

TRANSLUCENT Building Skins

Material Innovations in Modern
and Contemporary Architecture

Scott Murray

ROUTLEDGE



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First published 2013
by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

Simultaneously published in the USA and Canada
by Routledge
711 Third Avenue, New York, NY 10017

Routledge is an imprint of the Taylor & Francis Group, an informa business

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British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data

Murray, Scott (Scott Charles), 1971–

Translucent building skins : material innovations in modern and contemporary architecture / Scott Murray.

pages cm

Includes bibliographical references and index.

(pb : alk. paper) 1. Curtain walls. 2. Transparency in architecture.

3. Architecture—Technological innovations. I. Title.

NA2940.M89 2012

721'.2—dc23

2012007176

ISBN: 978-0-415-68930-4 (hbk)
ISBN: 978-0-415-68931-1 (pbk)
ISBN: 978-0-203-10153-7 (ebk)

Typeset in Avenir
by Keystroke, Station Road, Codsall, Wolverhampton

Translucent Building Skins

Exploring the design of innovative building enclosure systems (or skins) in contemporary architecture and their precedents in earlier twentieth-century modern architecture, this book examines the tectonics, the history and the influence of translucency as a defining characteristic in architecture. Highly illustrated throughout with drawings and full colour photographs, the book shows that translucency has been and continues to be a fertile ground for architectural experimentation.

Each chapter presents a comparative analysis of two primary buildings: a recent project, paired with a historical precedent, highlighting how architects in different eras have realized the distinctive effects of translucency. The included buildings span a variety of program types, ranging from a single-family residence to a factory to a synagogue. Whether it is Pierre Chareau's glass-lens curtain wall at the Maison de Verre, Frank Lloyd Wright's wall of stacked glass tubes at the Johnson Wax Research Tower, or Peter Zumthor's use of acid-etched glass in a double-skin envelope at the Kunsthhaus Bregenz, the included projects each offer an exemplary case study of innovations in materiality and fabrication techniques.

Today, among many contemporary architects, there is an engagement with new technologies, new material assemblies, and new priorities such as sustainability and energy efficiency. A resurgent interest in translucency as a defining quality in buildings has been an important part of this recent dialogue and this book makes essential reading for any architect looking to incorporate aspects of translucency into their buildings.

Scott Murray is an architect and Associate Professor of Architecture at the University of Illinois, USA. He is the author of *Contemporary Curtain Wall Architecture*.

PREFACE

It is worth recalling that the development of architectural glass—going back several hundred years—was directed up until about the first quarter of [the twentieth] century toward transparency, toward the perfection of an ever larger plate of glass to a point of perfect clarity. Now that transparency as a see-through characteristic has been technologically mastered, it's hardly surprising to find that it is no longer the issue. The mastery of the transparent glass pane makes way for more complex and interesting uses of this marvelous material.

Joan Ockman¹

As opposed to transparent glass, which allows the direct transmission of incident light rays, translucent materials can absorb, disperse, and amplify light, creating a hybrid condition which is neither transparent nor opaque but may embody qualities of both. These materials resolve the seemingly paradoxical combination in a single element of the properties of abundant light transmission, on one hand, and obscuration of view, on the other. Through various fabrication techniques—sandblasting, acid-etching, ceramic fritting, laminating, and casting—glass may be transformed from a putatively invisible, transparent surface to a translucent material with depth and presence. Building envelopes—or skins—that utilize translucency may do so for a variety of reasons, both practical and poetic: to maximize natural lighting to the building's interior by day, to outwardly illuminate a building at night, to provide privacy, to evoke a meditative or serene atmosphere, to infuse the architecture with a sense of mystery or ambiguity.

