RADICAL OPENNESS

Designing the glass theater
This thesis explores the glass box as a recurring architectural aspiration. The idea of using glass to dissolve the building enclosure has been a theme for centuries, particularly in western architectural tradition. By the early 1920s, the all-glass enclosure became a holy grail of sorts, inspired by the Crystal Palace, and German Expressionist visions of an enlightened, open society built entirely of glass. The glass box is most often understood within the context of modernist ideology, epitomized by the work of Mies van der Rohe, Philip Johnson, and the post-WWII skyscrapers of New York and Chicago.

Today, the continued pursuit of an ideal, pure and transparent building is visible in the proliferation of high-rises that demand structural efficiency and economies of scale. The building form has been appropriated and advanced by corporate brands such as Apple, and it has become a useful means of ‘imaging,’ or communicating the values of, the widely sought-after sustainable building.

Considering the Glass Box

Glass is both a substance and an ideology. It’s an apparatus that can be pulled and pushed in any direction.

Francois Roche
The reasons that make an all-glass building desirable are more elusive and varied than they may at first seem. In essence, the glass box embodies an ideal and paradoxical condition of immateriality that, in its purest form, can only be aspired to in buildings. This ideal has been revived again and again based on the material’s continuing ability to achieve new technological capabilities and historic association with the industrial sublime, the new, transformative and radical. Attached to this ideal are numerous possible claims for which glass becomes an effective means of expression: transparency, visibility, openness, slickness, modernity, simplicity, purity, etc.

But because a glass box, when built, is ultimately constructed of matter and placed on the Earth, the initial formal gesture confronts facts of structure, movement, sound and optics that force particular design decisions, such that no two glass boxes look anything alike. After a century of reinvention, the iconic and symbolic meaning of the glass box operates at a number of levels. For starters, the aesthetic and functional expectations of glass operate differently at domestic, institutional and large commercial scales, but even project to project, the glass box dazzles and blinds each in its own way.

The material limitations that force the ideal of glass to confront its true physical character have been raised by critics nearly for as long as glass walls have been attempted at a permanent scale. As technologies have improved, this tension has expanded and enriched the architectural language of glass. Discourse about transparency in architecture has extended beyond glass as a medium. Nevertheless, the ideal glass building is still a sought-after architectural goal, and in spite of more sophisticated discourse about materiality and transparency, the underlying aesthetic seduction often goes unquestioned. Meanwhile, to its critics, “the glass box” has become a synonym for a shallow aesthetic trap, with no sensitive regard for indoor environmental quality. Thus emerges a striking divide between the unquestioned architectural potential of the glass building in one corner of the industry and an equally unquestioned claim of its environmental carelessness in another. The central tension between the glass box as a means of expression and a physical condition is rarely discussed with equal respect offered to both.

Given this context, how do we understand the glass box as a real-world design solution today? Is it possible to express the compelling ideas glass evokes while designing with greater intention about how a person reads and experiences it? The objectives of this thesis are first, to better understand the specific ideas, metaphors and qualities that lead architects and clients to idealize a pure, platonic, transparent building, and then to propose a design solution to a real case study where the initial glass box “ideal” was challenged by physical constraints. The design proposal is a vehicle for understanding what notions of the “ideal” are preserved and compromised in order to realize the initial vision.

Chapter 1 maps different ways to understand the theoretical underpinnings of glass architecture. It includes taxonomies, perspectives and critiques that have been used to explain the desire for an ideal glass enclosure, drawn from the
literature as well as interviews with architects and design consultants.

Chapter 2 presents a journal of local projects that feature characteristics of an ideal glass enclosure. Local projects were selected for convenience but also for the reason that they do not occupy a global, iconic stature; rather they are used to examine how the functional and semiotic ideas are negotiated and resolved in normative practice, specifically in small institutional projects. The journal catalogues the stated functional and experiential aims of each, along with observations about what was built, what material properties are emphasized or stand out, and how the use of glass responds to its context. The chapter concludes with two case studies that trace the specific trajectory of design decisions that took each design team from the idea of a glass box to its material resolution.

The rest of the thesis focuses on one of these case studies for a desig exploration, in which a glass box became the winning proposal for a new performing arts center in Emeryville. Chapter 3 introduces the site and program for the Emeryville Center for the Arts and identifies the essential desires and claims that were made using glass, which form the basis of the design challenge.

The title of this thesis, “radical openness” was extracted from the language in the architects’ original competition submission. It was used in the written introduction to the proposal to encapsulate its central ideas of programmatic openness and its visibility in the neighborhood.

Chapter 4 illustrates the design approach used to address the specific aspects of “radical openness” claimed by the competition submission.
1. The Seduction of the Glass Box

If you look at the stores and the products you will see Steve’s obsession with beauty as simplicity - the Bauhaus aesthetic and wonderful minimalism, which goes all the way to the checkout process in stores.”

