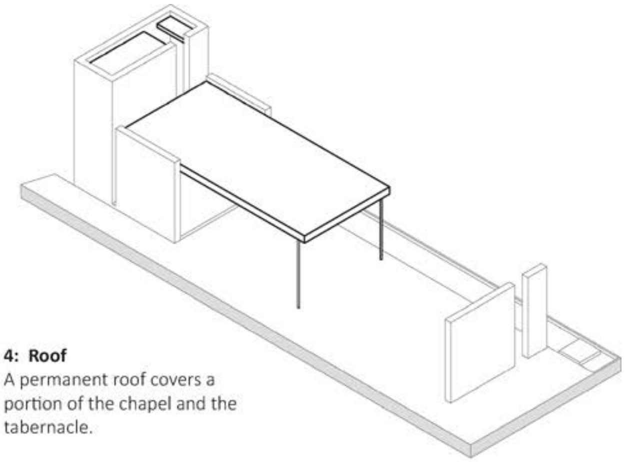
1: Earthwork
The chapel sits on a concrete plinth that also hosts a reflecting pool.



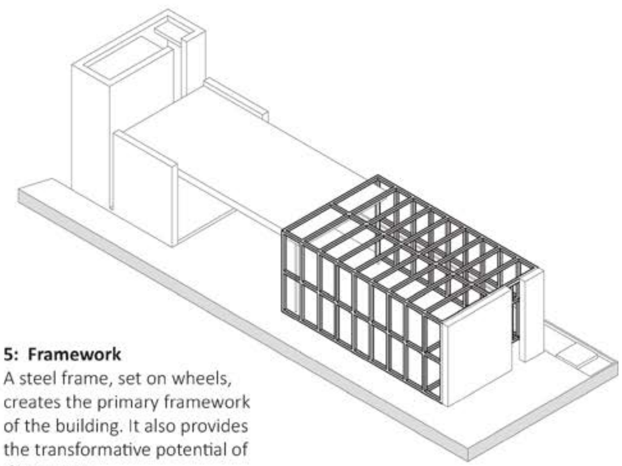
2: Stone Walls
A series of stone walls project up from the concrete and frame the ends of the building.



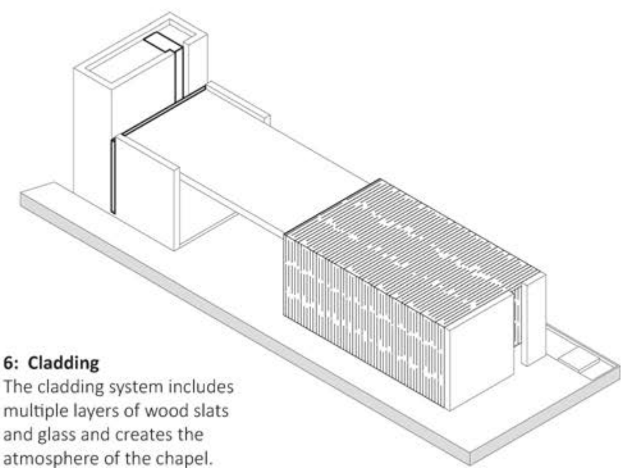
3: Hearth
The dais and altar mark the hearth of La Milagrosa. They sit between the stone walls in most situations.



4: Roof
A permanent roof covers a portion of the chapel and the tabernacle.



5: Framework
A steel frame, set on wheels, creates the primary framework of the building. It also provides the transformative potential of the project.



6: Cladding
The cladding system includes multiple layers of wood slats and glass and creates the atmosphere of the chapel.

11.13
Anatomy

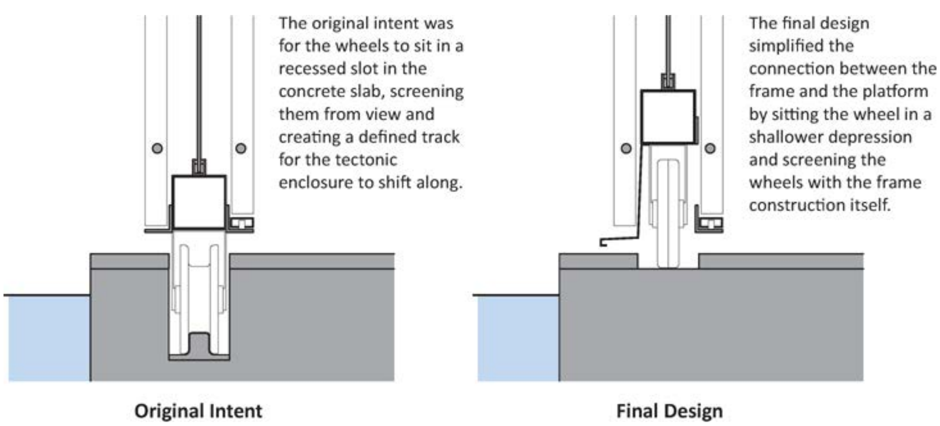
Anatomy

La Milagrosa Chapel sits on a concrete plinth perched on a grassy slope. The front garden conceals much of the concrete, but on approach, you can see the corners projecting out above the grass (Figure 11.13). The stone walls extend upward and bracket the transformative space, while the rolling steel chassis that allows for the movement of the building serves as a framework element. The frame is clad with multiple skins of wood and glass that combine to provide the atmosphere of the chapel.

The hearth of La Milagrosa Chapel is multifaceted. In its closed state, the altar is the sacred center of the building. This space is raised on a dais and compressed between the flanking stone walls; it is the protected epicenter of the chapel. When the building transforms, however, the hearth also shifts. When the nave moves to the hillside, the building becomes the altar or hearth, serving as a sheltered cradle of spirituality in the landscape.

Detail | Intersection

When asked about the details of La Milagrosa, Bonilla channeled the likes of Bötticher, Frascari, and Gregotti by simply stating: "All details in architecture are critical."[7] A deeper examination, however, reveals a singular detail of significant importance: the one that allows it to move (Figure 11.14). To accomplish this feat, the steel frame is set on large wheels that, in turn, sit in a reveal in the floor. The slot provides a simple mechanism for keeping the wheels on track while the structure is shifting. The movement is accomplished through brute force as opposed to more complicated and expensive mechanical systems. Handles are built into the ends of the steel frame to allow for ease of pushing and pulling while rolling the heavy frame from its closed to open position and back. This intersection also serves as the only point of significant contact between the primary tectonic and stereotomic systems. This intersection, described by Frampton as a transition that exemplifies the "very essence of architecture,"[8] is not a fixed condition. Instead it is the catalyst for the transformative power of the chapel.



11.14
Detail of the wheels

11.15
View through the slatted enclosure with the inner screens open

Representation

> The façade is an abstraction of the contiguous pine forest trunks. Through the pattern, the light washes the entire space, creating an atmosphere by means of representation.[9]
>
> Daniel Bonilla digital interview, 2014

The materials of Porciúncula La Milagrosa Chapel evoke the surrounding landscape in what Bonilla describes as a mimesis. The natural landscape is mimicked through texture and contrasting value. "The textures evoke those in the surrounding landscape, a dual language that states reference and contrast."[10] As described above, one of the primary materials is wood. The offset vertical striations of the slatted screens creates a reflection of the surrounding forest, but the patterning and assembly also emphasize the extrusion of the mobile volume – a set of thin frames knitted together to form a tube-like structure that shelters the space (Figure 11.15). This woven construction of wood and steel is also reflective of Semper's frame, draped with fabric to create space and monumentality. Here, the mobile volume acts as a veil, delicately concealing the sacred interior, but also revealing its magnificence when pulled back.

Additional Resources

Projects

Los Nogales School Chapel, Bogotá, Colombia, 2001 (4°46′53″N, 74°3′14″W)

Julio Mario Santo Domingo Building, Universidad de Los Andes, Bogotá, Colombia, 2007 (4°36′16″N, 74°3′58″W)

Los Nogales School Arts Center, Bogotá, Colombia, 2008 (4°46′58″N, 74°3′13″W)

Athinkia Building, Bogotá, Colombia, 2008

Omega Block, Colegio Anglo Colombiano, Bogotá, Colombia, 2008

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"Capilla De La Milagrosa La Calera, Colombia: Daniel Bonilla." *Arquine: Revista Internacional De Arquitectura*, no. 32 (2005): 56–63.

"Capilla Prociúncula De La Milagrosa, Bogota: Danial Bonilla, Arquitecto, 2003–2004." *Arkinka* 10, no. 124 (2006): 40–45.

"Daniel Bonilla: Capilla Prociúncula De La Milagrosa." *AAA: Archivos De Arquitectura Antillana* 9, no. 19 (2004): 117–22.

"Moving Moment: Chapel, La Calera, Colombia." *Architectural Review* 216, no. 1294 (2004): 42–45.

"Porciúncula De La Milagrosa Chapel Bogotá, Colombia: Daniel Bonilla Arquitectos." *C3 Korea*, no. 312 (2010): 76–81.

Notes

1 This firm brief was adapted from the firm profile and review on Daniel Bonilla Arquitectos' website: www.daniel-bonilla.com/intro.html

2 Information provided by Daniel Bonilla through a digital interview, September 2014.

3 Ibid.

4 "Moving Moment: Chapel, La Calera, Colombia," *Architectural Review* 216, no. 1294 (2004), 44.

5 Ibid., 43.

6 Daniel Bonilla as cited in "Porciúncula De La Milagrosa Chapel Bogotá, Colombia: Daniel Bonilla Arquitectos," *C3 Korea*, no. 312 (2010), 76–81.

7 Daniel Bonilla, digital interview.

8 Kenneth Frampton, "Botticher, Semper and the Tectonic: Core Form and Art Form," in *What Is Architecture?* ed. Andrew Ballantyne (New York: Routledge, 2002), 146.

9 Daniel Bonilla, digital interview.

10 Ibid.

12
Arabian Library
richärd+bauer

Architect Brief[1]

richärd+bauer is an award-winning design firm with extensive experience in the design of public, higher education, and research facilities for both public and private entities. As an integrated architectural and interiors practice, holistic design is a fundamental component to their design approach. The firm's principals – James Richärd AIA, Kelly Bauer FIDA NCIDQ, and Stephen Kennedy AIA NCARB – provide extensive experience in delivering facilities that function, respond to their context, and enrich how people work, learn, and play.

richärd+bauer does not promote a specific style. Instead, each project builds on a conceptual framework that is derived from the program and the response to the site and context. It is fundamental that each building speak to its purpose and internal processes, yet aspire to an intrinsic symbolic concept. The firm believes that architecture must raise the level of expectation and wonder, focusing on the experiential rather than formal language. It is this

scottsdale, arizona, united states
gps | 33°37'40"N, 111°51'48"W
program | community branch library
completed | 2007
area | 1000 m2 [20,800 ft2]

12.1
Vicinity map

experiential focus that provides the connection between the individual and the architecture, and through the architecture to the larger environment, context, and purpose.

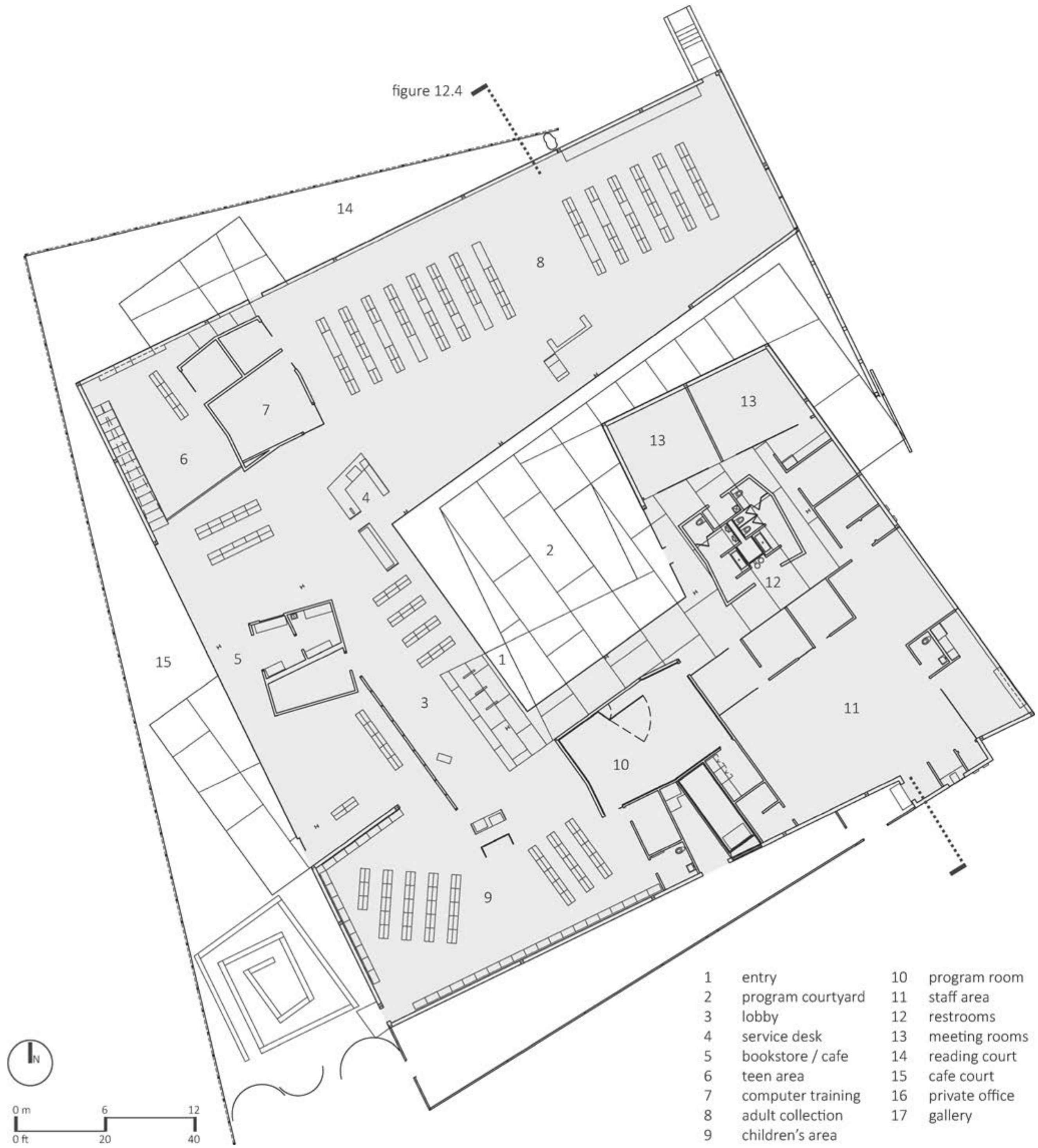
In their work, richärd+bauer chooses materials for their inherent integrity, natural beauty, and patina. Unlike synthetic surfaces that erase the mark of time, these materials express the effect of natural processes and develop a sense of permanence in the surrounding landscape. The mark of the hand has also become increasingly important in the firm's work. As with materiality, the understanding of the processes and techniques of craft allows the architects to integrate these as markers in the final architectural work.

Project Brief[2]

Arabian Library is one in a series of significant library projects built by the municipalities of Phoenix, Arizona in an attempt to enrich the quality of their local communities. This contribution sits on the north end of Scottsdale, a northeast satellite of the Phoenix metropolitan area. It is sited with stunning views of the McDowell Mountain Preserve in the distance, but the banality of suburban sprawl in the foreground (Figure 12.2).

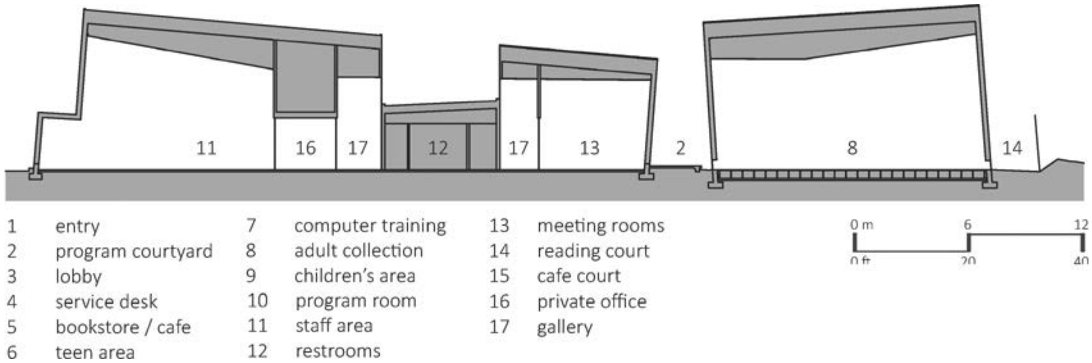
The library's program is reflective of trends in contemporary library design. The traditional reading room, book stacks, children's room and playroom, and staff/circulation spaces are complemented with scanning stations that replace the main circulation desk and a café that gives the space the quality of a bookstore instead of a library (Figure 12.3). This library

12.2
View of Arabian Library from the parking lot



12.3
Floor plan

12.4
Building section



12.5
View from interior out to the courtyard

is not a silent environment. The activity of the space is reflective of new visions for the community library, but one that still has a focus on the transfer of knowledge, especially to the youth of the community. The LEED Certified building incorporates a subfloor mechanical, electrical, and data distribution system, providing long-term flexibility in a rapidly changing informational environment (Figure 12.4).

Organized around a central courtyard, the building is entered through a canyon of steel and glass (Figure 12.5). The courtyard is used as a program space for the library and as a pre-function space for its meeting rooms. Two separate slender courts also flank the west and south sides of the building, expanding library lounge spaces to the exterior and ultimately opening the building again to both the sky and the desert floor.

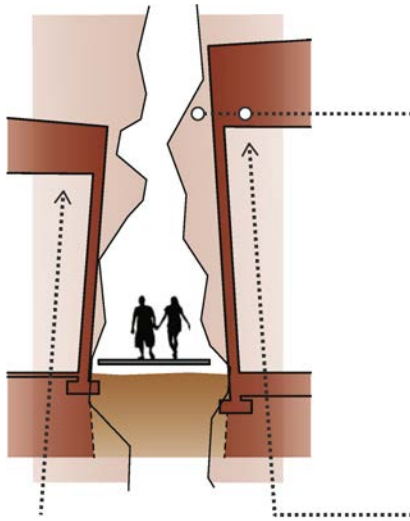
Tectonic Principles

Precedent

The building is designed with reference to the desert slot canyons of northern Arizona (36°55′19″N, 111°24′56″W) and monument valley. "Ever-patient threads of water, sculpting and polishing the massive walls, cut these natural sandstone canyons over millennia."[3] The library echoes this powerful natural sequence (Figure 12.6). The gesture of the building is

12.6
Comparison of the building entry sequence to a slot canyon

12.7
Geological relationships



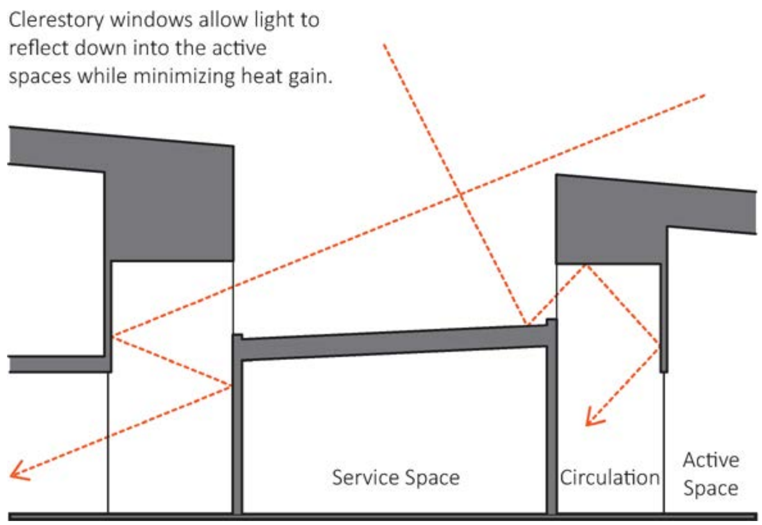
complemented by its materiality – rusting steel panels – which provides a similar intensity and tone of color as the canyon walls. Just as the slot canyons have changed (and continue to change) with time, the surface of the steel panels changes as well. This experience is most prominently felt in the entry/exit sequence. This threshold condition – akin to Frascari's formal joint – succeeds in "capturing the powerful and unique experience between the compressive stone walls and the ultimate release to the sky above."[4] As time works away on the canyon, the less dense stone is carved away while the denser stone remains. This process of carving is immediately identifiable in the library as well, and the effects continue on into the interior of the building. richärd+bauer note that:

> The building is lined with perforated hardboard and recycled cotton insulation to accommodate acoustical properties while reinforcing the homogenous notion of the canyon walls. A series of architectural ledges give way to internal clerestories, introducing daylight to the center of the space.[5]

In a separate geological process, the Arabian Library is seemingly subjected to an upward thrusting motion from the shifting of the earth (Figure 12.7). The sharp, angular lines of the building promote this reading. The design of the library utilizes the characteristics of geological tectonics both to shape space and to heighten the architectural tectonic reading of the building.

Place

The Arabian Library was designed as a filter of the harsh desert sun. The building utilizes slices of glass selectively, channeling light to the interior, while mitigating substantial heat gain. Again, this process is reflective of the slot canyons where, at certain moments, light filters down from high above. At several locations in the building, clerestory windows are paired with light shelves to bounce or reflect light into the space rather than receive it directly



12.8
Clerestory light

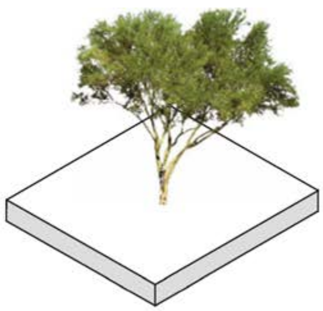
(Figure 12.8). This process can minimize the heat that travels into the space and can help throw natural light deeper into the building, allowing for additional energy savings during the day.

The building also responds to its physical surroundings. The glazing in the building is located to control not only light and heat but also views. The exterior of the building presents itself as a windowless mass, an earthen form. Strategically placed fissures in this skin allow the library to carefully open up to the surrounding environment, absorbing certain influences – views of the mountains beyond – while concealing others – the residential neighborhoods. The library is a good example of Semper's courtyard typology. Although Semper believed this configuration was developed to protect against the environmental forces of warmer climates, here richärd+bauer have also used the inwardly focused construction type to shield the project from the potentially harsher cultural influence of vast suburban sprawl.

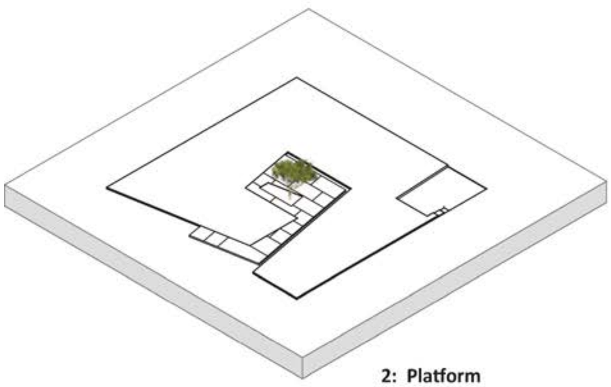
Anatomy

The earthwork of the Arabian Library is a concrete foundation system embedded in the desert soil (Figure 12.9). Although much of the building sits on grade, one corner is sunk about 46 centimeters [18 inches] below the surface of the desert floor, creating a bench-high seat along the glazed perimeter of that area. On this foundation system rests a steel framework that provides stability for the building and supports the steel roof structure above. Infilling the framework is a lightweight steel wall system clad with steel panels on the exterior and perforated hardboard panels on the interior. Glass also plays a key role in the cladding of the interior spaces, filling the slices in the building's mass.

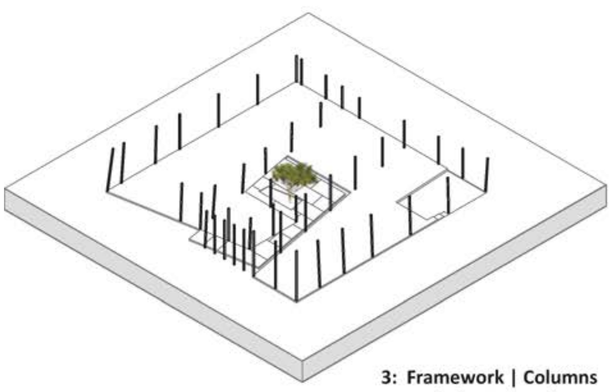
The hearth of the Arabian library is the protected central courtyard where a specimen paloverde tree sits as the focus. This symbol of life in the desert, sheltered by the surrounding building, is the figurative life of the library. As you move through the entry sequence and into the building, you pass by the tree and through this social center.



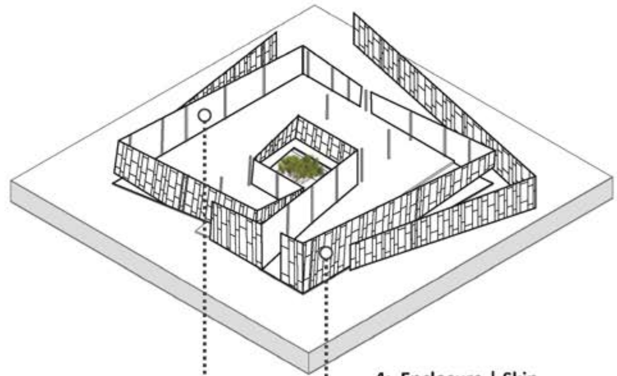
1: Hearth
Standing alone in the courtyard of the library is a single specimen paloverde - a symbol of life that is sheltered by the surrounding building.



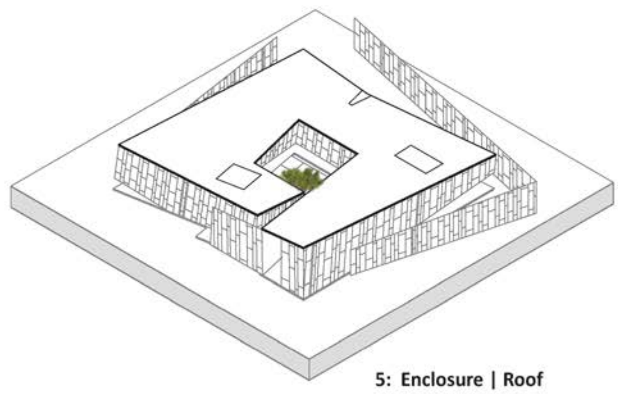
2: Platform
A concrete pad serves as the base of the building, extending to the court and depressing at the teen center.



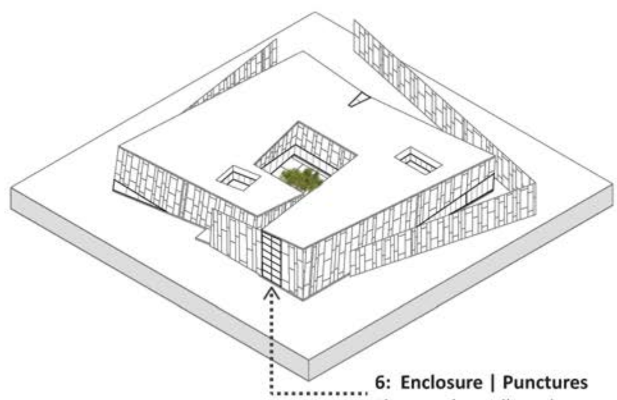
3: Framework | Columns
A gently sloping steel structure forms the frame of the building. A network of steel members also composes the roof structure (not shown).



4: Enclosure | Skin
The building is clad with steel panels on all exterior surfaces while the interior is clad with perforated hardboard.



5: Enclosure | Roof
Originally intended to be a green roof, the low-slope roof protects the building from the elements.



6: Enclosure | Punctures
Slices in the walls and punctures in the roof are filled with glass, allowing controlled light into the space and views out of the space.

12.9
Anatomy

Stereotomic | Atectonic

From a distance, the Arabian Library is a mass of weathered orange; it is a natural outcropping in the Sonoran Desert. The stereotomic here is embodied in the recycled Corten steel-clad walls of the building. Corten steel – which is a specific trademark of the generic product of weathering steel – is an alloy that forms a stable rust-like surface when exposed to the elements. The surface weathering protects the bulk of the steel from damage, eliminating the need for painting or other surface treatments.

The stereotomic quality of the library is enhanced through the nature of its openings (Figure 12.10). Instead of punched windows and doors, the mass of the building is carved away, seemingly in an act of subtraction. These subtractions are filled with mullionless glass, which is deployed in full-height and full-length runs. The lack of definition between interior and exterior created through this glazing construction reinforces the feeling of eroded space; you move through these crevices as you enter the building. The effect is also enhanced through the detailing. In the courtyard, the steel walls slip down into a narrow, gravel-filled channel running between the wall and the pavement. This reveal heightens the impression that the library is rising out the ground, part of the geology of the earth's crust.

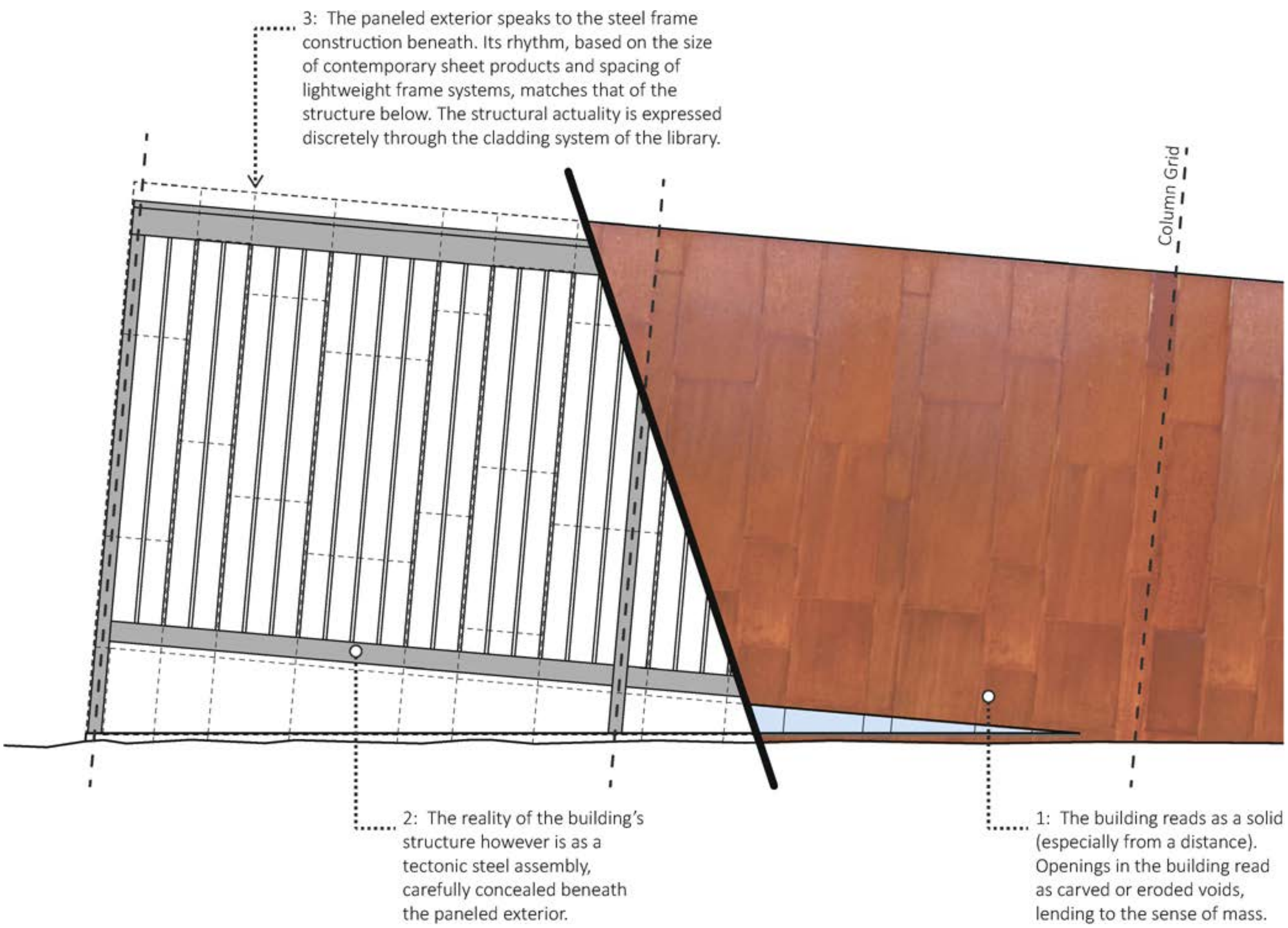
12.10
Tectonic | Stereotomic

The stereotomic qualities of the building, however, are just a mirage. Similar to one of Sekler's definitions of the atectonic, there is a disconnect in the Arabian Library between the presence of the building (or the perception of its structural principles) and the actual construction employed in its creation. The heavy masses are not constructed from traditional stereotomic materials – concrete, masonry, earth, or stone – but instead from steel.

Tectonic | Atectonic

Although the building is supported by a steel structure, much of this frame is concealed between the exterior and interior cladding systems (Figure 12.11). What steel is exposed, however, plays an interesting tectonic role. The slices in the building's exterior reveal the steel structure. In certain locations in the library, these exposed columns – a portion of the tectonic frame – visually support the carved mass above. In a reversal of the traditional tectonic language and roles posited by Frampton, the library's tectonic frame tethers the mass to the earth. This rather atectonic composition of slender steel columns supporting the stereotomic mass, which peels away from the ground below, creates a dynamic play of structure in the building.

12.11
Analysis of the exterior wall



12.12
End condition of the entry wall

The true assembly of the exterior walls is also revealed through their detailing. At the start of the main entry path into the building, you are confronted with the end of a wall that defines the beginning of the entry corridor. Here, unlike when viewing the wall from the face, it is revealed to be a core sandwiched between two thin sheets of steel (Figure 12.12). At this moment, the nature of the structure as a carved mass is compromised in favor of an assembled structure.

Representation* | *Ornamentation* | *Intersection

Like the wall end condition described above, the detailing of the steel cladding is reflective of the tectonic nature of the perceptibly stereotomic mass. The surface is actually created from a series of smaller steel panels that come in four different widths (Figure 12.13). The panels are tall and slender and the horizontal joints between the panels are staggered. This configuration creates a series of prominent vertical striations on the surface of the exterior walls which sharply juxtapose the horizontality of the building at its larger scale. These lines, along with the textural presence of the small steel fasteners used to hold the panels onto the surface behind, are indicative of the actual structure and flow of gravity load occurring within the walls themselves.

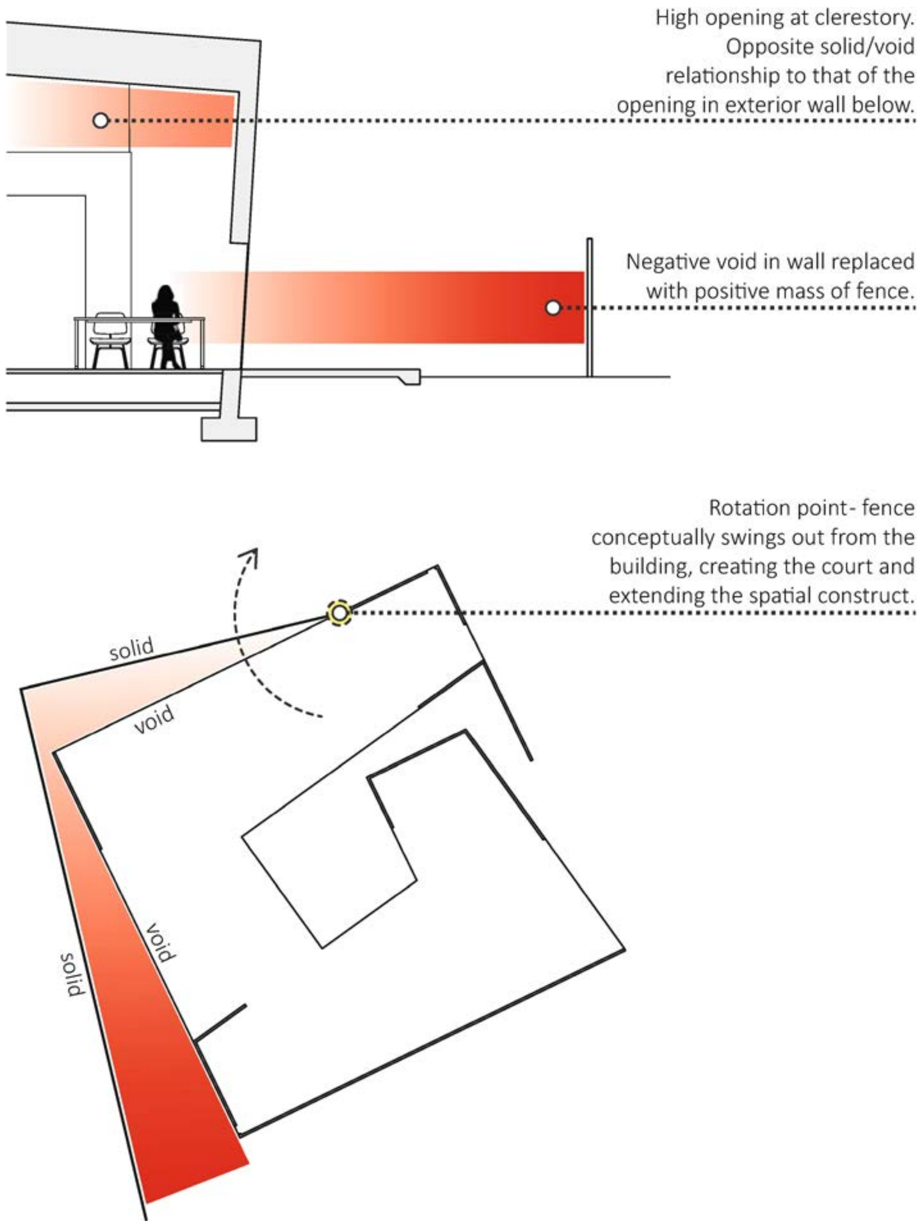
The patterning of the stark façades (both inside and outside), is quintessential contemporary ornamentation. The play of material and its jointing provides the texture and representational role of the building with respect to its construction. This pattern is evident not just in the Corten steel cladding but also carries through into the glass and the interior

12.13
Exterior steel panels

hardboard paneling. In all situations, the texture added creates a dual reading of the building: from a distance as a mass and closer as an articulated assembly. And as this detailing provides the key relationship between the reading of the stereotomic and the tectonic in the wall surfaces, it is also the primary intersection in the library. Unlike most of the other buildings discussed in this book, the relationship between tectonic and stereotomic in the Arabian Library occurs internally in a single element rather than between separate elements. The material detailing provides a dialogue between these two readings.

Space

The spatial tectonics of the Arabian Library are created through a perceptible peeling back of the building's skin. Although not a literal one-to-one relationship, the perimeter walls of the outer courts have a strong positive character that aligns with the negative connotation of the window walls (Figure 12.14). This peeling action is tied to Semper's theory of dressing; the concealing and revealing of the building acts in a similar fashion to the specific draping of fabric on the human form. These shifts are experienced by the user primarily in section as the mass/void relationship alternates high and low. The reveals created through this process are scaled to the program occurring in that area of the library (Figure 12.15). For example, along one exterior wall lined with tables, the slice in the building is ideal for getting light and views to an individual sitting and reading a book. This slice would be experienced very differently by someone standing next to it. In this building, the manipulations of the building's mass have clear relationships to the perception of and utilization of space by the user.



12.14
Peeling of the building

12.15
Interior seating area adjacent to the slot court

Additional Resources

Projects

Desert Broom Library, Phoenix, Arizona, United States, 2004 (33°45′16″N, 111°59′32″W)

Interdisciplinary Science + Technology Building 2, Arizona State University, Arizona, United States, 2005 (33°25′16″N, 111°55′46″W)

Meinel Optical Sciences Building, University of Arizona, Arizona, United States, 2006 (32°13′53″N, 110°56′52″W)

Harmon Library, Phoenix, Arizona, United States, 2009 (33°26′9″N, 112°4′48″W)

College Center, Central Arizona College, Superstition Mountain Campus, Arizona, United States, 2012 (33°24′32″N, 111°32′36″W)

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"Arabian Library [Scottsdale, Arizona, 2007]: Richard+Bauer." *C3 Korea*, no. 331 (2012): 114–23.

Levinson, Nancy. "Richard+Bauer Draws People through a Rusting Steel Canyon and into Scottsdale's Arabian Public Library." *Architectural Record* 196, no. 6 (2008): 96–101.

Notes

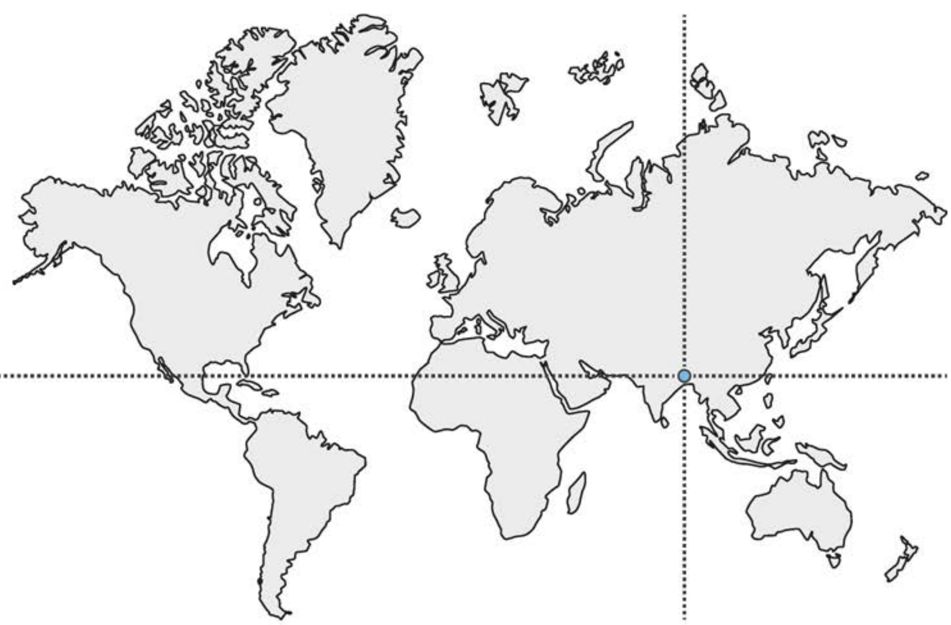
1 This section is adapted from a firm bio provided by richärd+bauer.
2 This section is adapted from a project narrative provided by richärd+bauer.
3 This quotation was taken from a project narrative provided by richärd+bauer.
4 This quotation was taken from a project narrative provided by richärd+bauer.
5 This quotation was taken from a project narrative provided by richärd+bauer.

13
METI Handmade School
Anna Heringer and Eike Roswag

Architect Brief

> For me, sustainability is a synonym for beauty: a building that is harmonious in its design, structure, technique and use of materials, as well as with the location, the environment, the user, the socio-cultural context. This, for me, is what defines its sustainable and aesthetic value.[1]

Anna Heringer's description of beauty goes beyond meeting utilitarian need. Her definition rises to fulfilling the aspirations of culture, community self-confidence, and environmental stability. This stance originated prior to her professional career. Heringer graduated from the University of Arts in Linz, Austria in 2004 having completed a diploma project entitled "School Hand-Made." This research – coupled with earlier experiences living in Bangladesh



rudrapur, bangladesh
gps | 25°45'23"N, 88°33'10"E
program | children's school
completed | 2005
area | 325 m2 [3,500 ft2]

13.1
Vicinity map

13.2
METI Handmade School with students playing

– provided a catalyst for the founding of BASEhabitat studio in the Architecture department at the University of Arts. From this platform and from her office, Heringer has developed projects in underserved areas around the globe.

Heringer's partner in the creation of the METI Handmade School was Eike Roswag, who served as the technical architect on the project. Roswag graduated from the Technical University of Berlin with a degree in engineering in 2000. In 2003, he was a founding partner of ZRS Architekten Ingenieure Bürogemeinschaft (Architecture and Engineering Partnership) in Berlin. The firm has a history of working on projects, like the METI School, that push for the development of sustainability through the use of natural materials. These materials facilitate the creation of comfortable and healthy dwellings that exist in harmony with the surrounding environment.

The work undertaken in these impoverished locations has earned the architects significant recognition and many honors; most prominently, in 2006, the METI Handmade School was awarded the Aga Khan Award for Architecture. Since this initial project, the body of work coming out of Heringer's philosophical stance on the role of architecture in global development has been honored with multiple Emerging Architecture Awards, a Global Award for Sustainable Architecture, multiple World Architecture Community Awards, and multiple prestigious exhibitions of the work, including one at the Museum of Modern Art in New York.