This book presents a series of architectural projects which explore these possibilities in different ways, with the goal of deciphering the materials and methods of construction that contribute to each building's unique skin. Another goal is to analyze the work of contemporary architects who engage the concept of translucency within a broader historical and conceptual context. To this end, each chapter presents a comparative analysis of two primary buildings: a recent project, completed within the last 15 years, paired with a historical precedent, generally from the early to mid-twentieth century, highlighting how architects in different eras have realized the distinctive effects of translucency. The included buildings span a range of program types, from a single-family residence, a school, and a factory, to a rare-book library, an art museum, and a synagogue. The paired projects in each chapter share a common theme (a particular material, a building type, etc.) and serve to link contemporary visionaries to earlier modern pioneers. This organizing structure is not intended to claim a linear progression or direct influence of the older project upon the newer, but rather to make an argument that translucency has been and continues to be fertile ground for architectural experimentation.

Whether it is Pierre Chareau's glass-lens curtain wall at the Maison de Verre, Frank Lloyd Wright's wall of stacked glass tubes at the Johnson Wax Research Tower, or Peter Zumthor's use of acid-etched glass in a double-skin envelope at the Kunsthhaus Bregenz, the included projects each offer an exemplary case study of innovations in materiality and fabrication techniques. As attempted in the following chapters, a thorough understanding of these projects requires equal attention to the often complex technical assemblies that constitute each building envelope as well as the remarkable experiential and spatial effects created by its interaction with light.

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Introduction

TRANSPARENCY / TRANSLUCENCY / OPACITY

"No term is more important to modern architecture than 'transparency.'"

Hal Foster¹

"Transparency is arguably one of the most allusive and illusive tropes of modern architectural discourse."

Eve Blau²

"Modernity has been haunted, as we know very well, by a myth of transparency."

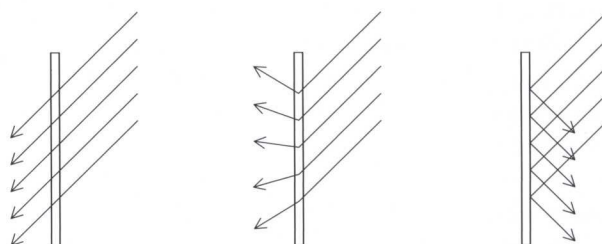
Anthony Vidler³

"I was never really interested in just transparency. In fact, I was always suspicious of it. The zone I feel very comfortable in is the distance between the translucent and the opaque."

Steven Holl⁴

Although the dominance of transparency as an architectural ideal is well established in the history of modern architecture, there are a series of exceptional and often overlooked modern buildings in which architects eschewed transparency in favor of the more complicated, alternative condition of translucency. It is this influential, though less examined, thread of modernism that this book explores.

Whereas *transparency* is characterized by visual openness and the direct transmission of light, and *opacity* results from the complete blockage or reflection of light, *translucency* is demonstrated by materials that capture, manipulate, and disperse light. In simplest terms, the adjective *translucent* is defined as allowing light to pass through while diffusing it such that objects on the other side are not clearly discernible; it is derived from the Latin *trans*, meaning through, and *lucere*, to shine. The condition of translucency as it occurs in architecture may be thought of as existing at a point along a spectrum, the polar ends of which are transparency and opacity. Thus, translucency is rarely a fixed state and may be perceived as nearly transparent, nearly opaque, or an apparently equal blurring of the two, with such variations dependent upon the material itself (the degree of roughness of a glass surface, for instance) or the ambient environmental conditions (the



Transparency

Translucency

Opacity

0.1 Interaction of light and material

angle or intensity of sunlight, for example). This idea of translucency, when deployed within windows, walls, and roofs, has, in recent decades, played an important role in expanding concepts of architecture beyond the orthodoxy of modernism (and its dominant association with transparency) and has contributed significantly to current innovations in contemporary architectural design.⁵ Today, among many of the contemporary designers whose work is defining early twenty-first-century architecture, there is a renewed interest in the building envelope as a site for experimentation and in translucency as an architectural effect. Although translucency can be deployed within other components—interior partitions, furniture, even floors—it is within the building skin, the interface between interior and exterior space, that it exerts its most significant influence.