- Larry Ellison, Steve Jobs, Walter Isaacson 2012

A recent Detail Magazine issue on Glass Construction begins with a retrospective on the Broadfield House Glass Museum addition built in 1994, the first and largest reigning all-glass structure, held together only by glass and adhesives, no metal connections or fittings. The author uses the building to discuss the renaissance of highly glazed facades that began to develop in the 1990s, when glass technology “attained a level in which nothing seemed beyond reach.” According to this author, advanced coatings, curtain wall technologies and structural glazing systems reignited a dream set in motion by the Berlin avant garde in the 1910s and 20s. The Broadfield addition was in fact meant to be a built metaphor for our culture’s “prolonged fascination with glass.” The project turned out to be simultaneously an extraordinary manifesto - achieving new spans and adhesive connections - while being a complete failure in another way, due to excessive heat gain that prompted retroactive measures to keep staff comfortable.

The disjuncture between the ideas expressed by glass and the problems with inhabitability is a hallmark of glass architecture. It is easy to blame plain ignorance about heat flows and comfort, in a society dominated by visual media that has
grown accustomed to environmental regulation by mechanical means. But acknowledging this ignorance does not address what it is about a glass building that makes it so irresistible in the first place, particularly given how many projects with explicit environmental quality goals still gravitate towards glass. In the case of the Broadfield house, the author points to pure technical novelty, and predicts the return of more “sensual” applications of glass based on its obvious failures. “It is certain that once complete transparency was achieved, the original fascination with it dissipated.”

This kind of critique is somewhat of a deja vu; in 1951, Lewis Mumford wrote a scathing rebuke of the UN Secretariat building in which he predicted the end of the curtain wall on similar grounds; now that the fully transparent facade had been achieved, the shallow aestheticism of the international style would be exposed and people would tire of it, overruling it based on the experience of people inside.

*Paraded as pure engineering and applied geometry, this new skyscraper proves really to be a triumph of irrelevant romanticism.*
The narrative that glass technologies have hastened a revival of an early modern vision that failed in the 50s is a common story. What does early modernism teach us about the symbolism of glass? For corporate brands like Apple, the glass box is a physical manifestation of an idea, and architects and consultants routinely struggle to make sure the stores are also pleasant shopping environments. In the case of Apple’s 5th Avenue store, the store is physically removed from the box, placed underground, and the box itself is shielded from sun by the canyon of midtown Manhattan skyscrapers. For Apple, the aesthetic aim is squarely in the spirit of Miesian minimalism, in which less is always more. As told in his biography, Jobs insisted on replacing the eighteen panes of glass comprising Apple’s 5th Avenue glass box store entry with five enormous single lites simply because fewer elements, is always better, simpler, and “at the forefront of technology.” He took pride in the fact that he would have to build new autoclaves in China in order to produce the glass, just as they had for the original.

Artur Korn articulated the promise of glass according to Bauhaus principles as follows in his 1928 book Glass in Modern Architecture:

> The contribution of the present age is that it is now possible to have an independent wall of glass...and with this we have come to a turning point...it is the disappearance of the outside wall....the outside wall is no longer the first impression one gets of a building. It is the interior, the spaces of depth and the structural frame which delineates them.

The theme of liberation through the removal of enclosure - the load-bearing wall - is often traced to Paul Scheerbart, Bohemian novelist of pre-WWI Berlin and collaborator of Bruno Taut of the Deutsche Werkbund. Scheerbart’s manifesto Glass Architecture, is credited with providing a generation vivid descriptions of a utopian world made of glass. The promise is about freedom from enclosure, but through his writing, Scheerbart expresses the sublimity of glass by emphasizing its materiality; for example, the psychological benefits of colored glass, glass fiber upholstery, and the feeling of a luminous, translucent floor. He was aware of the heat gain, heat loss and infiltration issues that would have to be handled, and prophetically discussed innovations such as double-pane glass and double-skin facades. Similarly in Bruno Taut’s Glass Pavilion, the versatility of glass as a material is emphasized, constructing the “mass” of the building of glass block, capped by a colored glass dome.