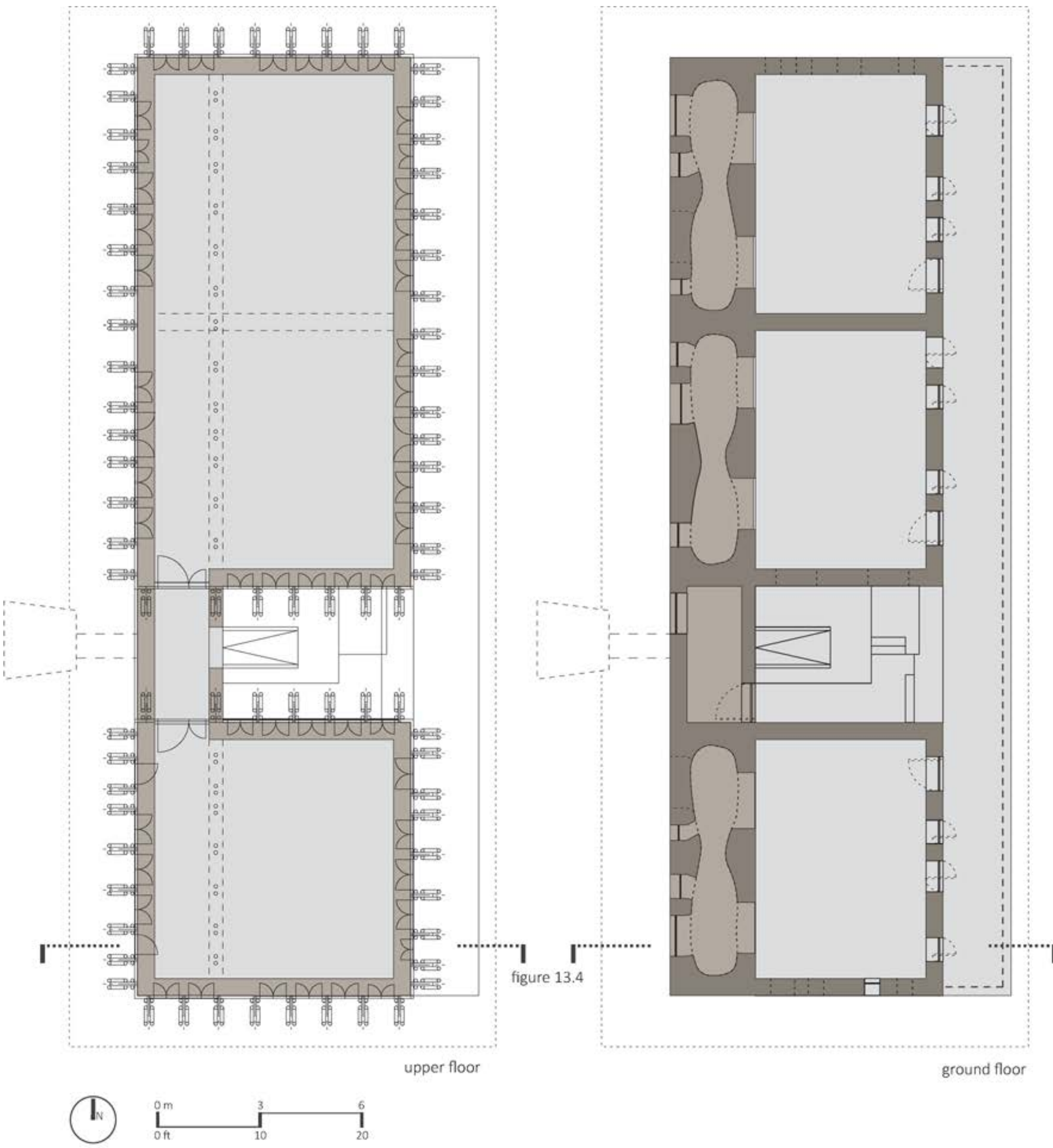
Project Brief

Rudrapur is a small rural community located in the northwest region of Bangladesh. The community is one of many supported by the Modern Educational Training Institute (METI) and Dipshikka, a nongovernmental organization (NGO). These two entities collaborated with two German organizations to construct a new school for the town built on METI's Montessori-style educational program that emphasizes life skills and experiential education in addition to more traditional lesson plans (Figure 13.2).

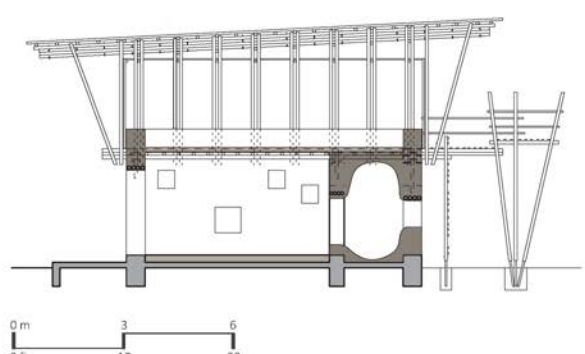
The school has six classrooms that serve around 170 students each year (Figures 13.3 and 13.4). The ground floor of the two-story structure – built from earth – contains three classrooms and a cave-like structure used for private work and play (Figure 13.5). The upper floor also houses three classrooms but is built from bamboo (Figure 13.6). The two floors are connected by a central, open-air stairway that divides the school into two distinct areas. The building is the only two-story structure and the most prominent building in the village. Outside of educational programming, it is used extensively for a variety of community events.

For the architects, the project centered on satisfying the needs of the community while making use of the abilities and supplies available to the people of this region. The school is built mostly with traditional materials but with detailing and construction techniques developed specifically for the METI School.

Over several months, 30 local craftsmen and laborers received instruction on the techniques developed for the project and constructed the building. By running the construction of the project in this manner, the money spent on the project stayed primarily within the community. In light of this working philosophy, the jury for the Aga Kahn Award stated that



13.3
Floor plans



13.4
Building section

13.5
Interior of the lower-floor learning environment

13.6
Interior of the upper-floor learning environment

> this joyful project, in a poor rural area of Bangladesh (said to be the world's most densely populated country), shows that new and refreshing local identity can be achieved by exploiting the immediate and the readily available – ironically via architects from Europe.[2]

Tectonic Principles

Anatomy

The METI Handmade School is built on a simple raised platform that provides a stable foundation for the building and a water-resistant barrier between the earth and the walls above (Figure 13.7). The thick earthen walls resting on the platform define the lower floor of the structure. They are an extension of the ground and are quite literally made from it. The framework of the school is constructed from bamboo and structures the upper floor of the building. The walls of this upper floor are clad with operable bamboo screens. Below, the earth walls are painted on the interior with a thin coat of lime and mud while the door openings are filled with colorful pivoting panels.

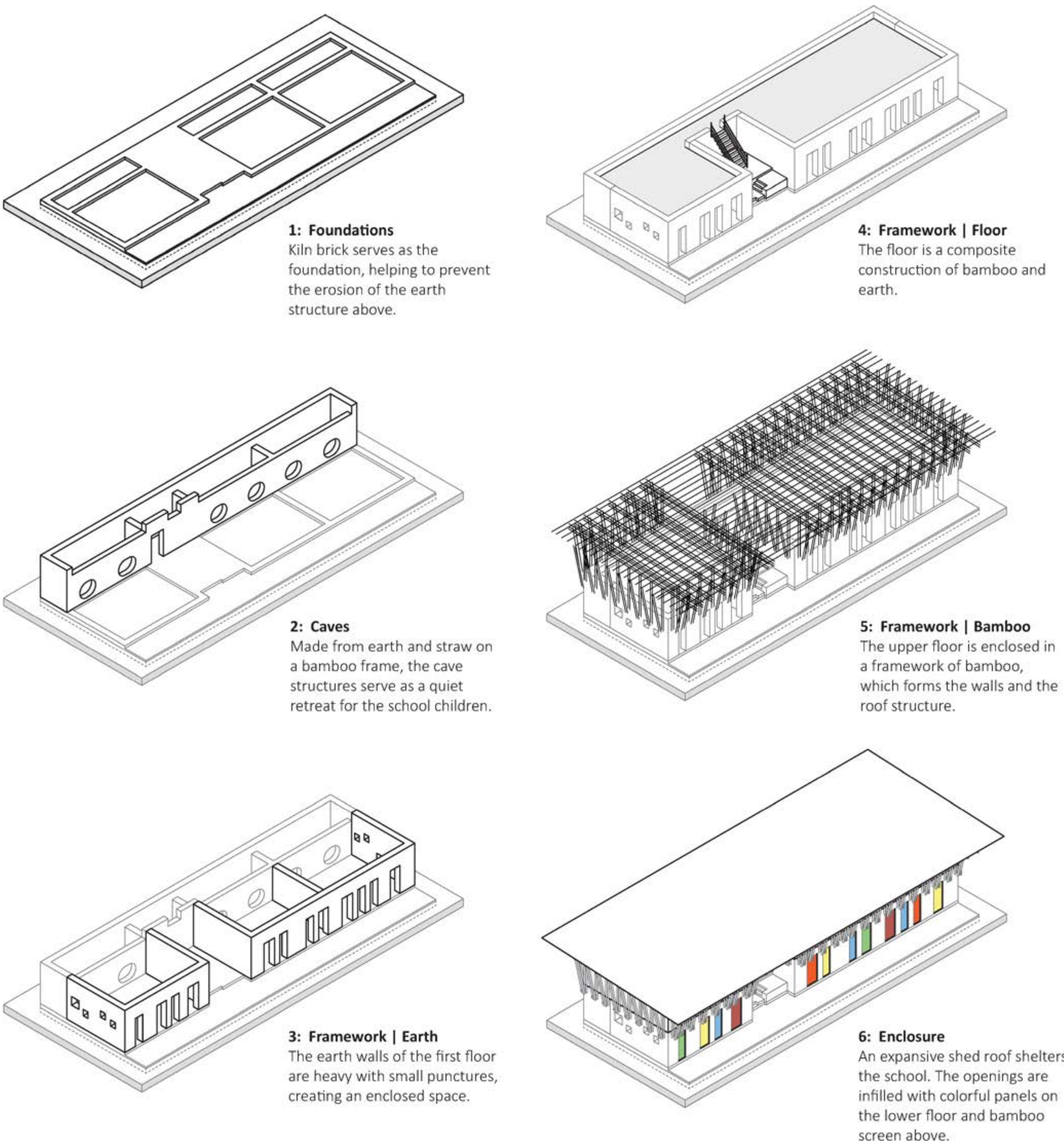
At the rear of the lower level of the building is a cave-like structure that serves as a retreat for the students of the school. It is used both as a social play space and as a site to quietly focus on the work at hand. Within the school, this construction serves as a hearth – a social center. However, the more direct connection to Semper's hearth in this project comes at a larger scale: that of the community or perhaps even the region. This building is a catalyst for change and a symbol of hope and progress, of education and knowledge building. It is the hearth of Rudrapur.

Precedent | Place

> The design solution may not be replicable in other parts of the Islamic world, as local conditions vary, but the approach – which allows new design solutions to emerge from an in-depth knowledge of the local context and ways of building – clearly provides a fresh and hopeful model for sustainable building globally.[3]
>
> Pamela Johnston, ed. *Intervention Architecture: Building for Change*, 2007

Buildings of stature in Rudrapur – government buildings and those owned by wealthier residents – have brick walls and thin, pitched roofs; the original intention of the sponsor organization was to construct something in a similar style. In this region, mud-walled buildings are widely seen as inferior because they tend to indicate a more impoverished situation. Heringer and Roswag persuaded the client to explore the use of mud construction not only to save money on the project but also to develop a more sustainable and economically responsible model for future building in the community. This new building strategy would be "based on two types of energy: muscles and sun, resources that are available everywhere."[4]

The process that was developed inserts sustainable local resources and new construction techniques into the vernacular building process (Figure 13.8). It is, therefore, deeply contextual in its relationship to utilizing resources, but it also seeks to improve the context rather than perpetuating less-than-ideal practices that have, over time, become routine. The METI School was a study in "how locally available resources, abilities and labour [could be]


1: Foundations
Kiln brick serves as the foundation, helping to prevent the erosion of the earth structure above.
4: Framework | Floor
The floor is a composite construction of bamboo and earth.
2: Caves
Made from earth and straw on a bamboo frame, the cave structures serve as a quiet retreat for the school children.
5: Framework | Bamboo
The upper floor is enclosed in a framework of bamboo, which forms the walls and the roof structure.
3: Framework | Earth
The earth walls of the first floor are heavy with small punctures, creating an enclosed space.
6: Enclosure
An expansive shed roof shelters the school. The openings are infilled with colorful panels on the lower floor and bamboo screen above.

13.7
Anatomy

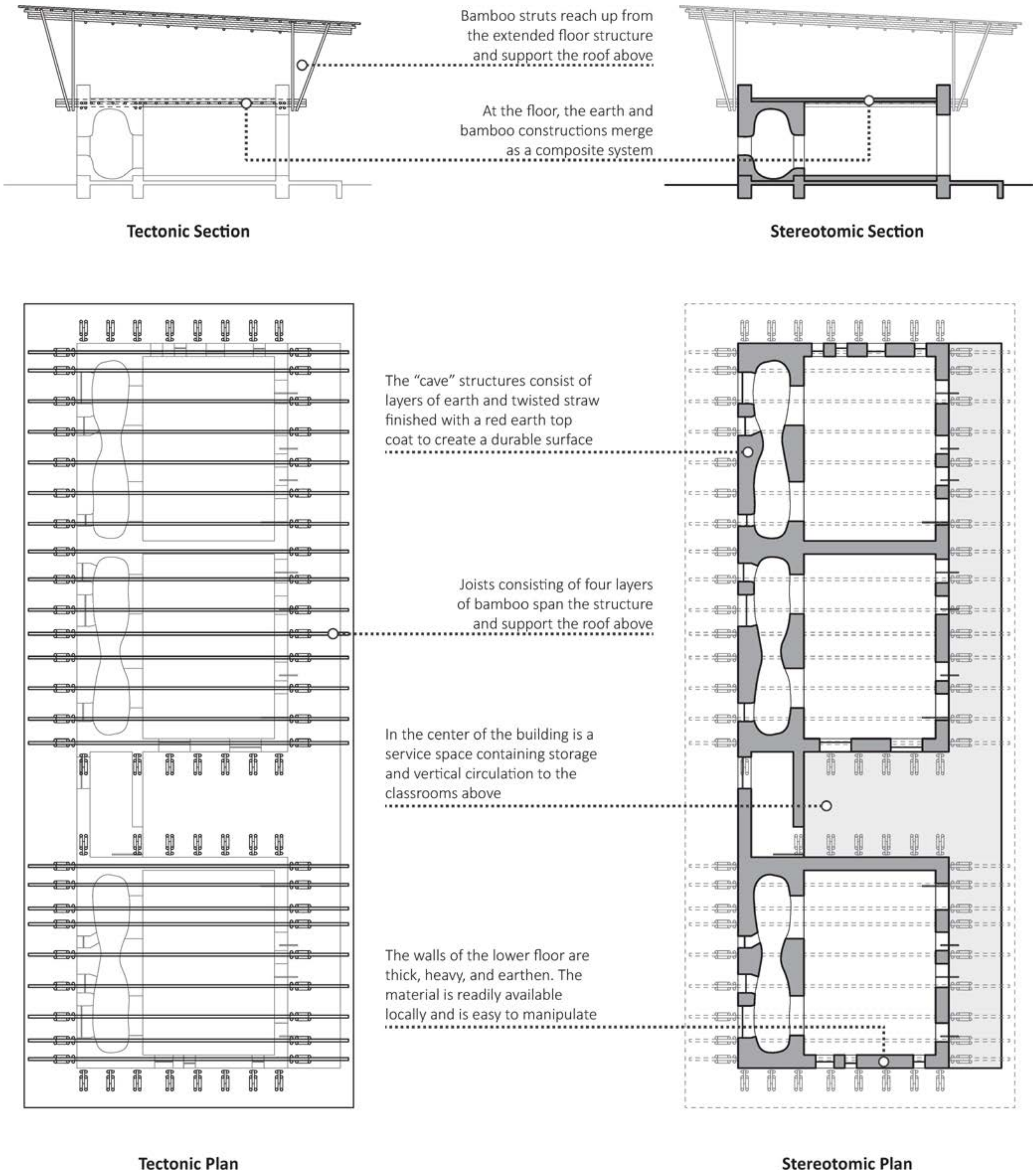
13.8
Local workers installing the bamboo structure of the upper floor

used to build cost-effective and better buildings, and how local labourers who took part in the construction [could be] trained in improved building techniques."[5] Here, precedent was not a building, but a place and its practices.

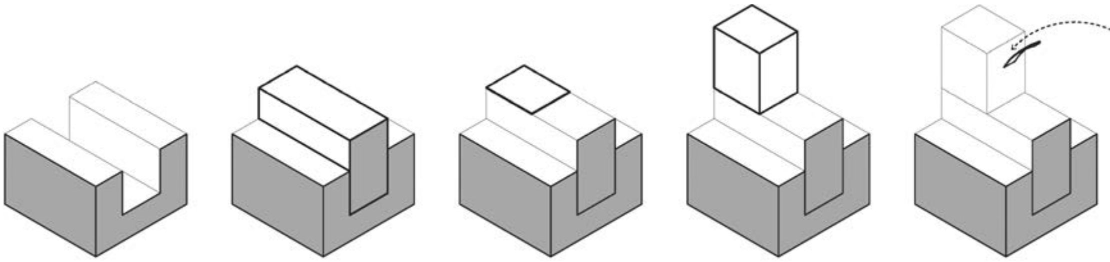
An example of this integrative practice can be found in the school's foundations. Mud buildings typically do not have a long lifespan in Rudrapur. Either the foundations are washed away or moisture seeps up through them into the earth walls and destabilizes the structure. To solve this issue, buildings must first be located on higher ground. Second, the foundations must be improved. Expensive materials – concrete, concrete masonry units, and brick – are not an option in poor rural areas. The METI School utilized cheaper kiln bricks rendered with concrete to help prevent moisture issues. The foundations were topped with two layers of polyethylene film that served as damp-proofing. These inexpensive materials are readily available at the local market and prevent water from migrating into the earth walls above.

Stereotomic

On these improved foundations sit the earthen walls of the lower floor – the stereotomic components of the METI Handmade School (Figure 13.9). These 50-centimeter-thick [19.5-inch-thick] walls consist of layers of earth and straw formed using a technique called *Wellerbau* or cob construction. First, wet loam or earth was combined with straw utilizing a local labor source: cows and water buffalo. The resulting mixture was then laid in a 70-centimeter-deep [27.5-inch-deep] layer and allowed to dry for several days (Figure 13.10). Once dried, the earth was shaped to its finished form using a sharp spade, creating a smooth finish. The next layer was then added on top and the process was repeated. The earthen walls rise to the upper story, forming a seat-high base for the bamboo structure above (Figure 13.11).



13.9
Tectonic | Stereotomic



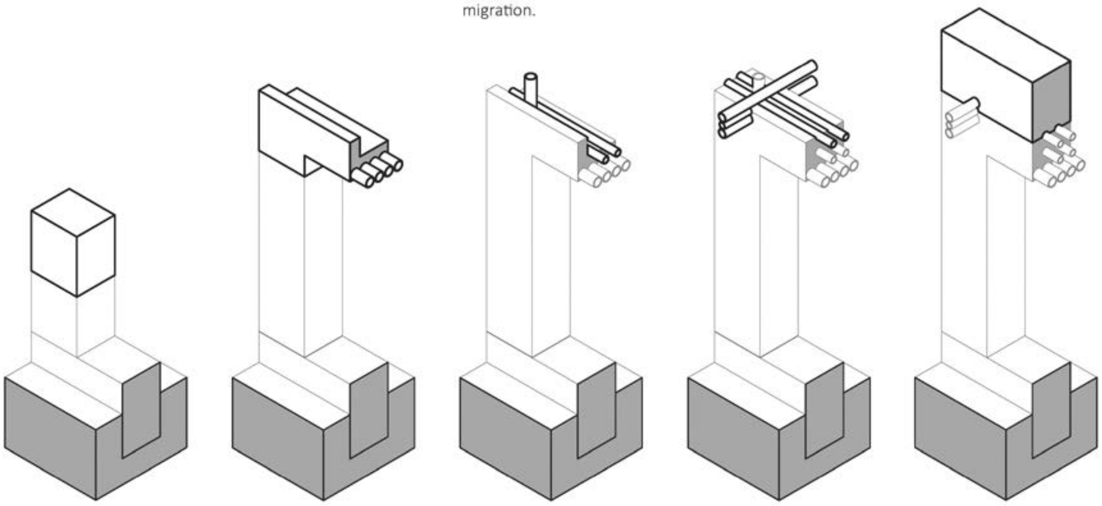
1: A shallow trench is dug to receive the foundation.

2: A foundation of kiln brick is brought up above the surface of the earth.

3: Where earth sits above, a dual layer of polyethylene film is used to prevent moisture migration.

4: The first layer of earth is installed. The earth is build in 70 cm lifts.

5: After a drying process, the earth is shaped with a sharp spade.



6: After shaping the layer, another layer of material is added and the process is repeated.

7: The fourth layer of earth contains the heads of the door openings, which are stabilized with bamboo reinforcement.

8: Bamboo is used to create a bond beam at the floor level and help stabilize the floor structure. Vertical bamboo is integrated for strength and stability.

9: The floor joists interweave with the bond beam reinforcement to create an integral structure.

10: The last layer of earth reaches past the floor, creating a bench on the upper story.

13.11
Worker installing a bond beam in the earthen wall

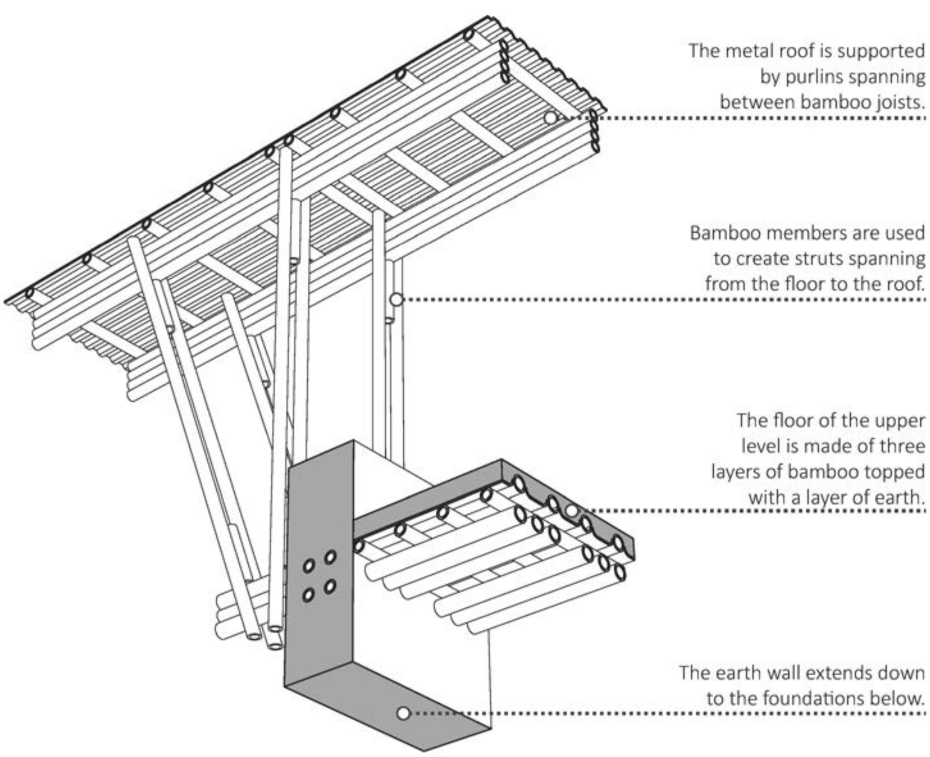
13.12
Interior of the lower-floor cave space

The cave-like spaces also serve as a stereotomic anchor for the school (Figure 13.12). They are made of earth as well, but formed using a different technique in which layers of earth and twisted straw were laid over a bamboo frame in a reinforced condition. The cave spaces were rendered with a red earth finish layer to create a smooth and durable exterior surface. "The soft interiors of these spaces are for touching, for nestling up against, for retreating into for exploration or concentration, on one's own or in a group."[6]

Tectonic | Detail

The upper floor of the METI Handmade School is as light and airy as the lower floor is heavy and earthbound. The construction on this level is primarily bamboo (Figure 13.13). The bamboo floor structure extends out past the earth walls. These extensions serve as the primary connection points for the vertical structure of the upper floor. Two pairs of bamboo columns – one pair vertical and one pair rotated out from the building at about 30 degrees – rise up from each connection point to carry the roof beams, which are formed from four layers of bamboo (Figure 13.14). The structure is capped with a corrugated metal roof.

Unlike traditional bamboo construction, the connections in this project were pinned together with steel bolts to create a stable condition. The joints were then lashed and tied using nylon cords. The combination of the bolts and the cord provided a very strong and durable joint. The use of knotting as a primary means of binding directly ties to the history of joinery posited by Semper and is indicative of the vernacular past of Rudrapur.



13.13
Bamboo construction detail

13.14
View up at details of the bamboo under construction

Both material choices – bamboo and earth – also reflect Semper's attitude toward the utilization of materials: "Let the material speak for itself; let it step forth undisguised in the shape and proportions found most suitable by experience and science."[7] Heringer and Roswag dedicated themselves to constructing with materials that were of best use to the experience and technology available in this particular place. The materials – inexpensive, normative, and underutilized by the local community – are proudly displayed for what they are. They speak for themselves as a means of both progress and community development for the people of Rudrapur.

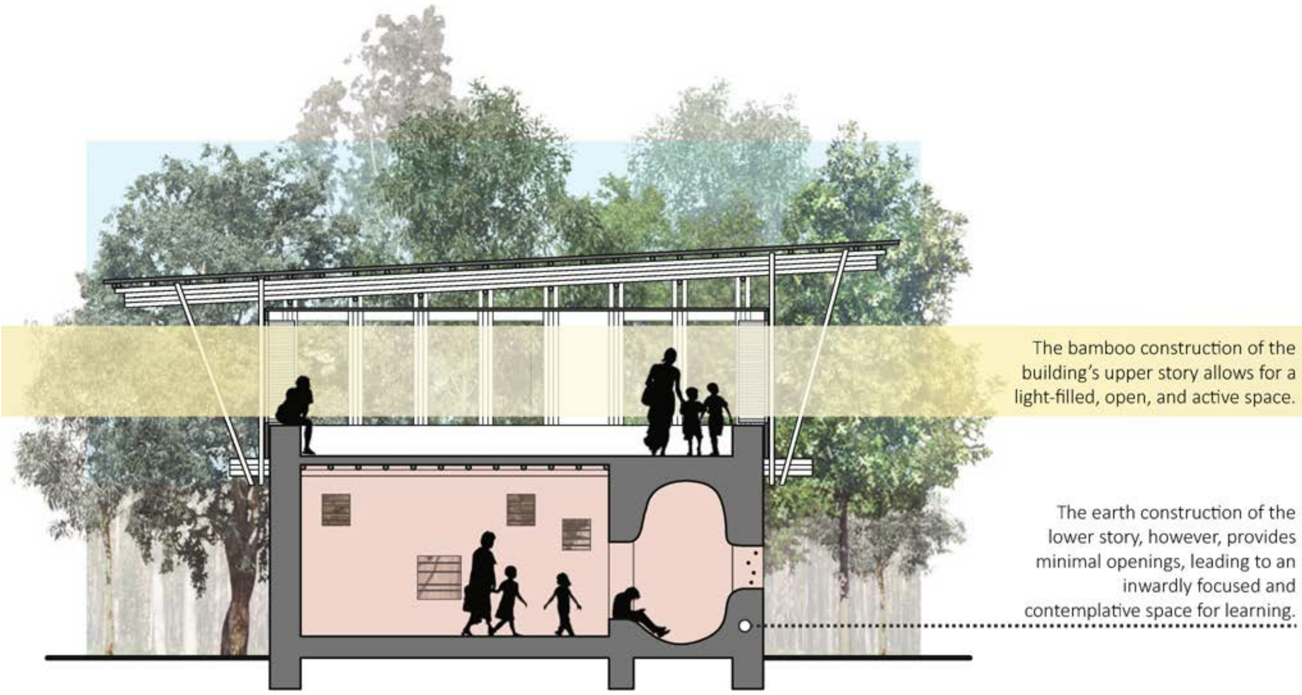
Space

Spatially, the different construction systems have a considerable effect on the qualities of the METI Handmade School (Figure 13.15). The ground floor is a reflective and inwardly focused space with minimal openings due to the properties of the earth-based construction. These classrooms house the more traditional academic components of the curriculum that require focus and attention. Therefore, constructive properties and user inhabitation are linked.

In contrast, the bamboo construction of the upper floor creates open, airy, and light-filled spaces that are connected to the surrounding environment. This floor, consequently, is used for the teaching of life skills, creative making, and experiential learning. The juxtaposition of these two construction systems follows that of the school's learning objectives. Here, construction is paired with the ritual use of space.

Representation

There are several key moments in the METI Handmade School where representation plays a significant role. In *The Four Elements of Architecture*, Semper discusses the evolution of



13.15
Inward vs. outward focus

the use of textiles and attributes the use of fabrics as door and window curtains, the inlaying of wood floors, and the use of mosaics as key successors of the wall-carpet.[8] The school's upper floor has a ceiling of draped fabrics that, as Semper has indicated, bring life and energy to the space. These brightly colored fabrics are actually a local garment: the sari. Again in the spirit of Semper, a relationship is developed between the clothing of the body and the clothing of space. The use of fabric is also prevalent, although in a more subdued way, on the ground floor. Here, the door openings are filled with a combination of saris and solid panels that have been painted to match the bright colors of the textiles (Figure 13.16).

The doors on the ground floor are also clad with another form of ornamentation: the names of the children in the school. This list, which will continue to grow over time as new children enter the school, is not a true *Kunstform*, but it is reflective of the mission of the school. This building is as much a social project as it is a construction project. The list of names is a representation of the community and the strongest force acting within the building. As time progresses, the ornamentation will grow to match the developing community and its citizens.

13.16
Night view highlighting the impact of color on the building

Additional Resources

Projects

DESI Training Centre, Rudrapur, Bangladesh, 2008 (25°45’25”N, 88°33’10”E)

Jahili Fort Al Ain, Abu Dhabi, 2008 (24°12’58”N, 55°45’8”E)

HOMEmade, Rudrapur, Bangladesh, 2008

Earthen School Tipu Sultan Merkez, Jar Maulwi, Pakistan, 2013

Bamboo Hostels, Baoxi, China, 2014

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Finch, Paul. “Earth Works: Handmade School, Rudrapur, Bangladesh.” *Architectural Review* 220, no. 1318 (2006): 40–43.

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Johnston, Pamela, ed. *Intervention Architecture: Building for Change*. London: I. B. Tauris & Co. Ltd., 2007.

Notes

1 This quote was taken from the architect’s statement found at www.anna-heringer.com/. Further information on the architects can be found here as well as at www.zrs-berlin.de/.

2 Paul Finch, “Earth Works: Handmade School, Rudrapur, Bangladesh,” *Architectural Review* 220, no. 1318 (2006), 41.

3 Pamela Johnston, ed. *Intervention Architecture: Building for Change* (London: I. B. Tauris & Co. Ltd., 2007), 148.

4 “Anna Heringer: Desi, Rudrapur, Bangladesh, 2007–08 and Meti, Rudrapur, Bangladesh, 2005,” *Lotus International*, no. 140 (2009), 9.

5 Kazi Khaleed Ashraf, “This Is Not a Building! Hand-Making a School in a Bangladeshi Village,” *Architectural Design* 77, no. 6 (2007), 116.

6 From a press release supplied by the architect.

7 Gottfried Semper, “Preliminary Remarks on Polychrome Architecture and Sculpture in Antiquity,” in *The Four Elements and Other Writings*, ed. Harry Francis Mallgrave and Wolfgang Herrmann (New York: Cambridge University Press, 2010), 48. (Originally published in 1834.)

8 Gottfried Semper, “The Four Elements of Architecture: A Contribution to the Comparative Study of Architecture,” in *The Four Elements and Other Writings*, ed. Harry Francis Mallgrave and Wolfgang Herrmann (New York: Cambridge University Press, 2010), 106. (Originally published in 1851.)

14
Brain Studio
Olson Kundig Architects

Chapter co-written with Suzanne Abell

Firm Brief

Olson Kundig was founded by Jim Olson in the late 1960s. Olson's work "explore[s] the relationship between dwellings and the landscape they inhabit in the Northwest." The firm was established "on some simple ideas: that building can serve as a bridge between nature, culture and people, and that inspiring surroundings have a positive effect on people's lives."[1] In 1986, architect Tom Kundig joined the firm, and just a decade later, he was named an owner. Kundig's visionary designs and inspired investigations into the making of place have significantly broadened the reach of the firm's reputation to an international audience. In 2008, two more owners came to the firm – Alan Maskin and Kirsten R. Murray – while Kevin Kudo-King became an owner in 2015. Their range of expertise pushed the firm more significantly into the arenas of exhibit design and interiors.

Olson Kundig's wide range of projects includes museums, educational buildings, places of worship, and, most notably, residences. The firm prides itself on its ability to "combine

seattle, washington, united states
gps | not provided for residences
program | home office and studio
completed | 2002
area | 92.9 m2 [1,000 ft2]

14.1
Vicinity map

the capacity of a large firm with the intensity of a small one."[2] Each project is taken through a rigorous process of iterative design and critique, carefully exploring every detail of the work both internally and with a host of consultants including artists and skilled craftspeople. This approach has fostered ever-growing success for the firm. In 2009, Olson Kundig was awarded the American Institute of Architects' Firm of the Year Award. Their work continues to be published extensively in both journal and book form, including numerous books by four of the firm's partners.

Olson Kundig's architecture nurtures a symbiotic relationship with art and craft; it is derived alongside works of art creating "a seamless spatial experience" for inhabitants.[3] This relationship was established by Jim Olsen and has been strengthened through the integration of the kinetics that play a subtle but stunning role in the architecture of Olson Kundig, most prominently in the design work of Tom Kundig. Since earning his undergraduate and graduate degrees in architecture from the University of Washington – the latter awarded in 1981 – the Washington native has received countless awards at all levels for his signature use of sleek, kinetic architecture and artful, rustic designs, including multiple high-level awards from the American Institute of Architects. In 2012, he was inducted into *Interior Design* magazine's Hall of Fame while garnering their top award for his product line of steel hardware and accessories. According to Billie Tsien:

> Whether opening a window or touching a stair railing, each time we are tugged, tapped, and whispered into paying attention. There is always an element of elegant invention . . . He reminds us that small moments in life are precious. That is his gift to us.[4]

Project Brief

> How to turn work into play? Build an austere concrete studio. Add romantic, 16-foot windows, books and a piano and start dreaming.[5] (Figure 14.2)
>
> Pilar Viladas, "Editors' Choice: DESIGN; Think Tank," 2002

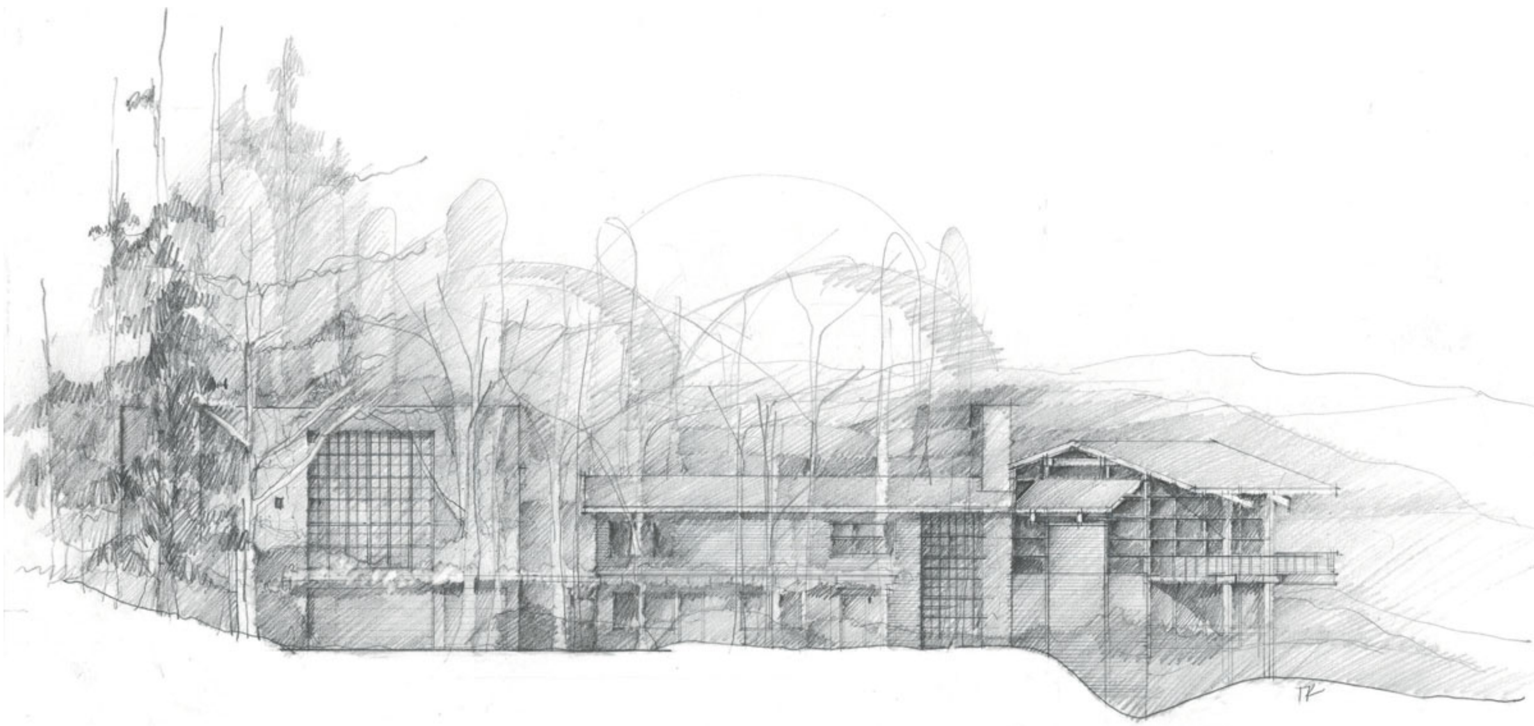
The Brain Studio is a small yet highly functional workspace that was designed and built for David Wild, a writer, photographer, and film director. It sits next to Wild's fifties-era lap siding home north of downtown Seattle, which he shares with his wife, daughter, and beloved dog Oscar[6] (Figure 14.3). Wild's studio needed to be a place for him to think, work, and play in peace; he referred to this retreat as being inside his brain, which resonated with the team and eventually inspired the project's name.[7] The small building "combines the expansive space of an industrial loft with the soft light of a forested hillside and the comfort of a favorite chair."[8]

The structure is simple; it consists of a double-height cast-in-place concrete box with large steel windows on two sides. On the east end of the box is a loft crafted from raw steel (Figure 14.4). Tucked below are bookshelves, a darkroom, and storage space. The box sits into the sloping topography, allowing entrance to the main level on the near side of the structure (relative to the main house) and to a lower garage level from the far side. In addition to the three-car garage, this lower level also contains a sizeable storage room (Figure 14.5).

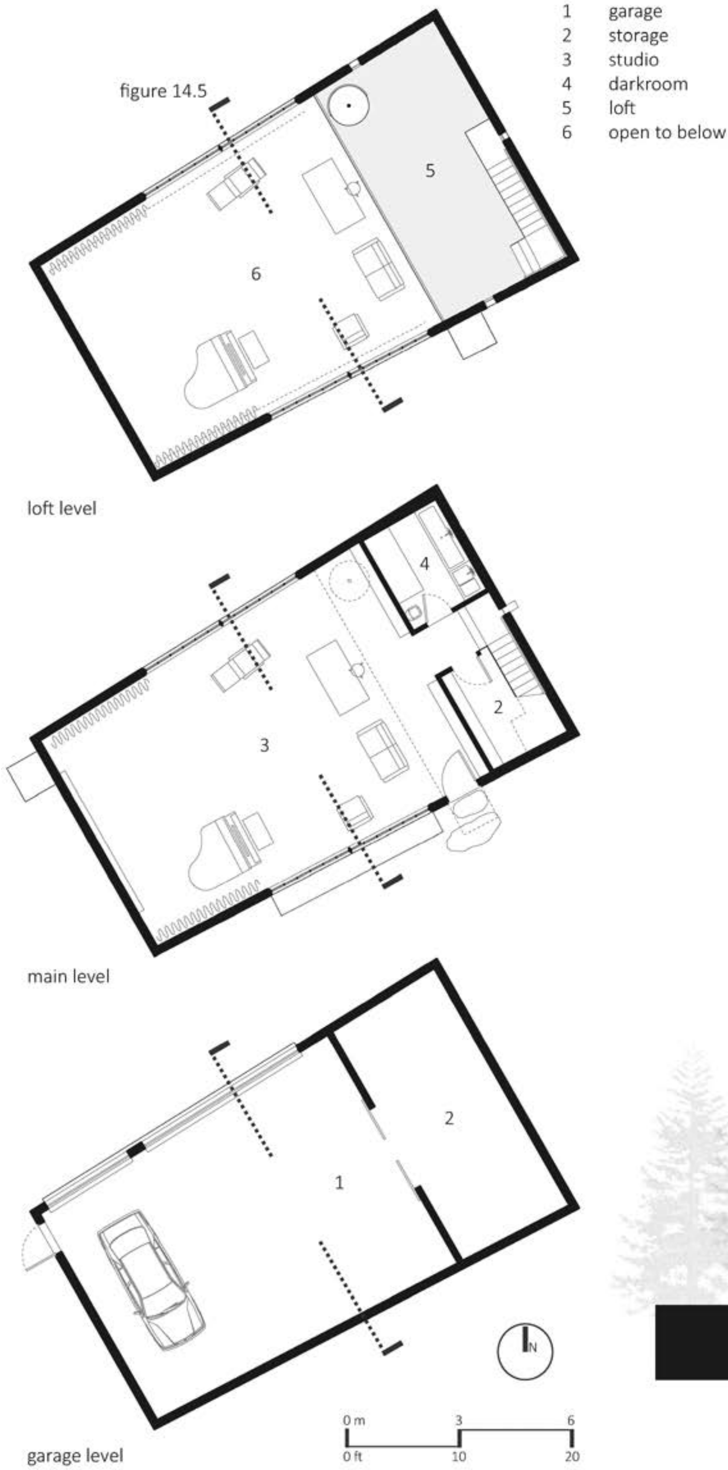
14.2
Building exterior and lower drive

The space is accessorized to allow for flexibility (Figure 14.6). Heavy light-blocking curtains can be pulled to cover the large windows and darken the entire space for film editing. In addition, industrial pulleys are utilized to hold six hanging lightbulbs. The system allows the lights to be repositioned vertically in order to manipulate the ambiance and character of Wild's working environment.[9]

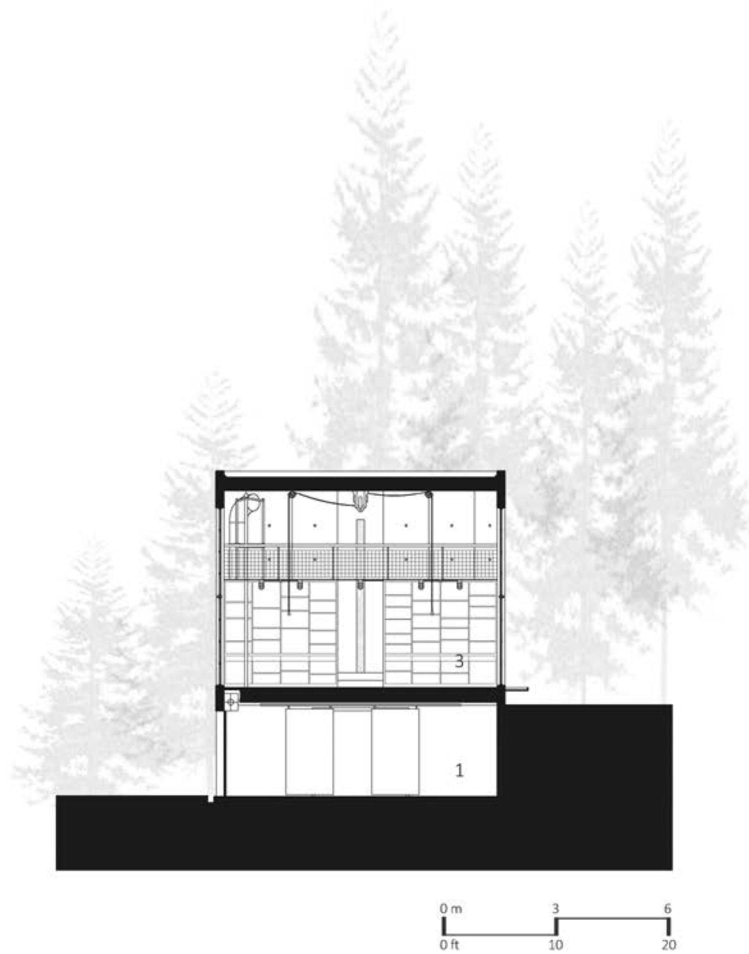
The conceptual model for this workspace was based on the garage, the "neighborhood birthplace of invention."[10] It was designed to serve as a neutral background to the creative work undertaken on a daily basis by Wild. But the space also needed to be flexible and adaptable to the changing needs of this field of work. Kundig explains that "the simpler the space, the more it becomes background to the complex sorting out of ideas."[11] Although designed as a serious workspace, the architecture also exudes a playful spirit. From the loft, you can hop on the recycled fire pole to swiftly move back down to the main level or join Oscar for a view out of one of his personal dog-height lookout windows. This space wraps work and play together in a simple but effective architectural design.