As the quotations above suggest, modern architecture has had a fundamental but also complicated relationship with the concept of transparency. The well-documented lineage of this association, as manifested in theoretical texts and built works, can be traced from earlier twentieth-century figures like Sigfried Gideon, Walter Gropius, and Ludwig Mies van der Rohe, to the rise and ubiquity of the 1950s curtain wall, the 1963 critique of literal transparency by Colin Rowe and Robert Slutzky, and the critique of Rowe and Slutzky themselves by subsequent theorists, to the waning influence of transparency (in favor of opacity) during a postmodern interlude, and finally to the resurgence of an interest in glass architecture and optics, as seen, for example, in the work of

contemporary architects featured in the 1995 exhibition "Light Construction" at the Museum of Modern Art. Key early works, like Mies's unbuilt Glass Skyscraper Projects (1921–22) and Gropius's Bauhaus Building (1926) in Dessau, Germany, exploited recent developments in frame-structure technology and glass fabrication to envision transparent façades at an unprecedented scale. Writing about his Bauhaus design, Gropius praised transparent glass for provoking "the growing preponderance of voids over solids" and for its "sparkling insubstantiality . . . the way it seems to float between wall and wall, imponderably as the air."⁶ In his 1929 book, *Glass in Modern Architecture*, Arthur Korn announced that "the contribution of the present age is that it is now possible to have an independent wall of glass, a skin of glass around a building," which he hailed as "the disappearance of the outside wall."⁷ To a greater degree than many of his contemporaries, Mies recognized the complex visual properties of the new glass architecture, noting that "the important thing is the play of reflections and not the effect of light and shadow as in ordinary buildings."⁸ Mies's Tugendhat House (1930) in Brno, Czech Republic, displays a unique combination of transparency and translucency in its extensive glazing, and is in that sense a precursor to his later design for Crown Hall (1956) in Chicago. At the Tugendhat House, a long row of transparent floor-to-ceiling windows opens the main living space to a garden. In fact, two of these large windows can be fully lowered into a slot in the floor, thus literally achieving Korn's metaphor of the "disappearance of the outside wall." Mies used equally large panes of translucent glass to enclose the entry hall and stair, providing the desired degree of privacy while creating a carefully choreographed transition from inwardly to outwardly focused spaces.

In their influential 1963 essay, "Transparency: Literal and Phenomenal," Colin Rowe and Robert Slutzky make a distinction between "literal" (or actual) transparency—the ability to see through a material—and the more abstract "phenomenal" (or illusionistic) transparency, in which the layering of planes and volumes suggests the interpenetration of partially revealed, partially hidden spaces beyond.⁹ Among other examples, the authors contend that literal transparency is manifested in Gropius's Bauhaus Building while phenomenal transparency is represented by Le



0.2 Bauhaus Building, Dessau, Germany. Walter Gropius, 1926.

Corbusier's Villa at Garches, with a bias clearly expressed toward the latter. The essay proposed a new understanding of transparency as "spatial stratification" and was quickly received as a critique of the accepted notion of transparency and its dominance



0.3 Entry hall. Tugendhat House, Brno, Czech Republic. Ludwig Mies van der Rohe, 1930.

in the mainstream architecture of the time. However, although Rowe and Slutzky present these two types of transparency in binary opposition, they are neither mutually exclusive nor exhaustive. In fact, many of the qualities they attribute to phenomenal transparency would find a closer fit within an expanded definition of translucency, which forgoes literal transparency but still reveals spatial depth and layering in abstraction. Rowe and Slutzky's essay has been skillfully critiqued by Detlef Mertins, who calls it a "reductive and restrictive interpretation" of transparency.¹⁰ Mertins correctly points out the limitations of their exclusively formal analysis of phenomenal transparency, relying as it does on a two-dimensional, frontal reading of a building's façade from a singular fixed viewpoint, as if viewing a painting instead of experiencing a three-dimensional spatial construct.¹¹