14.3
Tom Kundig's elevation of the studio and the main house



14.4
Floor plans



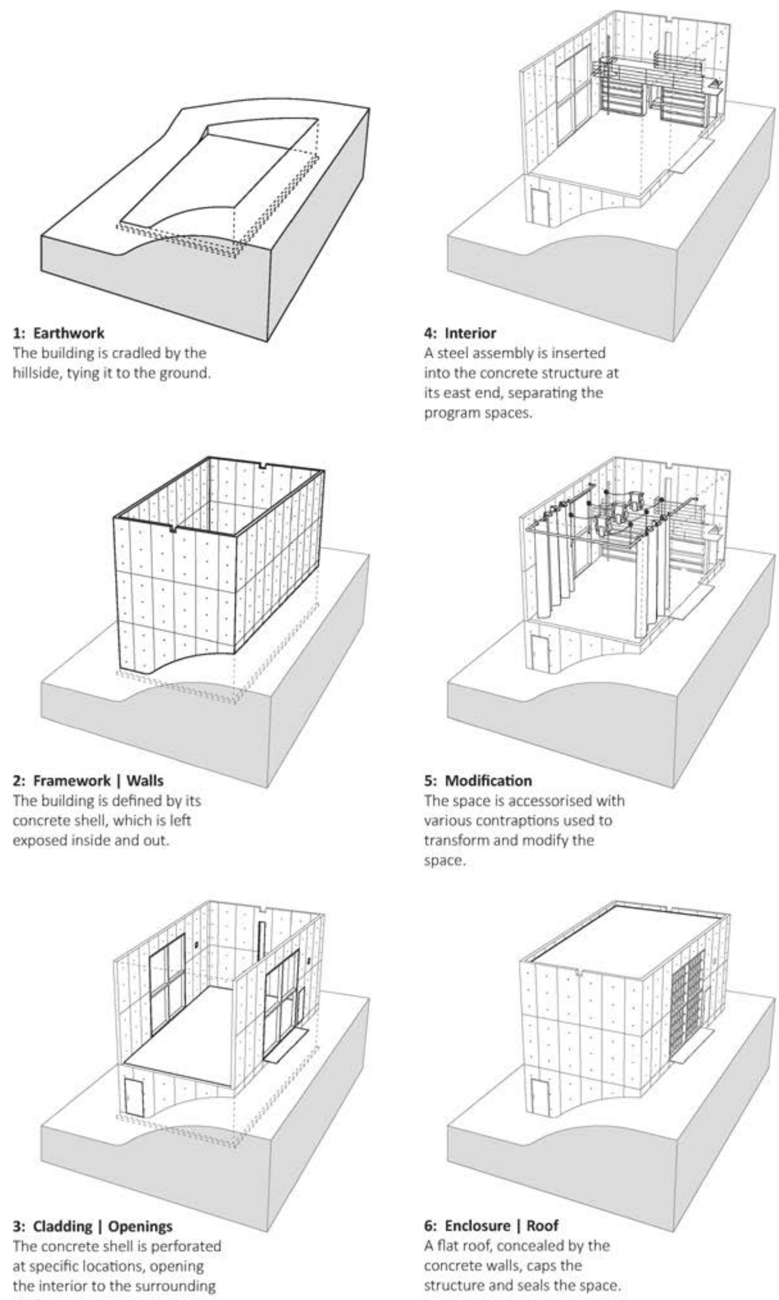
14.5
Building section

14.6
View through the interior to the loft
Source: © Mark Darley/Esto

Tectonic Principles

Anatomy

The Brain Studio's concrete box is embedded in the sloping terrain (Figure 14.7). The hillside cradles the building and ties it to the ground. The framework of concrete rises from the earth, the poured-in-place walls serving as both a supporting structure and the expression or cladding of the building as the material is left unfinished inside and out. A floor



14.7
Anatomy

and roof are inserted into the box to provide full definition for the spaces. The loft, formed from steel and placed on the northeast end of the building, divides the studio's volume into programmatic zones and contrasts the concrete shell.

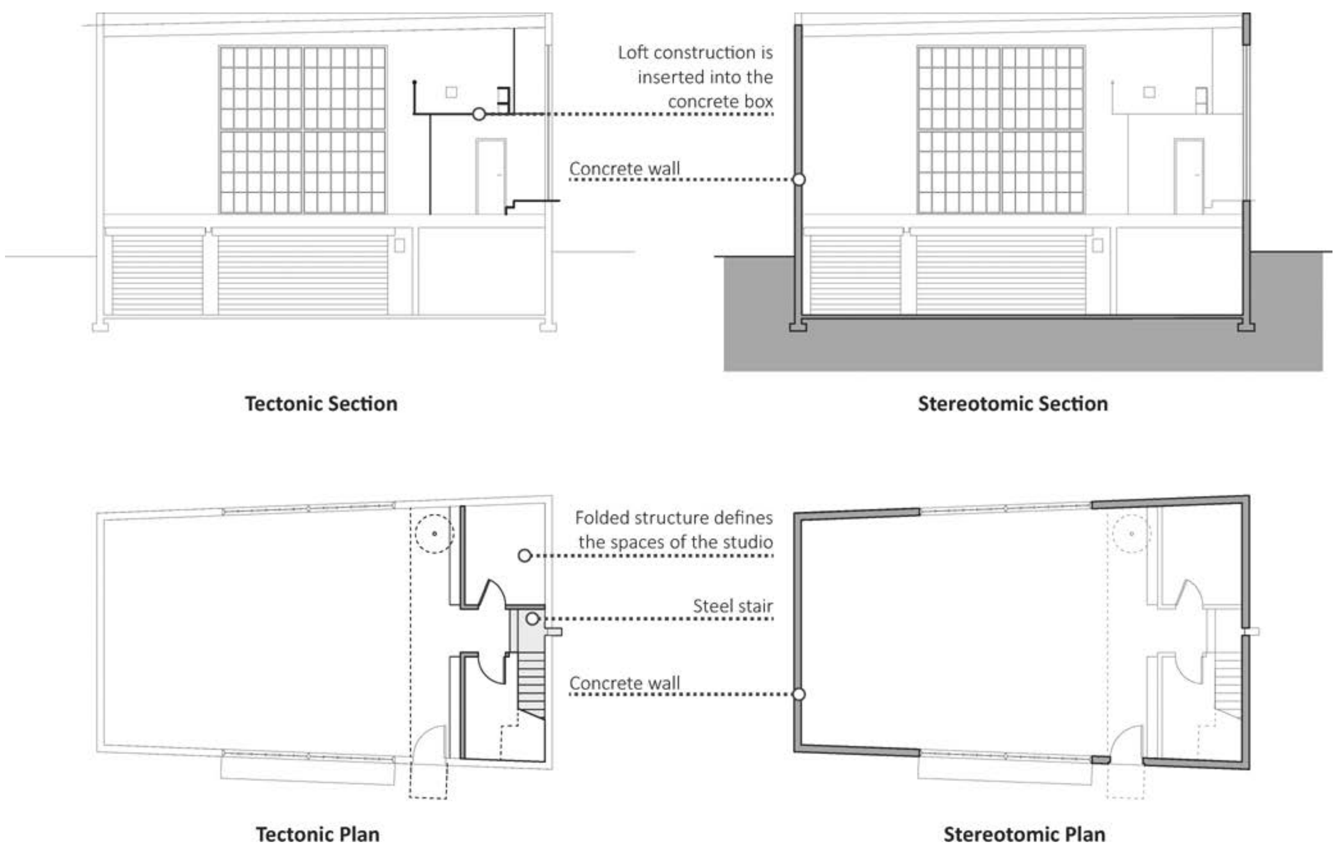
Semper believed that architecture develops not from construction, but from the need for enclosed space.[12] The Brain was created as a private and secluded workplace, a space of inspiration and creation. The Brain is a storehouse of knowledge; it is a hearth and its construction protects and nourishes the activity within.

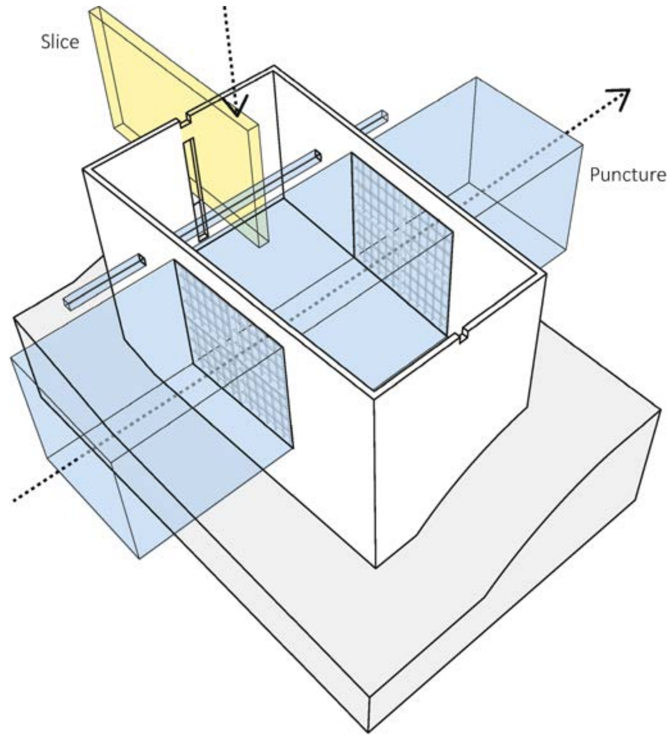
Stereotomic

The stereotomic mass of the Brain Studio lies in the three-story cast-in-place concrete walls that form the box (Figure 14.8). Each wall is 20.3 centimeters [8 inches] thick. Although they appear with the naked eye to sit orthogonally to each other, the walls actually shift slightly in plan to a subtle trapezoidal shape. This configuration prevents reverberation of sound, which can be amplified with right-angle (90 degree) spaces, optimizing the experience of listening to music or other audio recordings.[13] The unfinished concrete provides a rugged expression and serves as a neutral backdrop for the activities in and around the building.

The openings created in the concrete walls affect the reading of the studio (Figure 14.9). Punctures, such as those containing two 4.9-meter-square [16-foot-square] steel windows,

14.8
Tectonic | Stereotomic





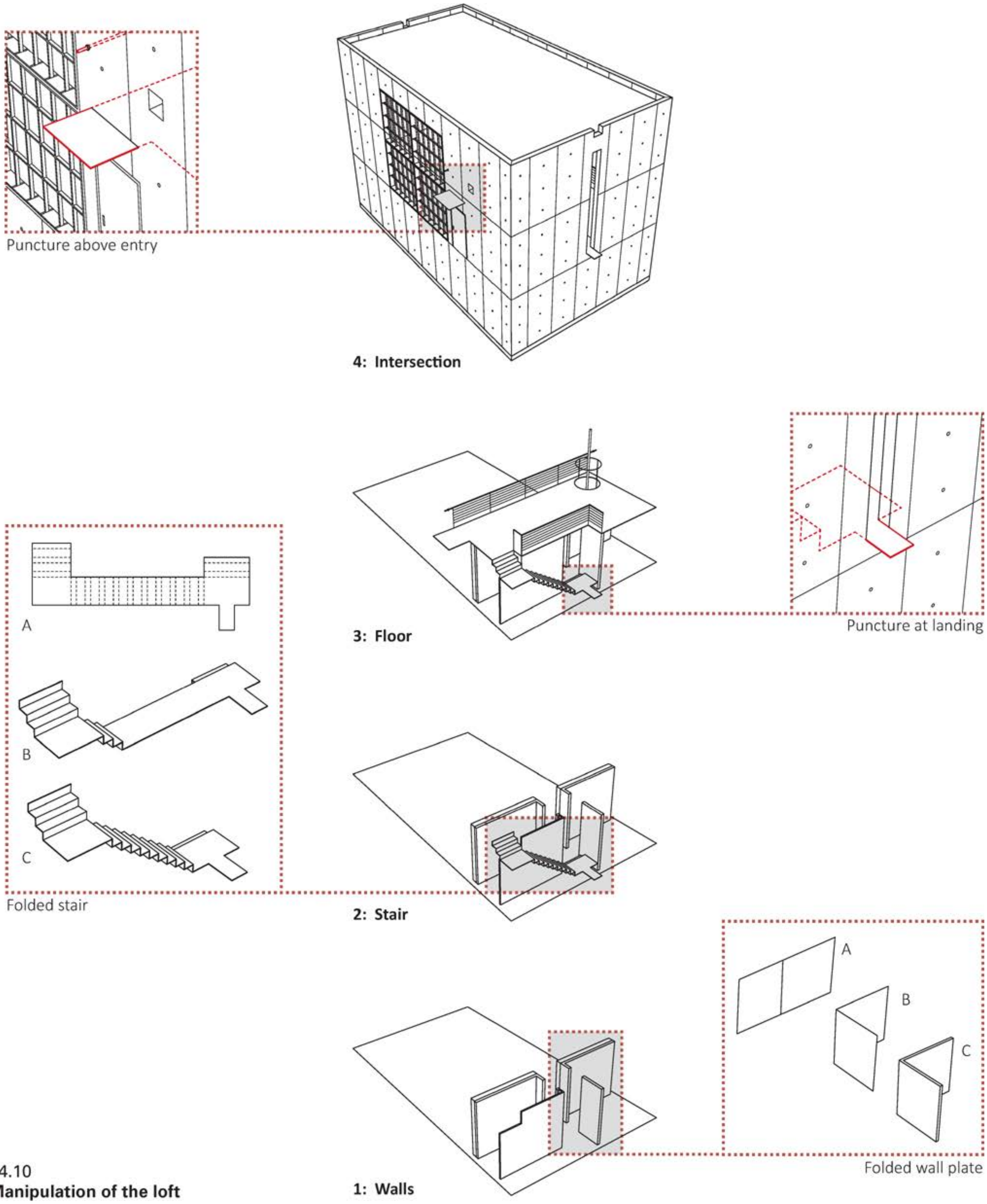
14.9
Manipulation of the building mass

are complemented by slices like the tall slit window on the east wall. These openings usher light into the space and manipulate the impression of the building's mass. From the exterior, a view through the large windows can give the impression of an interior carved from a concrete block. When inside, however, a view towards the vertical slot window changes the impression dramatically; here, the concrete wall appears to have been sliced with the resulting fissure oriented to frame a specific view. The different openings provide distinct impressions of the stereotomic mass of the building's walls.

Tectonic

Within the heavy concrete box of the Brain Studio are elements that are decidedly tectonic in character. The only interior construction is formed entirely out of 13 millimeter [1/2-inch] hot-rolled steel plates. These planes are welded and folded like origami to create structural stability[14] (Figure 14.10). Semper believed that designers should "[l]et the material speak for itself; let it step forth undisguised in the shape and proportions found most suitable by experience and science."[15] Although Semper surely would have disapproved of the use of steel as a structural element (see page xlviii), the raw steel plates are manipulated to demonstrate their material qualities, emphasizing their inherent strength, ductility, and malleability. The use of sheet steel was inspired by road construction plates as part of a creative process Kundig calls "the reinvention of the commodity." This reinvention of everyday items is prevalent in his work and serves to infuse "poetics into the pragmatic."[16]

In addition to the steel construction, a series of kinetic accessories adorn the interior of the studio. Kundig, who is known for his *gizmos*, and the design team engineered the



14.10
Manipulation of the loft

14.11
Manipulation of the lighting
Source: © Marco Prozz

assemblies that are used to manipulate the surrounding space. These constructions are composed of a series of precise joints, intersections, and relationships between elements. They are explorations of the tectonic assembly of parts. In The Brain, the lighting of the main studio is rigged on a pulley system that allows a series of naked bulbs to be lowered and raised over the full height of the two-story space (Figure 14.11). This intervention, like Kundig's others, embraces the idea of the joint, but a joint that allows not for secure connection but transformation. As a result, the shifting light transforms the space based on the needs of the owner.

Space | Representation

> It's not about the architecture, but the space. Ideally, the building fades into the background.[17]
>
> Tom Kundig as cited in Lubell, "Five Cubes and a Blimp," 2005

The representative qualities of the Brain Studio are firmly rooted in Semper's ideas about the use of fabrics to define spatial quality. As permanent construction became common-place, Semper theorized that mass construction was utilized predominantly for security and enclosure, but it was the interior adornment of the walls with carpets and other elements that defined space. The Brain's studio space at completion of the project was raw and unfinished, but soon it was clad in the creative process. Over time, the space changed as the mind and will of the inhabitant were imprinted on the structure. It transformed (and continues to transform) into a palimpsest of etchings, memories, and past work. Some of this cladding is permanent. The stair to the loft is inscribed with the words: "You'll have lots of time to rest when you're six feet under." These were inspirational words from the owner's father.[18] Other elements that clad the space are temporary, continually changing with the introduction of new projects. These include sketches and photos attached to the steel construction with magnets and the projection of films on the concrete walls. In this small building, the character of the space is continuously changing based on the activities undertaken and facilitated by the ingenious construction of the project.

Intersection

At several points in the Brain Studio, the folded steel loft intersects with the concrete perimeter wall, helping both to engage a dialogue between the two elements and to project some of the interior conditions on to the exterior of the building. The first intersection occurs at the entry door. Directly above the door is a canopy formed from a single sheet of steel (Figures 14.10 and 14.12). This steel is an extension of the floor of the loft, penetrating through a slot

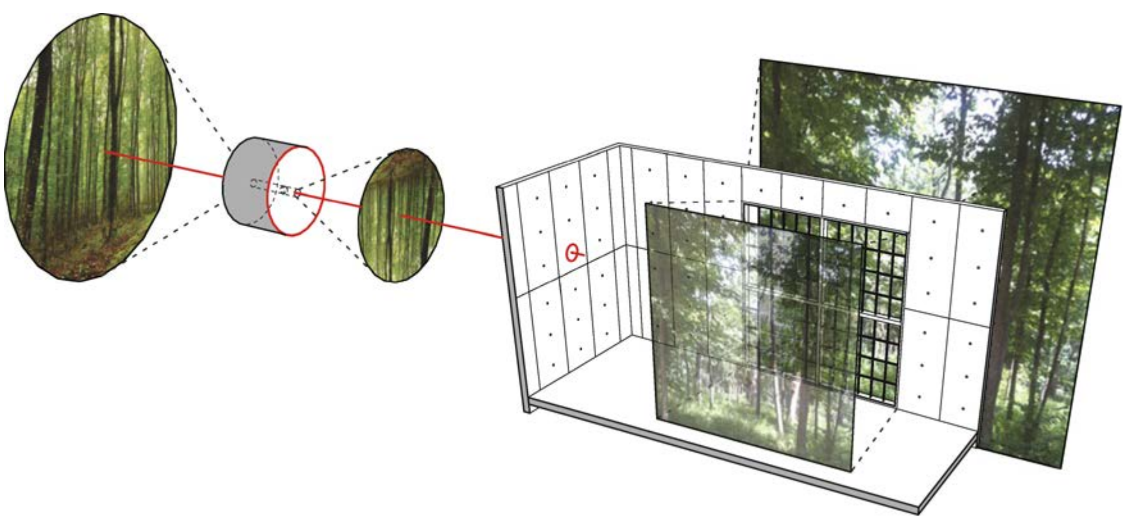
14.12
Exterior at the main entry
Source: © Mark Darley/Esto

in the concrete wall above the door. The element promotes the notion of a continuous folded plane of steel forming the loft, while also serving a functional role at the entry. In a similar fashion, the landing of the folded steel stair projects through the slot window. This finger of steel cuts through the wall and defines the bottom of the slice in the protective concrete wrapper of the studio.

A third example of intersection occurs with the loft's railing. Although the original sketches show a railing composed of steel folded up from the floor, the final scheme utilized a steel pipe as a top rail. The pipe runs from exterior wall to exterior wall, projecting through the concrete to the exterior of the building. The pipe is secured from the exterior on each end using what Kundig refers to in his sketches as a "neck bolt." Again, the construction on the interior is projected to the exterior, this time in the form of an exaggerated joint.

Detail

The process of constructing a poured-in-place concrete wall requires the use of formwork to hold the concrete in place while it is curing. The formwork is held together with steel form ties that, when removed, leave small holes that run through the wall. These are typically patched or plugged, but Kundig decided to take advantage of this construction phenomenon to further tie the building to the activities undertaken within. In The Brain, the holes were plugged with glass spheres. As the outdoor lighting changes throughout the day, these spheres cast subtle and playful beams of light across the space and sparkle at night as light



The insertion of glass marbles into the formwork holes creates the potential for a camera obscura effect, transposing the building's surroundings into the interior for a viewer. Although certainly not a true camera obscura, the construction is reflective of the process and ties directly to the nature of the work occurring within the Brain.

The large windows are also uniquely suited to the idea of projection. The space is conceived as reflective and inwardly focused. Therefore, the windows are not so much for looking out of as they are for bringing the surrounding environment into the space when desired.

14.13
The interjection of the camera obscura

escapes from the interior of the studio.[19] These glass plugs can also be seen as small lenses. In theory, when gazed through, each oculus would create an inverted camera obscura effect, an ode to the media work undertaken within the concrete walls[20] (Figures 14.13 and 14.14).

14.14
Form tie puncture at entry

Additional Resources

Projects

Tacoma Art Museum Haub Galleries, Tacoma, Washington, United States, 2014 (47°14′51″N, 122°26′12″W)

Art Stable, Seattle, Washington, United States, 2010 (47°37′25.5″N, 122°19′48″W)

Wing Luke Museum of the Asian Pacific American Experience, Seattle, Washington, United States, 2008 (47°35′54″N, 122°19′22″W)

Delta Shelter, Mazama, Washington, United States, 2005

Chicken Point Cabin, Northern Idaho, United States, 2002

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Notes

1 "Firm History," www.olsonkundigarchitects.com/About/FirmHistory (accessed March 22, 2015).

2 Ibid.

3 "Working with Artists & Craftspeople," www.olsonkundigarchitects.com/About/FirmCulture (accessed March 22, 2015).

4 Billie Tsien, "Doing," in *Tom Kundig: Houses*, ed. Dung Ngo (New York: Princeton Architectural Press, 2006), 109.

5 Pilar Viladas, "Editors' Choice: DESIGN; Think Tank," *New York Times*, April 28, 2002.

6 Clair Enlow, "Thinking inside the Box," *Pacific Northwest: The Seattle Times Magazine*. Updated August 2, 2005, www.seattletimes.com/pacific-nw-magazine/thinking-inside-the-box/.

7 Dung Ngo, ed. *Tom Kundig: Houses* (New York: Princeton Architectural Press, 2006), 55.

8 Enlow, "Thinking inside the Box".

9 Ngo, *Tom Kundig: Houses*, 60.

10 "The Brain," www.olsonkundig.com/projects/the-brain (accessed August 27, 2015).

11 Tom Kundig as cited in Sam Lubell, "Five Cubes and a Blimp," *Architectural Record* 193, no. 4 (2005), 116.

12 Gottfried Semper, *Style in the Technical and Tectonic Arts: Or Practical Aesthetics*, trans. Harry Francis Mallgrave and Michael Robinson (Los Angeles: Getty Research Institute, 2004), 247. (Originally published as Semper, Gotfried. *Der Stil in den technischen und tektonischen Kunsten; oder, Praktische Aesthetik: Ein Hndbuch fur Techniker, Kunstler und Kunstfreunde*, 2 vols. Frankfurt am Main: Verlag fur Kunst & Wissenschaft, 1860.)

13 Ngo, *Tom Kundig: Houses*, 55.

14 Ibid.

15 Gottfried Semper, "Preliminary Remarks on Polychrome Architecture and Sculpture in Antiquity," in *The Four Elements and Other Writings*, ed. Harry Francis Mallgrave and Wolfgang Herrmann (New York: Cambridge University Press, 2010), 48. (Originally published in 1834.)

16 Dung Ngo, "In the Realm of the Senses," in *Tom Kundig: Houses*, ed. Dung Ngo (New York: Princeton Architectural Press, 2006), 50.

17 Tom Kundig as cited in Lubell, "Five Cubes and a Blimp," 121.

18 Ngo, *Tom Kundig: Houses*, 67.

19 Enlow, "Thinking inside the Box".

20 This idea was taken from a series of process sketches provided by the architect.

15
Chapel del Retiro
Undurraga Devés Arquitectos

Architect Brief

Cristián Undurraga – a native of Chile – founded Undurraga Devés Arquitectos in 1978 after graduating from Pontificia Universidad Católica de Chile a year earlier in 1977. His work is well respected, and amongst many honors, he has been awarded the Andrea Palladio International Prize (1991), the International Award of the Biennale Iberoamericana de Quito (2004), and the Gold Medal of the Miami Biennial (2005). In 2009, Undurraga was also appointed an Honorary Fellow of the American Institute of Architects.

Project Brief

> The small chapel['s] . . . expressive form confirms that the space for religion, within the typological-formal succession of the religious building, goes beyond geography and

auco, chile
gps | 32°54'1"S, 70°40'40"W
program | chapel
completed | 2009
area | 620 m2 [6,674 ft2]

15.1
Vicinity map

> location, constructing a temporal line that connects different eras, places and attitudes of spirituality.[1]
>
> Massimo Ferrari, "Cristián Undurraga: Cappella Nella Valle De Los Andes, Chile," 2010

The Chapel del Retiro, or the Chapel of Retreat, is located 70 kilometers [43.5 miles] north of Santiago in the Valley of the Andes, a beautiful area in the center of Chile. The chapel is part of a larger complex of buildings that includes the Sanctuary of Teresa de los Andes and the Carmelite Monastery of Auco along with other support buildings. It sits south of the rest of the structures along the central axis of the building complex, which runs north/south in alignment with the valley (Figure 15.2).

The chapel's program is simple, but the procession is powerful. Moving south from the Monastery, you reach an entry walk that stretches out from the building (Figure 15.3). Stepping on to the path, you begin a gradual descent beneath the building looming before you (Figure 15.4). Stone walls rise on each side, retaining the earth as you move down into the ground. In addition to the main ramp, two smaller paths, located out from the near corners of the building, approach the chapel from other parts of the complex and descend via stairways to an underground tunnel that intersects with the main entry ramp.

The chapel is entered through a glass threshold. The lower third of the chapel is also wrapped in glass, creating a transparent separation between the subterranean room and the recessed exterior environment in which the building sits (Figure 15.5). The depression is lined with stone that reflects light indirectly into the space. Inside, above the ring of glass, a wooden box floats over the space, providing the atmosphere of the chapel. Simple wooden pews face a raised platform at the far end of the sanctuary. The chapel is serene and disjoined from everyday life. It is a place of pilgrimage and a place of silence; it is a retreat.

Tectonic Principles

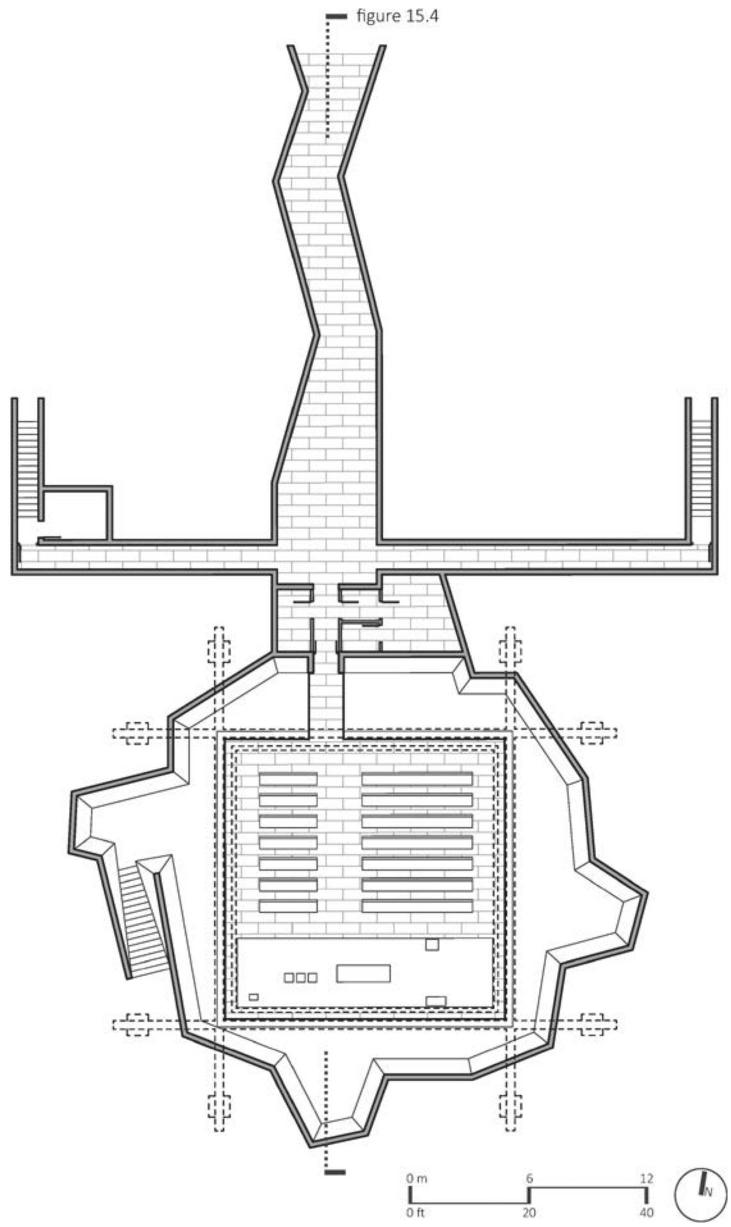
Anatomy

Gustav Klemm (and later Semper) describes the earthwork of the four elements as a platform. It is the shaping of the earth to allow it to receive the building. Undurraga takes a significantly different approach in the Chapel del Retiro (Figure 15.6). Instead of building up, he digs down into the ground. The resultant cradle of stone and earth shelters the sanctuary, the hearth of the campus. Sitting above this depression are four concrete walls that intersect to form a cube-like volume. These walls provide the structural frame for the building as well as the principle form and exterior expression. Inside the concrete box is a second box made of wood. This structure forms an interior shell, providing character and quality to the sanctuary. Essentially, the building has been turned inside out; the structure is exposed on the exterior, while the cladding adorns the interior of the space. The concrete walls also support a trussed roof sheathed with wood that completes the interior schema. Finally, the nearly invisible line of glass circles the chapel, sealing its interior space from the elements. According to Massimo Ferrari:

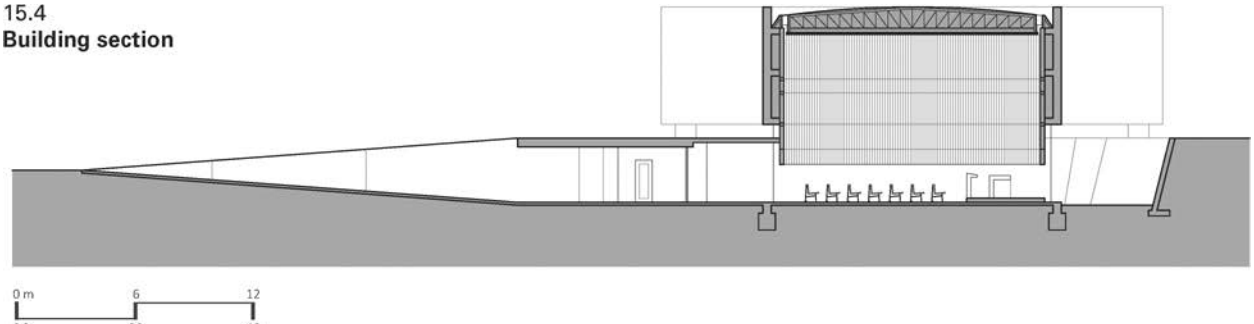
> The project . . . illustrates the extreme simplification of the compositional elements, a reduction that constructs the space of ceremony, relying on two archetypal elements for the definition of the space. Only the roof and the excavated ground structure the indivisible space of the chapel, [reflect the] clear expressive intent of its constituent parts.[2]

15.2
View of the chapel from the south entry stair

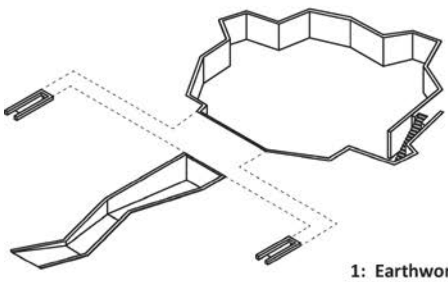
15.3
Floor plan



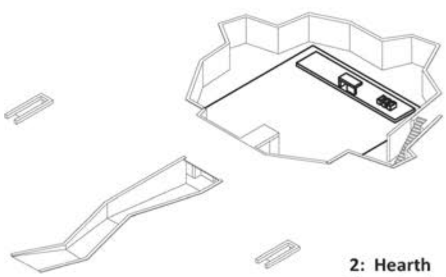
15.4
Building section



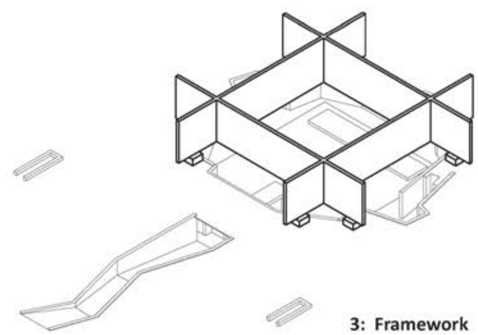
15.5
Sanctuary space



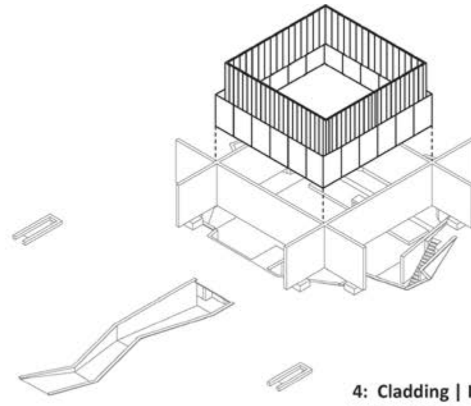
1: Earthwork
The building began with an excavation. A hole was dug into the valley floor to receive the chapel.



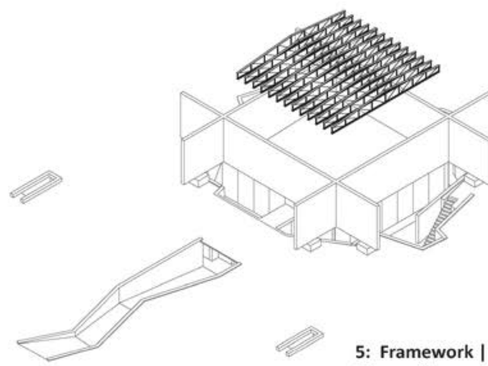
2: Hearth
The raised platform, used for conducting ceremonies, is the ceremonial center of the Chapel of Retreat.



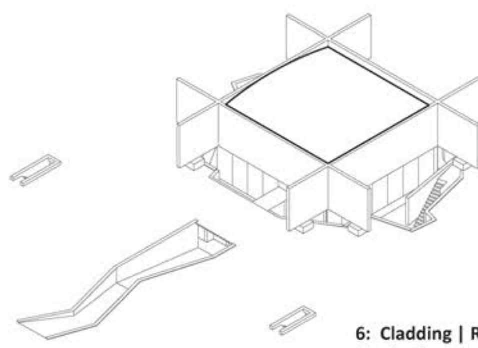
3: Framework
Four concrete walls are suspended above the depression in the earth. They rest on concrete foundation blocks.



4: Cladding | Interior
Two skins- one of wood and one of glass- are inserted into the concrete box.

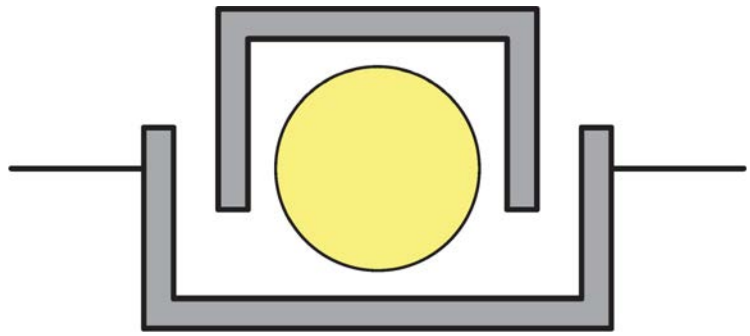


5: Framework | Roof
The roof is supported by a series of trusses that span between the concrete walls.



6: Cladding | Roof
Finally, the space is sealed with a low slope roof that sits inside the concrete walls, invisible from below.

15.6
Anatomy



15.7
Duality parti

In this passage, Massimo Ferrari simplifies the Chapel del Retiro to two elements: the roof and the earthwork. The two halves, separated ever so slightly by a series of concrete blocks, encompass the chapel's sacred space (Figure 15.7). They are reciprocals of each other, dualistic in nature. One is assembled, an additive process; the other is excavated, a subtractive process. One floats; the other sinks. They stand as a critical reflection of Rykwert's framework of Semper's pair of archetypal elements – the hearth and the cloth. The primary primitive activities of "jointing and heaping" are embedded in the pairing, never merging their conceptual ideas but, instead, complementing each other through character, structure, and representation.[3]

Stereotomic | Place

The Chapel del Retiro thrives on its relationship to the ground. Carles Vallhonrat contends that the study of the relationship between building and earth will "dispose of any careless fantasies about the impermanence of the building's imprint" on its place.[4] In this chapel, Undurraga examines the world above and below the ground plane and – with disregard to Frampton's concerns with artificially manipulating the earth – manufactures his own topography (Figure 15.8). An excavation is made and lined with rough stonework, a construction reflective of the qualities of the valley the chapel calls home. As you descend into the chapel, your relationship to the earth continually changes. Stone walls *grow* up around you and you slide under the hanging mass, engulfed by the stereotomic construction. The building is as much of the earth as it is a mark of human occupation on it (Figure 15.9).

The connection of the building to the earth is accomplished through eight concrete foundation blocks positioned just outside the excavated depression. These points mark the only tangible and structural connection between the upper and lower halves of the chapel. While the materiality and weight of the concrete walls create a stereotomic appearance, especially from a distance, these elements are in fact disconnected from the ground.

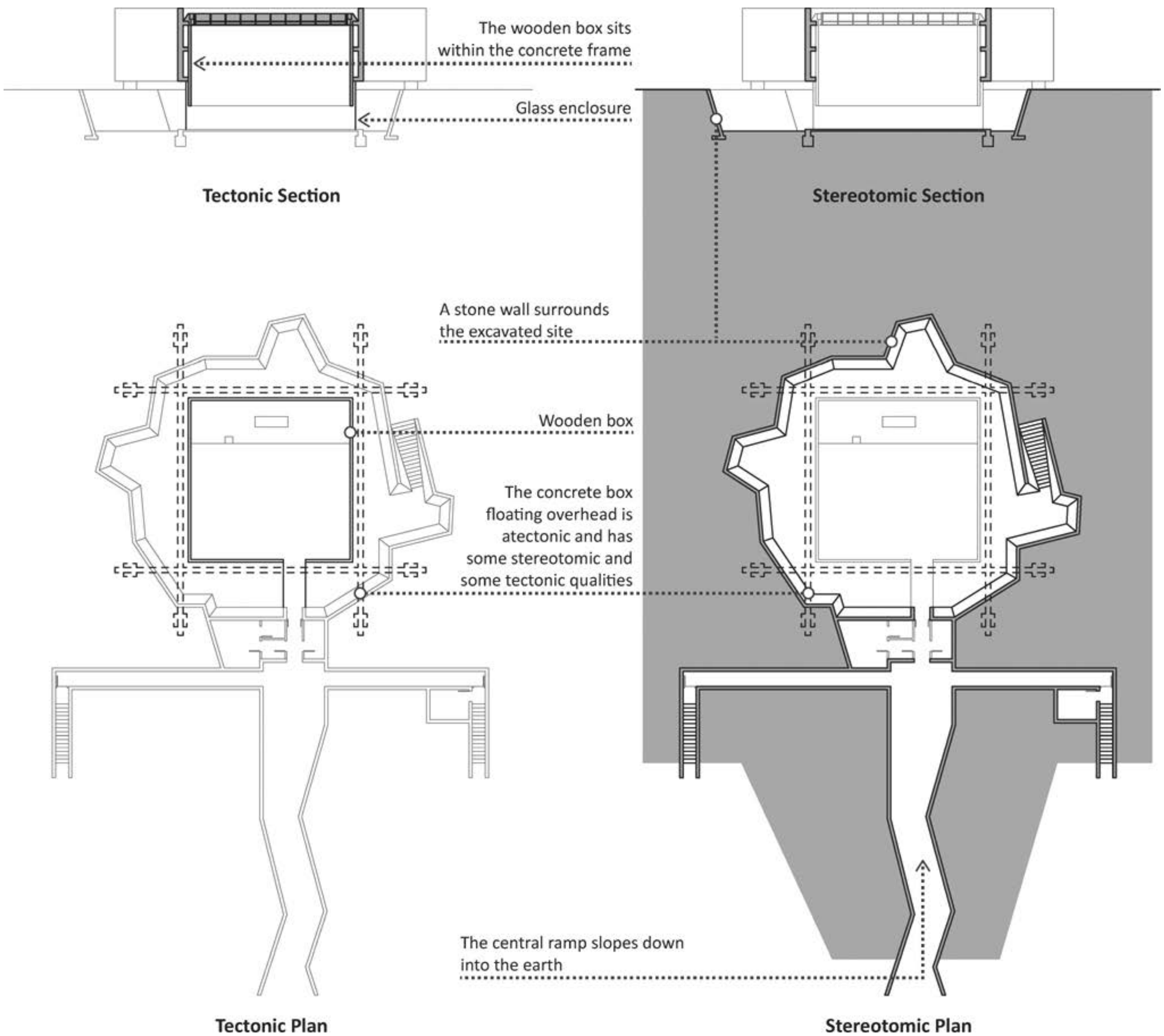
Atectonic | Tectonic

In the Chapel del Retiro, the typically stereotomic mass of the building is vaulted into the air on foundation blocks. Mass is dematerialized and disconnected. These qualities directly reflect one of Sekler's points of the atectonic: a tectonic expression that is purposefully kept vague.[5] In this project, the floating concrete walls create an unsettled perception of how the

15.8
View down the main entry ramp

structure is supported (Figure 15.10). Undurraga exaggerated the effect by extending the concrete walls beyond their supports, creating a cantilever condition that hovers above the ground.

The effect of floating is also pronounced on the interior of the building where no structural support is visible. Attached to the inside face of the concrete frame, a steel frame supports the installation of the wood cladding – a composition of recycled railroad ties. This cladding constricts the view out and conceals the concrete construction. A similar condition occurs at the roof. A narrow skylight runs around the entire perimeter of the chapel's ceiling. The roof's structure – a series of lightweight trusses – is concealed above, giving the effect of a floating ceiling in the space. The progressive dematerialization of these heavy elements is the primary tectonic – or atectonic in this case – expression of the chapel (Figure 15.11).



15.9
Tectonic | Stereotomic

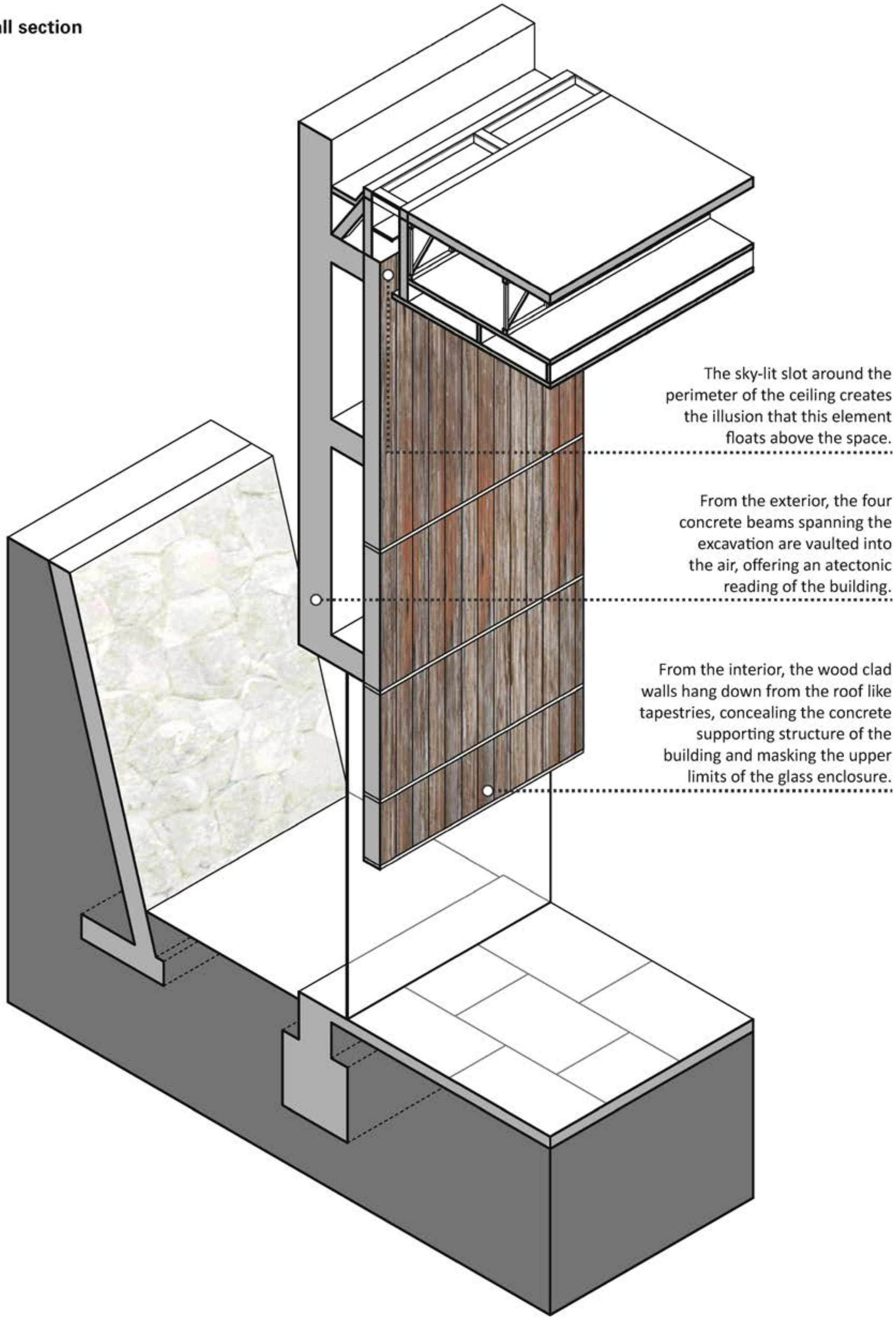
The glass also plays a role in this reading of the space. Between the bottom of the concrete beams and the floor of the chapel, there is a 2-meter [6.5-foot] void. A frameless glass enclosure fills this void. Each pane of glass slides into a reveal in the bottom edge of the concrete box above, while a similar groove cut into the concrete slab below holds the bottom edge of the glass wall. These *invisible* connections combine with the butt-glazed assembly to create a transparent separation between interior and exterior at the level of occupation.

Representation | Space

In the Chapel del Retiro, a clear separation has been made between the surface of the construction and its structural core. The concrete box is the core-form of the project, while

15.10
Corner intersection highlighting concrete, wood, and glass elements

15.11
Floating wall section



the wooden box, or art-form, has been hung from this structural core, separating the form doing the work from the ornamental interior. This separation of roles, represented as nesting boxes, relates to the evolution of tectonic thought in the early 1900s. At this time, many scholars and architects sought to separate the "ornamental hull" from the "corporeal kernel"[6] (see page liv). In this chapel, however, the two elements are not in opposition. They are, instead, complementary opposites that provide two distinctly different impressions of the chapel while enhancing the spiritual qualities of the space.

This division is also closely tied to Semper's development of interior space. In *The Four Elements of Architecture*, Semper states:

> Hanging carpets remained the true walls, the visible boundaries of space. The often solid walls behind them were necessary for reasons that had nothing to do with the

15.12
View up between layers of wood and glass with concrete above and stone on exterior

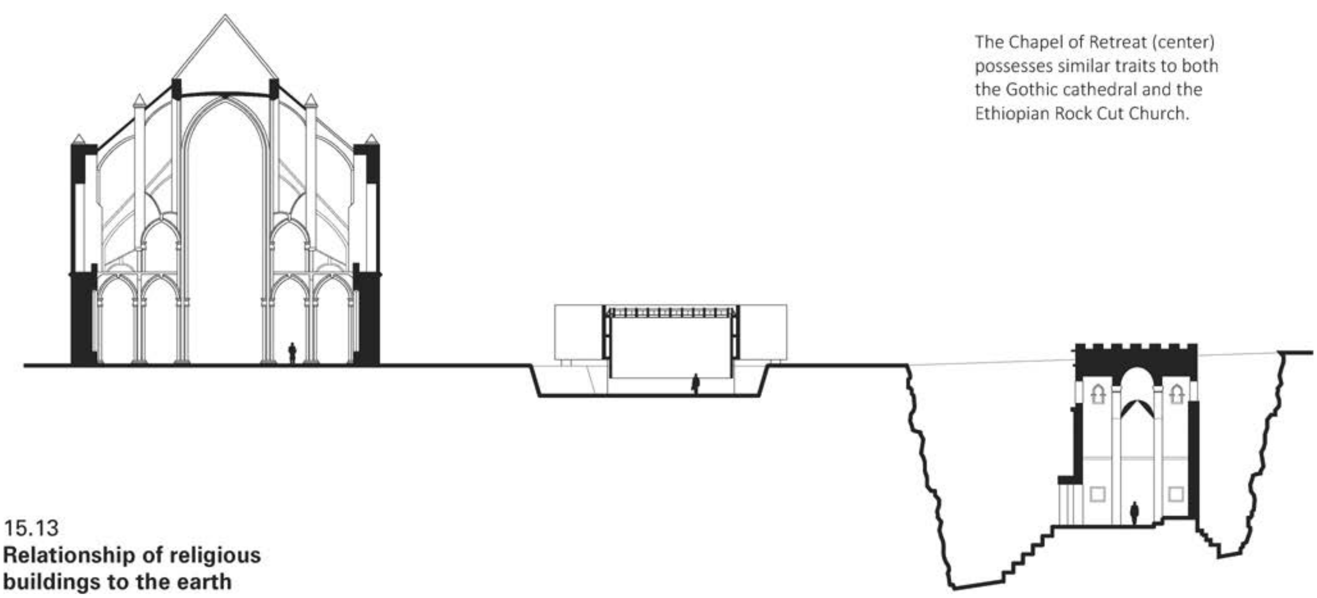
creations of space; they were needed for security, for supporting a load, for their permanence, and so on.[7]

This distinction between carpet and solid wall describes the relationship between the two boxes in the chapel. The wood box fills the role of Semper's wall-hung textiles (Figure 15.12). This inner surface is a structure woven from wood and steel. The steel creates the warp threads, the structure of the fabric, while the wood ties provide the weft or pattern in this simple construct. Each block of wood is subtly different in tone and texture because of their nature as aged, recycled material. These variations create richness in the fabric of the space and provide a textural condition on the interior of the building comparable to the rough stone used to line the excavation and retaining conditions of the site.

The wooden fabric of the Chapel del Retiro has weight. It is dark and encompassing and floats precariously above your head. Hanging down from the concrete frame, it constricts your view of the outside – almost like a curtain being drawn. The chapel is a protected environment, wrapped in this warm, rich fabric. The nature of the construction and its materiality lead to an inwardly focused space designed for retreat and reflection.

Precedent

The Chapel del Retiro is the inverse of what you may expect from the typical ecclesiastical space (Figure 15.13). Most religious buildings are formed with the base of the building serving as an anchoring condition and dematerialization occurring as the construction rises from the ground. This configuration allows light to shine down from the heavens above into the sacred space. Here, the heavy elements sit above and light streams in from below, reflected off of the stone lining the excavated depression. This reversal of light and heavy in the Chapel del Retiro sets the project at odds with normative practice while also running contrary to Frampton's distinction of the earthbound mass and the dematerialized assembly. Instead,



15.13
Relationship of religious buildings to the earth

the sinking of the sanctuary into the earth is reminiscent of a much more literal act found in the rock-cut churches of Ethiopia (12°1′54″N, 39°2′28″E), which are believed to have been built during the twelfth and thirteenth centuries. These buildings have been carved from the earth itself. They are places of pilgrimage that promote internal reflection and reverence in a similar manner to the Chapel del Retiro.

Despite significant differences, the chapel is also reflective of the Gothic cathedral. Similar to a Gothic structure, the Chapel del Retiro is allowed to be free of internal clutter through structural work that remains hidden behind an ornamented façade. Undurraga refers to this as the duality of the rational exterior and metaphysical interior. Whereas in the Gothic cathedral, the soaring height and immense surfaces of glass are supported by a series of unseen buttresses and other ingenious structural techniques, in this small chapel, it is the four concrete walls that provide stability while remaining unseen. Construction technique, structural sophistication, and the resulting empathetic space, while very different in appearance, conceptually tie the chapel to a lineage of the design of sacred architecture.

Additional Resources

Projects

Mirador House, Santiago, Chile, 2002
Las Condes Municipal Building, Santiago, Chile, 2004 (33°24′58″S, 70°35′41″W)
Santiago Archaeological Museum, Santiago, Chile, 2005 (33°26′14″S, 70°38′27″W)
Citizen's Square, Santiago, Chile, 2005 (33°26′38″S, 70°39′13″W)
Padre Hurtado Shrine, Santiago, Chile, 2008 (33°27′44″S, 70°41′12″W)

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"Chapel of Retiro los Andes Valley, Chile: Undurraga Devés Arquitectos." *C3 Korea*, no. 312 (2010): 66–75.

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Notes

1 Massimo Ferrari, "Cristián Undurraga: Cappella Nella Valle De Los Andes, Chile," *Casabella* 74, no. 791 (2010), 43.
2 Ibid.
3 Joseph Rykwert, *The Necessity of Artifice* (New York: Rizzoli International Publications, 1982), 129.
4 Carles Vallhonrat, "Tectonics Considered: Between the Presence and the Absence of Artifice," *Perspecta* 24 (1988), 126.
5 Eduard Sekler, "Structure, Construction, Tectonics," in *Structure in Art and Science*, ed. Gyorgy Kepes (New York: Braziller, 1965), 94.
6 Werner Oechslin, *Otto Wagner, Adolf Loos, and the Road to Modern Architecture* (New York: Cambridge University Press, 2002), 52–53.
7 Gottfried Semper, "The Four Elements of Architecture: A Contribution to the Comparative Study of Architecture," in *The Four Elements and Other Writings*, ed. Harry Francis Mallgrave and Wolfgang Herrmann (New York: Cambridge University Press, 2010), 103–4. (Originally Published in 1851.)

16
Lanxi Curtilage Building
Archi-Union Architects

Firm Brief[1]

Founded in 2003 by Dr. Philip F. Yuan, Archi-Union Architects is a Shanghai-based architecture firm specializing in architecture, urban planning, and interior design. Having received a Grade A design certification from China's Ministry of Housing and Urban-Rural Development, Archi-Union provides forward-thinking solutions to architectural problems by combining traditional practice with advanced academic research.

Archi-Union has an architectural style that is an amalgam of current global trends and established local practices. This blending of styles has resulted in a low-tech digital fabrication method the firm calls Digital Tectonics. This theory – catalyzed through a **parametric design** process – combines digital technology and craftsmanship, tectonic construction and ecology.

parametric design = a design process based on a set of parameters and rules that are used to create, manipulate, and define the relationships between elements that make up the overall structure

Yuan, who serves as the firm's director, is also an associate professor at the Architecture and Planning Institute of Tongji University in Shanghai. His teaching focuses on the integration of architectural design practice and theory while his research focuses on digital design

16.1
Vicinity map

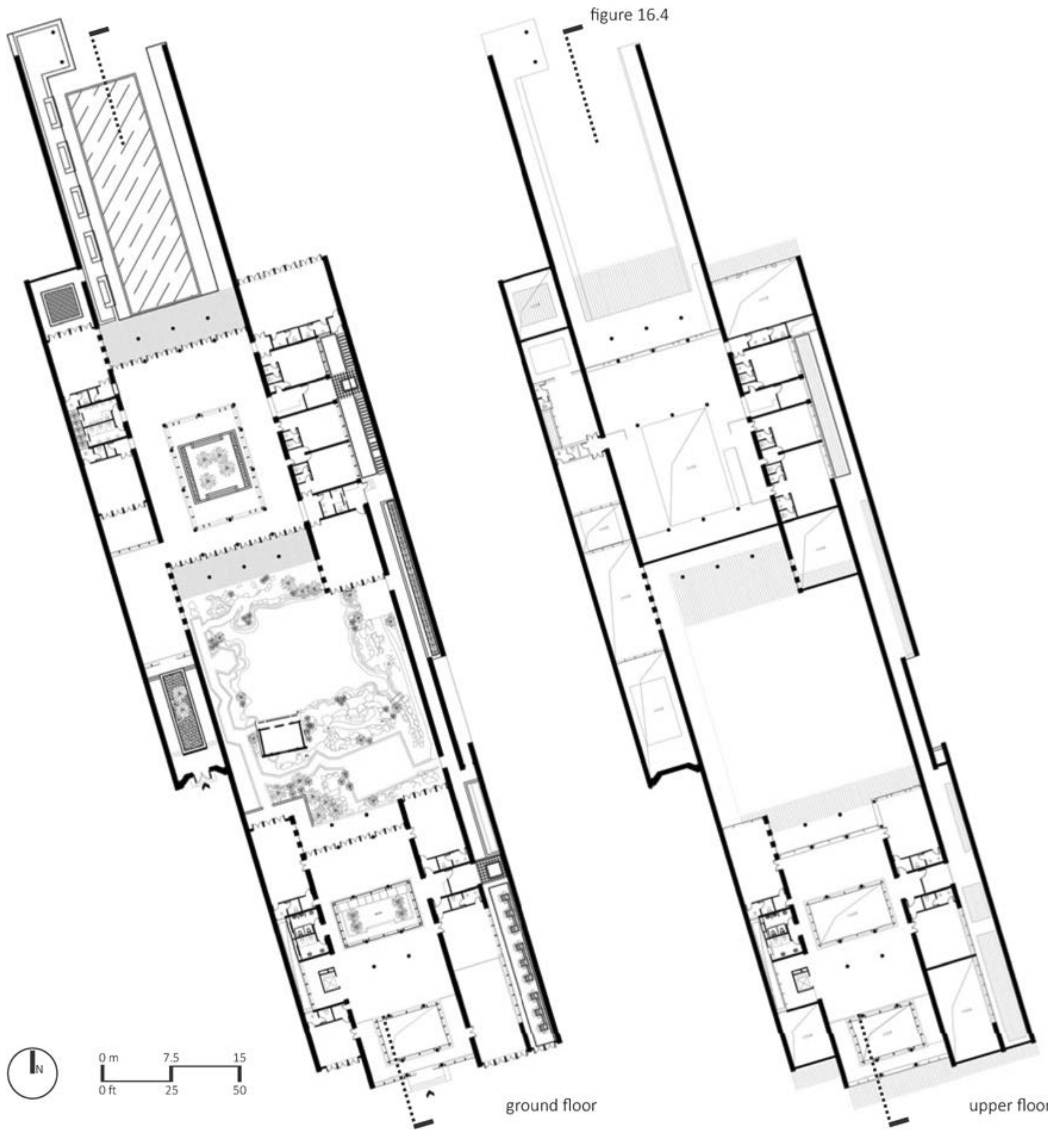
and fabrication methodology with a particular interest in the manipulation of masonry materials. His endeavors within the university have provided a forum for initiating and developing the research interests that carry through into the professional work in his office.

Yuan has delivered numerous keynote speeches at academic conferences including CAAD Futures in 2013. His built work and research have also been widely published in recent years and he is the author or editor of several books including *A Tectonic Reality* (2011), *Theater Design* (2012), and *Fabricating the Future* (2012 with Neil Leach).

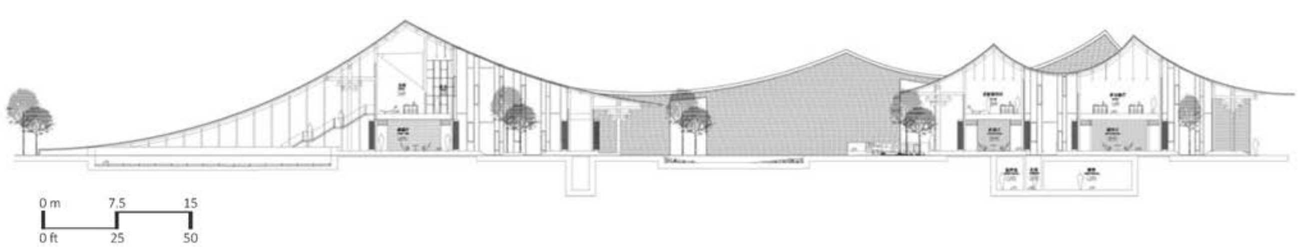
Project Brief

Curtilage is a legal description for the area around a dwelling. In particular, the term refers to the immediately adjacent land and outlying structures that define the private space utilized by the inhabitants of that building. The Lanxi Curtilage Building is aptly named. Its collection of walls define a series of spaces – both indoor and outdoor – for the private gathering of people from in and around the densely populated urban area of Chengdu, China (Figure 16.2). The project sits in the International Intangible Cultural Heritage Park. The park was established through a partnership between the Chinese government and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) as part of an effort to revitalize

16.2
Main entry of the Lanxi Curtilage Building



16.3
Floor plans



16.4
Building section

16.5
View through the courtyard

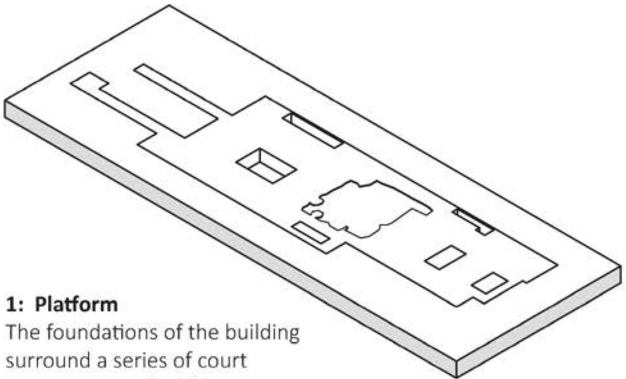
the area after the 2008 Sichuan earthquake. The 109-hectare [270-acre] park includes many amenities, all devoted to honoring and preserving national traditions.

The Lanxi Curtilage houses a restaurant and a private club, arranged around a series of courtyard spaces (Figures 16.3 to 16.5). The building formally reads as the silhouette of a mountain range or the abstraction of a rolling river; but outside of its form, the building was conceived on two premises: how does building reflect culture and how can the contemporary merge with the traditional? In this project, Archi-Union sought to understand how the practice of building can stay true to (and build upon) the traditions of the cultural past while still utilizing progressive attitudes towards the means of constructing the built environment. How can a dialogue be established between tradition and innovation?

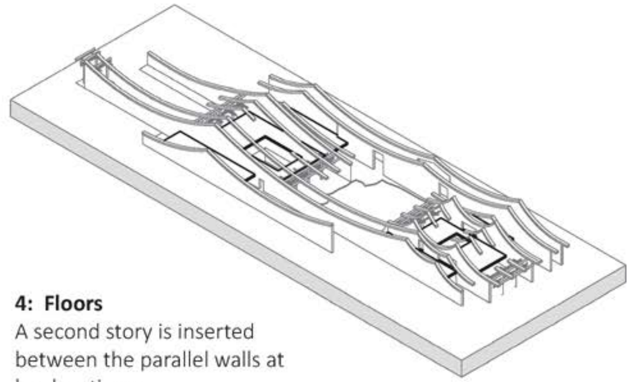
Tectonic Principles

Anatomy

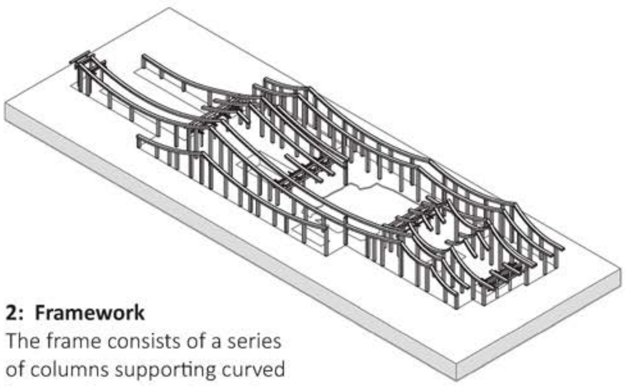
The Lanxi Curtilage Building is organized around a series of parallel masonry walls (Figure 16.6). Each wall has two components: skin and structure. The structure – the framework of the building – consists of reinforced brick columns that are hidden within the walls between two wythes of brick that form the building's cladding system. These columns are built specifically to resist seismic loading, especially critical given that the instigation for the park in which the building resides was a deadly earthquake. Filling in the end conditions between the parallel walls are infill panels – composed of brick, wood, and glass – that complete the cladding system.



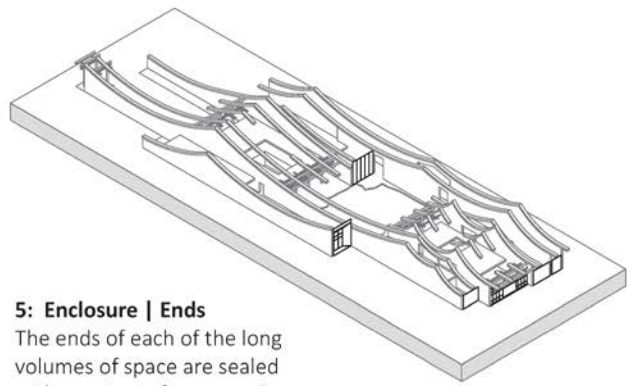
1: Platform
The foundations of the building surround a series of court spaces, some of which puncture through to a lower level.



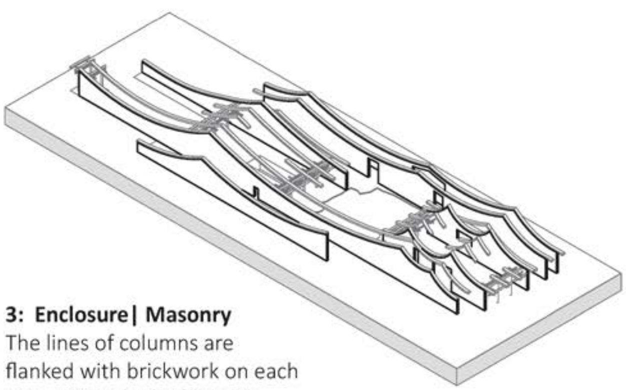
4: Floors
A second story is inserted between the parallel walls at key locations.



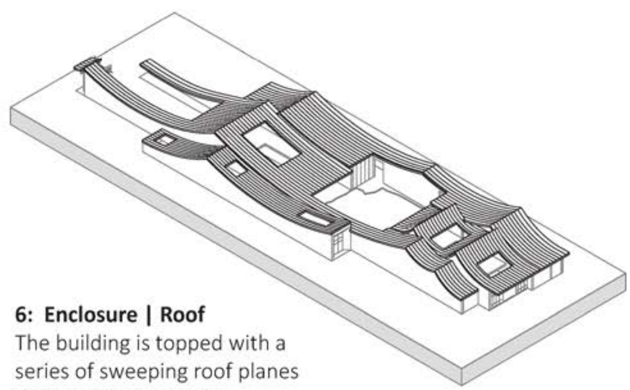
2: Framework
The frame consists of a series of columns supporting curved beams above that define the profile of the roofs.



5: Enclosure | Ends
The ends of each of the long volumes of space are sealed with a variety of constructions ranging from brickwork to glazing.



3: Enclosure| Masonry
The lines of columns are flanked with brickwork on each side, giving the building its defining character.



6: Enclosure | Roof
The building is topped with a series of sweeping roof planes that span between the masonry walls below.

16.6
Anatomy

Above, spanning between the columns, sit concrete beams. These elements complete the simple post and beam framework of the Lanxi Curtilage. Atop the beam system, concrete slabs form the roof enclosure. The slabs are ornamented on their upper surface with wood strips that extend past the structure at the eaves.

These primary elements all serve to shelter the network of spaces contained within the project. Although there are a variety of nodes within the Lanxi Curtilage that serve as social hubs, the entire project is centered on a large courtyard situated between the restaurant and the private club. This part of the building is designed not only as a serene environment for patrons to enjoy, but as a historical reference to the legacy of Chinese gardens.

Precedent

Many aspects of the Lanxi Curtilage Building are drawn from the traditions of this region of China. The "cantilevered wooden gantries, brick walls, and . . . sloping roof" are all characteristics of regional building typologies.[2] The roof, in particular, is constructed to match the profile of traditional Sichuan homes in this region of southern China (Figure 16.7). As the building's walls stretch outwards, the linear composition created also reflects the traditional garden designs of southern China.[3]

The Lanxi Curtilage was also conceptualized by Archi-Union as a contemporary expression of *Shan shui*.[4] *Shan shui* is a style of traditional Chinese painting that depicts natural

16.7
The west elevation of the building

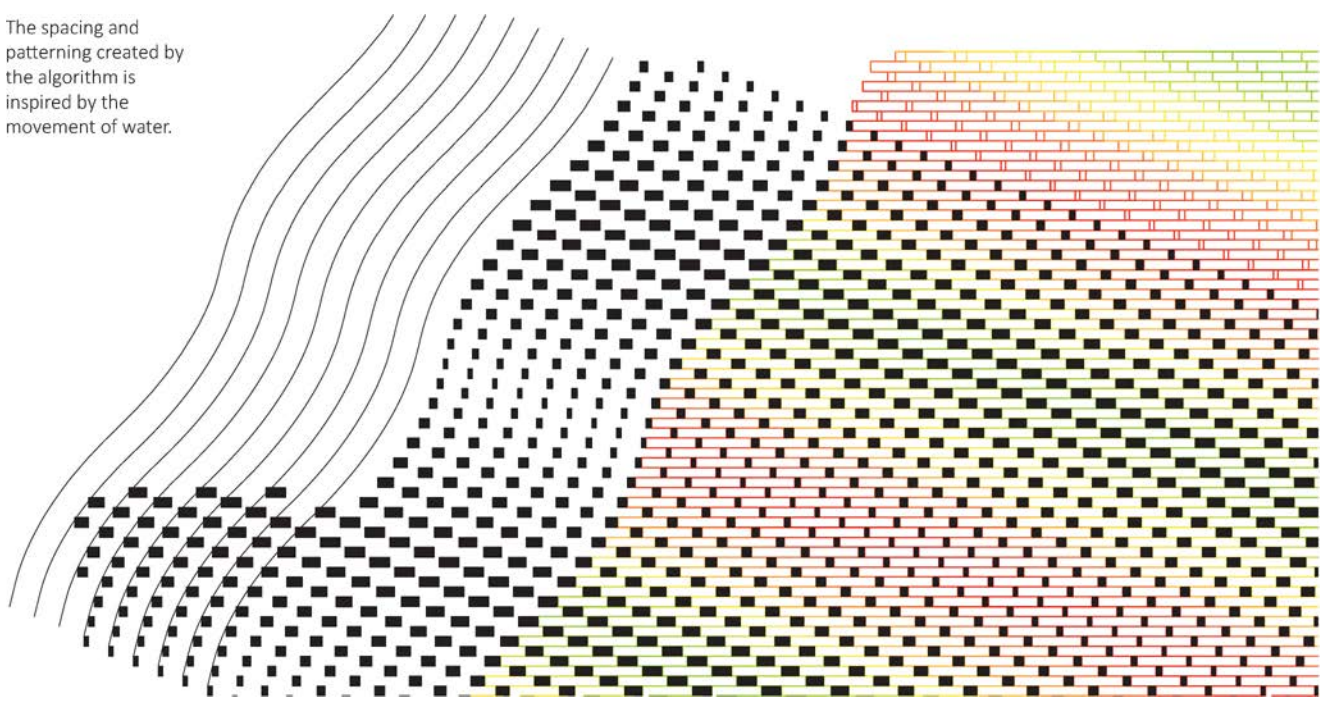
landscapes – often including mountains and rivers – and uses a brush and ink rather than more conventional paints. While the natural inspirations of this type of painting are revealed in the building's form, the translation of the art-form through its *brushwork* can also be clearly seen. Broad strokes are evident in the concrete bands that outline the curving roof planes, while the texture of the brush is realized through the grain of the masonry surfaces.

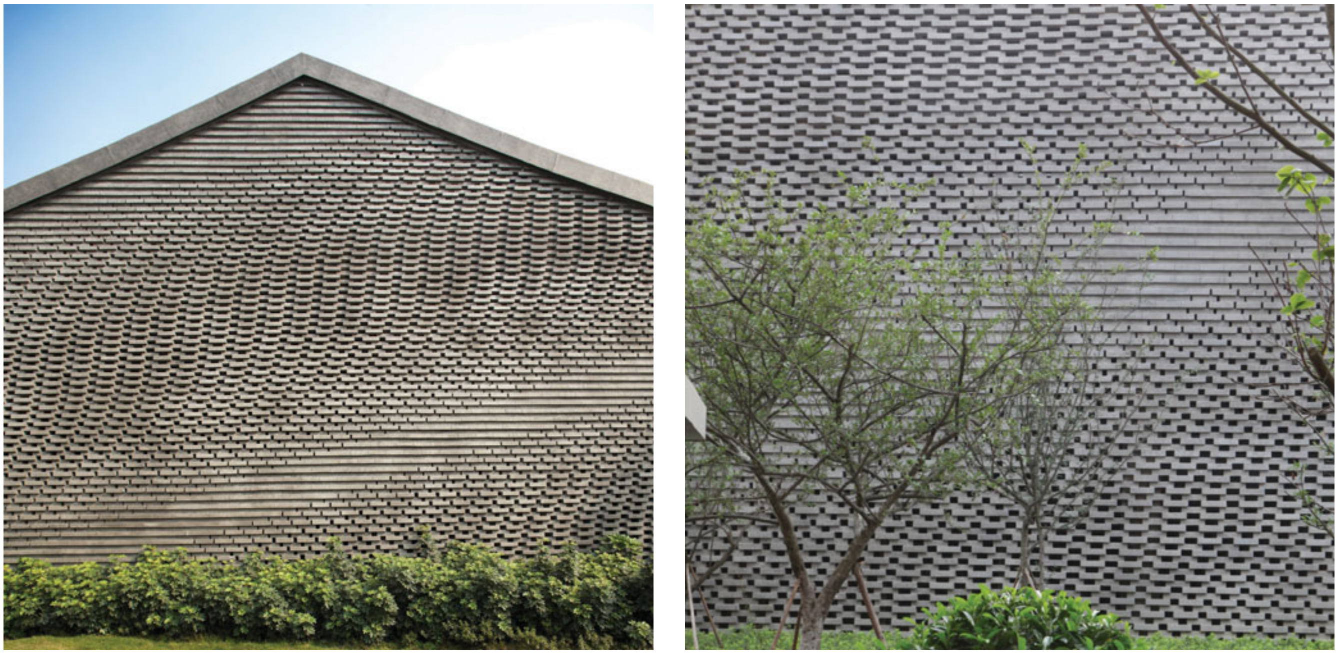
Representation

Building on the theme of abstracted nature, the patterning of the masonry is derived from water. Disrupting the surface of water creates a pattern of ripples that roll across the surface. Archi-Union captured images of ripples in water and translated them into a digital interpretation using advanced software such as Rhino and Grasshopper. The firm developed "an algorithm that mimicked the transient behavior of water, which could be frozen in time allowing a literal architectural expression of its transient behavior"[5] (Figure 16.8). After the translation of the imagery, the process continued with the introduction of materiality and the re-creation of the image as a masonry skin. The program merged the water patterning with the physical realities of the masonry, creating a staggered joint pattern that plays with light, shadow, and transparency[6] (Figure 16.9).

The cladding system is reflective of Semper's ideas regarding the translation of cloth into more durable materials. Here, the masonry is treated as a fabric inspired by the movement of water.[7] The material is draped across masonry piers not only to enclose space but also to

16.8
Parametric patterns





16.9
Brickwork detailing

bring to it its character and essence. Masonry is at once a stable structural core (Semper's original framework) and a flowing cladding system that dramatizes the structure. The Lanxi Curtilage is also a contemporary example of Schelling's "solidified music." Technology has been used to isolate and freeze the physics of fluid dynamics, translating the three-dimensional artwork into the expression of the building. The processes of nature are examined, explored, and projected in the art-form of the building.

In *Constructing Architecture*, Andrea Deplazes states that contemporary ornament is frequently based on the scaling and multiple repetitions of angled surfaces.[8] The ornamentation of the Lanxi Curtilage serves as a contemporary example of this type of art-form. His discussion of the dialogue between "technological immanence" and "cultural permanence" is also evident in the project (see page xlxii).[9] Devised to help explain Semper's ideas of the translation of fabric patterns into more permanent materials, this concept is equally adept at reflecting on the integration of technology and craft. The Lanxi Curtilage Building was created with a spirit of technological innovation that is dramatically shifting the discipline of architecture. But this project was not based solely in the advancements of the present day. Traditional processes of building, provided by local craftsmen, were utilized to realize the technologically derived aesthetic.

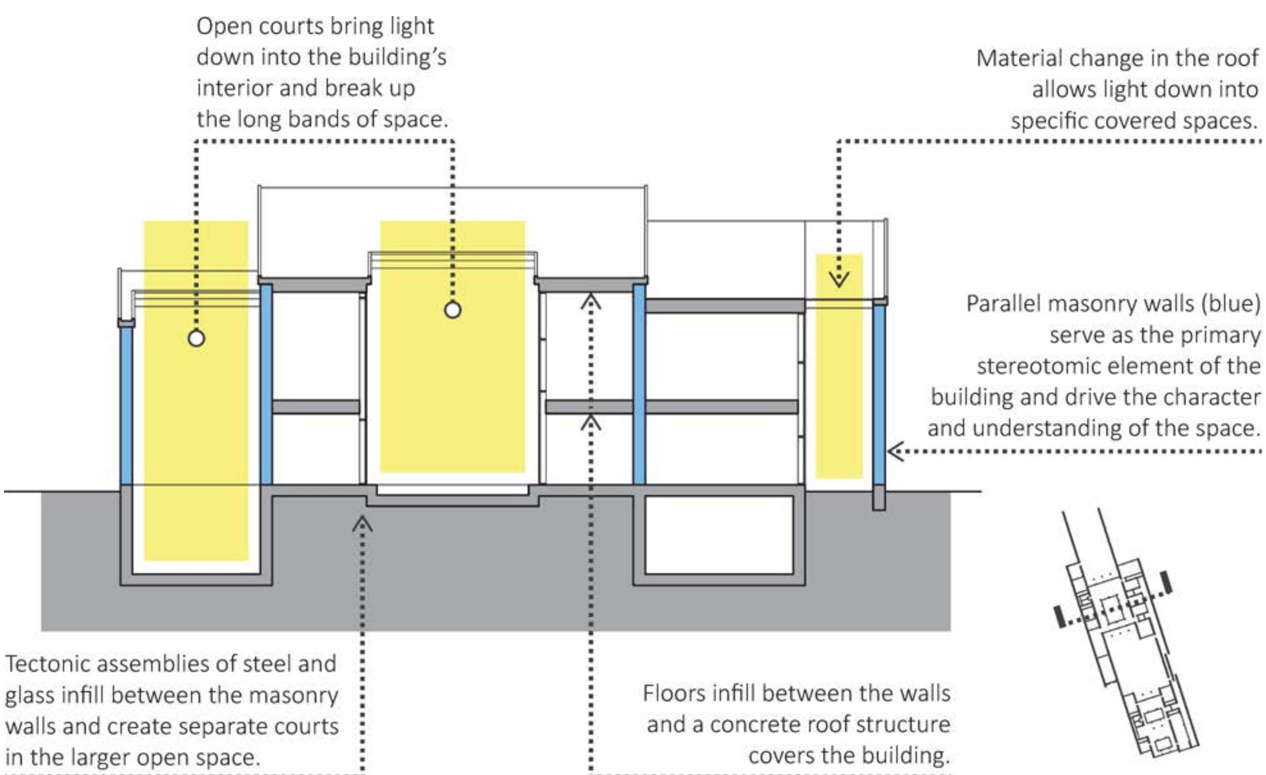
Stereotomic

The Lanxi Curtilage's walls are built with local brick – called blue brick – composed of locally sourced materials (Figure 16.10). Unlike traditional masonry walls that are built using a simple pattern like running bond, the configuration here was far more complex. The original intent was to have the walls constructed by a robotic arm controlled by the parametric-based computer program that generated the algorithm. That strategy, however, proved to be far too expensive.[10] In lieu of robotic placement, a group of local workers were employed to construct the walls within the tight three-month time frame available. Because of the shift to manual labor, the intricacy of the brick pattern had to be simplified in order to make the construction feasible within the realm of human limitations.

A module, within the algorithm, consists of one brick and the adjacent gap between it and the next brick (Figure 16.11). Each brick in Lanxi Curtilage is 100 × 500 × 500 millimeters [3.9 × 19.7 × 19.7 inches]. Variation in the pattern is introduced by varying the width of the gaps between the bricks. Nine variations in spacing were used in the conceptual modeling of the project, ranging from 60 × 100 × 350 millimeters [2.4 × 3.9 × 13.8 inches] to 220 × 100 × 350 millimeters [8.7 × 3.9 × 13.8 inches]. This variation generated the complex patterning on the walls of the building.

To help convey the assembly instructions, Archi-Union developed a template that repeated at every other column or about every 6 meters [19.7 feet]. The masons were taught how to read the template, but they were also invited to participate in the development of the construction process. Yuan commended the workers for their quick understanding of the digitally derived strategy and their constructive feedback on how to improve it.[11] Technology and craftsmanship were linked to create this structure; computer generated, but man-made.

16.10
Tectonic and stereotomic qualities



A: Primary Module
The primary masonry unit is 100 mm [4 in] tall and 500 mm [19.7 in] wide.

B: Traditional Construction
In a traditional masonry building, the units are laid side-by-side.

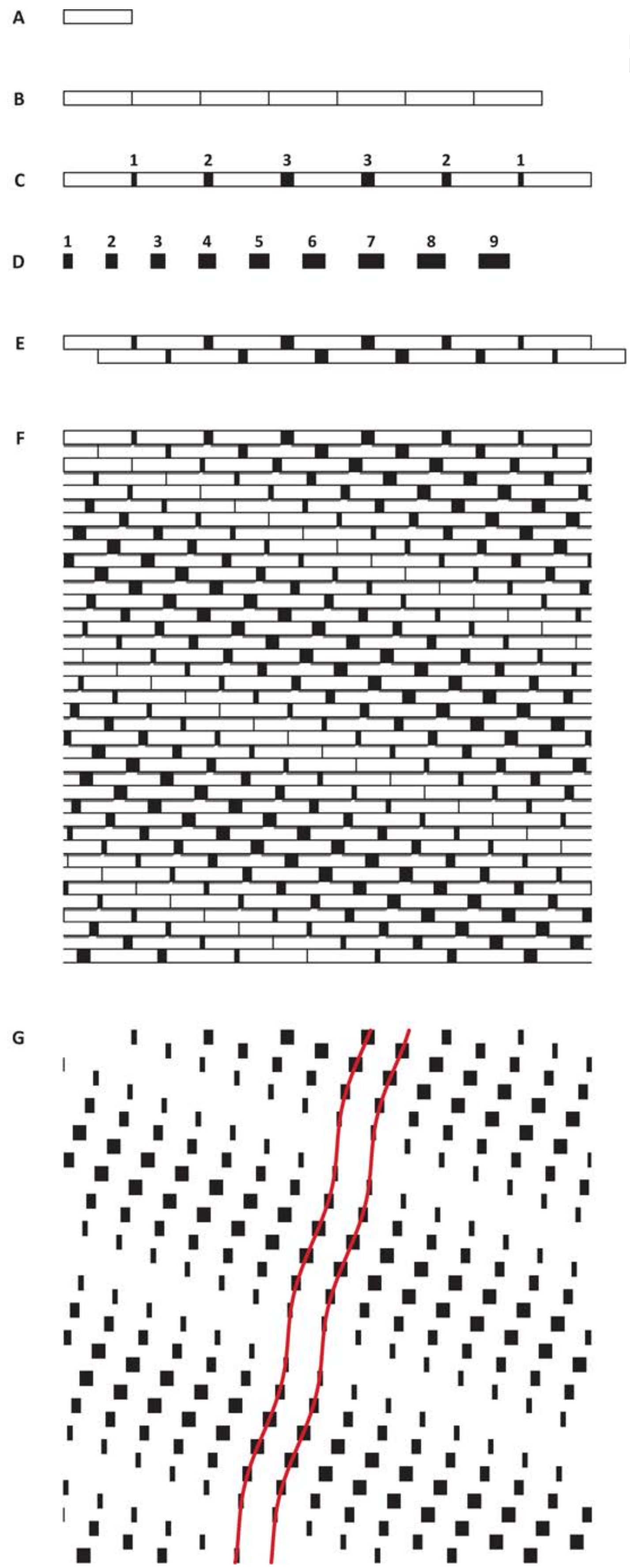
C: Parametric Introduction
Instead of side-by-side, at Lanxi Curtilage the masonry units are spaced apart. The gaps between the units vary in size based on a computer-generated formula. In a single course, the gaps gradually increase in width and then the pattern reverses and they decrease.

D: Complexity
Line C shows three different gap sizes. The conceptual model developed by Archi-Union shows a total of nine different sized gaps ranging from 60 mm [2.4 in] to 220 mm [8.7 in] wide. The building itself however is far more complex. Each course of masonry on the building goes through a cycle of around 50 different gap sizes before returning to its starting size (as opposed to the six shown in line C).

E: Coursing
As with a traditional running bond, each course is staggered half of the width of a masonry unit from the courses above and below.

F: Masonry Wall
Adding the rest of the courses, the wall's surface becomes a complex pattern of solid and void, positive and negative space. The textural qualities of the wall are extended through the use of offset in the z-axis. Every other course is shifted outward (toward you) about 50 mm [2 in]. This offset creates shadow lines that increase the perceived depth and relief of the masonry walls.

G: Parametric Resolution
When examining the parametric components of the wall - the voids - the wavelike pattern is clearly revealed. This diagram demonstrates a much simpler version of this algorithm than the actual building presents.



16.11
Parametric bricklaying process

Space

The design of the woven pattern of the brick fabric is not just aesthetic but also programmatic. The expansion and contraction of the brick weave responds to the adjacent spatial needs; it opens to capture views and light and compresses to form a solid face at private areas. The spatial qualities of the Lanxi Curtilage are also derived from the arrangement and composition of these walls, which subdivide the building into programmatic compartments.

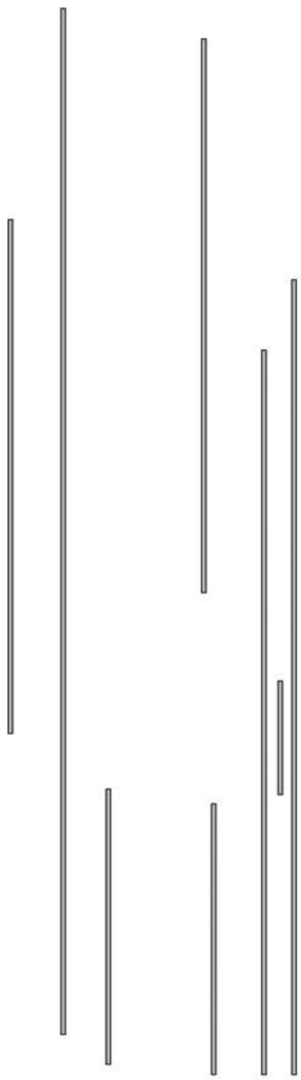
Archi-Union designed the varying spatial experiences to be similar to that of Chinese gardens. A traditional garden is enclosed by walls and includes ponds, structures, and paths in addition to vegetation. The garden unveils itself in a narrative sequence – space by space – creating a structured path that guides the visitor. In essence, the Chinese garden is a series of slides, each showing just a fragment of the whole. This spatial makeup is closely related to Helmholtz's concept of indirect vision, where the user must piece together individual experiences to create a perceived whole. In the Lanxi Curtilage, the whole is experienced only after the narrative is complete and the slides can be stitched together like the weaving of the walls (Figures 16.12 and 16.13).