The related concepts of transparency and translucency are also of course inextricably linked with the phenomenon of light, the luminous energy that has influenced architectural design for

centuries.¹² Early examples of translucent building skins can be found in such diverse instances as the soaring stained-glass walls of Gothic cathedrals, like the radiant Sainte Chapelle (1248) in Paris and the Choir at Aachen Cathedral (1414), and the white paper shoji screens of traditional Japanese architecture, like those of the Shoren-in Temple, built in the late thirteenth century in Kyoto (rebuilt in 1895).¹³ Many leading architects of the modern movement acknowledged the great theoretical significance of light to our experience of the built environment. Le Corbusier famously defined architecture as "the masterly, correct and magnificent play of masses brought together in light."¹⁴ Louis Kahn declared that "no space, architecturally, is a space unless it has natural light."¹⁵ Steven Holl, a central figure in the contemporary discourse on translucency, writes that "an attention to phenomenal properties of the transmission of light through material can present poetic tools for making spaces of exhilarating perceptions."¹⁶ Holl also observes that "light is for space what sound is for music."¹⁷

In addition to recognizing the qualitative and experiential impact of light and its interaction with architecture, this discussion also requires an understanding of the quantitative, technical aspects of light. The solar spectrum—what we call sunlight—actually consists of three distinct categories of light distinguished by differences in wavelength. Only one of these types, known as visible light, is perceptible to the human eye. Visible light occupies the middle of the spectrum (with a wavelength range of 380–780 nanometers). The other two types are ultraviolet light, found at the low end of the spectrum (300–380 nm), and infrared light, at the high end (790–3,000 nm). Visible light constitutes about 47 percent of the solar spectrum, while infrared is about 51 percent and ultraviolet light is just 2 percent. Each of these types is relevant to the design of building envelopes, but for different reasons. Infrared light converts to heat when it is absorbed by a material and therefore has implications for thermal performance. Ultraviolet light can have a potentially damaging effect on materials like fabrics and plastics and must therefore be blocked in certain situations. Visible light, however, obviously has the greatest impact when considering the association of light with the architectural conditions of transparency and translucency.



0.4 Literal transparency. Design Research Store, Cambridge, Massachusetts, USA. Benjamin Thompson and Associates, 1969.



0.5 Shoren-in Temple, Kyoto, Japan. Late thirteenth century, rebuilt 1895.

The physicist Richard Feynman has written about “the truly strange behavior of light” and its interactions with matter. His description of glass as a “terrible monster of complexity” acknowledges the many varied ways that glass can disturb or manipulate photons (particles of light) through partial reflection and refraction.¹⁸ It should be noted that no architectural material of actual substance is truly and fully transparent—a single sheet of clear float glass, for instance, in its basic form (without coatings or other treatments) typically transmits about 92 percent of the visible light striking its surface and reflects the other 8 percent. Such material, however, is normally perceived in application as fully transparent, depending upon environmental conditions and perspective. The light rays that pass through transparent glass do so relatively undisturbed. This contrasts with a translucent material, such as a sheet of sandblasted or acid-etched glass. The surface of this glass, which has been physically roughened through the application of sand or acid, essentially consists of a continuous network of faceted planes that act at the micro-scale as lenses that transmit light particles but divert them from their original paths. Through etching, the surface also acquires a matte finish and therefore reduces the reflective tendencies of the glass. Light becomes complicated; through refraction it becomes diffuse. When used in a building envelope, regular clear glass tends to oscillate in perception between transparency and reflectivity; translucent glass, particularly when rendered with a matte surface, tends to oscillate between translucency (when a light source is present on the other side) and opacity. The oscillation of transparent glass can be experienced at the Glass Pavilion (2006), designed by SANAA for the Toledo Museum of Art in Toledo, Ohio, where, depending upon environmental conditions, the tall double-skin walls of clear glass alternately provide a direct view through the wall or produce a multiplication of reflections that fills the glass surface with distorted imagery. The oscillation of translucent glass is apparent at the Nelson-Atkins Museum of Art (2007) in Kansas City, Missouri, by Steven Holl Architects, where the translucent channel-glass building skin can appear as opaque as stone or may glow brightly from within, depending upon the presence or absence of internal lighting.

When contemplating these issues of light and translucency, the



0.6 Glass Pavilion, Toledo Museum of Art, Ohio, USA. SANAA, 2006.

0.7 Nelson-Atkins Museum of Art, Kansas City, Missouri, USA. Steven Holl Architects, 2007.





0.8 Nelson-Atkins Museum of Art, Kansas City, Missouri, USA. Steven Holl Architects, 2007.

architect is obliged to consider a series of interesting dualities. The first, already mentioned above, is the necessity to engage two modes of architectural performance: the physical/technical properties of materials and their related phenomenal/experiential effects. A second duality relates to the passage of time and the diurnal cycle: translucent building skins often transform dramatically from day to night, creating cyclical variation in the character of interior and exterior spaces. And this leads to yet another: the duality of nature and artifice, relating to the source of light. Translucent façades typically transmit sunlight inwardly by day and electrical lighting outwardly at night.

Translucency is often defined by what it is not. It clearly stands in emphatic contrast with the dominant modernist theme of transparency, as seen in the buildings included in this book. Whereas transparent materials immediately reveal the space beyond, translucent materials do not. However, nor do they completely conceal the space beyond, as opaque materials do. Translucent materials are neither one nor the other, and for this reason, translucency is often identified with a sense of mystery or ambiguity. The architectural theorist Juhani Pallasmaa has written eloquently of the allure of ambiguity:

Mist and twilight awaken the imagination by making visual images unclear and ambiguous: a Chinese painting of a foggy mountain landscape, or the raked sand garden of Ryoan-ji Zen Garden give rise to an unfocused way of looking, evoking a trance-like, meditative state. The absent-minded gaze penetrates the surface of the physical image and focuses in infinity.¹⁹

In this sense, ambiguity can generate a productive complication of sensory experience. Architects who engage these ideas in their work often do so through the deliberate use of innovative cladding materials and fabrication techniques, resulting in building skins imbued with an enigmatic ambiguity. These constructions respond to the most subtle changes in lighting conditions, and, in contrast to transparency, fully reveal their nature only through the passage of time and through the exploration and experience of both interior and exterior space.

1

Solidified Light

MAISON DE VERRE, PARIS, FRANCE, 1932

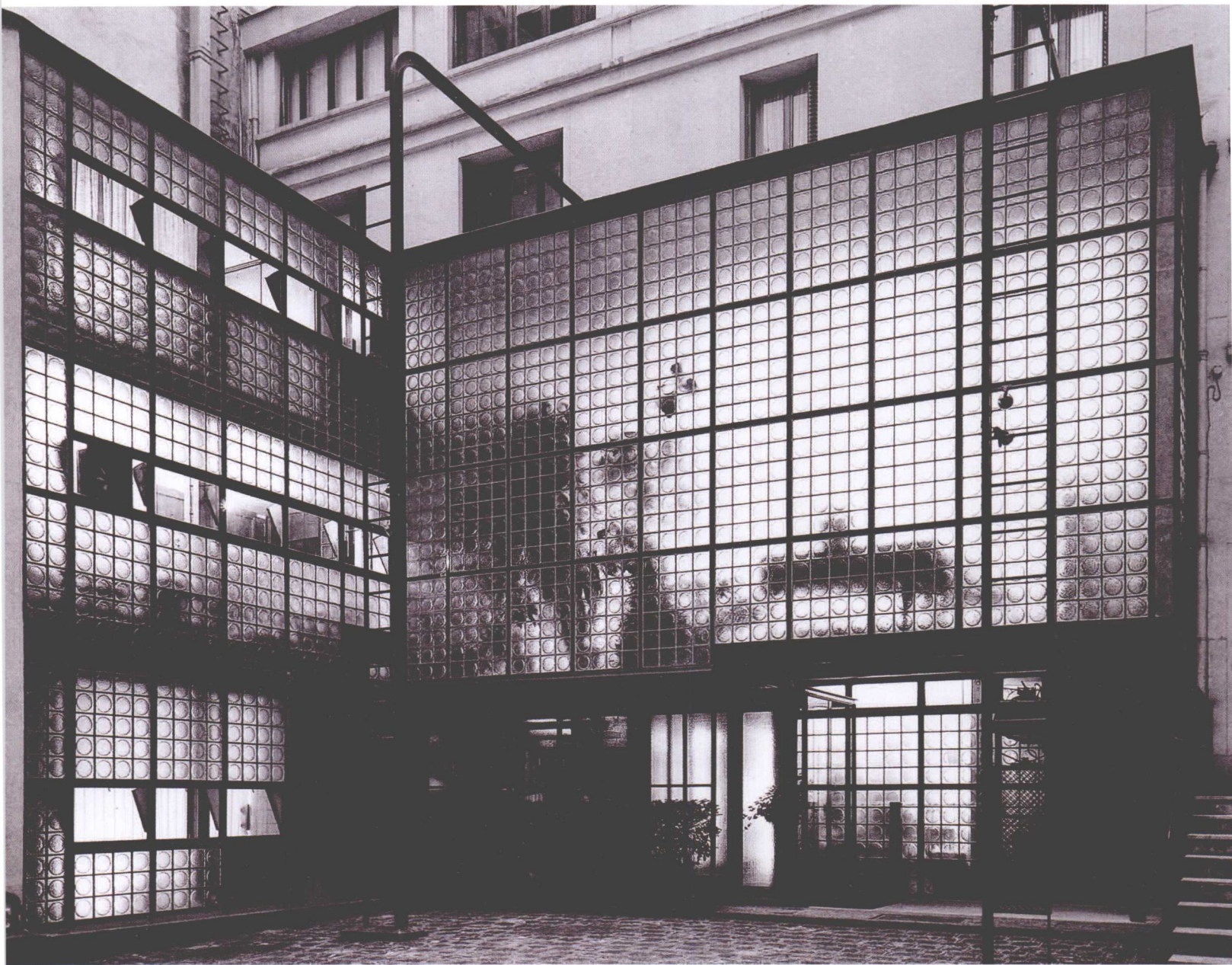
HIGGINS HALL INSERTION, NEW YORK CITY, USA, 2005