Intersection

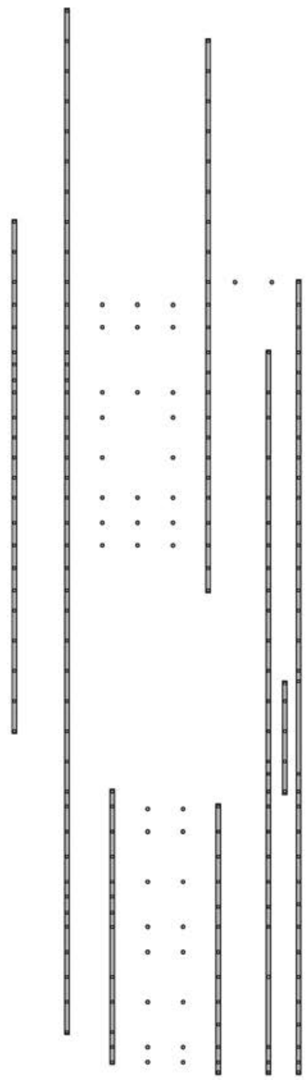
> The new paradigm [of digital technologies] brings to mind the radical introduction of Modernism, where the technical advances of steel, concrete and glass construction, reshaped the modes of operation and reinterpreted the traditional values for the new era ahead. However, the ontological essence of architecture and construction developed coherently through history has remained unchanged and the study of building materials and novel tectonics has kept moving forward. This means that, even when equipped with the current advanced technologies which allow great freedom in the design of extreme forms, architects are still required to focus on architectural tectonics.[12]
>
> Philip F. Yuan, Mei Zhang, and Li Han, "Low-Tech Digital Fabrication: Traditional Brick as Material in Digital Practice," 2013

In this discussion, Yuan claims that despite progressing technology, the tectonic notions of assembly and construction are still primary considerations in the creation of architecture. This pairing often requires the resolution of digital design and manual construction, as was the case in the Lanxi Curtilage Building. Yuan refers to the resulting process as low-tech parametric fabrication. Here, the traditional construction strategies of the region are augmented with technological innovation; thousands of years of craftsmanship intersect with new digital frontiers. Together, they are asked to transmit cultural meaning and uphold the traditional values of the place.[13]

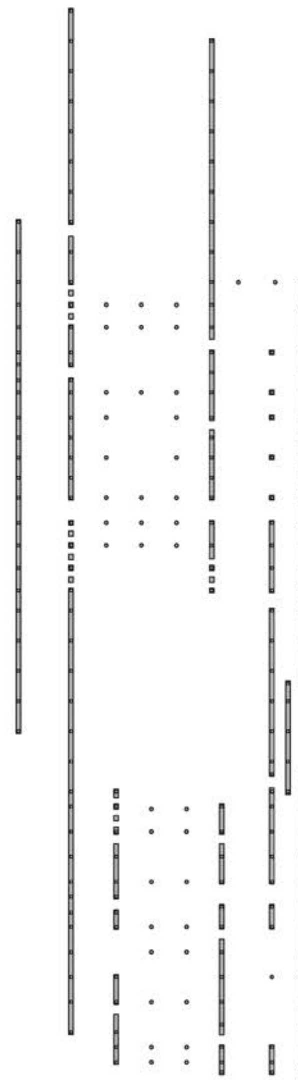
To successfully blend these two radically different approaches in a single project, a series of parameters must be met: local materials and labor sources must be comprehensively understood; digital processes must be simplified to ensure straightforward instructions and assignments; fabrication processes must be carefully selected to align with available fabrication tools; and formal complexity should be reduced to minimize the errors attributed to conventional construction methods.[14] These parameters were generated through the



1: Parallel Walls
The project is governed by a series of parallel masonry walls that divide the space of the building into strips.

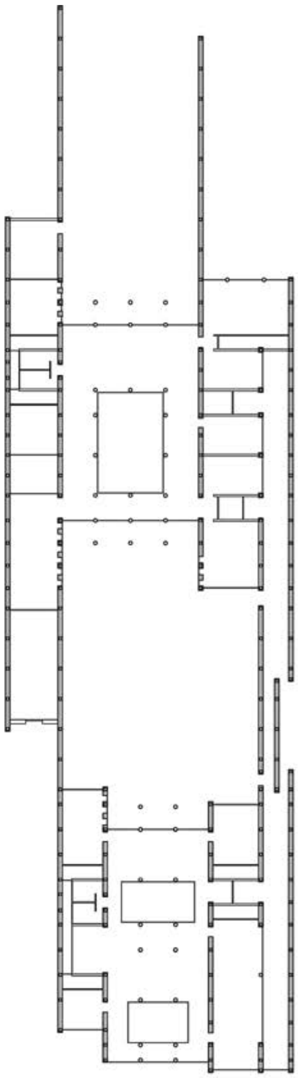


2: Structure
The walls dictate the structure and are supplemented by a grid of free standing columns.

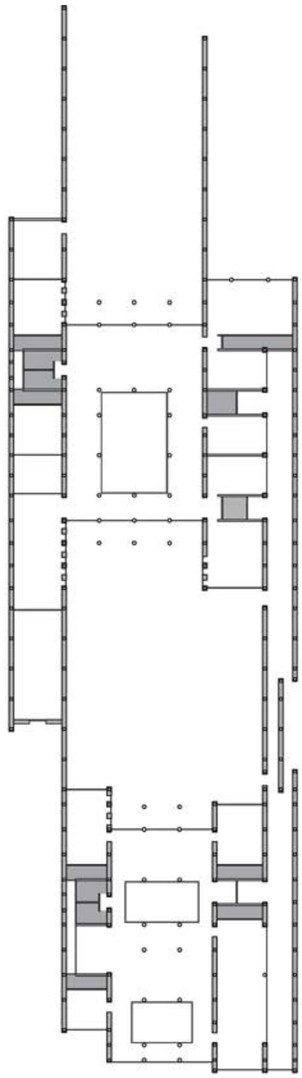


3: Punctures
Circulation pierces the walls at specific points, allowing visitors to move and/or view between the strips of space.

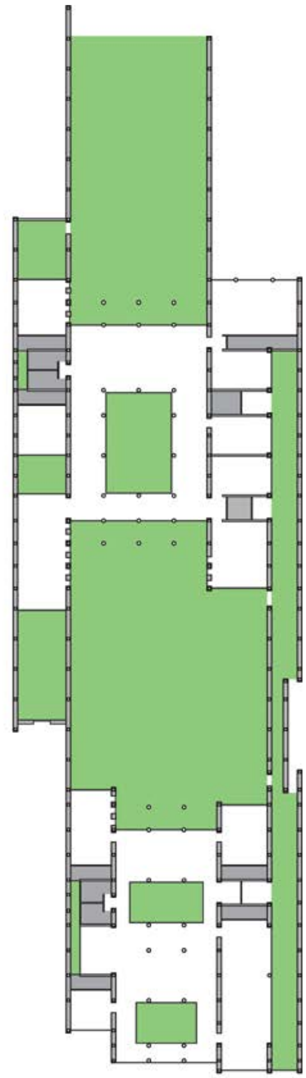
16.12
Spatial narrative



4: Infill and Segmentation
Infill walls are inserted, running perpendicular to the masonry walls. These segment space creating distinct zones for occupation.

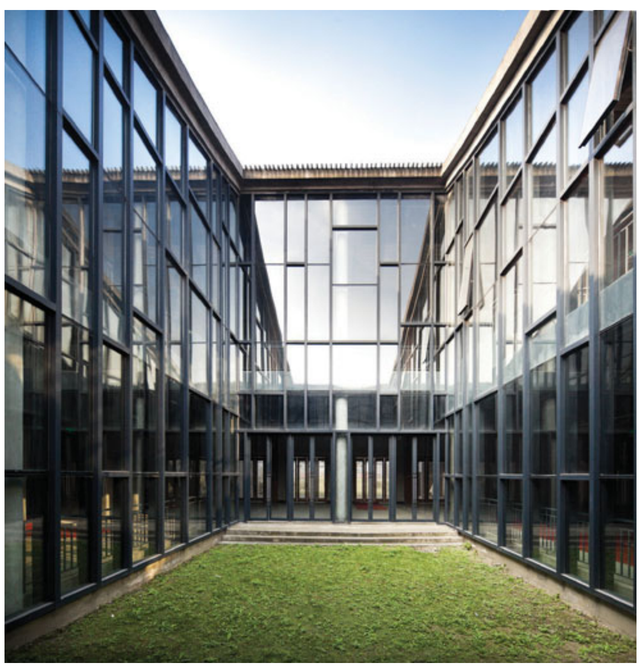


5: Public | Private
Solids are formed through the insertion of private and service space, creating impediments in the spatial strips.



6: Patchwork
Interior (white) and exterior (green) space are interwoven to create a patchwork reminiscent of the solid and void relationship of the brickwork. Moving through this space becomes a varied, narrative experience much like that of a Chinese garden.

16.13
Interior hallway



16.14
Small court space

experience of building Lanxi Curtilage. Careful study of traditional construction in Chengdu provided an avenue for the use of cutting-edge technology in the development of this small part of the built environment (Figure 16.14).

Additional Resources

Projects

Tongji U+A Bookstore, Tongji University, Shanghai, China, 2012
DigitalFUTURE Exhibition, with Neil Leach, 2011
Tea House, Shanghai, China, 2011
J-Office & Silk Wall, Shanghai, China, 2010
Linear House-Jiujiantang, Pudong District, Shanghai, 2006

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"Archi-Union: Restaurant Et Club Privé, Chengdu, Chine = Restaurant and Private Club, Chengdu, China." *Moniteur Architecture AMC* (2013): 96–99.

"Píxeles De Barro: The Lanxi Curtilage in Chengdu, China." *Arquitectura Viva*, no. 158 (2013): 46–51.

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Yuan, Philip F., Mei Zhang, and Li Han. "Low-Tech Digital Fabrication: Traditional Brick as Material in Digital Practice." In *Global Design and Local Materialization: 15th International Conference, CAAD Futures 2013, Shanghai, China, July 2013: Proceedings*, edited by Jianlong Zhang and Chengyu Sun, 139–48. Berlin, Heidelberg: Springer, 2013.

Notes

1 This firm brief was adapted from the company profile on Archi-Union's website: http://archi-union.com/company.asp and http://archi-union.com/people.asp
2 "Archi-Union: Restaurant Et Club Privé, Chengdu, Chine = Restaurant and Private Club, Chengdu, China," *Moniteur Architecture AMC* (2013), 96.
3 Taken from a project narrative provided by Archi-Union.
4 Taken from a project narrative provided by Archi-Union.
5 Quotation taken from a project narrative provided by Archi-Union.
6 Taken from a project narrative provided by Archi-Union.
7 In another similarly inspired project undertaken by Archi-Union – J-Office & Silk Wall – the masonry patterning was inspired by silk fabric.
8 Please see Andrea Deplazes, ed. *Constructing Architecture: Materials Processes Structures: A Handbook*, 2nd ed. (Boston: Birkhauser, 2009) for an outstanding discussion of the translation of Semper's views on tectonics into historical and contemporary masonry construction.
9 Ibid., 309.
10 Taken from a project narrative provided by Archi-Union.

11 Murrye Bernard, "Moiré in Masonry: Despite Their Digital Origins, the Rippling Brick Walls of the Lanxi Curtilage are Steeped in Chinese Tradition," *Architect* 102, no. 1 (2013), 62, 64.

12 Philip F. Yuan, Mei Zhang, and Li Han, "Low-Tech Digital Fabrication: Traditional Brick as Material in Digital Practice," in *Global Design and Local Materialization: 15th International Conference, CAAD Futures 2013, Shanghai, China, July 2013: Proceedings*, ed. Jianlong Zhang and Chengyu Sun, (Berlin, Heidelberg: Springer, 2013), 139.

13 Taken from a project narrative provided by Archi-Union.

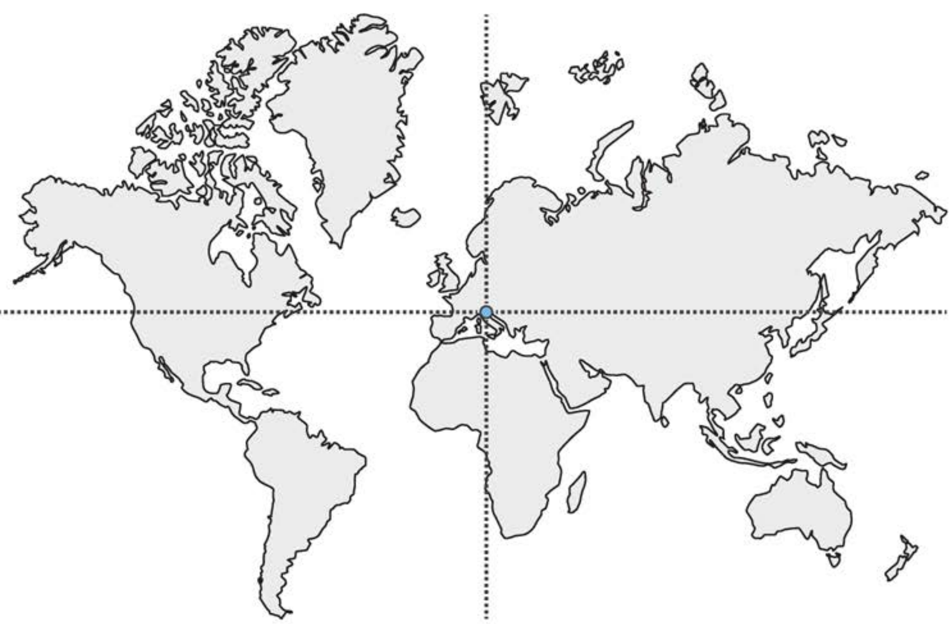
14 Yuan, Zhang, and Han, "Low-Tech Digital Fabrication," 147.

17
Punta della Dogana
Tadao Ando Architect & Associates

Architect Brief

Tadao Ando's architectural journey began without the formal training of a traditional architectural education or an apprenticeship. Instead, Ando began his professional life as a boxer. Boxing instilled in Ando an understanding of the relationship between a person's body and his or her soul.[1] He also studied with a Japanese carpenter and spent his free time scrutinizing the architecture of Osaka (his hometown) and the surrounding areas to fully understand the qualities of Japanese design and construction. At 18, he received his first architectural commission. At 24, Ando left boxing and his work behind to travel the world, closely examining the architecture of the great masters of Asia, Europe, and the Americas firsthand. Four years later, Ando returned to Osaka and formally opened his own practice. The firm continues to create the masterpieces that have won him countless awards including the Pritzker Architecture Prize in 1995.

venice, italy
gps | 45°25'50"N, 12°20'10"E
program | contemporary art museum
completed | 2009
area | 4,331 m2 [46,618 ft2]



17.1
Vicinity map

One significant theme that carries through Tadao Ando's work is the exploration of *shintai*. This term refers to the idea of the body being a sentient receptor of the surrounding environment. "In the *shintai* there is no distinction between mind, body, and spirit. It is only through all the senses that architecture can be truly understood."[2] Ando's work centers on the tactility of material and the introduction of nature into the built environment. His designs edit out unnecessary clutter and focus on the development of the path of the inhabitant as he or she moves through the space. By designing this specific narrative, Ando creates a forum for the development of the *shintai*. The stark simplicity of his buildings is elevated through the highest quality of craft and workmanship with material. His concrete work, in particular, is often praised for its delicate qualities that give the heavy masses a sense of lightness and translucency.[3]

Project Brief

> My aim was to provoke a dramatic clash between the old and new by inserting a space confined in concrete walls inside the existing structure; an exercise that highlights the series of historical layers, bringing forth a sense of clarity and understanding, instead of covering or destroying history.[4]
>
> Tadao Ando as cited in Francesco Dal Co,
> *Tadao Ando for François Pinault*, 2009

The Dogana del Mar was built in the fifteenth century to serve as a Custom House for the city of Venice. It is located on the westernmost point of the island of Dorsoduro, adjacent to the church of Santa Maria della Salute and directly across the Grand Canal from Piazza San Marco (Figure 17.2). As part of a collaborative strategy to renew its historic buildings, the Venetian authorities held a design competition to renovate the structure. The winning scheme, presented by shopping magnate François Pinault, proposed transforming the warehouse into an art museum.

The existing building is triangular and consists of a series of parallel bays running roughly north–south, gradually getting longer towards the west. Much of the building is two stories with a tower on the eastern point. The original structure is primarily brick construction with bearing walls separating the bays. The framing of the roof and floors was accomplished with heavy timber construction. Over the years, Dogana del Mar was routinely modified and added to, usually with the intent of expanding the available floor space. A second floor was added throughout much of the structure along with intermediate walls. The additions rarely respected the initial design intent of the building. The brickwork and trusswork were also progressively covered over with the additions, concealing the original qualities of the space.

Tadao Ando was selected to lead the work on the development of the Punta della Dogana after another project he designed for Pinault in Venice – the renovation of the Palazzo Grassi – opened with lauded success. As with the Palazzo Grassi, one of Ando's goals was to design around the historic building and it characteristics. For the Punta della Dogana, this desire meant much of the clutter that had been added to the structure had to be removed to return the building, as much as possible, to its original state.

17.2
View of Punta della Dogana from the northeast

The other primary design consideration for the museum centered on visitor circulation. Ando's surgical creation of openings and minimal addition of new elements were "particularly concerned with the route that visitors would follow as they passed from one warehouse to another, and from the ground floor up to the raised floor level"[5] (Figure 17.3). The journey begins on the northwest corner of the building, where the building entrance was relocated off of the Campo della Salute. From this point, you enter into a lobby space with ticket sales and restrooms. Moving east, you are gradually led through several gallery bays to the Central Court where the largest of Ando's interjections frames a prominent display space. Continuing east, you encounter a café and bookshop/gift shop on the first floor of the building. Staff space is located on the upper floors of the building at the tower on the eastern point (Figure 17.4).

This museum successfully blends old and new in an interplay of material, light, texture, and history. Ando's "subtle alterations work so effectively that one has the impression that these buildings were, from their very construction, intended to house works of art."[6] Atypical of the traditional design project, the Punta della Dogana is composed of "superb spaces and volumes [which] Ando has part discovered, part created"[7] (Figure 17.5).

17.3
Floor plans

17.4
Building section

17.5
Gallery space

Tectonic Principles

Anatomy

> In the continuous and diffused tissue of restoration interventions, aimed at eliminating invasive additions that through the years had attacked the Punta della Dogana complex, the insertion of new architectural objects appears instead as discrete episodes. Through this continuous dialogue between new elements and old, the building connects its past to its present and future.[8]
>
> Lina Malfona, "Museo Di Punta Della Dogana, Venezia," 2010

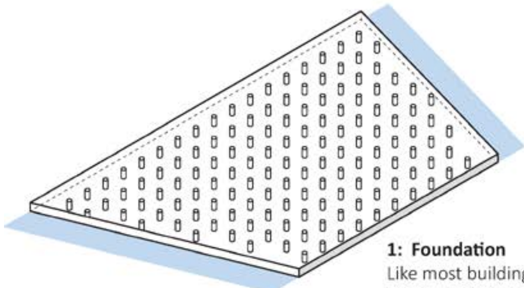
As a Venetian building, the Punta della Dogana sits on a platform not of earth, but of structural piles that hold the construction above the waterline of the surrounding canals (Figure 17.6). An existing system of piles support the existing building elements, while new pile foundations were installed to support Ando's interventions in the building. The historic brick walls serve as the framework of the structure, supporting the timber frames of both the roof and the upper floor. Although primarily historic, these systems were augmented as necessary with contemporary construction to match the existing conditions. The new concrete components, however, are cladding devices used to define, enclose, and create space. The most significant of these concrete installations is the central cube. It is the critical node around which Ando's narrative of space winds, the center of the museum, and the crux of interaction; it is the building's hearth.

Place

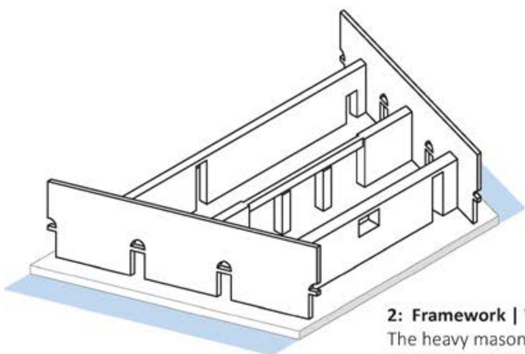
The Punta della Dogana required an intensive survey of the existing building – one that examined not just what the building was today, but what it was historically. After all, in order for the building to be returned to an original state, when that point occurred and what it included had to be determined. The result of the survey was a mapping of the building over time. Substantial work followed. The reinforced concrete floors and the multitude of added walls were removed. Much of the historic building – such as the roof trusses and the brickwork – was painstakingly disassembled, restored, and reassembled. At many points, however, the scars left by the process of removal and reconstruction were retained. These blemishes allow the layers of history to maintain a presence in the museum and serve as a palimpsest of the history of the place.

One significant exception to the plan for the return to an original state for the historic building was the preservation of a "courtyard" that had been created in the center of the building by replacing a section of bearing wall with a pair of columns. Ando embraced this open space and utilized it for housing his concrete cube gallery. Existing throughout the museum, but felt prominently in this particular gallery, was the challenge of balancing Ando's precision design work within the wildly imperfect existing environment where "walls bulged, floor levels were never uniform and no two doorways or rooms were ever the same size"[9] (Figure 17.7).

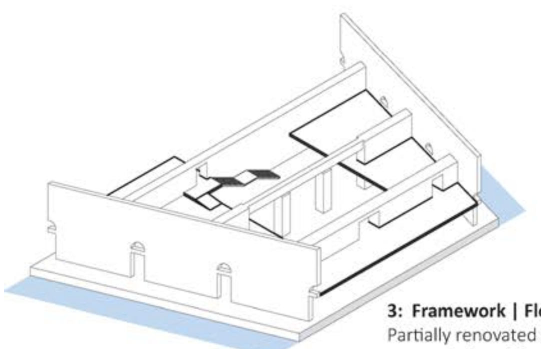
On a larger scale, Venice is defined by water. Amongst numerous water-related challenges was a fear of flooding. To ensure protection while maintaining the aesthetic goals of



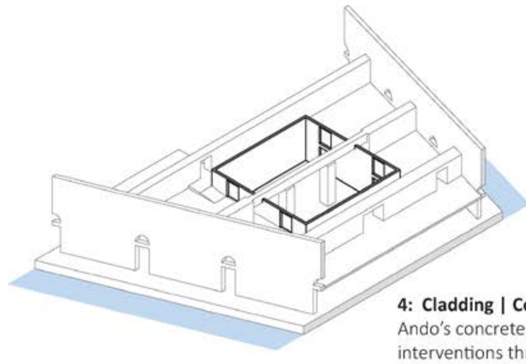
1: Foundation
Like most buildings in Venice, Punta della Dogana is elevated above the surrounding water on a field of piles.



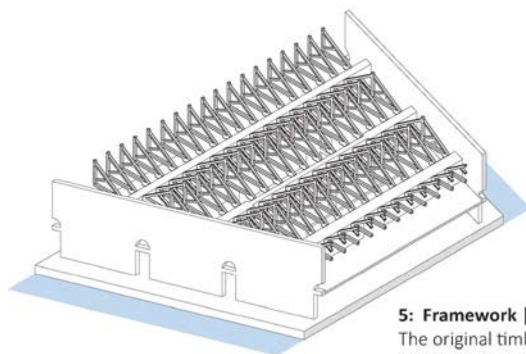
2: Framework | Walls
The heavy masonry walls of the existing building define its spatial composition.



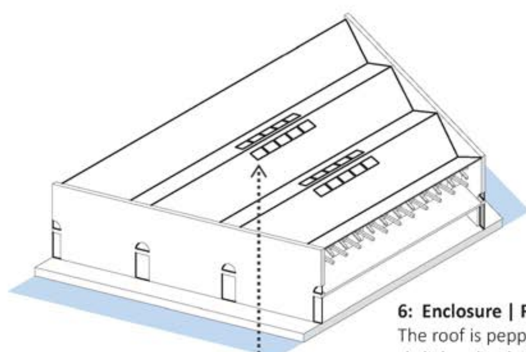
3: Framework | Floors
Partially renovated and partially new, a series of floor plates span between the walls creating a second level in some areas of the museum.



4: Cladding | Concrete
Ando's concrete work creates interventions through the museum, such as the large central cube.

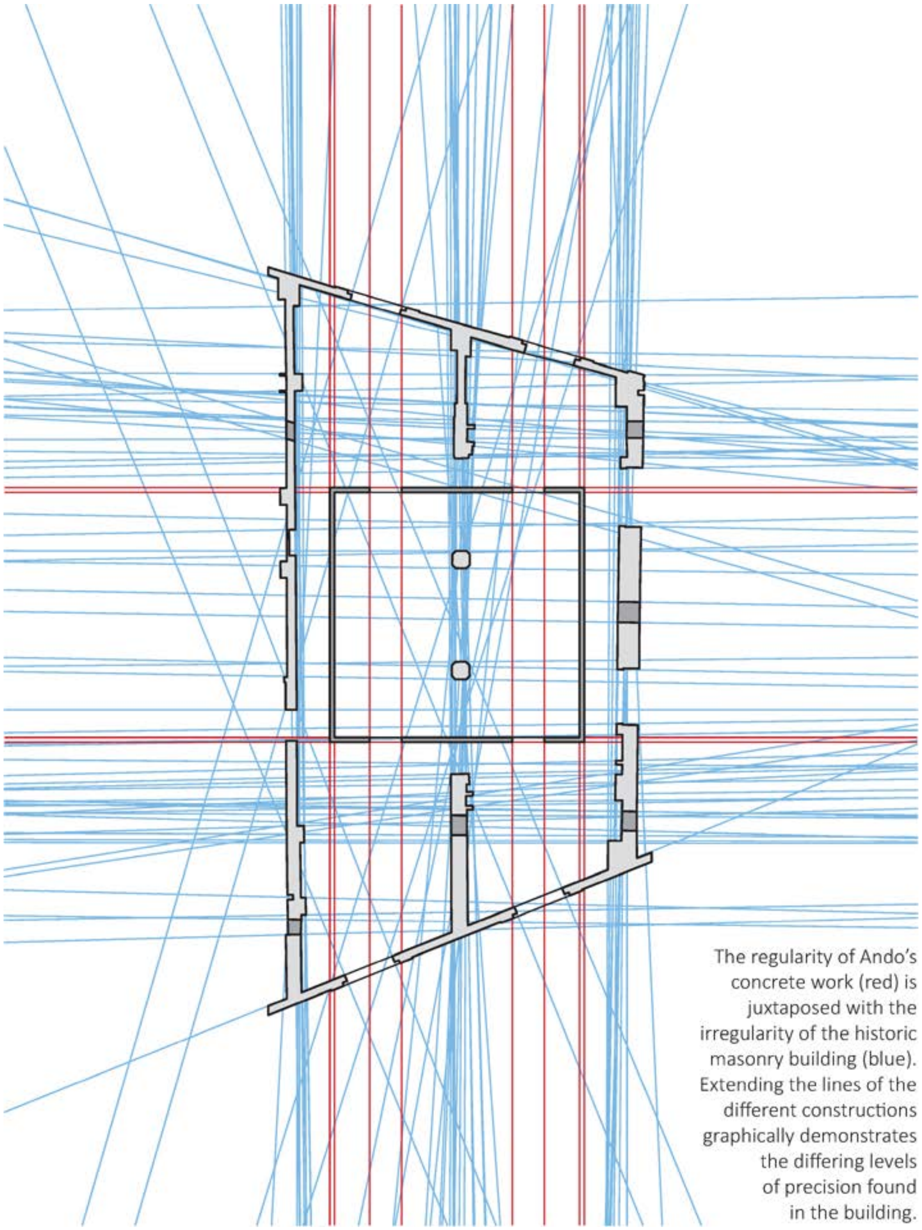


5: Framework | Roof
The original timber trusses were removed, renovated, and reinstalled to support the roof.



6: Enclosure | Roof
The roof is peppered with skylights that bring natural light down into the galleries below.

17.6
Anatomy



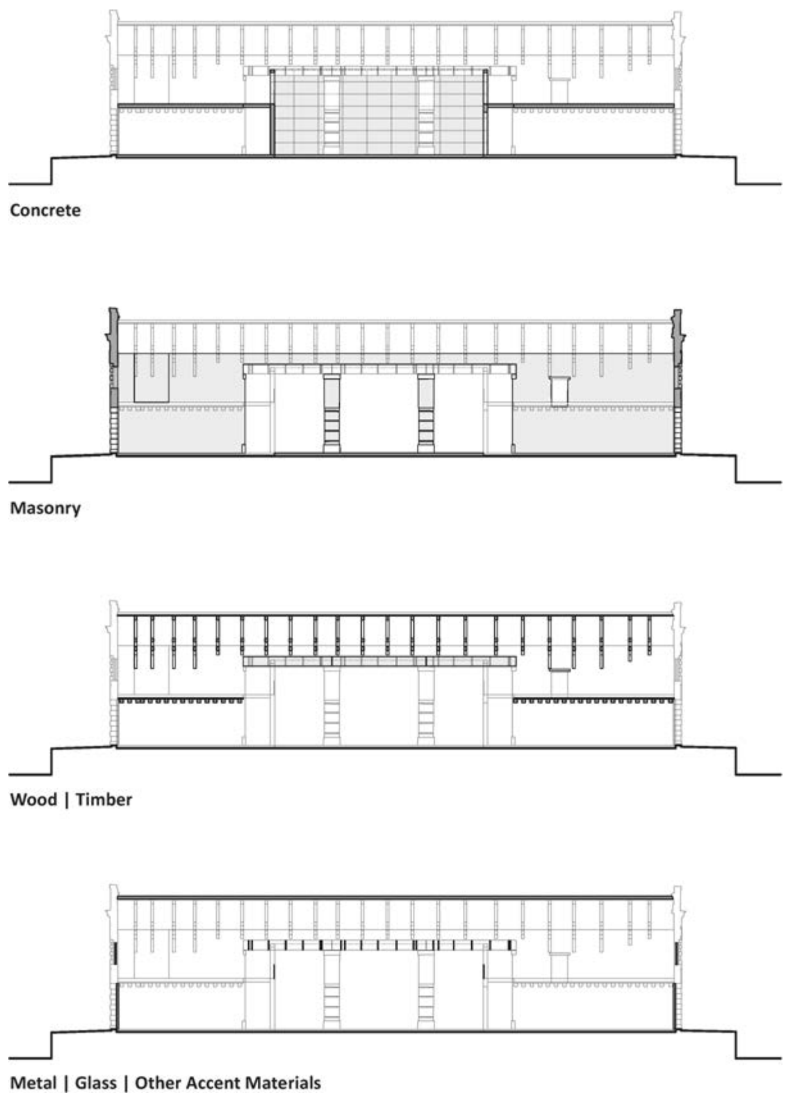
17.7
Irregularity vs. precision

the architect and client, the existing brick walls were stripped to a depth of 12 centimeters [4.7 inches] and up to a height of 2 meters [6.5 feet] above the zero level of the adjacent canals. This area was then covered with a layer of PVC sheathing to protect against flood waters and refinished using salvaged brick – a somewhat atectonic concealing of the inter-workings beneath. In this project, instead of the building conforming to a topographical site, it had to conform to an ever-changing water level, a fluid topography.

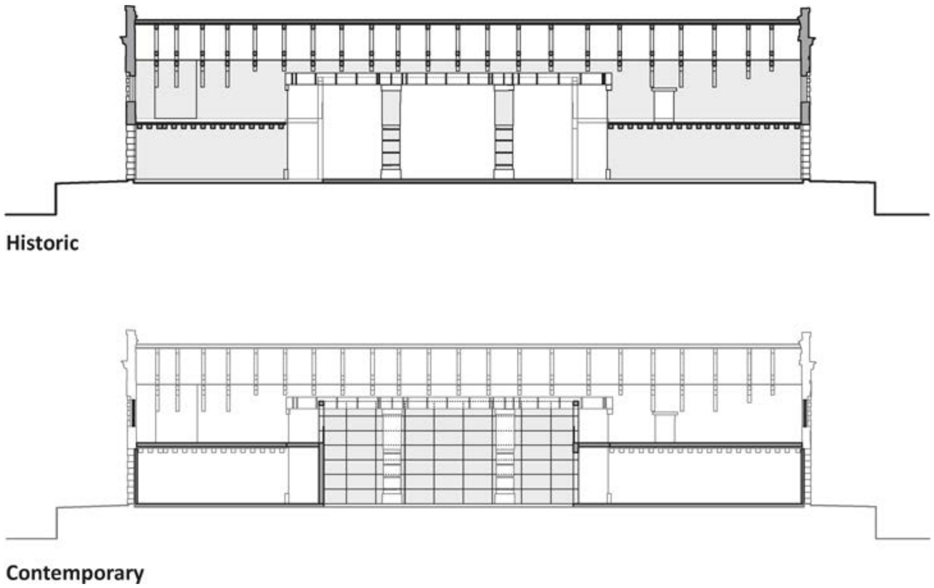
Stereotomic

Ando's primary design medium in the Punta della Dogana is concrete. But Ando's concrete is no ordinary material. "The concrete which I use," he states, "does not give the impression of solidity or weight. My concrete forms a surface which is homogeneous and light."[10] The 30-centimeter-thick [11.8-inch-thick] walls of the central cube are reflective of these qualities. They are absolutely precise and "reflect light and feel like silk"[11] (Figure 17.8).

The cube measures 16 meters [52.5 feet] on each side and it stands over 7 meters [23 feet] tall. The precision comes in the detailing of the concrete work. Immense effort went into placing each component of the formwork – which is designed on a module – to create "a single, smooth surface of water-tight junctions [as] any leakage would have left an indelible irregularity on the surface of the . . . concrete wall."[12] The concrete pours had to be carried out without interruption to ensure a perfect and consistent finish for the walls' full height.



17.8
Material constructs



17.9
Historic vs. contemporary construction

The stereotomic qualities of the Punta della Dogana are conveyed through more than just concrete. According to Philip Jodidio:

> Legend has it that Venice is crumbling into the sea, and yet the visitor to the Punta della Dogana . . . has a very definite impression of solidity generated by the stony appearance of the building. . . . The broad brick walls and strong wooden beams that are . . . apparent in the building contribute to its very real solidity.[13]

The existing brick walls provide a foil to Ando's concrete work. Whereas the new material additions are smooth, clean, and precise, the walls of the historic warehouse are textured, imprecise, and degrading. In the museum, concrete and brick are separated by time, appearance, and texture (Figure 17.9). The brick walls take on the character of a ruin, anchoring the building to its place. The pairing of the two wall types brings a tactile experience to the passage of time, which serves as a key intersection in the building.

Intersection

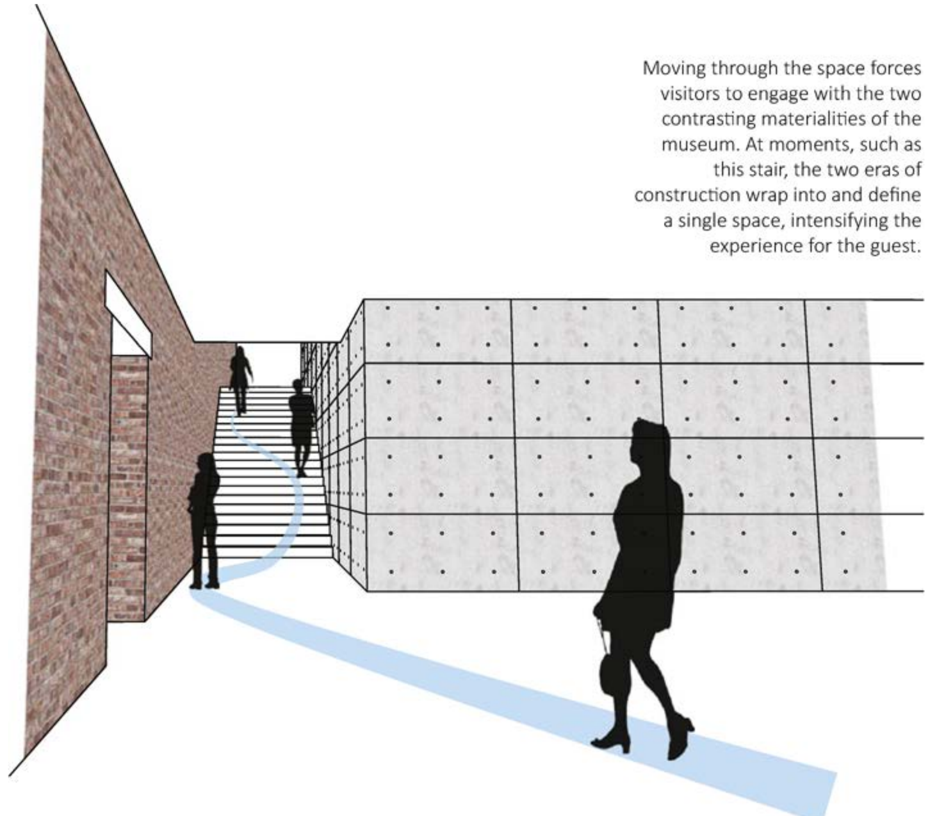
The primary intersection in the Punta della Dogana is not between tectonic and stereotomic, but between old and new; it is temporal. Ando designed the project to ensure every new wall, railing, and floor would just "brush against the existing [building], almost without touching [it] at all."[14] While the contemporary and historic constructions generate spatial friction, they do not appear to have a direct relationship (Figure 17.10).

The qualities of this intersection are most prominently expressed in the central cube (Figure 17.11). Here, Ando chose to restore the ***masegni*** stone tile flooring. During restoration, the 10,789 *masegni* stone pavers salvaged from the warehouses were removed from the building, numbered, and stored. A selection of these pavers was then reused as the floor inside the cube. While occupying this space, the historic floor is underfoot in the cube,

masegni = rectangular trachyte (a type of stone) blocks that were traditionally used by the Venetians as paving

17.10
Cube gallery at the upper level

17.11
Within the cube gallery



17.12
Material spatial relationships

but the brick walls are only visible through the minimal apertures in the concrete walls. This environment is a "photographic negative" of the space outside of the central cube, where the textural experience flips and the polished concrete is now the walking surface and the past is echoed through the surrounding brick walls[15] (Figure 17.12).

The temporal intersection is not just ephemeral. The concrete structure is isolated on a new double ring pile foundation. Not only are the constructions separated, their foundations move independently to ensure that any shifting of the existing structure does not compromise the integrity of the new concrete cube.

Representation

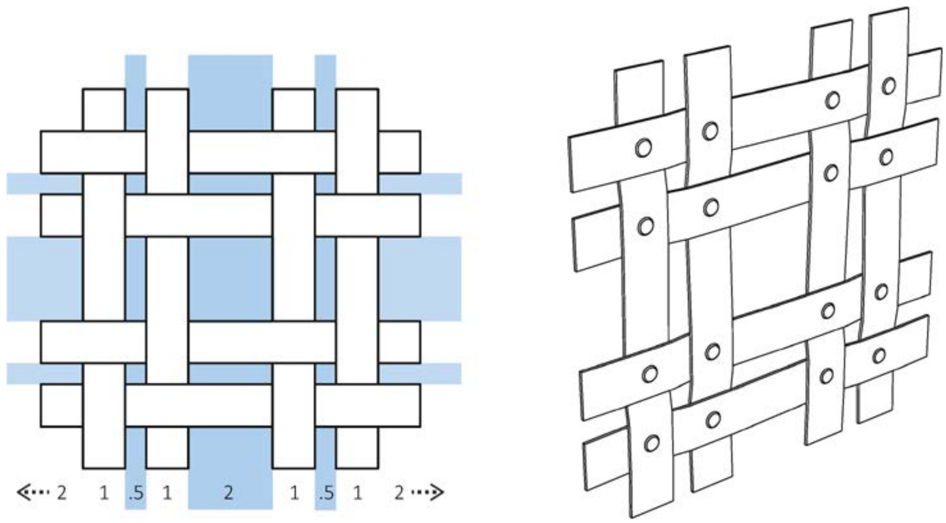
The character of Punta della Dogana's brick walls also serves as ornamentation. Ando has left the past visible on the surface of the brick. This art-form refers to a core-form not of the present, but of the past. Scars and inclusions on the surface indicate points of connection and load delivery that happened long ago; fallen brick tells the story of weathering or structural shearing from years past. The layers of history that Ando has left in place in the Punta della Dogana do not just relate to the forces at work within the construction today, but those that have held the structure up every day for the past six hundred years.

The details and ornamentation of Ando's design work also paid homage to a master architect of Venice – Carlo Scarpa. New screenwork was added to the restored door and

17.13
Exterior screenwork

window openings on the building's exterior, amongst other locations (Figure 17.13). The new screens are accurate representations of the gates that Scarpa designed for the Olivetti shop in the Procuratie Vecchie in St. Mark's Square (45°26′3″N, 12°20′15″E). Scarpa's screens were fabricated from black steel and woven, like thread, in a tartan grid. In this configuration, the bands' spacing alternates from narrow to wide in both the horizontal and vertical directions.[16] The clustered intersections of the steel bands are fixed with circular brass fasteners (Figure 17.14). Ando's use of this screen in the Punta della Dogana, ties the architecture to yet another era of Venetian history.

17.14
Screenwork of Carlo Scarpa



The rhythm, scale, and impact of the screens Ando designed for the openings on the exterior of the building are inspired by the screens designed by Carlo Scarpa for the Olivetti Showroom in St. Mark's Square in Venice.

Additional Resources

Projects

Church on the Water, Tomanmu, Hokkaido, Japan, 1988 (43°3′49″N, 142°37′34″E)

Church of the Light, Ibaraki, Osaka, Japan, 1989 (34°49′7″N, 135°32′14″E)

Komyo-ji Temple, Ehime, Japan, 2000 (33°55′7″N, 133°11′26″E)

Pulitzer Arts Foundation, St. Louis, Missouri, United States, 2001 (38°38′25″N, 90°14′4″W)

Modern Art Museum, Fort Worth, Texas, United States, 2002 (32°44′58″N, 97°21′48″W)

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Notes

1 Masao Furuyama, *Tadao Ando: The Geometry of Human Space* (Hong Kong: Taschen, 2006), 10.

2 Tom Heneghan, "Architecture and Ethics," in *Tadao Ando, The Colours of Light*, by Tadao Ando and Richard Pare (New York: Phaidon Press Limited, 2003), 17.

3 Ibid.

4 Tadao Ando as cited in Francesco Dal Co, *Tadao Ando for François Pinault: From Ile Seguin to Punta Della Dogana* (Milan: Mondadori Electra S.p.A., 2009), 258.

5 Francesco Dal Co et al., “Venezia: Ill Chilometro Dell’arte,” *Casabella* 73, no. 778 (2009): 26.

6 Dal Co, *Tadao Ando for François Pinault*, 249.

7 Paul Finch, “Punta Della Dogana Art Museum, Venice, Italy: Tadao Ando,” *Architectural Review* 226, no. 1352 (2009), 76.

8 Lina Malfona, “Museo Di Punta Della Dogana, Venezia = Punta Della Dogana Contemporary Art Centre, Venice,” *Industria Delle Costruzioni* 44, no. 411 (2010), 97.

9 Ugo De Berti, “Punta Della Dogana: Work on Site,” in *Tadao Ando for François Pinault: From Ile Seguin to Punta Della Dogana*, by Francesco Dal Co (Milan, Italy: Mondadori Electra S.p.A., 2009), 156.

10 Tadao Ando as cited in Heneghan, “Architecture and Ethics,” 20.

11 Dal Co et al., “Venezia: Ill Chilometro Dell’arte,” 27.

12 Alberto Anselmi, “Punta Della Dogana: The Project Designs,” in *Tadao Ando for François Pinault: From Ile Seguin to Punta Della Dogana*, by Francesco Dal Co (Milan: Mondadori Electra S.p.A., 2009), 111.

13 Philip Jodidio, *Tadao Ando, Venice: The Pinault Collection at the Palazzo Grassi and the Punta Della Dogana* (New York: Skira Rizzoli, 2010), 32.

14 Dal Co et al., “Venezia: Ill Chilometro Dell’arte,” 26.

15 Anselmi, “Punta Della Dogana: The Project Designs,” 110.

16 Robert McCarter, *Carlo Scarpa* (New York: Phaidon Press Inc., 2013), 119.

18

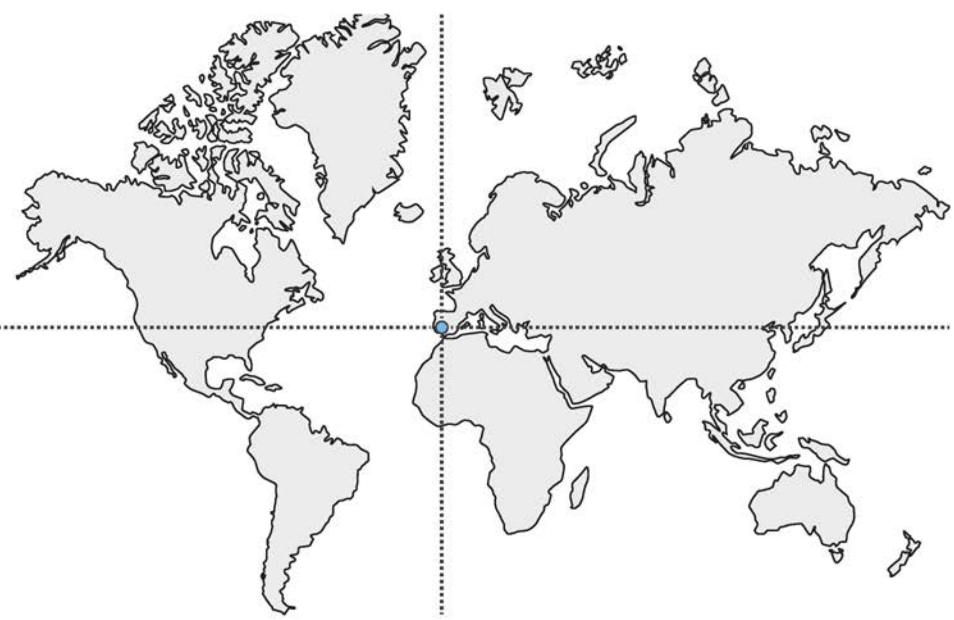
National Museum of Roman Art

Rafael Moneo

Architect Brief

José Rafael Moneo Vallés has an architectural pedigree derived from academic pursuits at the Madrid University School of Architecture, from his apprenticeship with Francisco J. Sáenz de Oiza and Jórn Utzon, and from his research fellowship at the Academy of Rome. In 1963 when Moneo returned to Spain from Rome, he leapt into an academic career that has rivaled his notable professional accomplishments. Most notably, Moneo served as the Chair of the Graduate School of Design (GSD) at Harvard from 1985 to 1990, and he maintains an active role there to this day.

Moneo seemingly has very little interest in a defined personal style of design. His body of work "contains buildings which, on superficial inspection, have relatively little resemblance to each other."[1] Instead, he designs from a careful reading of the place, time, culture, and context of each individual project. For Moneo, structure plays a key role in project development, as do the rhythms of the built environment. He designs with great respect for materials



merida, spain
gps | 38°55'02"N, 6°20'24"W
program | museum
completed | 1986
area | 9,605 m2 [103,387 ft2]

18.1
Vicinity map

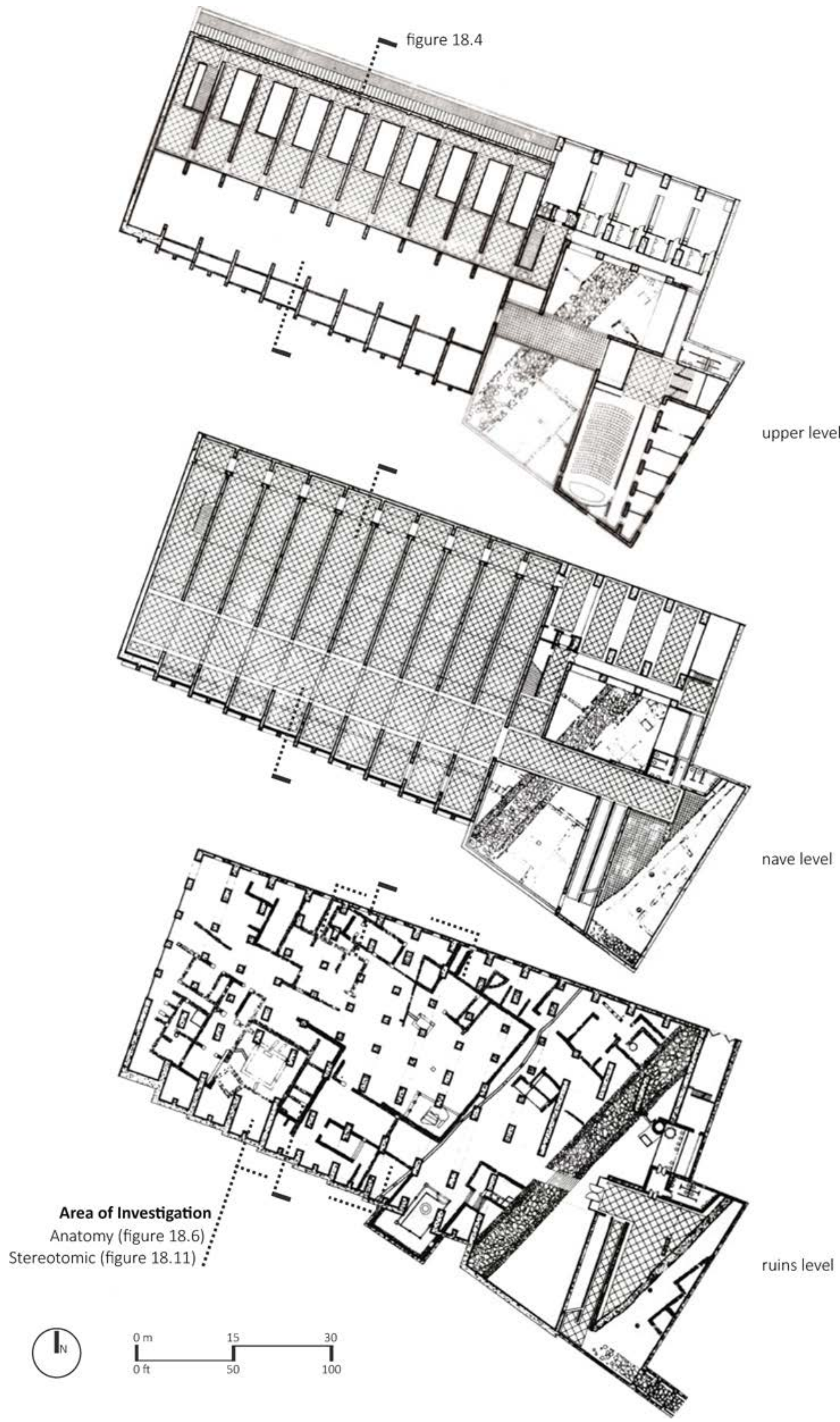
and for their intersection with each other. However, "[a]t its best, Moneo's architecture is about tying together the damaged tissue of the city and evoking memory."[2]

Project Brief

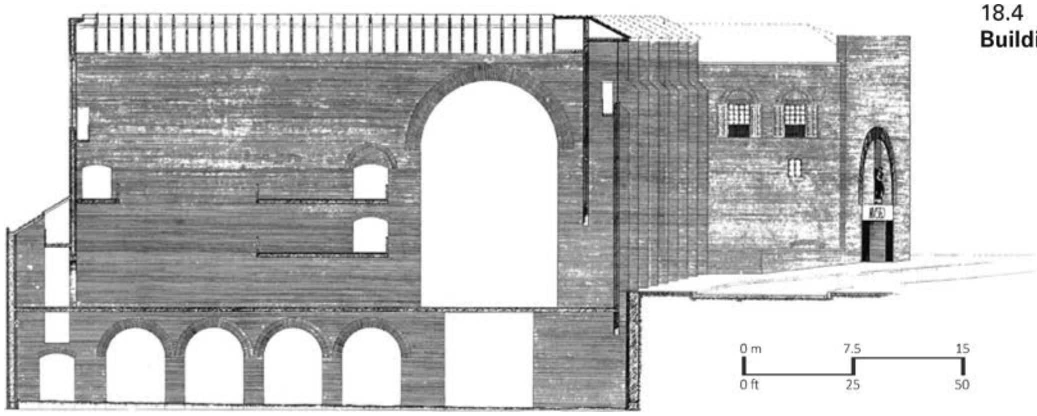
Mérida, Spain is located at the intersection of two major roads of the Roman Empire. During its height, this city – called Augusta Emerita in Roman times – was the thriving capital of the region. The ruins of this ancient crossroads are amongst the best preserved in Spain (Figure 18.2).

The design of the museum began with an excavation of the site. This process revealed a suburban area outside the ancient city walls that included homes, a necropolis, part of a Roman road, and part of the St. Lazarus aqueduct. The National Museum of Roman Art was situated directly over these ruins; they are an active part of the project, accessible at the lower level and visible from the street, the museum entry, and the upper floors of the building. Previously excavated, a Roman theater and amphitheater sit across the road from

18.2
View of the National Museum of Roman Art from across the road to the southeast



18.3
Floor plans



18.4
Building section

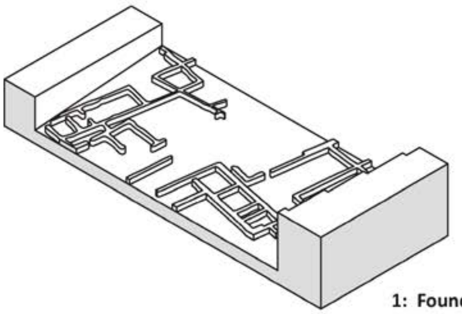
the museum. These structures, along with others, are an integral part of the museum campus and the history of the site. The National Museum is the latest addition to the *building continuum* of this place.

The museum is composed of two buildings. The western building contains the museum proper along with its archives while the eastern building contains the entry lobby, the restoration workshops, the library, the auditorium, and administration (Figure 18.3). The unearthed Roman road lying below serves as a divide between the two, with connection provided by a walkway suspended over the ruins. The public entry to the museum is off of the main adjacent road. From here, visitors have their first view down into the sunken court and the Roman ruins below.

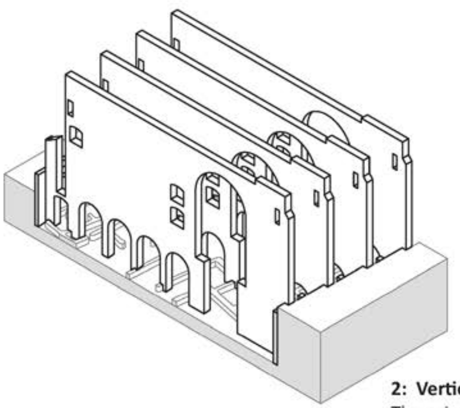
The primary program spaces are organized around a central well that also opens to the ruins below. From the lobby, you move past the well and over the bridge into the museum's main gallery. The gallery is composed of a series of parallel brick walls punctured with arched openings (Figure 18.4). "The intersection between the system of walls and the system of vacuums settles the organization of the building; one large space of a nave type in which the most valuable pieces will be installed and perpendicular corridors which can shelter the lesser collections"[3] (Figure 18.5). The parallel walls run perpendicular to the street grid of the contemporary city of Mérida. The alignment is rotated off axis from the Roman streets below, emphasizing the contrast between old and new.

All of the light in the gallery spaces filters in from above, primarily through a continuous line of skylights located between each pair of walls. The quality of light entering the galleries changes throughout the day, altering the reading of the space from one moment to the next, similar to The Parrish Art Museum (see Project 08). This lighting strategy is reflective of Frampton's views on the tectonic development of a critical regionalism. The changing light affects the materiality of the space. It continually shifts color, texture, and shadow while creating drama in the space through its interaction with the galleries' ancient sculptures.

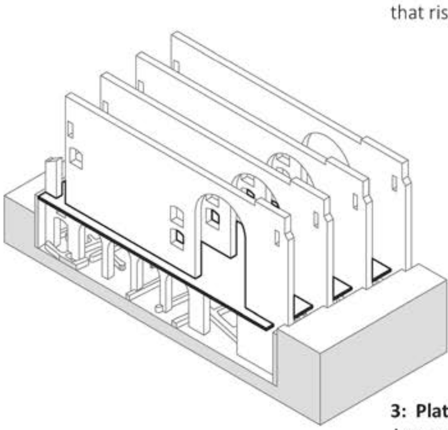
18.5
Main gallery



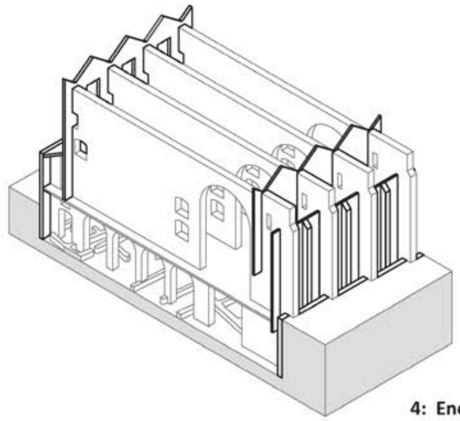
1: Foundation
The museum is built on the remains of the ancient city that lies buried beneath the modern city of Merida.



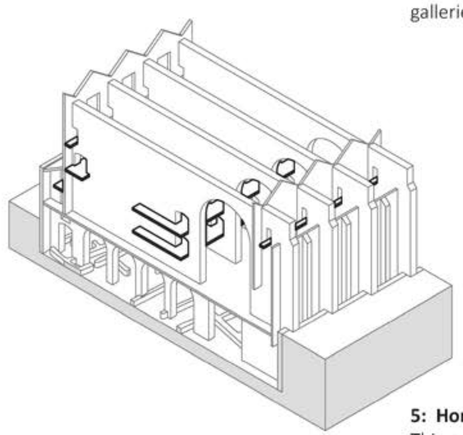
2: Vertical Planes
The primary expression of the building comes from the series of parallel brick walls that rise from the ruins below.



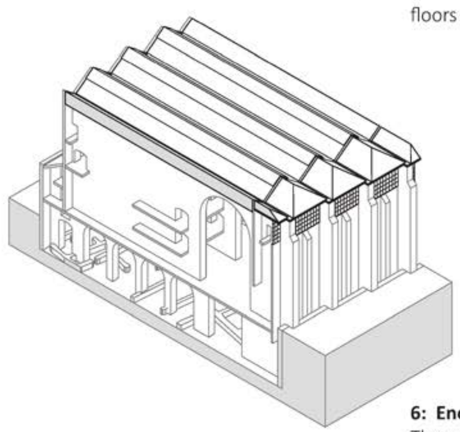
3: Platform
A concrete floor separates the ancient from the contemporary and creates a new datum for the museum.



4: Enclosure | Skin
The ends of the museum halls are capped with brick walls with high openings that let indirect light down into the galleries below.



5: Horizontal Planes
Thin concrete slabs run perpendicular to the walls and create gallery space on upper floors of the museum.



6: Enclosure | Roof
The roof contains skylights that run the length of the building. Large windows infill the gaps between the walls at the ends.

18.6
Anatomy

Tectonic Principles

Anatomy

The National Museum of Roman Art is built on the foundations of a past civilization (Figure 18.6). From these ruins spring the series of parallel brick walls that define not only a framework for the building but also the space of the exhibition galleries and the character of the façades both inside and out. As essential to the museum as the walls are the openings cut through them. These arches were formed, according to Moneo, by a process of "digging, of hollowing out the static wall system with a series of voids that bring movement into the space."[4] This movement is accomplished on concrete floor plates that infill between the massive brick walls and connect the openings. Finally, perched on the top of the walls is the glazed roof from which natural light enters the building.

Place | Precedent

The museum is just one of several projects built in this time frame, by a number of different architects, centered on "the penetration to the 'substructures' of regional and universal traditions; in the unearthing of historical memory in particular places . . . and in the exploration of ideas of construction."[5] In this particular case, the contextual relationships involve an "imaginative excavation of past stages of a civilization."[6] The new construction not only rises from, but is reflective of the history of this place.

Preserving the ruins below the building proved challenging for the design team (Figure 18.7). It was determined that a long span system would not work as the massive foundations required would do significant damage to the existing structures. Instead, small foundations were laced into the ruins at optimal points creating a system of arches that are less regular than those in the galleries above (Figure 18.8). These subtle structural shifts allowed the building to touch the ground gently in and amongst the remains. "For this reason Roman systems of construction have been literally adopted, entrusting to them, and not to molds and orders, the satisfaction of the desire to be near the Roman world which is clearly the basis of this project."[7] In essence, the brick used in the walls does not compete with the ruins for prominence; it complements them.

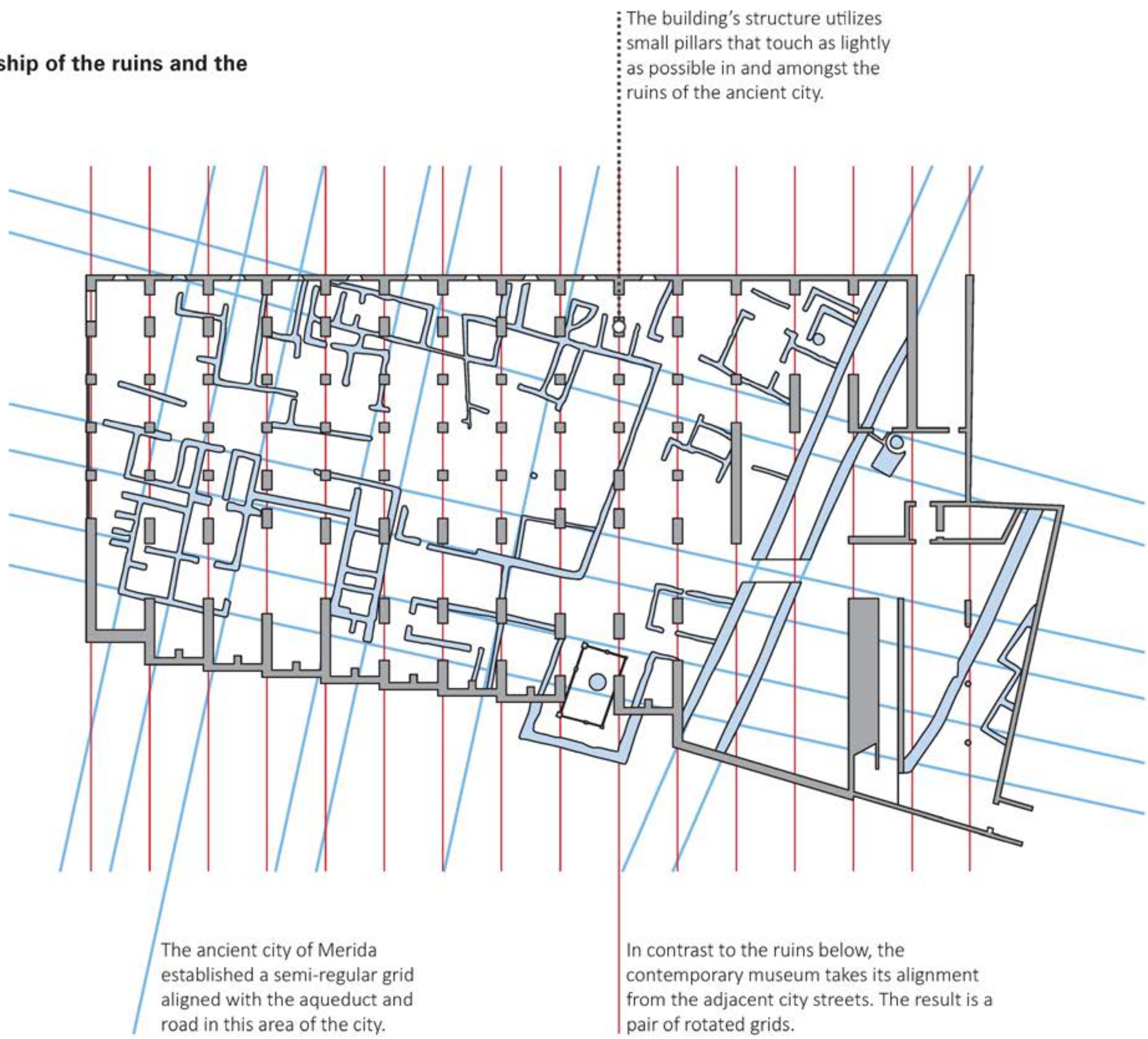
By focusing on Roman construction practices instead of ornamentation and Roman orders, the Museum of Roman Art develops a more generic relationship to the cultural past. It was "conceived as an echo chamber of local history which also resonated with more distant sources and archaeological remains in the region"[8] such as "the hypostyle hall and the aqueduct"[9] (Figure 18.9). Others have compared the project to the Mosque Cathedral at Córdoba (37°52′45″N, 4°46′47″W) and the "almost industrial spatial rhythms of Roman *horrea* – vast public warehouses found in urban centers throughout the Empire."[10] This relationship reaches beyond the immediate placement of the building on this particular ruin to the regional character of an entire civilization.

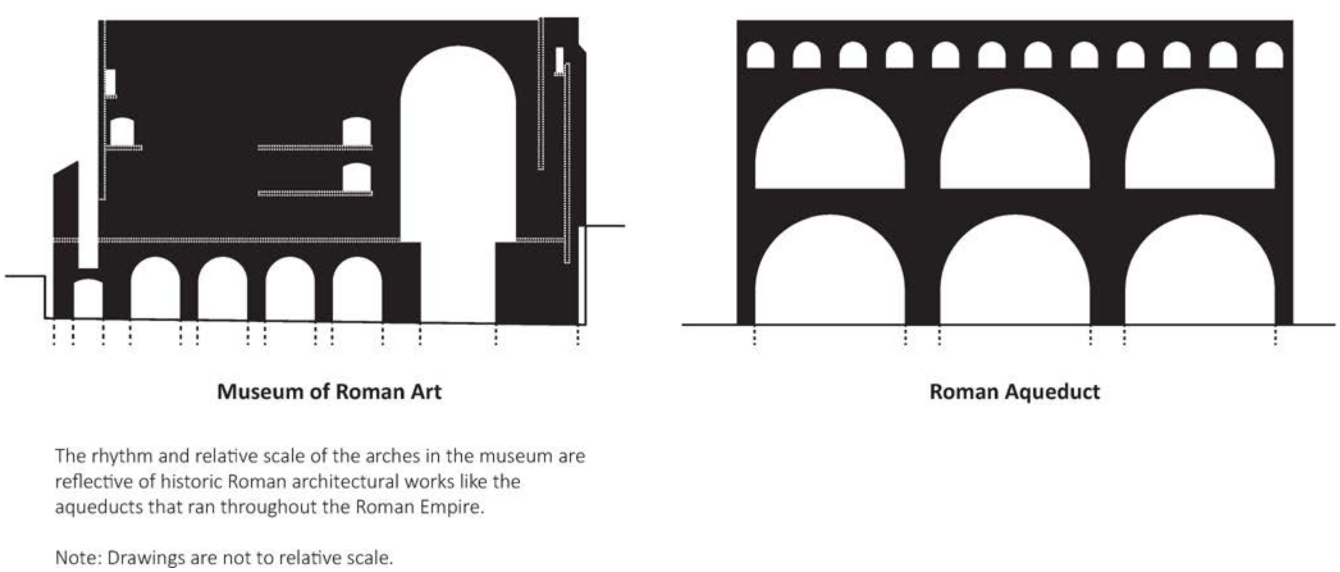
Stereotomic | Atectonic

The primary stereotomic components of the National Museum are the massive brick walls. The parallel walls sit 6 meters [19.7 feet] apart and establish a strong order. The potentially overwhelming repetition is alleviated by the inclusion of arched openings that carve out

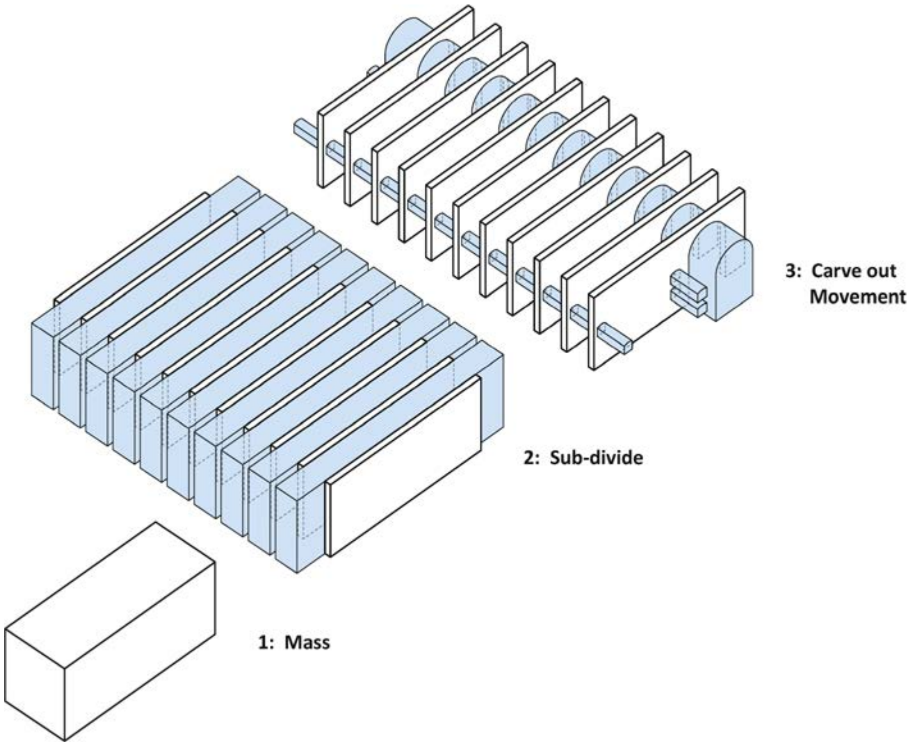
18.7
View through the ruins below the museum

18.8
Relationship of the ruins and the museum



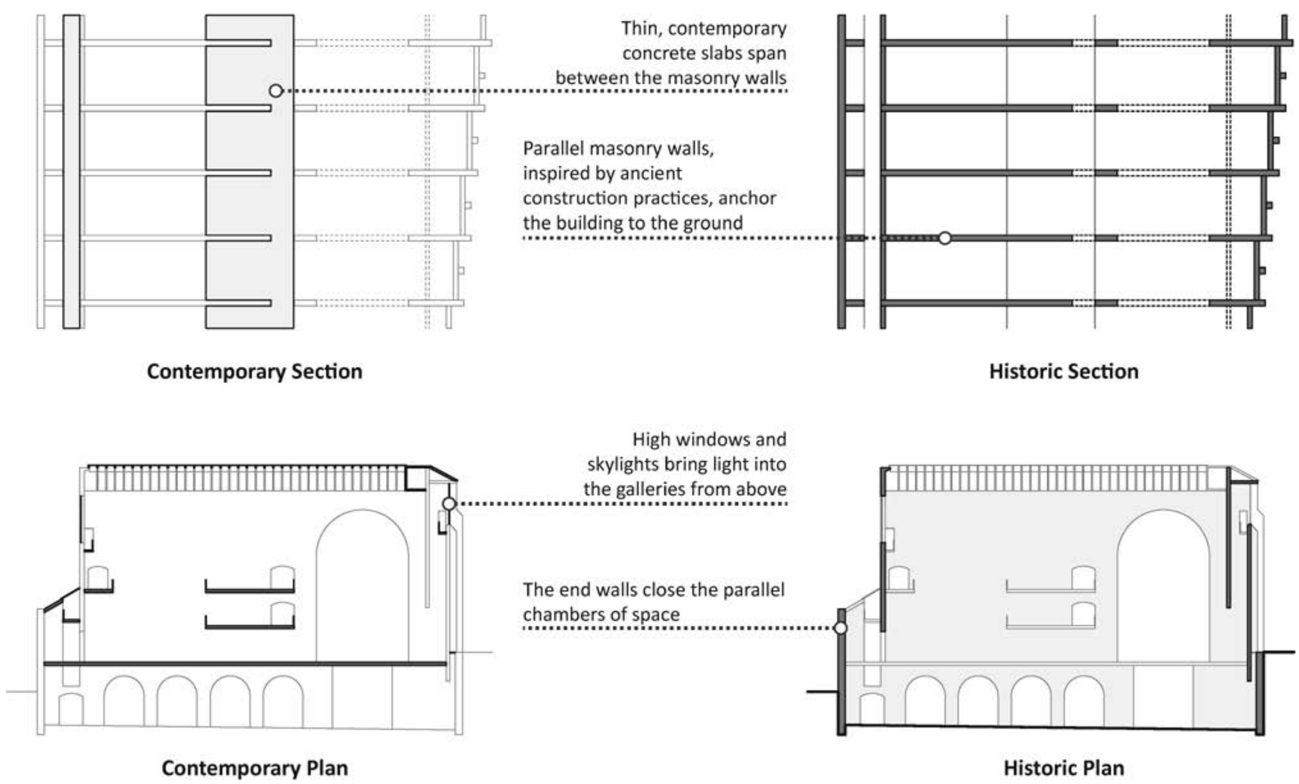


18.9
Comparison of the museum and an aqueduct[11]



18.10
Manipulation of mass

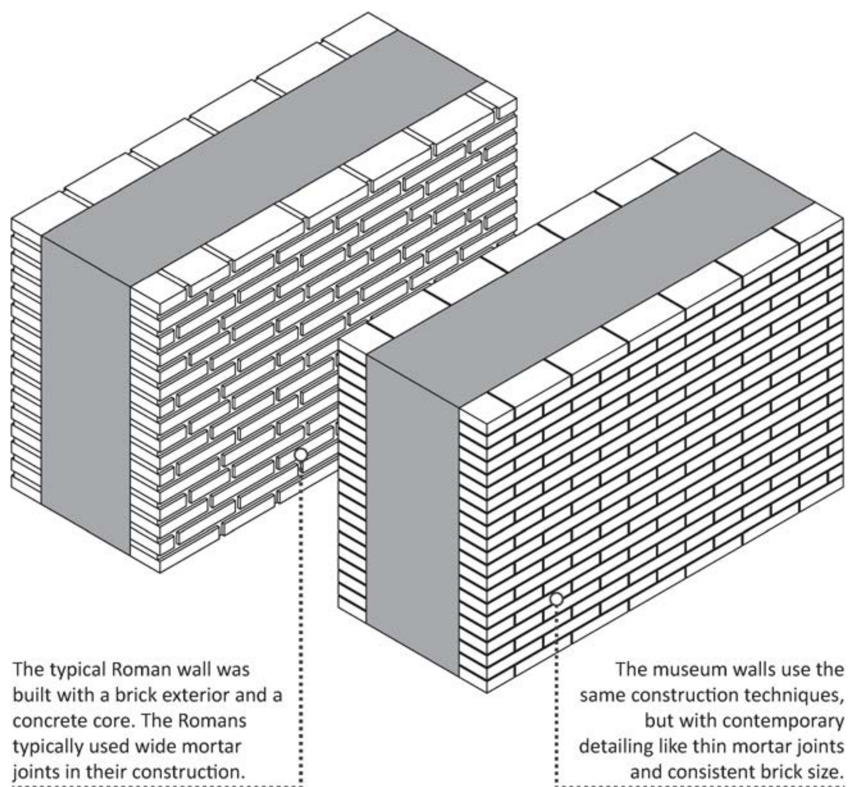
18.11
Historic vs. contemporary systems of construction



implied barrel vaults running perpendicular to the walls (Figure 18.10). Most prominently, a series of four-story openings create a main hall or asymmetrical nave that serves as the main axis of the gallery. The series of "titanic arches . . . enhances the perception of depth across the length of the plan"[12] (Figure 18.11).

The walls were made using Roman construction techniques. The brick skins were built first and used as shuttering (formwork) for the concrete infill. Moneo believed this would be the most respectful way of coexisting with what had been built before. To the structural purist, "the camouflaged concrete arches of the Merida Museum were disturbing, but it was Moneo's intention to evoke associations with ancient structures rather than express the constructional realities of his own day."[13] This condition is decidedly atectonic. The realities of the internal conditions are masked by a cladding that tells a different story; these are really concrete walls, not brick. The deception is balanced, however, through its connection to centuries of building in the distant past.

Moneo's construction techniques were not entirely ancient though (Figure 18.12). Unlike traditional Roman construction, in the Museum of Roman Art the bricks were laid with no visible mortar. As opposed to the heavy mortar joints found in Roman brickwork, this technique provided a minimalist and contemporary quality. "The absence of joints turns the wall into a pure presence of baked clay, a neutral backdrop for the archeological artifacts."[14] The museum is very "Roman" in its materiality and construction, but not Classical in the least with its contemporary detailing (Figure 18.13). As Javier Frechilla states:



18.12
Comparative wall constructions[15]

18.13
View into the side galleries

> Our attention, in contrast with the magnitude of the space, is concentrated on detail. We take pleasure in the geometry and calligraphy of each piece, we calibrate the stonework, we measure widths and heights, we take note of the poor quality of the brick or the few places where the bricklayer didn't place close attention or the paver didn't do his job perfectly. We believe we have found the key to the building: its character is in its construction, Roman details for a museum of Roman art.[16]

Tectonic

Despite their material weight, the horizontal concrete floor slabs of the galleries serve as a tectonic foil to the vertical brick walls. Their slender profile gives the impression of floating planes that span between the much more substantial supporting walls. As with the Punta della Dogana (see Project 17), there is a characterization of old versus new in this museum. The polished concrete, along with the steel elements of the railings, windows, and skylights, bring a modern character to the space that creates a dialogue with the ancient character of the brick construction. The masonry walls rise from the ruins and support the more delicate, contemporary elements of the building. Although a departure from the traditional definition of tectonic (with respect to the stereotomic), the detachment of these elements from the ground and their horizontality provide their reading in the space.

Space

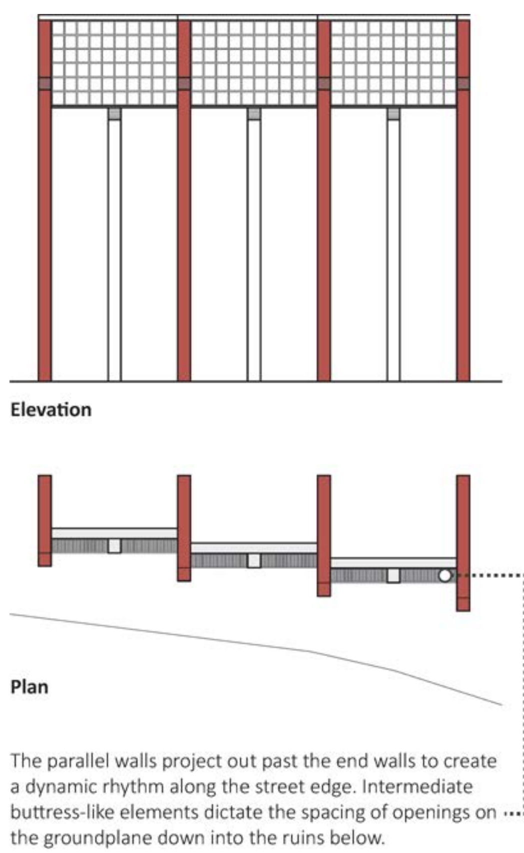
A forced perspective exists in the main gallery of the National Museum of Roman Art, generated by the receding openings in the brick walls (Figure 18.14). This construct focuses your view on the marble statues, an effect that is further emphasized by the stark contrast between the smooth, white marble statues and the textured warm tones of the brick. The spatial makeup of the project is derived from the intersection of wall and void. Per Bötticher, the primary building supports – the heavy walls – create the dominant spatial character of the museum.

18.14
View through the upper level

A significant spatial understanding also occurs within the excavations below the museum, which are accessible only by going outside and "are thereby experienced as continuous below the town in all directions, not local and unique to the museum."[17] Although this underground space was constructed to "serve as a vast library of Roman stone remains,"[18] the experience of moving down to them changes their reading. They are not seen as objects, but instead as a small part of a much larger continuum of the ancient city. Spatially, the ruins are not *in* the museum, but a literal and figurative foundation *for* the museum. Perceptibly, a contained space loses its boundaries.

Representation

A critical representational element of the National Museum of Roman Art is the exterior expression of the brick walls. These elements puncture the exterior surface of the building at their ends. "Thus, the building on Jose Ramon Mélida St. appears to be a series of slanting buttresses which, in their unadorned construction, make one of the principles upon which Roman architecture was based clear: the strength of construction."[19] The primary construction of the building – its organization, weight, and structural strategy – is revealed on its surface. The *Kernform* is revealed in the *Kunstform*, albeit in a way that is relatively contemporary and "unadorned" in its ornamentation (Figure 18.15).



18.15
Relationship of structure and skin

Additional Resources

Projects

Miro Foundation, Palma de Majorca, Spain, 1992 (39°33′18″N, 2°36′35″E)

Kursaal Concert Hall and Convention Center, San Sebastian, Spain, 1999 (43°19′29″N, 1°58′40″W)

Our Lady of the Angels Cathedral, Los Angeles, California, United States, 2002 (34°3′29″N, 118°14′43″W)

General and Royal Archive of Navarra, Pamplona, Spain, 2003 (42°49′13″N, 1°38′40″W)

Contemporary Art Centre of Aragon, Beulas Foundation, Huesca, Spain, 2005 (42°9′2″N, 0°25′44″W)

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1 William J. R. Curtis, "Pieces of City, Memories of Ruins," in *El Croquis 64: Rafael Moneo 1990–1994*, ed. José Rafael Moneo, Richard C. Levene, and Fernando Marquez Cecilia (Madrid: El Croquis, 1994), 47.

2 Ibid., 48.

3 Rafael Moneo as cited in Museo Nacional de Arte Romano (Mérida, Spain), *National Museum of Roman Art Merida*, (Madrid: Ministry of Culture General Directorate of Fine Arts and Archives Directorate of State Museums, 1991), 72.

4 Rafael Moneo, *Rafael Moneo: Remarks on 21 Works* (New York: Montacelli Press, 2010), 113.

5 William J. R. Curtis, *Modern Architecture since 1900*, 3rd ed. (New York: Phaidon Press Inc., 2006), 623.

6 Ibid., 630.

7 Rafael Moneo as cited in Museo Nacional de Arte Romano (Mérida, Spain), *National Museum of Roman Art Merida*, 72.

8 Curtis, *Modern Architecture since 1900*, 629.

9 Ibid., 623.

10 Jeffrey Balmer and Michael T. Swisher, *Diagramming the Big Idea: Methods for Architectural Composition* (New York: Routledge, 2013), 167.

11 Drawing inspired by the conceptual work of Lauren Ovca during her time in my third-year architectural design studio.

12 Balmer and Swisher, *Diagramming the Big Idea*, 167.

13 Curtis, *Modern Architecture since 1900*, 629.

14 Moneo, *Rafael Moneo: Remarks on 21 Works*, 109.

15 Drawing inspired by the conceptual work of Lauren Ovca.

16 Javier Frechilla as cited in Museo Nacional de Arte Romano (Mérida, Spain), *National Museum of Roman Art Merida*, 75.

17 Richard Weston, *Plans, Sections and Elevations: Key Buildings of the Twentieth Century* (London: Laurence King Publishing, 2010), 200.

18 Moneo, *Rafael Moneo: Remarks on 21 Works*, 113.

19 Rafael Moneo as cited in Museo Nacional de Arte Romano (Mérida, Spain), *National Museum of Roman Art Merida*, 79.

19

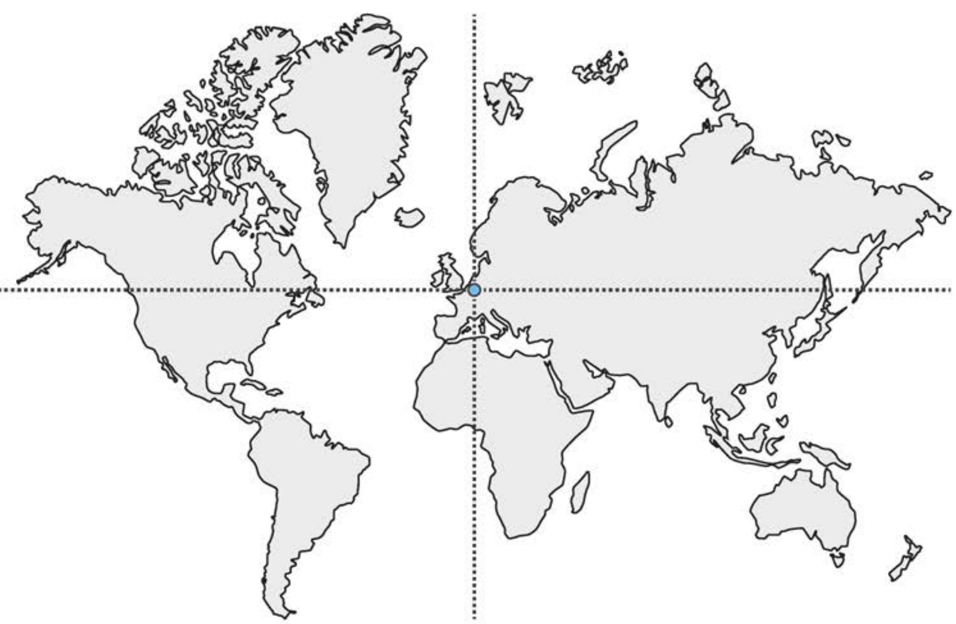
Bruder Klaus Field Chapel

Peter Zumthor

Architect Brief

As the son of a cabinetmaker, Peter Zumthor spent his youth surrounded by the crafting of materials. Later, he formally studied furniture design at the University of Art and Design in Basel. These studies expanded to the architectural environment, and in 1967, Zumthor began his architectural career working for the Swiss government. In 1978, Zumthor opened his private practice in Haldenstein, Switzerland, which continues to produce highly regarded work around the world to this day. In 2009, Zumthor was selected as the recipient of the Pritzker Architecture Prize, followed by the RIBA Royal Gold Medal in 2013. Both awards are amongst the most significant of the profession and honor Zumthor's lifetime of substantial achievement.

Zumthor's work centers on materiality, the activation of the senses, the quality of details, and the creation of atmosphere within space. His two architectural manifestos – *Thinking Architecture* (1998) and *Atmospheres* (2006) – outline his philosophy on the making of space.



wachendorf, eifel, germany
gps | 50°35'32"N, 6°43'39"E
program | chapel
completed | 2007
area | 39.6 m2 [426 ft2]

19.1
Vicinity map

> Architecture is always concrete matter. Architecture is not abstract, but concrete. A plan, a project drawn on paper is not architecture but merely a more or less inadequate representation of architecture, comparable to sheet music. Music needs to be performed. Architecture needs to be executed. Then its body can come into being. And this body is always sensuous.[1]

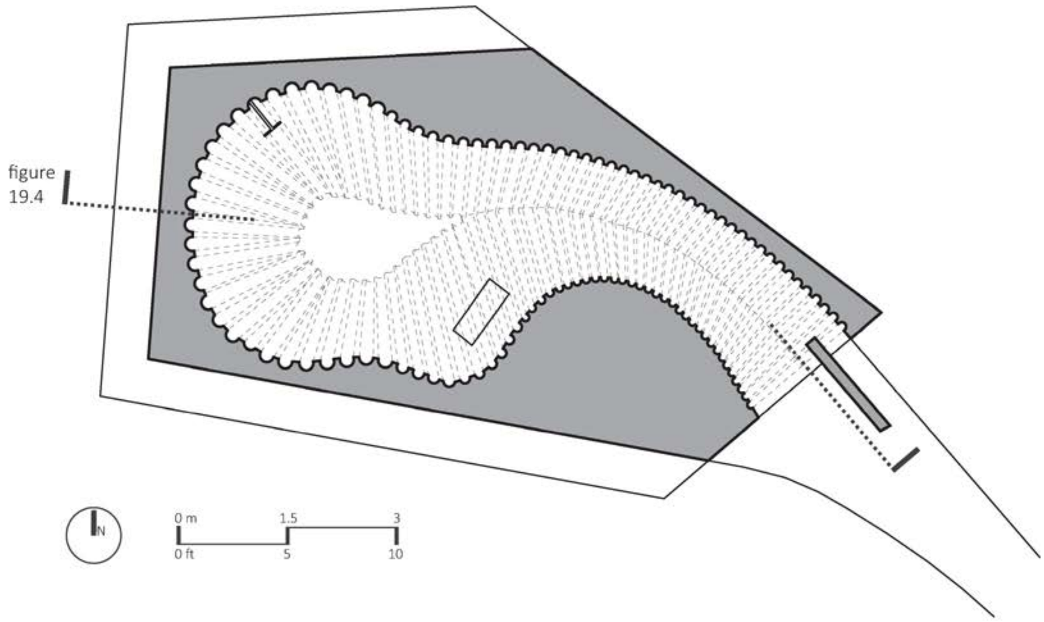
Project Brief

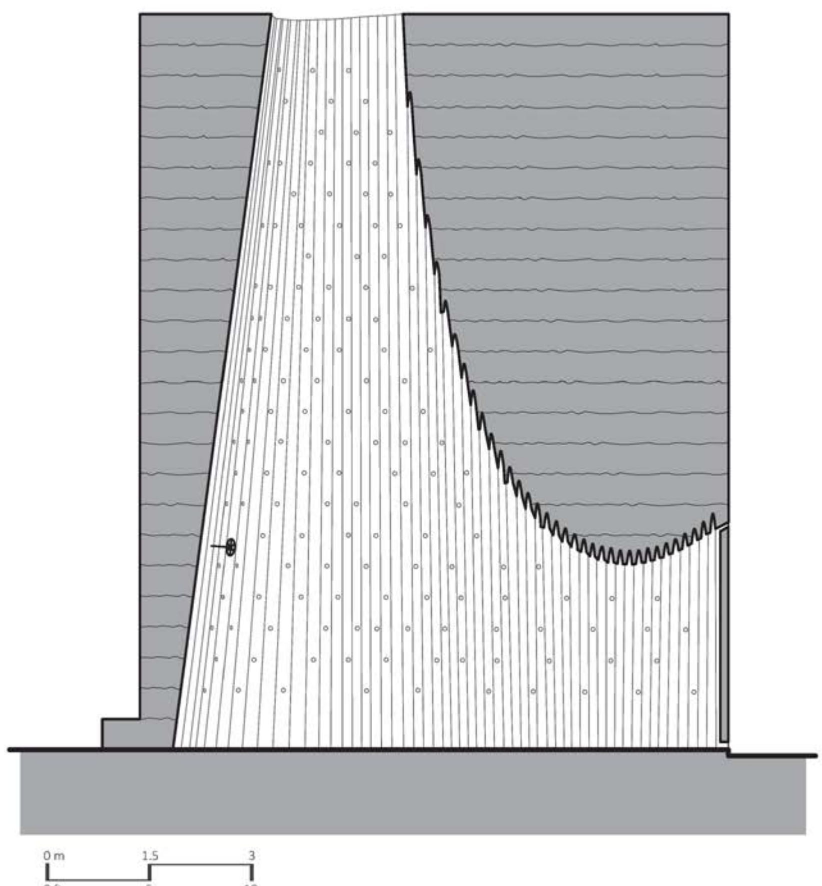
> The chapel is located in the middle of some fields. Thus a path leading from the road to the chapel is created that serves as a path of preparation for our entry into something else. . . . In this path of slow motion through fields of wheat, one leaves behind the mundane world, forgets about images and conscious conceptions, while approaching a place of transition into a different time and space.[2] (Figure 19.2)
>
> Jerneja Acanski Veber, "Sveto v Architekturi," 2012

Bruder Klaus Field Chapel is a beacon in the agricultural landscape, sitting in stark contrast to the fields that surround it. It is located in a rural area outside of a small town in Germany.