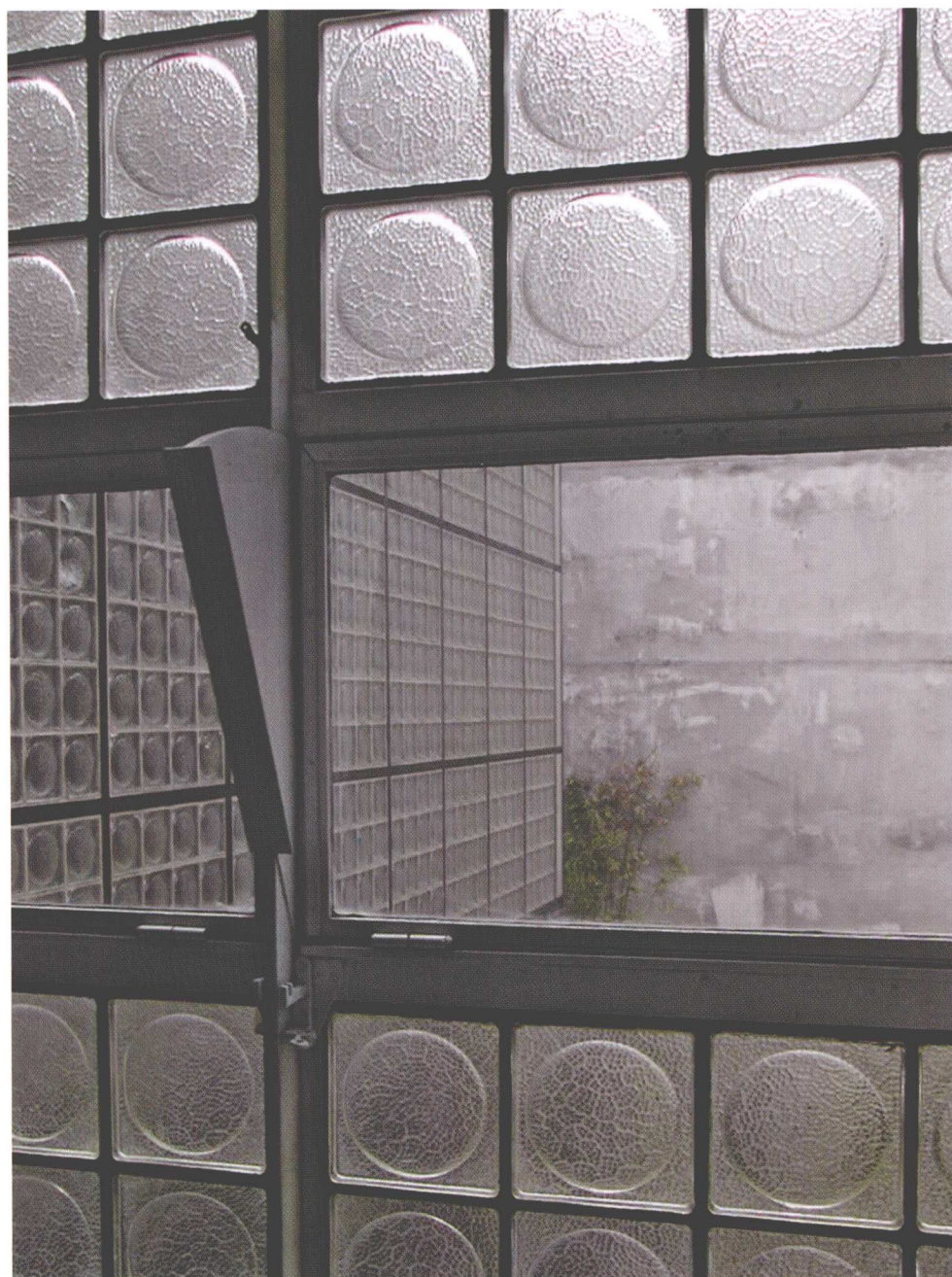
The related conditions of translucency and luminosity have been definitive themes in the work of Steven Holl, who writes, “The idea of trapping light or building out of blocks of light is something I’ve long been obsessed with.”¹ Indeed, Holl’s body of work, dating back to the late 1970s, clearly shows the numerous results of this fascination.² More recent designs for large-scale cultural institutions built around the world—beginning with the Kiasma Museum (1998) in Helsinki and including the Nelson-Atkins Museum (2007) in Kansas City and the Nanjing Sifang Art Museum (2012) in China—have focused, in part, on the development of innovative glass building skins that deliver the “trapped light” of Holl’s obsession.³ However, a smaller and perhaps lesser known project, located in Holl’s home territory of New York City, offers a particularly instructive case study of this pursuit. The Higgins Hall Insertion (2005) in Brooklyn, designed by Steven Holl Architects, houses the Pratt Institute School of Architecture and includes a distinctively translucent building envelope that infuses the interior with natural light and glows from within at night. It is also the project which most directly recalls an earlier twentieth-century building that has undoubtedly been influential to the work of Holl and other contemporary architects similarly engaged with translucency—Pierre Chareau’s *Maison de Verre* of 1932. This chapter will present an analysis of the unique enclosure systems of these two buildings, their material innovations, and the ways in which the condition of translucency is deployed to address concerns both practical and poetic.

Pierre Chareau had been primarily an interior decorator and furniture designer when he was commissioned in 1928 by Dr. Jean Dalsace and his wife, Annie, to design what would become *Maison Dalsace*, eventually known as the *Maison de Verre*, a house clad almost entirely in translucent glass.⁴ It would also be the defining project of Chareau’s career. Designed in collaboration with the architect Bernard Bijvoet, the *Maison de Verre* remained relatively obscure in the years following its completion in 1932 but has since come to be recognized as a canonical, yet still somehow estranged, work of modernism. *New York*

1.1 Higgins Hall Insertion, Brooklyn, New York, USA. Steven Holl Architects, 2005.



1.2 Maison de Verre, Paris, France. Pierre Chareau and Bernard Bijvoet, 1932.



1.3 Maison de Verre, Paris, France.
Pierre Chareau and Bernard Bijvoet,
1932.