19.2
View of Bruder Klaus from across the adjacent field
Source: © François Dantart | Dreamstime.com

19.3
Floor plan



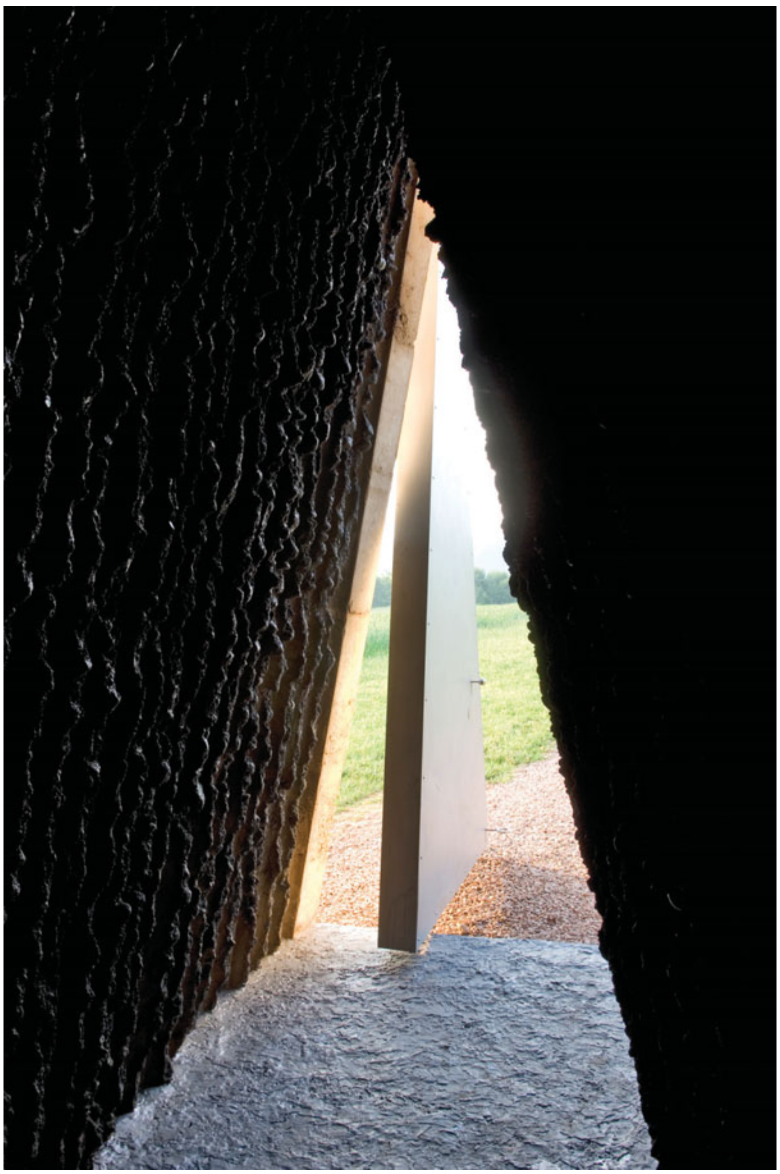


19.4
Building section

The chapel was commissioned by a local farmer, Hermann-Josef Scheidtweiler, and his wife. They dedicated the building to Swiss Saint Nicholas von der Flüe, also known as Brother Klaus, who is the patron saint of Switzerland.

"The irregular five-cornered shape of the construction provides surprisingly different views from every side," while concealing the complexities of the inner sanctum.[3] Upon entering the structure, you are greeted with a very narrow hallway, tapering upwards (Figures 19.3 to 19.5). Progressing forward, the space widens and twists to reveal a teardrop-shaped room that opens, through an oculus, to the sky above. During this short journey, "the horizontal of the motion slowly remoulds itself into a vertical, reaching its final realization in the middle of the central hall, pierced by the **axis mundi**."[4]

axis mundi = the connection between heaven and earth



19.5
Inside the chapel entry

Bruder Klaus is minimally furnished; a narrow wooden bench, a candle holder, and a cast bronze head of a Swiss artist are the only contents outside of a wall-mounted brass ornament that is used as a focal point for meditation. This ornament "has the shape of a wheel, with three spokes pointing outwards and three pointing inwards, which Zumthor based on the image [found] in Brother Klaus' cell."[5] Open to the air and elements from above, Bruder Klaus Field Chapel is a space of reflection, meditation, and sensuousness.

Tectonic Principles

Anatomy

Bruder Klaus Field Chapel sits on a concrete platform, buried in the earth, that served as a sturdy base for the construction above (Figure 19.6). On this base was placed a framework of logs. The framework remains today only as an etching in the finished concrete enclosure, having been removed prior to completion. The framework now serves as a memory of the process of construction and as an interior cladding.

The concrete structure is a perfect example of the *die Mauer* style construction referred to by Semper and, later, Frampton.[6] It is an extension of the platform below, slowly rising in layers from the ground. The interior has the characteristics of a carved space – a cave slowly formed by water intruding from the oculus above. In addition to the exposed concrete, the chapel's other primary material expression is in the hand-poured metal floor consisting of a 2-centimeter-thick [3/4-inch-thick] layer of an amalgam of zinc and lead created by local artisans.

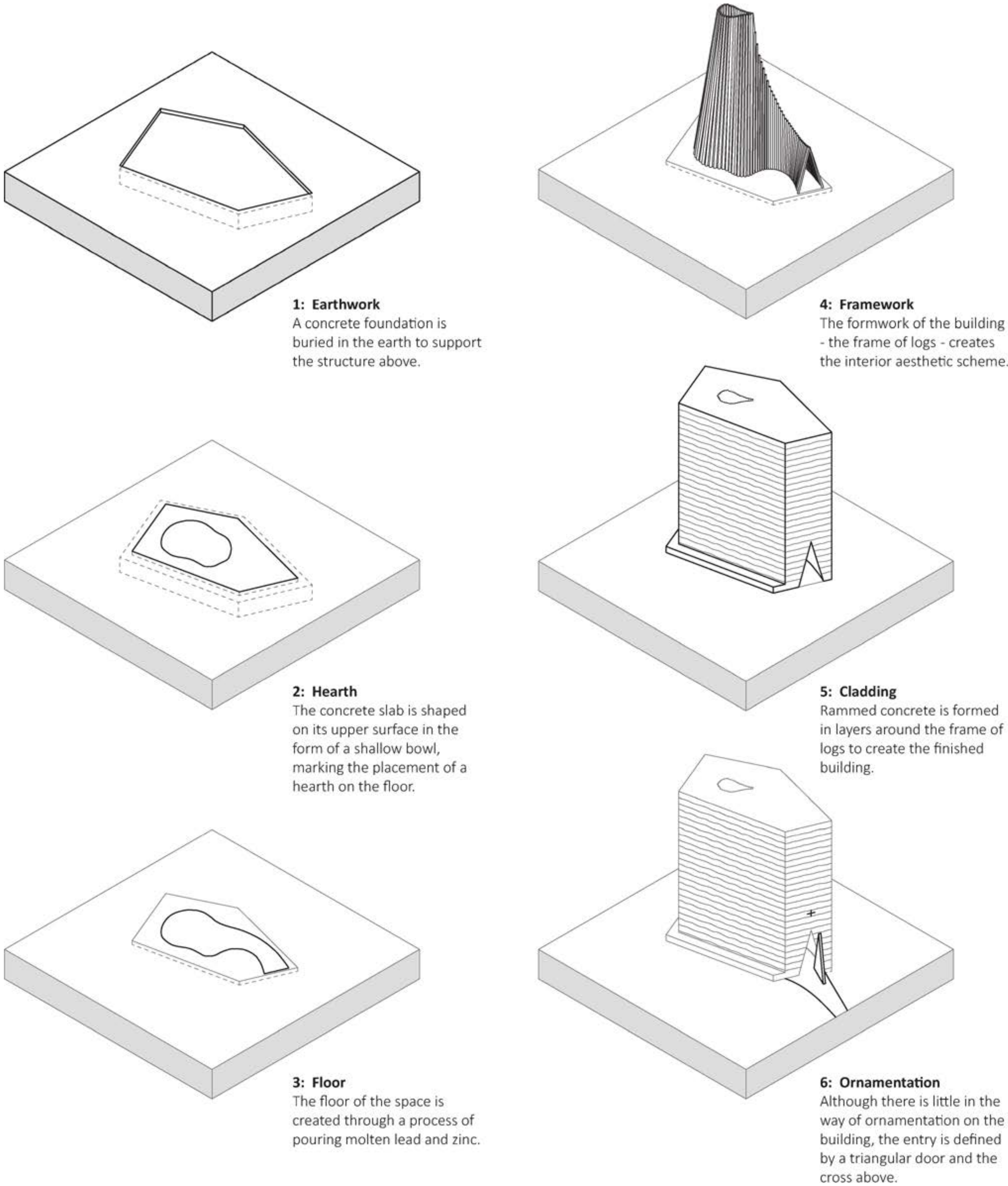
It could be argued that Bruder Klaus itself serves as a hearth for the local farming community. This concept of center, however, appears in the chapel primarily as a spatial construct. The vertical axis that aligns with the oculus in the roof – the axis mundi – is the experiential center of the space and the spiritual hearth of the chapel.

Tectonic

The qualities of the field chapel are rooted in its processes of construction (Figure 19.7). The work of building Bruder Klaus was largely undertaken by the client with the help of their friends and family along with some expertise provided by select craftsmen. The construction of Bruder Klaus began with the harvesting of 112 local trees from the town forest of Bad Münstereifel. With the assistance of a master carpenter, the client prepared the trees for construction and assembled the trunks into a teepee-shaped structure on top of the concrete foundation slab. This construction comprised the inner cribbing or formwork of the chapel. After the completion of the concrete work, a low fire was lit inside the chapel until the trunks dried and shrank, allowing for them to be pried loose and removed mechanically from the interior of the structure. This strategy – utilizing a low-temperature fire for an extended smoldering period – is reminiscent of the process used to make charcoal.

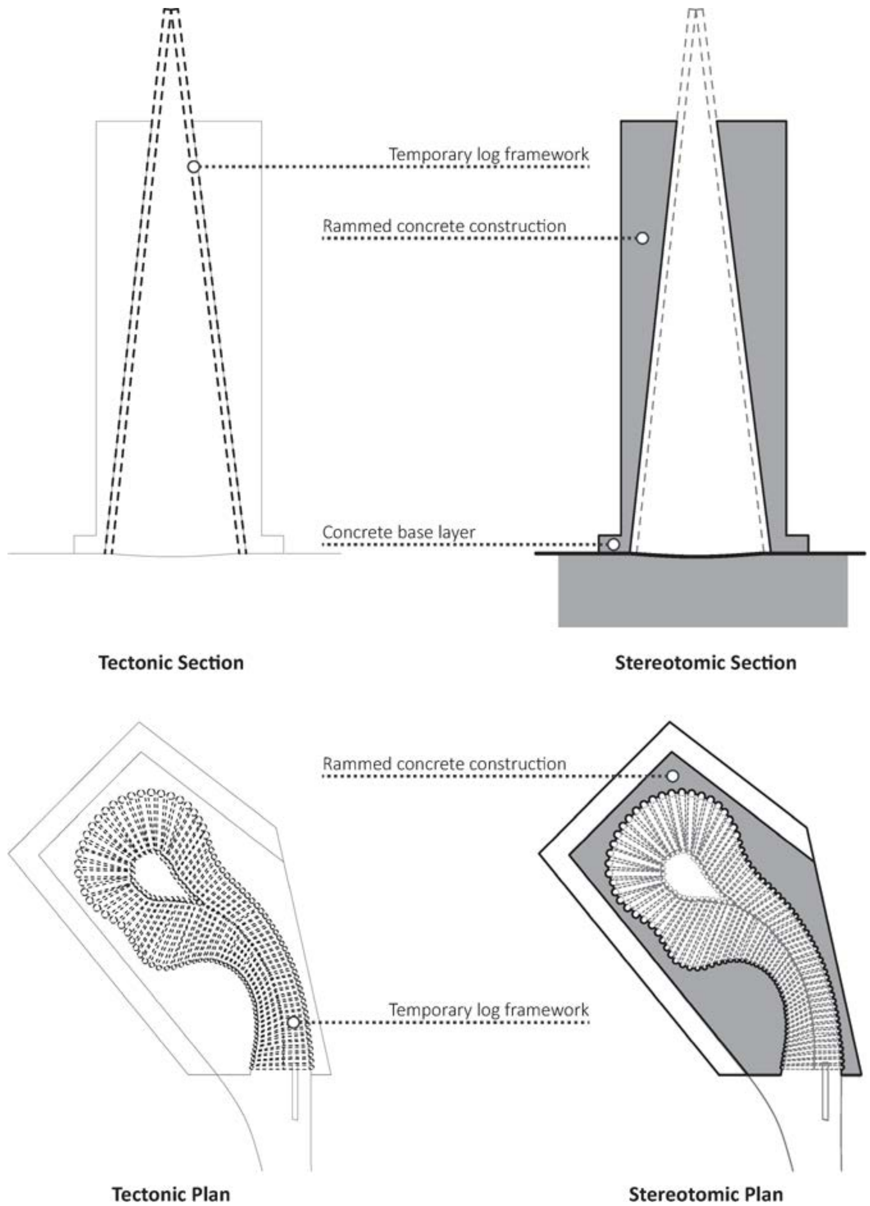
Stereotomic

The concrete mass of Bruder Klaus can be characterized as the building of a mound, referring back to primitive construction methods.[7] As with the timber, the concrete utilized local materials, with the gravel and reddish yellow sand obtained from nearby town of Erp. After


1: Earthwork
A concrete foundation is buried in the earth to support the structure above.
2: Hearth
The concrete slab is shaped on its upper surface in the form of a shallow bowl, marking the placement of a hearth on the floor.
3: Floor
The floor of the space is created through a process of pouring molten lead and zinc.
4: Framework
The formwork of the building - the frame of logs - creates the interior aesthetic scheme.
5: Cladding
Rammed concrete is formed in layers around the frame of logs to create the finished building.
6: Ornamentation
Although there is little in the way of ornamentation on the building, the entry is defined by a triangular door and the cross above.

19.6
Anatomy

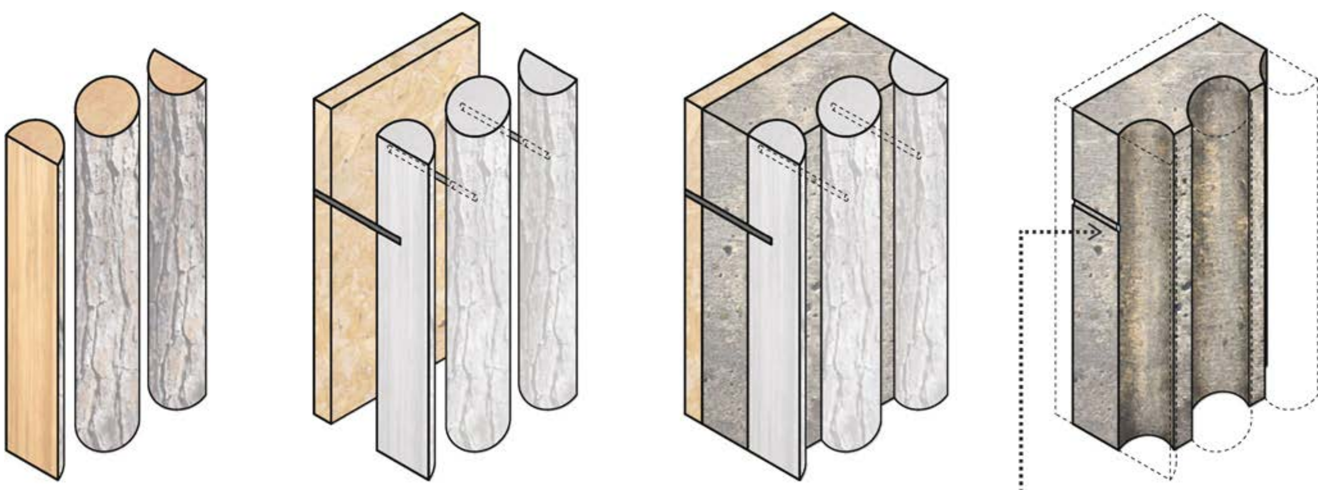
19.7
Tectonic | Stereotomic



finishing the formwork, the concrete was laid in 24 layers or lifts, each a separate pour. One lift was poured each day for 24 straight days, each with an approximate height of 50 centimeters [19.7 inches].

The technique used for this concrete work is called rammed concrete and is similar to the process used to create rammed earth structures. It results in a final product that reveals its layered nature. The striations in the concrete reflect the earth's composition and highlight the process of construction – the individual pours made by the building team. The resulting appearance is not only critical to the overall quality of the project but is also a distinct departure from the texture left on the inside of the space by the log formwork.

19.8
Interior wall surface with crystal plugs and meditation object



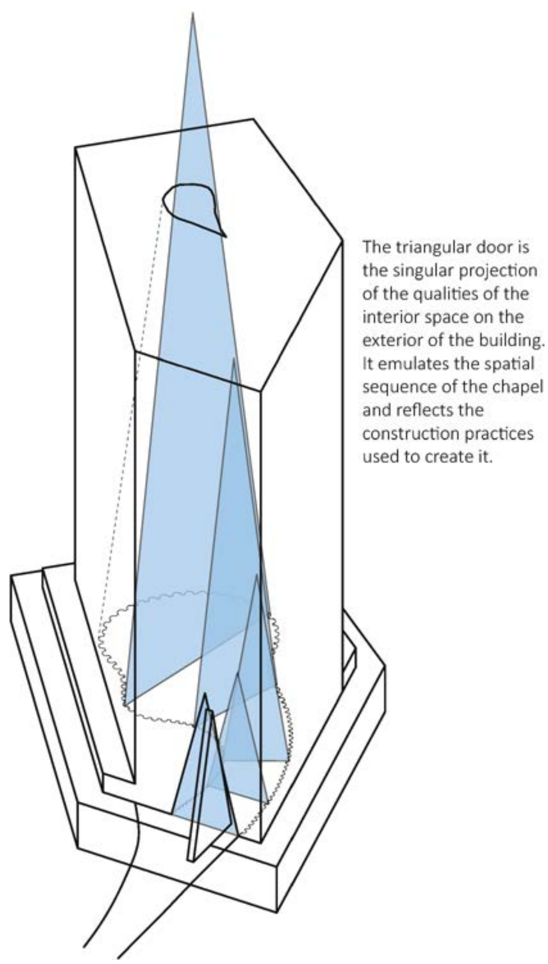
19.9
Wall construction sequence

Intersection

The primary intersection of the stereotomic and tectonic in Bruder Klaus is not the joint or juncture between materials or systems commonly found in other projects. Instead, in this chapel, these two systems intersect as texture or ornament: the impression of the tree trunks in the concrete structure (Figure 19.8). This intersection is as much sensual as it is representational. The charcoal that remains on the interior from the burning of the logs activates the senses and creates an expression in the space that can be touched and smelled. This intersection is directly derived from the means of construction and is a lasting mark of process on product (Figure 19.9).

Representation

The exterior of Bruder Klaus Field Chapel reveals little about the qualities of the space within. The horizontal striations in the concrete serve as its primary exterior ornamentation, telling the story of the 24 days of labor that resulted in the magnificent small structure. The lone exterior inclusions are the entry door and a small cross that sits directly above it. The door is unadorned, but its acute triangular form does serve as an exterior reflection of the teepee form of the interior space (Figure 19.10).



19.10
Representational qualities of the entry door

Except for the door and the oculus, the only components that run from interior to exterior are the 300 small shafts that once held the steel ties that bound the outer and inner cribbing together during construction (Figure 19.11). While in process, these elements were structural solids, but afterward they became negative space in the concrete mass. These holes add to the composition of both the interior and exterior surfaces, but the effects are far more evident on the interior. Zumthor elected to plug each shaft with a hand-blown crystal element that refracts light through the dark interior, creating points of light in the darkness. Again the building process becomes the conveyor of experience in the space.

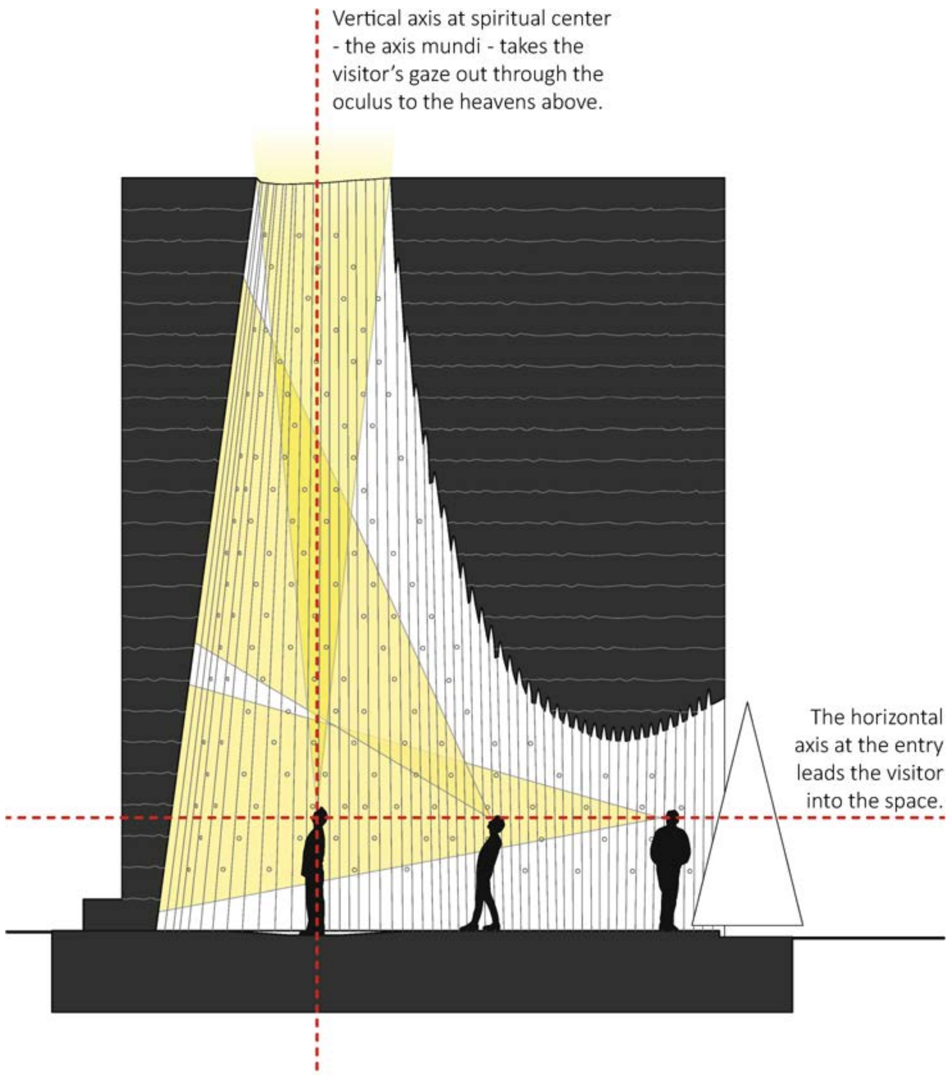
Quite in line with the ideas of both Bötticher and Semper, the ornamentation on the interior surface of the concrete walls – the impression of the trunk formwork – is quite literally derived from the natural materiality of wood and the elemental effects of fire. In a stark contrast to the ideas of Karl Bötticher, however, who believed that the outer form is a "sculptural representation" of its inner concept or function,[8] the interior surface or *Kunstform* of Bruder Klaus is reflective not of the inner function of the concrete wall but of the function of the now absent formwork. The representation is a graphic record of the process of building the chapel, not the static function of the wall's structure.

19.11
Close-up view of the concrete texture

19.12
View up towards the chapel's oculus

Space

As in Thorncrown Chapel (see Project 03) and countless other sacred spaces, one goal of religious buildings is to draw the visitor's eyes upward towards God (Figure 19.12). In Bruder Klaus Field Chapel, the verticality of the space is accentuated by the vertical striations of the interior surface; each projecting rib pulls your view up to the oculus above. Light filtering down into the interior highlights the texture of the surface. The light is also the catalyst for the reorientation of axis described earlier. The horizontal movement through space is slowly shifted to a vertical movement with the eyes – ascension through light and texture (Figure 19.13). Again, the process of construction is integrated with the experience of space.



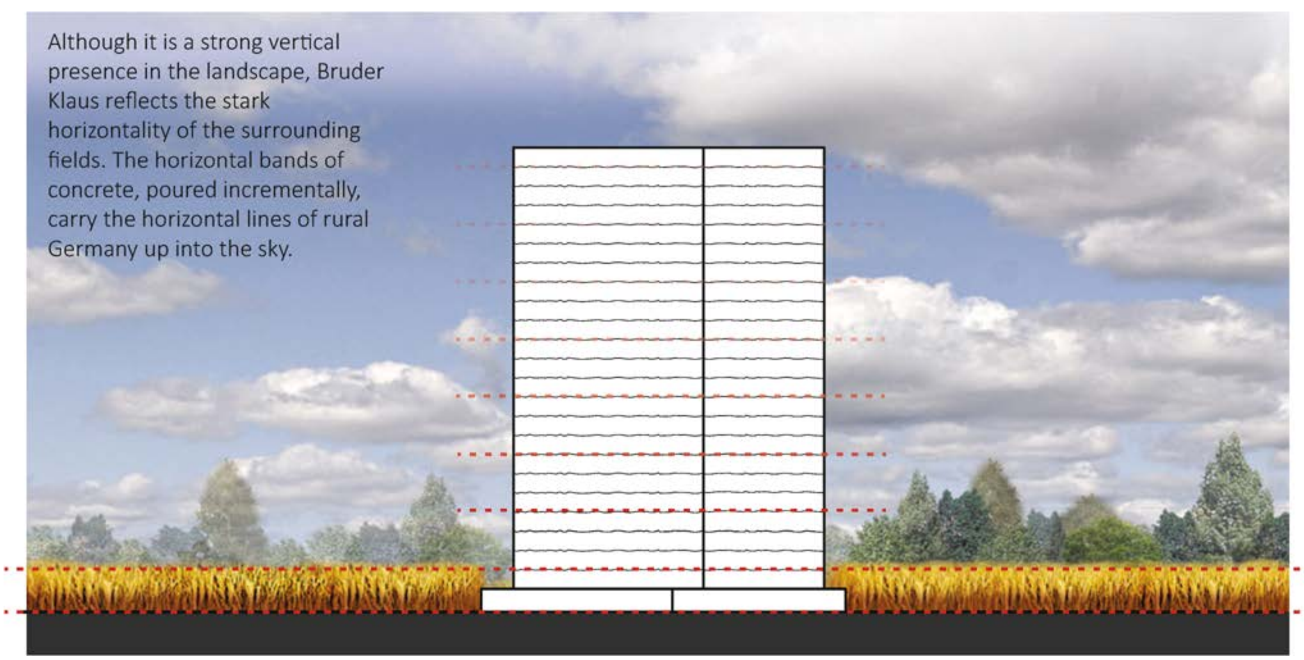
19.13
Horizontal to vertical movement

Place

> Sometimes mistaken for a defensive tower, a silo or a campanile, the Field Chapel evokes an air of remarkable and awe-inspiring individuality combined with a sense of proportional harmony with the surrounding green and meandering landscape.[9]
>
> Andreas Rossmann, "Feldkapelle Bei Wachendorf = Field Chapel near Wachendorf," 2008

Peter Zumthor states that "it [was] important for the Chapel to rise up vertically in order to stand out from afar against the open, level fields with their few undulations."[10] The conceptual mounding of Bruder Klaus, however, also replicates the striations of the earth, reflecting the horizontal nature of the place. The horizontal lines of the earth and fields are arrayed upwards through the structure in its striated construction (Figure 19.14).

In addition to the relationship to the site, the building also responds directly to the environment through its materiality and configuration. The oculus in the roof is aligned with a slight recess in the concrete slab below. Here, on the lead and zinc flooring, rainwater gathers in a small pool. The floor is built so that excess water runs off out of the building, but a small pool will remain until it evaporates; the water shimmers in the light and accentuates the metal floor. The addition of water to the material palate of the space enhances its sensory qualities – augmenting sound, smell, humidity, and visual input for the visitor.



19.14
Horizontal lines of the building

Additional Resources

Projects

Shelter for Roman Ruins, Chur, Switzerland, 1986 (46°50′48″N, 9°31′36″E)

Saint Benedict Chapel, Sumvitg, Switzerland, 1989 (46°44′5″N, 8°56′20″E)

Thermal Baths, Vals, Switzerland, 1996 (46°37′19″N, 9°10′52″E)

Swiss Sound Box, Hannover, Germany, 2000 (52°19′5″N, 9°49′5″E) (also featured in this book)

Kolumba Museum, Cologne, Germany, 2007 (50°56′19″N, 6°57′15″E)

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Notes

1 Peter Zumthor, *Thinking Architecture*, 2nd ed. (Boston: Birkhauser, 2006), 66.

2 Jerneja Acanski Veber, “Sveto v Architekturi = the Sacred in Architecture,” *Piranesi* 20, no. 31 (2012), 40.

3 Andreas Rossmann, “Feldkapelle Bei Wachendorf = Field Chapel near Wachendorf,” *Detail* 48, no. 1–2 (2008), 14.

4 Veber, “Sveto v Architekturi = The Sacred in Architecture,” 40, bold added

5 Rossmann, “Feldkapelle Bei Wachendorf = Field Chapel near Wachendorf,” 14.

6 Kenneth Frampton, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture* (Cambridge: MIT Press, 2001), 5.

7 Veber, “Sveto v Architekturi = The Sacred in Architecture.”

8 Karl Bötticher, “Excerpts from *Die Tektonik Der Hellenen*,” in *Otto Wagner, Adolf Loos, and the Road to Modern Architecture*, ed. Werner Oechslin (New York: Cambridge University Press, 2002), 192. (Originally published as Bötticher, Carl Gottlieb Wilhelm. *Die Tektonik Der Hellenen*, Potsdam, 1844.)

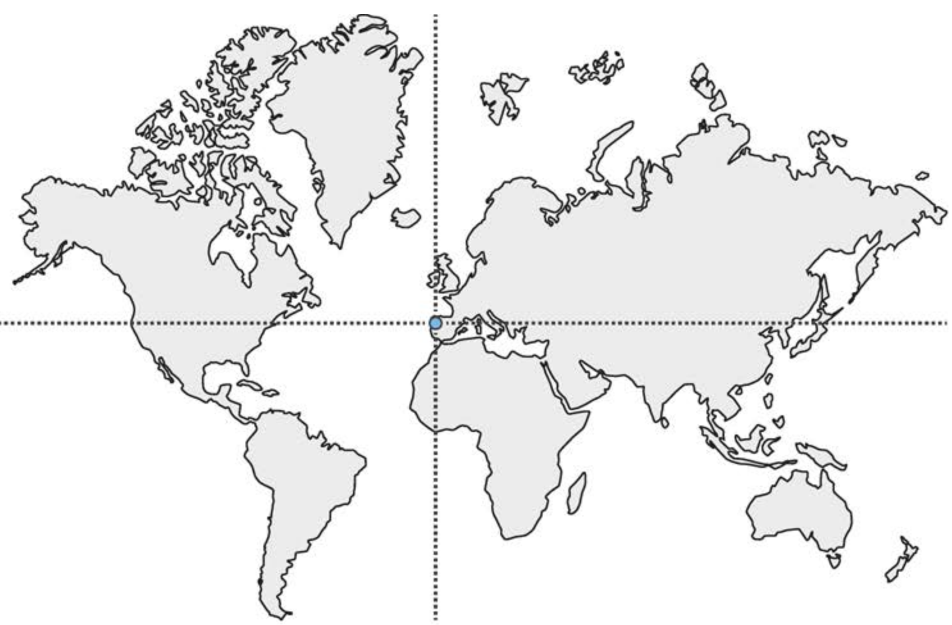
9 Rossmann, “Feldkapelle Bei Wachendorf = Field Chapel near Wachendorf,” 14.

10 Peter Zumthor as cited in Stefano Casciani, “Il Santo E L’architetto = a Saint and an Architect,” *Domus*, no. 906 (2007), 58.

20
Casa Tóló
Álvaro Leite Siza

Architect Brief

Álvaro Leite Siza is the son of the renowned Portuguese architect Álvaro Siza Vieira. Despite the potential pressures of being compared against – and often confused with – his father, Leite Siza has managed to develop a strong architectural voice of his own. In 1992, shortly after the start of his professional career, Leite Siza spent time as an apprentice in the office of 2011 Pritzker Prize-winning architect Eduardo Souto de Moura (a longtime collaborator of the elder Siza). Two years later, in 1994, Leite Siza graduated from the Faculty of Architecture at the University of Porto. Since that time, he has developed a thriving practice. In addition to having designed numerous well-received buildings, Leite Siza has expanded his work to include the design of household items, jewelry, and furniture. He has also found other outlets to expresses his creativity – including painting and sculpture – which have led to multiple exhibitions.



alvite, vila real district, portugal
gps | not provided for residence
program | vacation residence
completed | 2005
area | 180 m2 [1,940 ft2]

20.1
Vicinity map

20.2
The upper entrance of Casa Tóló

Leite Siza's design philosophy centers on people and their movements, actions, and interrelationships in space. Both his architectural and artistic work explore this set of ideas, conceptually connecting his drawing, sculpture, painting, and architecture; they are a continuous record of his explorations. Leite Siza says:

> Each minute and each second of the day is linked to a different situation. Each day and each year is different from another, not just by way of the seasons, weather conditions, people's movements, the wind (external situations), but also different for [us] (internal situations), because I believe that each day, each hour, each minute changes us. Every day we live is a day in which we see . . . and assimilate a great deal.[1]

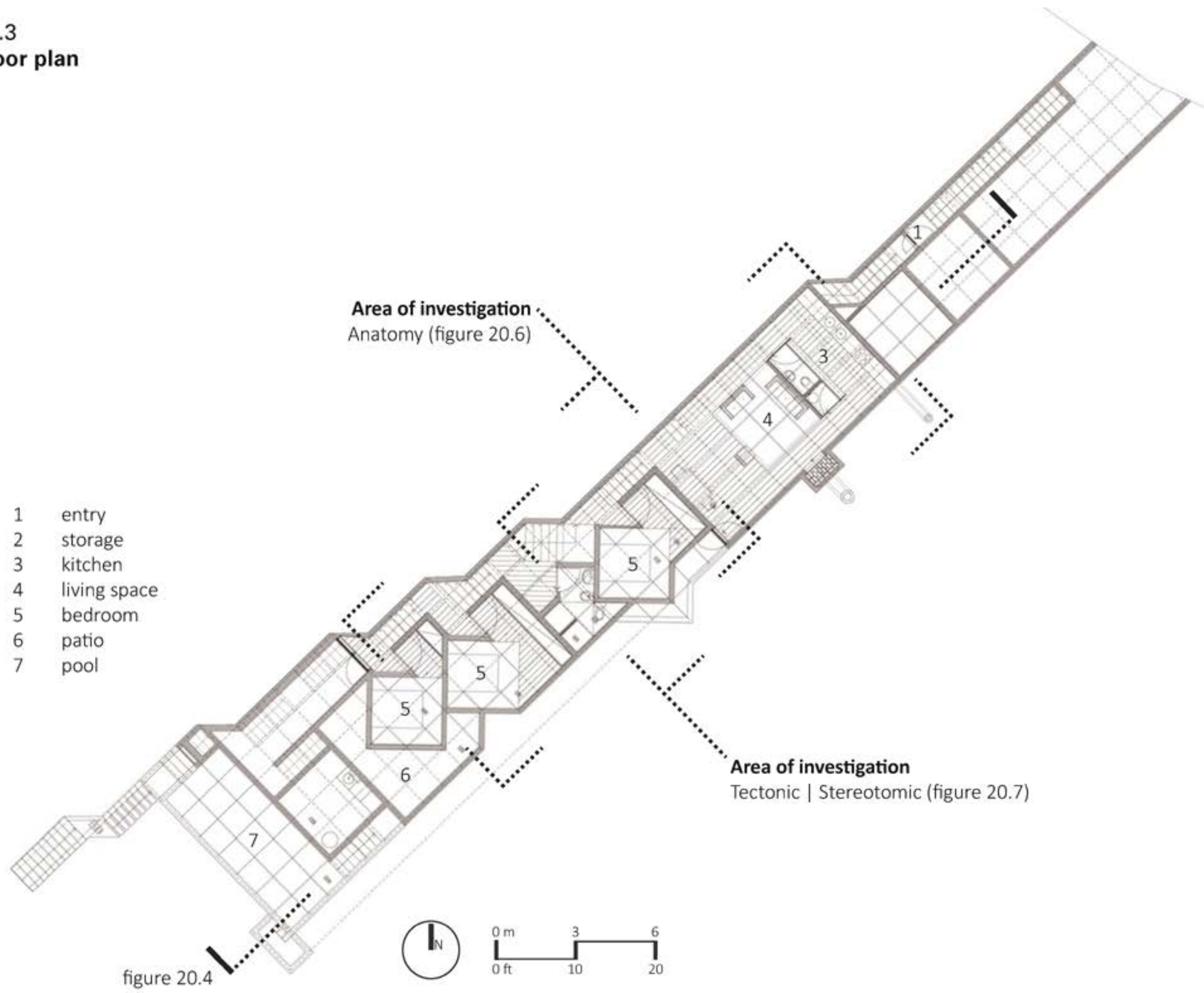
Project Brief

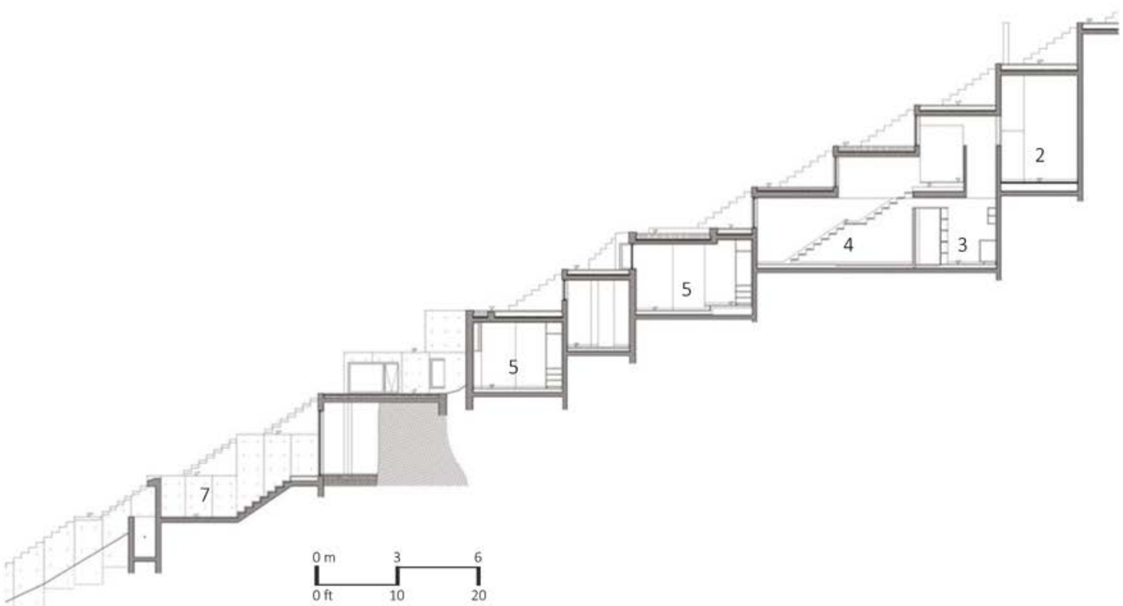
> From certain vantage points, it looks like a relic from an ancient civilization, maybe an exposed portion of a stepped pyramid or some kind of Mayan monument. Partially buried in a steep hillside in the rural Vila Real district of northern Portugal, the Casa Tóló presents itself as a Jimmy Stewart kind of character: self-effacing at first, but then increasingly bold.[2]
>
> Clifford A. Pearson, "In Northern Portugal, Alvaro Leite Siza Vieira Cascades Casa Tóló Down a Steep Slope through Terraced Gardens," 2006

Casa Tóló sits on a 1,000-square-meter [10,764-square-foot] site with a very particular set of characteristics: very long and narrow, relatively steeply sloping, facing south, and with a spectacular view of the surrounding environment. The home contains three bedrooms, typical residential living spaces, plenty of outdoor space, and a small pool on the lowest level. Its primary entrance sits at the top of the hill where a road allows access to the site via car. At the bottom of the hill, a pedestrian path allows an alternative means of access to the site. Between these two points sits Casa Tóló. It is as much a staircase connecting the two points of access as it is a residential structure. Much like the drawings of M. C. Escher, the building is a game of stairs.

On approach from the top of the hill, you are greeted with a concrete slab and a stair descending into the earth; no building is visible (Figure 20.2). The descent you are asked to make as a visitor is an "act of faith."[3] You terrace down through a series of concrete modules, encountering program spaces in sequence (Figures 20.3 and Figure 20.4). Each occupies its own level of the structure. The finishes are white plaster and wood in this clean, contemporary environment (Figure 20.5). Towards the bottom of the building, you are released to the lower terrace and the pool. Looking back up the hillside from this vantage point, the entire volume of the home is on display.

20.3
Floor plan





20.4
Building section

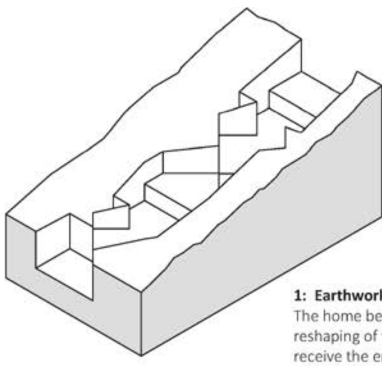
20.5
The living room

Tectonic Principles

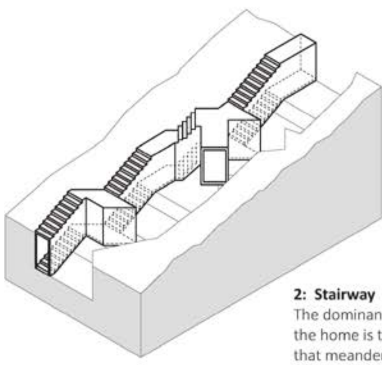
Anatomy

The anatomy of Casa Tóló is different from most of the other projects featured in this book. The project begins with the carving of the site (Figure 20.6). The excavation allows the building to nestle into the slope of the existing hillside. Within the excavation sit the concrete boxes that form the program spaces of the residence and the stairway, which serves as a circulation spine. These elements consist of a slab-on-grade with concrete walls and a concrete roof structure; all poured in place. They define the spaces of the house and serve as its framework. In this contemporary structure, the concrete is exposed as the exterior finish and glazing lines the south-facing exposure. Both interior and exterior spaces utilize raised flooring, which clads the walking surfaces in some areas. On the interior, the wooden floors sit up on sleepers, while on top of the concrete boxes, concrete pavers sit above a drainage system to allow the rooftops to be occupiable but functional.

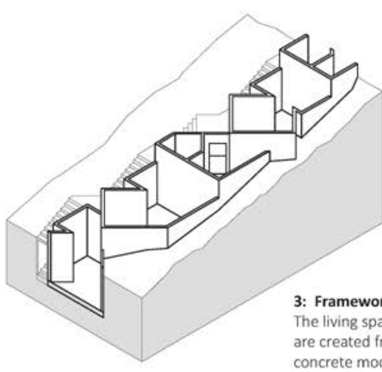
Semper's notion of the hearth is of a central social space that draws the residents or family together. Casa Tóló, by its very nature, is a linear project. There is no singular center to the building, no social space that serves as the primary nexus of the home. Instead, the role of the hearth has been separated. Each of the cubes focuses on a specific aspect of living in this



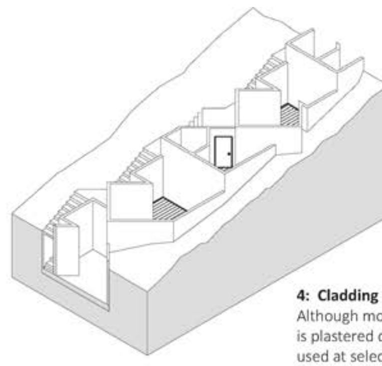
1: Earthwork
The home begins with the reshaping of the hillside to receive the embedded construction.



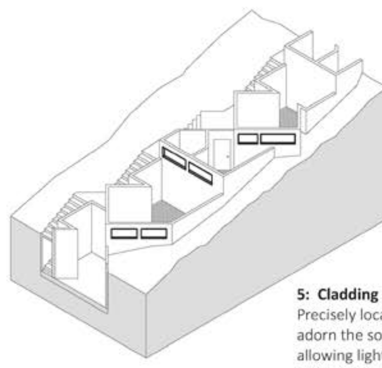
2: Stairway
The dominant component of the home is the two story stair that meanders down the hillside.



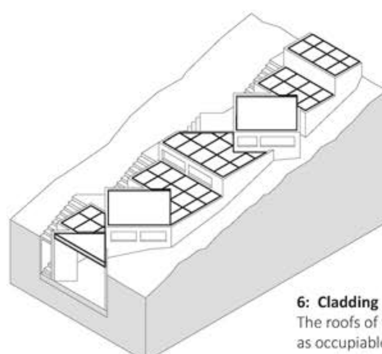
3: Framework | Units
The living spaces of the home are created from a series of concrete modules that build off the southeast side of the stair.



4: Cladding | Wood
Although most of the building is plastered concrete, wood is used at select locations within the interiors of the home.

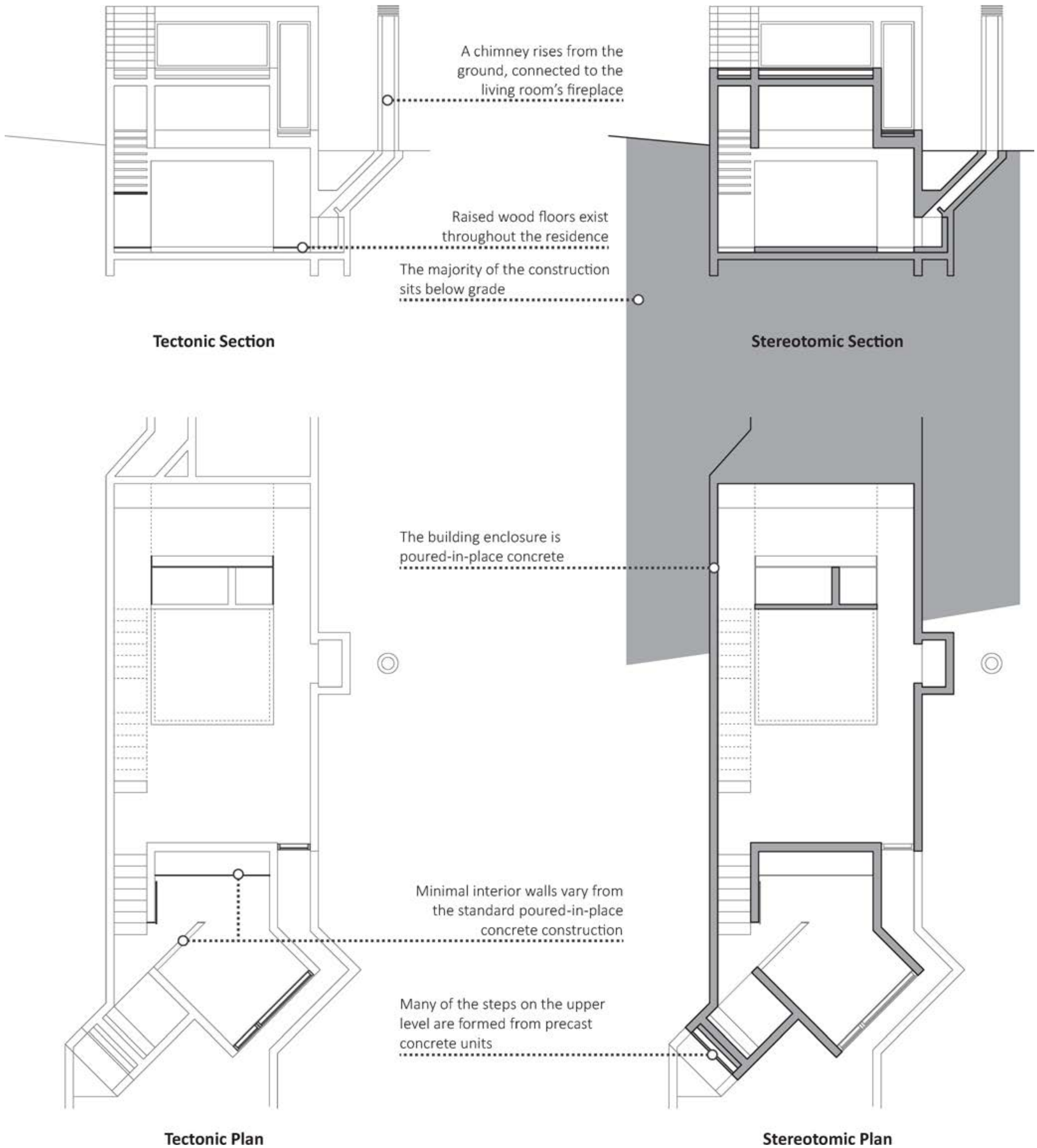


5: Cladding | Windows
Precisely located windows adorn the south facade, allowing light into the spaces embedded in the earth.



6: Cladding | Roof
The roofs of the home serve as occupiable space. Some are paved and others serve as garden space.

20.6
Anatomy



20.7
Tectonic | Stereotomic

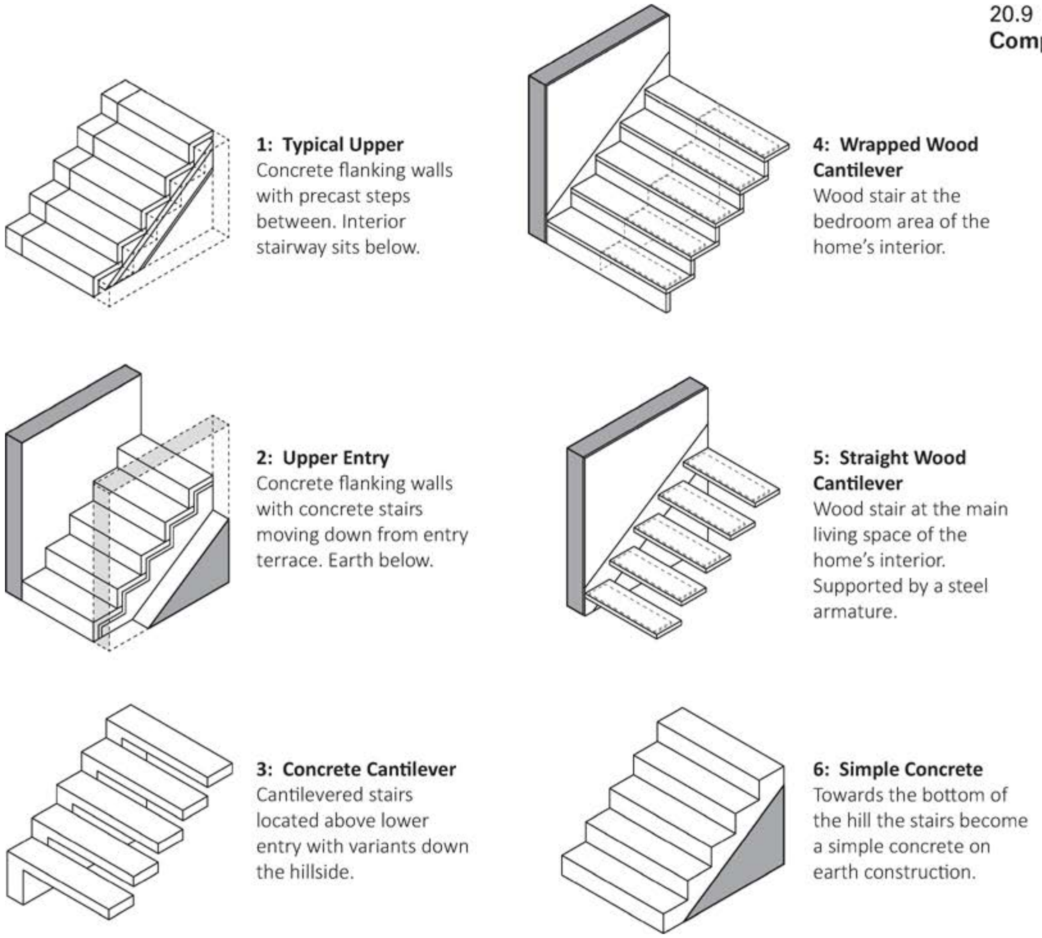
place. The decentralization of space eliminates the use of a traditional hearth and, instead, focuses its energy on the development of the home as a space of movement and transition.

Stereotomic

The modest budget available to build Casa Tóló led to use of simple and readily available materials.[4] The budget also played a role in the decision to bury the house in the earth. More than half of the total volume of the building is embedded in the hillside. Not only does this decision create a strong connection between the building and the earth, but the ground provides a natural and affordable means of providing both security and thermal comfort for the residents.

The concrete modules of the home are stereotomic anchors (Figure 20.7). They act like massive boulders, hollowed out through a process of carving and scattered down the hillside. The concrete construction is reinforced and the mix was laced with polyvinyl chloride (PVC) to increase the insulation value of the material.[5] On the interior, all of the walls and ceilings were plastered and painted white. This finish is not just a contemporary aesthetic, however; it is also a functional aspect of the residence. The careful placement of openings on the southeast façade and the bright interior finishes allow light to be reflected back into the recessed spaces that are buried in the earth (Figure 20.8).

20.8
View up at the house from the bottom of the hill



20.9
Comparison of stair typologies

Tectonic | Atectonic | Detail

There is minimal tectonic expression in Casa Tóló. The traditional tectonic materials and systems that are utilized are primarily finishes. The raised wood flooring system on the interior is the most prolific example of tectonic materiality in the home, creating a welcome contrast to the neutral palate with its rich graining and warmth. But the most dramatic tectonic expression of this floor system can be found as it rises and transforms into vertical circulation. Although most of the stairs in the building are concrete, on the interior of the building there are several sections of the stair system that are fabricated out of steel and wood (Figure 20.9).

These stairs are very delicate in comparison to the heavy concrete construction that surrounds them (Figure 20.10). This impression is heightened by the fact that each tread is cantilevered off of the adjacent concrete wall using a steel armature, allowing the stair to float in space and project a decidedly atectonic expression. In one of the stairs, the tread and riser conditions operate as a continuous ribbon moving from one floor to the next. In another version, the risers do not exist and the stair consists solely of a series of hovering wooden treads. This deception is accomplished through the use of steel stringers mounted

20.10
Interior stairway

on the concrete wall. The stringer is the same width as the plaster finish. Painting both white makes the steel disappear in the space. Tube steel is welded to the stringer and used to create a cantilevered structure to hold the wooden treads. Although minimal in use, the tectonic components of Casa Tóló provide a considerable amount of character to the interior spaces of the home and directly contrast the earthbound nature of the building.

Place

Casa Tóló is a comprehensive study on how to build on a sloped site. The project is not constructed as a vertical or horizontal system. It moves at the angle of the site. The site controls the construction and dominates the image of the building. As a result, Casa Tóló is part of the topography, not a building that sits upon it. The earth was not bulldozed or cleared of obstructions prior to the commencement of the construction of the building. Instead, the site was carefully studied to allow the house to respond to the qualities of the place, much as Kenneth Frampton and others have urged.

The site sits at an incline of approximately 30 degrees and is very narrow for its length. Casa Tóló was designed to use this particular site in a rational way without undue expense from major excavation. To accomplish this feat, Leite Siza designed the home as a series of small interconnected volumes that tumble down the hill. The volumes are arranged to respect the existing landscape of the site, shifting and rotating to align with views, avoid significant trees, and match topographical changes (Figure 20.11). This strategy required "certain modules to adapt to the natural morphology of the terrain, respecting the distance from neighboring regulation walls, thus appearing to move naturally and with absolute freedom" down the hillside.[6]

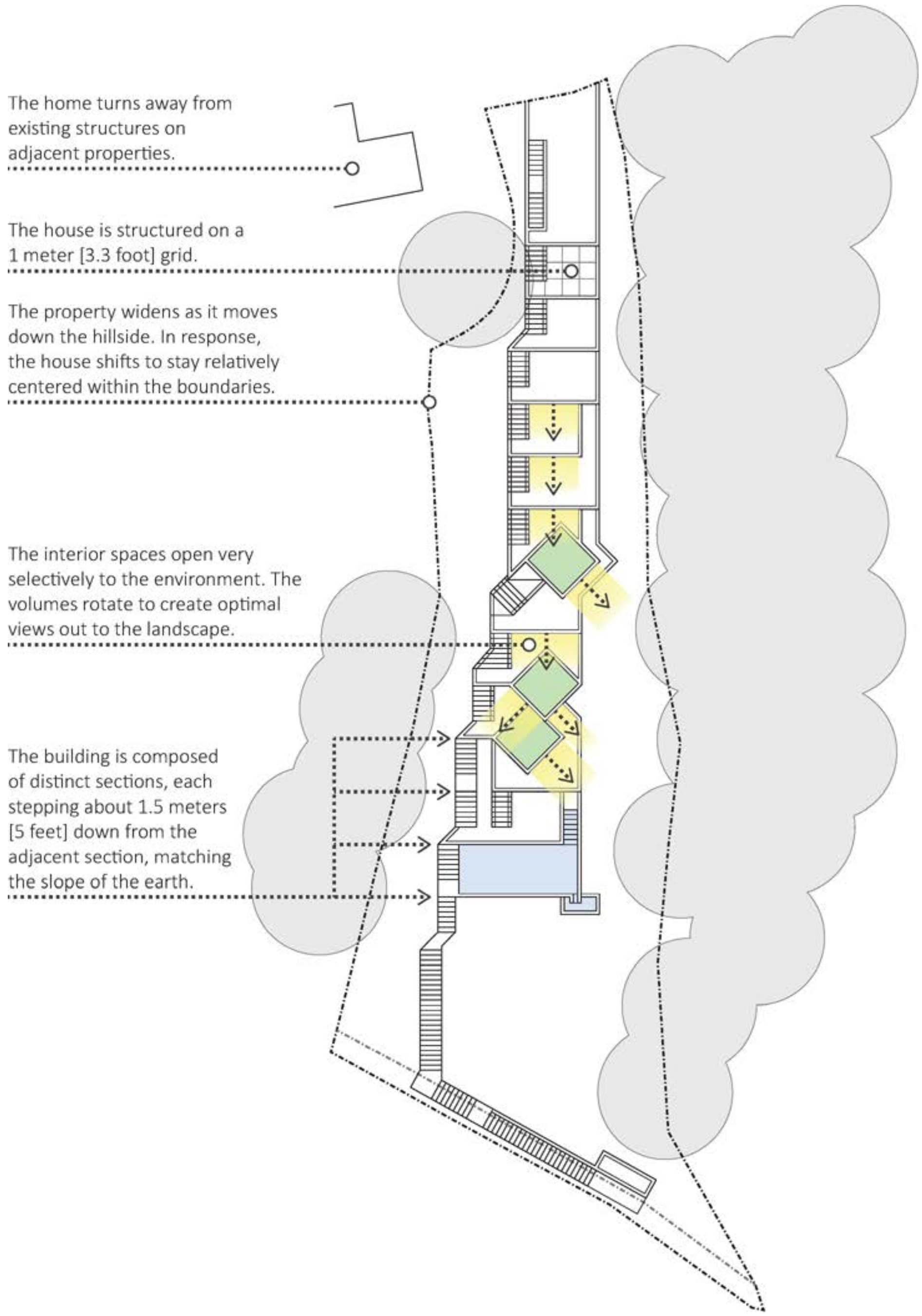
This house is an ideal example of the tectonics of place. The materiality, design, construction process, and representative character are all derived from the careful study of this hillside in northern Portugal. Casa Tóló could exist nowhere other than here; it is of this place.

Space | Precedent

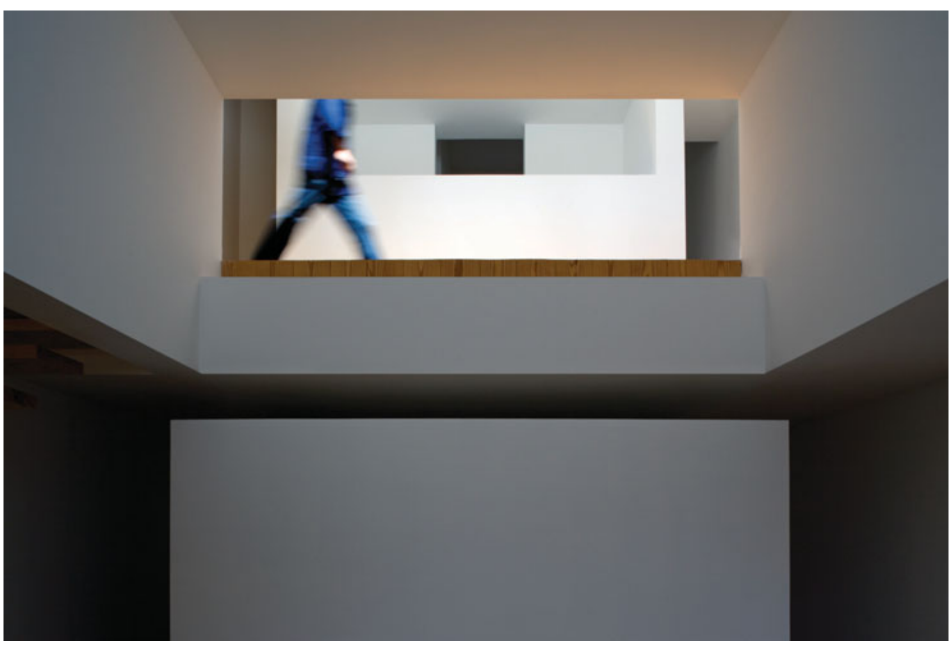
Leite Siza defines three functions for the house. The first is the interior space of the home, which is divided into a series of distinct areas. The second is the outdoor space afforded by the patios that occupy the roofs of the interior spaces below (Figure 20.12). And the third is the pedestrian walk that links the upper and lower paths. The relationship of the interior and exterior space is a function of the nature of the sloped house. The roof of one module serves as an outdoor space, or garden for one located up the hillside. This technique is reflective of Mediterranean vernacular strategies for living in vertically layered environments and for supporting soil on upper floors.[7] The unique relationships between spaces extend to the interior as well. The stacked system of modules allows for views up and down in space, creating connections between modules in unusual ways due to the modular nature of the concrete boxes (Figure 20.13).

At its core, however, Casa Tóló is a staircase; in fact it is a pair of staircases. The first staircase is exposed on the upper surface of the building and creates a path from the upper street to the lower street in the project. This aspect of the home creates a "fundamental outdoor route" through the formal gesture of the home[8] (Figure 20.14). But this stairway also

20.11
Analysis of the response to the site



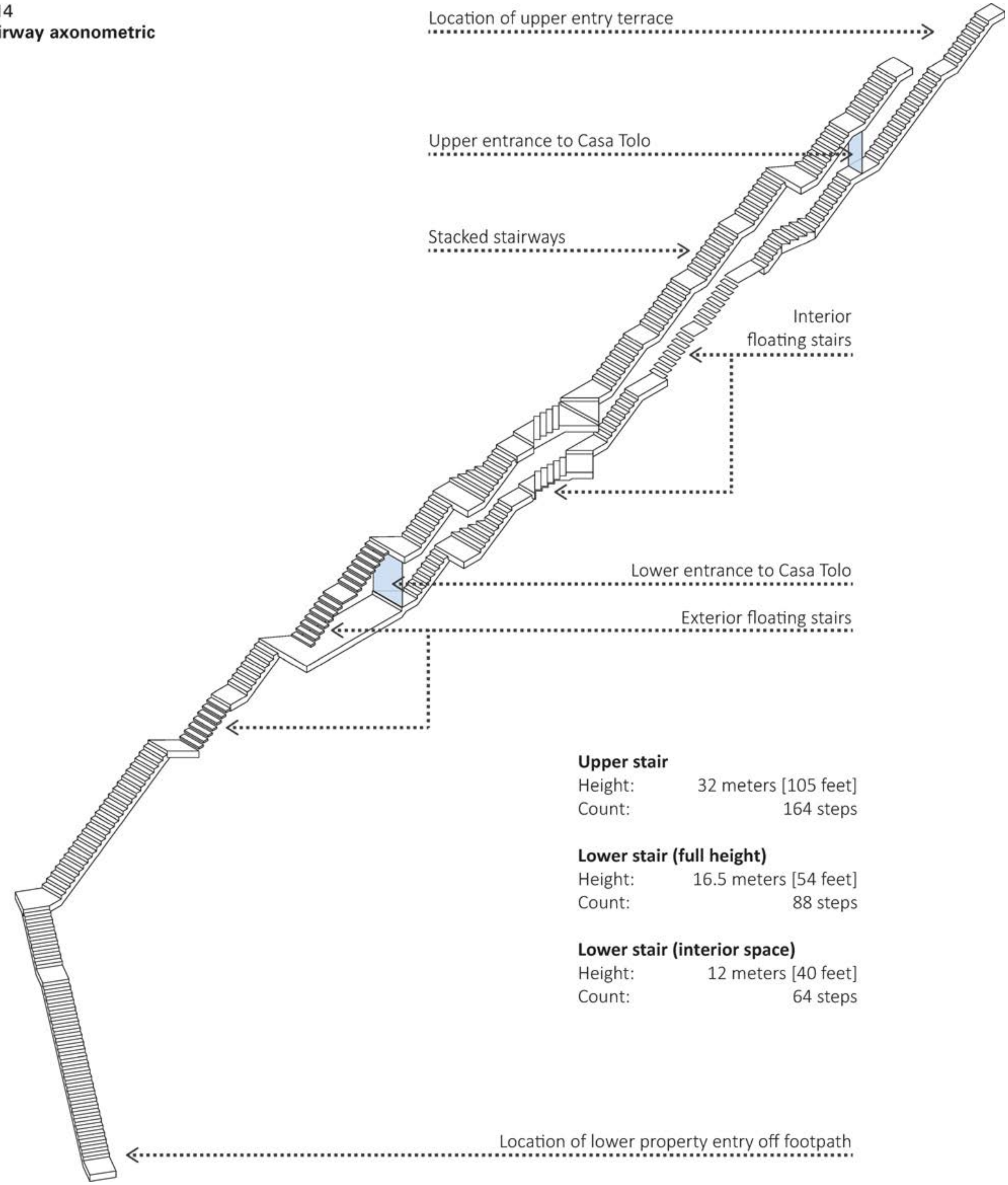
serves as a roof for the building, creating a complex composition reflective of Bötticher's elements of spatial tectonics. The upper stair projects down and defines the interior stair directly below it that connects the spaces of the home. The upper stair is functional as a means of circulation, but it is also a representational component and a space-defining element. As in the Peninsula House, Pikionis' statement that "the surface of the ground is



20.12
View down at the house from the top of the hill

20.13
View through the interior spaces

20.14
Stairway axonometric



kinetically experienced through the gait" (see Chapter 05) is clearly expressed as a primary concern in this project. Movement is the central character of Casa Tóló. The building is best experienced not by sitting in one place, not through sedentary inaction, but through the activity of the inhabitants.

Additional Resources

Projects

Chapel at Quinta do Eirado, S. Mamede Infesta, 1998

Leite Faria House, Porto, Portugal, 2001

Museological Centre for the Manuel Cargaleiro Foundation, Quinta da Torre-Vila Velha de Ródão, 2003

Sport Club do Porto, Porto, Portugal, 2004

Fez House, Porto, Portugal, 2010

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Slessor, Catherine. "Stair Master." *Architectural Review* 221, no. 1323 (2007): 44–49.

Notes

1 Taken from text provided by Álvaro Leite Siza.

2 Clifford A. Pearson, "In Northern Portugal, Alvaro Leite Siza Vieira Cascades Casa Tóló Down a Steep Slope through Terraced Gardens," *Architectural Record* 194, no. 4 (2006), 129.

3 Ibid.

4 "Álvaro Leite Siza Vieira: Casa Tóló, Vila Real, Portugal 2005," *A+U: Architecture and Urbanism* 3, no. 426 (2006), 16.

5 Jonathan Bell and Ellie Stathaki, *The New Modern House: Redefining Functionalism* (London: Laurence King Publishing, Ltd, 2010), 60.

6 "Álvaro Leite Siza Vieira: Casa Tóló, Vila Real, Portugal 2005," 16.

7 Ibid; Bell and Stathaki, *The New Modern House: Redefining Functionalism*, 60.

8 Álvaro Leite Siza as cited in Bell and Stathaki, *The New Modern House: Redefining Functionalism*, 60.

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SUPPORTING MATERIAL

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Afterword

Reflections on an Exploration

Organization of space is an integral aspect of human society, as fundamental as language and fire. A hundred thousand years ago, it may not have manifested itself in the archaeological record with quite the clarity of a Mailu village, but it cannot be dismissed that when humans first began to develop social groupings, spatial coherence in one way or another also became an attribute.[1]

Mark Jarzombek, *Architecture of First Societies: A Global Perspective*, 2013

21.1
Entry space of the Center of Gravity Foundation Hall, Predock_Frane, Jemez Springs, New Mexico, United States, 2004

In this quote, taken from the introduction to *Architecture of First Societies*, architectural historian Mark Jarzombek locates the beginning of architectural intervention in our world. From this point, the development of our built environment has been a continuum. We frequently subdivide this history into chapters to allow for it to be more easily studied, learned, and taught (as I have done to a certain extent in this book). Architectural history, however, should not be understood solely as discrete episodes, but as a constantly evolving, shifting, morphing, and very active sequence of ideas and practices. Variation and progression are generated in this process by any number of catalysts – regional differences, technological innovation, or popular sentiment, to name just a few.

A vast number of lessons regarding architecture and the built environment exist within this timeline; some of them span eras, while others may only exist at a particular moment. We can excavate these lessons by studying and analyzing the history of architecture. These investigations should not seek replication, which is a concern often discussed with respect to historicist modes of practice; they should, instead, attempt to draw out model practices and concepts that can be adapted to new works.

In the nineteenth century, Semper, Bötticher, and many others were searching for these lessons. They actively explored the work of the ancient Greeks and Romans, attempting to decipher the reasoning behind the architectural choices they made. Semper went as far as returning to the origins of building described by Jarzombek above to trace the evolution of the craft and project its future development. As Harry Francis Mallgrave stated in *Gottfried Semper: Architect of the Nineteenth Century*:

> And whereas we often choose to describe historicism in terms of history's stifling grasp over design, architects of this time were perhaps somewhat more honest in admitting that design can never entirely free itself from the dialectic of historical development – that is, historical analyses can also be powerful agents in crafting a new and more cogent architecture for the present.[2]

Yes, the histories that these theorists and philosophers explored – and in some cases invented – were, by most accounts, inaccurate. But as Edward Ford stated in the Foreword to this book, "despite our efforts to displace them, the work of Schopenhauer, Bötticher, Wölfflin, and Semper remain correct in their general, if not specific, conclusions, regardless of the inaccuracy of much of the historical analysis used to support them."[3] Despite its flaws, this line of thinking is not irrelevant. It can be, however, difficult to define. In "The In-Visibility of Tectonics," Carles Vallhonrat says:

> Tectonics, of course, is less than clearly defined anywhere, because of all that has been done to the word. We all vaguely think of the Greek origin in its etymology and satisfy ourselves with its generally accepted meaning of "building well" (I like that) or "art of construction." *Funk & Wagnall* says for the adjective "pertaining to building," or "relating to construction," and reminds us that in Greek *tecton* means carpenter (and *tekhne* skill, of course). *Webster's* (Ninth New Collegiate) doesn't even have the term other than as a branch of geology concerned with structure, especially with folding and faulting. Maybe the word doesn't belong to us, after all.[4]

I firmly believe that tectonics does belong to the practice of architecture. As I stated at the beginning of the introductory essay, this theory provides an opportunity to initiate a dialogue between the constituent elements of architecture – construction and materiality, structure and support, space and function, context, and ornamentation and appearance. As long as buildings continue to have a relationship with the ground, continue to be influenced by gravity and the forces of nature, and continue to need to be assembled, fabricated, or constructed, tectonics will play a significant role in the development of the built environment. If we can accept the multifaceted nature it has developed over 160 years of evolution, architectural tectonics will remain a powerful tool for studying and practicing architecture. Like the rest of architectural history, tectonics is not a fixed point; it is a continuum of lessons ready and waiting for us to unearth. We must look to the past for inspiration, but we cannot linger there. These lessons must be used to develop contemporary strategies for designing the spaces within which we live, work, worship, and play.

21.2
Courtyard of the Government Canyon Visitor Center at dusk, Lake|Flato, San Antonio, Texas, United States, 2005

After writing this book, I cannot help but feel that this investigation is a critical piece of a much larger discussion occurring regarding our relationship with the built environment. While the evolution of contemporary culture and architectural practice may have skewed the historical meaning of tectonics, it has also generated new opportunities for examining our intimate connection to the spaces we create and inhabit. Tectonics is one lens – along with empathy, phenomenology, hapticity, etc. – through which we can study how intimacy is developed between architecture and its residents. This theory provides an avenue to understand the connection between the physical acts of construction and occupation in our built environment. This skill is particularly useful in a contemporary world that appears to be refocusing on the making of things rather than the making of representations of those things. In the end, we are learning that *how we make* is just as essential to the creation of a built work as *what we make*.

Notes

1 Mark Jarzombek, *Architecture of First Societies: A Global Perspective* (Hoboken: John Wiley & Sons, Inc., 2013), ix.

2 Harry Francis Mallgrave, *Gottfried Semper: Architect of the Nineteenth Century* (New Haven: Yale University Press, 1996), 4.

3 Please see page xiii.

4 Carles Vallhonrat, "The In-Visibility of Tectonics: Gravity and the Tectonic Compact," *Perspecta* 31 (2000), 35.

Glossary

Key Individuals

For a timeline of the influential individuals involved in the development of tectonic theory, please see Figure 00.2 on page xxxiv.

Key Terminology

architectonics = the primer of architectural form given in accordance with the principles of tectonics

architekton = master builder

Bekleidung = dressing or raiment = Semper's theory that the origins of architecture can be traced back to the development of clothing for the human body as well as other textiles

die Mauer = a massive fortified wall

die Wand = a lightweight screen wall

Einfühlung = empathy = the projection of bodily form into the form of another object

historicism = the theory that the past cultures were built on timeless principles that should be adapted for contemporary use

Kernform (also referred to as *Werkform*) = Bötticher's underlying core-form that serves as the mechanically necessary systems of a building

Kunstform = art form = the exterior or visible description of the underlying mechanically necessary systems (*Kernform*)

Modernism = a twentieth-century architectural style characterized by efforts to connect architectural design with the rapid advancement of technology and the modernization of society

Neoclassicism = a period during the late eighteenth century and early nineteenth century characterized by the widespread use of Greek ornament, motifs, and characteristics in architecture and the arts ontology = the study of the nature of existence or being = (in architectural terms) the study of the essence of a building that is simultaneously both its fundamental structure and its substance

Order = an arrangement of classical architecture first named during the Renaissance

phenomenology = a line of architectural thinking centered on the experience of built space through multisensory input

purposiveness = to serve a useful function despite the fact that it was not purposely designed to do so

stereotomic = construction characterized by piled or stacked mass elements such as stone, brick, or earth

stereotomy = the practice of cutting and shaping stone for construction

structural rationalism = a nineteenth-century architectural theory stating that form should be based on the study of structural principles

structural-symbolic = Semper's term for the expressive presentation of the structural-technical

structural-technical = Semper's term for the underlying order and substance of a building

techne = an act of making that is driven by both a predetermined goal and the existing knowledge necessary to achieve that goal

tectonic (the general theory) = an architectural theory that examines the relationship between the design of space and the reality of the construction that is necessary for it to exist

tectonic (as opposed to stereotomic) = construction characterized by the assembly or joining of distinct elements such as wood or metal components

tekton = carpenter

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Project Credits

Arabian Library	
Client:	City of Scottsdale
Architect:	richärd+bauer
	James Richärd, Design Principal
	Kelly Bauer, Interior Design Principal
	Steve Kennedy, Project Architect
	Ben Perrone, Project Architect
	Mark Loewehthal, Staff Architect
	Stacey Crumbaker, Interior Design
Architect Website:	www.richard-bauer.com/
Structural Engineering:	Caruso Turley Scott, Inc.
Mechanical Engineering:	Kunka Engineering Incorporated
Electrical Engineering:	OMB Electrical Engineers, Inc.
Civil Engineering:	PK Kland Engineering
Landscape Architect:	E-Group
Lighting Consultant:	Roger Smith Lighting Design
General Contractor:	Redden Construction, Inc.

Brain Studio	
Client:	David Wild and Lulu Gargiulo
Architect:	Olson Kundig Architects
	Tom Kundig, Design Principal
	Les Eerkes, Project Manager
Architect Website:	www.olsonkundigarchitects.com/
Structural Engineering:	Monte Clark Engineering
Craftspeople:	A&S windows (glass and steel windows)
	Aaron Schmidt (steel loft)
General Contractor:	d. Boone Construction

Bruder Klaus Field Chapel

Client:	Trudel and Hermann Josef Scheidtweiler
Architect:	Peter Zumthor
Collaborators:	Michael Hemmi
	Frank Furrer
	Pavlina Lucas
	Rosa Goncalves
Engineering:	Jürg Buchli, CH-Haldenstein
	Jung-Consult, D-Euskirchen
General Contractor:	Anton Mahlberg & Söhne GmbH, D-Bad Münstereifel-Schonau
Carpenters:	Zimmermeister Markus Ressmann, D-Növenich
Forester:	Forstamt, D-Bad Münstereifel

Casa Tóló

Client:	Luís Marinho Leite Barbosa da Silva
Architect:	Álvaro Leite Siza Vieira
Structural Engineering:	GOP
MEP Engineering:	GOP
Landscape Architect:	Álvaro Leite Siza Vieira
General Contractor:	Oscar Gouveia

Center of Gravity Foundation Hall

Client:	Bodhi Manda Zen Center
	Abbess Jiun Hosen
Architect:	Predock_Frane Architects
	John Frane, Principal
	Hadrian Predock, Principal
Architect Website:	http://predockfrane.wordpress.com/
Structural Engineering:	Sonalyst
MEP Engineering:	Norman Estanislad
Architectural Consultant:	Devendra Contractor
Rammed Earth Consultant:	Gary Wee
General Contractor:	Kenderdine Construction

Chapel of Reconciliation

Client:	Protestant Reconciliation Church Parish
Architects:	Rudolf Reitermann
	Peter Sassenroth
Rammed Earth Consultant:	Martin Rauch

Chapel del Retiro

Architect:	Undurraga Devés Arquitectos
	Cristián Undurraga, Principal
	Cristián Larrain Bontá
	Pablo López
	Jean Baptiste Bruderer
Architect Website:	www.undurragadeves.cl/
Structural Engineering:	Rafael Gatica Engineers
	José Jiménez
Altar Design Consultant:	José Vicente Gajardo
General Contractor:	Terrano S.A.

GC Prostho Museum Research Center

Client:	GC Corporation
Architect:	Kengo Kuma & Associates
Architect Website:	http://kkaa.co.jp/
Structural Engineering:	Jun Sato Structural Design
MEP Engineering:	P. T. Morimura & Associates, LTD
Lighting Consultant:	Daiko Electrics
General Contractor:	Matsui Construction

Government Canyon Visitor Center

Client:	Texas Parks and Wildlife
Architect:	Lake|Flato Architects
	Ted Flato, FAIA
	Bob Harris, AIA
	Roy Schweers
	Dale Riser
Architect Website:	http://lakeflato.com/
Structural Engineering:	Architectural Engineers Collaborative
MEP Engineering:	Encotech Engineering Consultants
Civil Engineering:	Pape-Dawson Engineers
Landscape Architect:	TPWD
Lighting Design Consultant:	Archillume Lighting Design
Project Specifications:	Craig Haney
Environmental Consultant:	Center for Maximum Potential Building Systems
General Contractor:	Tom Page and Company

Lanxi Curtilage Building

Client:	Chengdu Qingyang Suburb Construction & Development Co. Ltd.
Architect:	Archi-Union Architects
	Philip F. Yuan, Principal
	Lv Dongxu
	Meng Yuan
	Alex Han
Architect Website:	www.archi-union.com/

Loblolly House

Client:	Stephen Kieran
Architect:	KieranTimberlake Associates
	Stephen Kieran, Principal-in-Charge
	James Timberlake, Principal-in-Charge
	Marilia Rodrigues, Project Architect
	David Riz
	Johnathan Ferrari
	Alex Gauzza
	Jeff Goldstein
	Shawn Protz
	George Ristow
	Mark Rhoads
Architect Website:	http://kierantimberlake.com/
Structural Engineering:	CVM Structural Engineers
MEP Engineering:	Bruce Brooks & Associates
Interior Design:	Marguerite Rodgers, Ltd.
Landscape Architect:	Barbara Seymour Landscapes
Site-based Contractor:	Arena Program Management
Prefabrication Contractor:	Bensonwood Homes
	Tod Benson, Owner
	Tony Poanessa
	Paul Boa
	Hans Porschitz

METI Handmade School

Client:	Dipshikha and METI Non-Formal Education, Training and Research Society for Village Development
Architects:	Anna Heringer
	Eike Roswag

Architect Websites:	www.anna-heringer.com/ www.zrs-berlin.de/roswag-architekten/profile
Structural Engineering:	Ziegert Roswag Seiler Dr. Christof Ziegert Uwe Seiler
Landscape Architect:	Khondaker Hasibul Kabir Abdun Nime
Energy/Solar Consultant:	Oskar Pankraz Jakob Schaub
Weaving/Bamboo:	Emmanuel Heringer
Blacksmithing Consultant:	Stefanie Haider
Earth Construction:	Ziegert Roswag Seiler Christof Ziegert Uwe Seiler Martin Rauch
Core Construction Team:	Austria/Germany: Anna Heringer, Eike Roswag, Dr. Christof Ziegert, Emmanuel Heringer, Stefanie Haider, Christiane Liebert, Christine Karl, Clemens Bernhardt, Michael Bitto, Ursula Nikodem-Edlinger-Holzinger, Cornelia Reithofer, Veronika Reithofer, Kurt Hörbst Bangladesh: Raboti Roy, Nikhil Chandra Roy, Buden Chandra Roy, Aminul Islam, Apon Chandra Roy, Suresh Chandra Roy, Jitendra Nath Roy, Sonjib Roy, Satish Chandra Roy, Romesh Roy, Fatik Roy, Bimol Roy, Bimol Roy, Upendra Nath Roy, Khokendra Nath Roy, Susen Roy, Vhomol Chandra Roy

National Museum of Roman Art

Client:	Ministry of Culture
Architect:	Rafael Moneo
Assistant Architects:	Francisco González Peiro Rafael Luque
Structural Engineering:	Jesús Jiménez Alfonso Garcia Pozuelo
General Contractor:	Cubiertas and M.Z.O.V. Manuel Juan García

Parrish Art Museum

Client: Parrish Art Museum

Design Architect: Herzog & de Meuron

- Jacques Herzog
- Pierre de Meuron
- Ascan Mergenthaler, Partner-in-Charge
- Philip Schmerbeck, Project Director
- Jayne Barlow, Associate
- Raymond Gaëtan
- Jack Brough
- Marta Brandão
- Sara Jacinto
- Tom Powell
- Nila Sanderson
- Leo Schneidewind
- Camia Young

Architect Website: www.herzogdemeuron.com/

Executive Architect: Douglas Moyer Architect PC

Structural Engineering: S. L. Maresca & Associates

MEP Engineering: Buro Happold

Civil Engineering: Nelson, Pope & Voorhis Engineers and Surveyors

Landscape Architect: Reed Hilderbrand Landscape Architecture

Furniture Consultant: Konstantin Grcic Industrial Design

Lighting Consultant: ARUP Lighting

General Contractor: Ben Krupinski Builders

Peninsula House

Client: Not Disclosed

Architect: Sean Godsell Architects

- Sean Godsell, Principal-in-Charge
- Hayley Franklin

Architect Website: www.seangodsell.com/

Structural Engineering: Felicetti Pty. Ltd.

Landscape Architect: Sean Godsell with Sam Cox

General Contractor: Kane Constructions Pty. Ltd.

Porciúncula La Milagrosa Chapel

Client:	Familia Durán Gómez
Architect:	Daniel Bonilla Arquitectos
	Daniel Bonilla, Principal
	Akira Kita, Architect-in-Charge
Architect Website:	www.daniel-bonilla.com/
Collaborator:	Ana Lucia Cano
General Contractor:	Arq. Jamie Pizarro

Prayer Pavilion of Light

Client:	Phoenix First Assembly
Architect:	DeBartolo Architects
	Jack DeBartolo Jr., FAIA
	Jack DeBartolo III, AIA
	J. Eric Huffman
	Aaron Taylor
	Tim Smith
	Kent McClure
Architect Website:	http://debartoloarchitects.com/
Structural Engineering:	Rudow + Berry
Mechanical Engineering:	Kunka Engineering
Electrical Engineering:	Associated Engineering
Civil Engineering:	WRG Design
Landscape Architect:	Michael Boucher
Lighting Designer:	Roger Smith
General Contractor:	Arthur Porter Construction

Punta della Dogana

Client:	Palazzo Grassi S.p.A
	Francois Pinault
Design Architect:	Tadao Ando Architect & Associates
	Tadao Ando
	Kazuya Okano
	Yoshinori Hayashi
	Seichiro Takeuchi
Architect Website:	www.tadao-ando.com/
Architect of Record:	Studio Lagrecacolonna
	Adriano Lagrecacolonna
Project Coordinator:	Equilibri S.r.l.
	Eugenio Tranquilli

Structural Engineering:	Tecnobrevetti S.r.l.
	Gian Domenico Cocco
	Luigi Cocco
Existing Building Survey:	Alberto Torsello
Mechanical Engineering:	Studio Lagrecacolonna
Existing Building Survey:	Alberto Torsello
Mechanical Engineering:	Studio Lagrecacolonna
	Adriano Lagrecacolonna
Electrical Engineering:	Studio Lagrecacolonna
	Adriano Lagrecacolonna
Lighting Consultant:	Ferrara Palladino S.r.l.
	Cinzia Ferrara
General Contractor:	Dottor Group S.p.A.
	Pietro Dottor
	Paolo Bonan

Swiss Sound Box

Client:	Swiss Confederation
Architect:	Peter Zumthor
Structural Engineering:	Conzett, Bronzini, Gartmann
Mechanical Engineering:	Hans Hermann
Electrical Engineering:	IBG
Composer:	Daniel Ott
Light-Scripts:	Plinio Bachmann
Food and Beverages:	Max Rigendinger
Mise en Scene:	Karoline Gruber
Outfits:	Ida Gut
Site Manager:	Franz Bartsch

Thorncrown Chapel

Client:	Jim Reed
Architect:	E. Fay Jones
Website:	www.thorncrown.com/

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