In contrast, the Bauhaus concerned itself with generating a new design that could be read visually; “new objectivity” governed new forms, like light fixtures, that were designed to signify their use, rather than to improve the quality of use. The theme is freedom from enclosure, but the dominating tone focused on literal transparency -- glass as absence -- and spatial depth. But even among “functionalists,” rhetoric about the intent of this new glass and steel construction is a misleading wash over the material sensitivity these architects must have had. Mies van der Rohe, for example, was interested in the reflective qualities of glass, how light played against glass to generate a sense of both mass and transparency.
Beginning in the 1950s, critics began to unravel the idea of a single modern movement with a common stylistic vision. Colin Rowe and Robert Slutsky’s essay *Transparency: Literal and Phenomenal* (1964) argued that the ideas about transparency that fascinated architects in the early 1900s had as much to do with a phenomenal notion of transparency - providing new and alternate ways of reading space - as a literal one. In his 1959 essay "The Glass Paradise," Reyner Banham, like Mumford, discusses the disjunctures between functional objectives and reductionist aesthetic agendas that marked the modern movement. He describes the “glass legend” as a selective, “skeletal history” re-written based on false notion of reason, “with all the futurists, romantics, expressionists, elementarists and pure aesthetes omitted.” As told by Banham, the International style that was popularized had not only been based originally on expressionist notions of a liberating glass architecture, but that these earlier visions had been more sensitive to human experience.

The dislocation between a functional agenda and how it is expressed through glass is particularly complex for Le Corbusier, whose domino house and concept of the “free facade” is commonly regarded as the key progenitor of the all-glass curtain wall. 

> Now a house can be built of a few reinforced concrete posts...leaving total voids in between...what good is it, I ask, to fill this space up again, when it has been given to me empty?  
> Le Corbusier, in Banham, p 154

For Le Corbusier, the free facade referred to the freedom of the designer to compose a facade according to the needs of daylight, primarily for the benefit of human health. But in the quest for a new architectural language that could be read visually, the logical extension of the free facade was to embrace sealed, south-facing glass facades with controlled ventilation, according to Banham, only later to welcome back mediations like the brise soleil and “neutralizing wall” (Le Corbusier’s version of air conditioning) to handle greenhouse effects.
Put together, early modernism deputized glass to free society from the load-bearing brick and stone walls from old Europe, introducing three important dimensions to the symbolic expectations of glass:

1. An abstracted notion of environmental quality and social wellbeing
2. Freedom of the designer
3. An architectural language of progress, efficiency and economy

The glass box assumed a physical identity in the 1950s, when a confluence of interests accelerated the use of glass to clad commercial buildings. Meanwhile, float glass was invented in 1952, introducing an age of glass production that was to be more centralized and stubborn to technological experimentation. The modern aesthetic, coupled with technological innovation, the economics of the curtain wall and the potential to maximize glass size, rentable floor area, and structural efficiency, made this construction system appealing to the emerging commercial developer-driven building boom. At the smaller scale, the glass houses of Mies and Philip Johnson were built manifestos of the new modern style, exploring notions of domesticity and transparency, and connection to nature. Greg Castillo discusses three different “personas” of the glass building that became evident:

1. The commercial, a transparency deployed literally for people to see and sell merchandise.
2. the use of a glass facade to express a cleanliness or hygiene, as in the Lever House
3. the democratic persona, buildings whose images express openness and institutional transparency

Although we no longer hold the mythological link between glass and a clean, more democratic society, the Miesian, monumental glass box skyscraper is an enduring type.
THE SEDUCTION OF GLASS TODAY

In January, 2012, I conducted a few interviews with Bay Area architects and consultants to track how these desires survive in practice. In today’s commercial towers, a dramatic, unbroken view is enough to justify expansive, floor-to-ceiling glass, according to Leo Chow at SOM.

Chow was involved in the design of Poly Corporation Headquarters in Beijing, 2007, which has the largest cable-net wall system to date. In response to whether this extremely thin, clear, and light glass wall was about “absence” or “presence,” he said that the notion that glass is used to suggest an “absence of material” is obsolete; that the physical qualities of glass—smooth, delicate, dynamic—are exploited for their own sake, particularly at large scales.

The idea of literal transparency, the ability to literally see into the building remains a common stated desire of clients, particularly in describing the goals for corporate headquarters, according to sustainability consultants at Atelier 10 that I interviewed. The idea is to associate the company with a notion of honesty and generosity, the willingness to show the public what’s going on inside the company. This is fascinating given that some of the most iconic glass corporate headquarters are not situated in a particularly public context; the New York Times building towers above the public realm, buildings in Silicon Valley are usually isolated. Furthermore, seeing in requires lighting conditions that usually only occur at night, and assume occupants don’t take measures to block the lines of sight. Since these claims so often fail, they must not rely on the real condition, but depend on the representation of the building as an image, or advertisement for the company. The A10 consultants added that luxury and exclusiveness also act at an unconscious level in this image-building.

In 2008, a New York Post article on New York’s construction boom of the 1990s and 2000s adopts a similar position to Kahn: “The chief allure of glass in this era of deceptive exhibitionism is its usefulness in crafting illusion.”

Kramen and Schempp (1999) conducted interviews with 20 contemporary architects who had “realized important works in the field of glass architecture,” and provide a new construct for thinking about why designers love glass (Kramen and Schempp, 1999). The conversations revealed that the promise of glass has shifted away from having a mythologized connection to social improvement, but has now adopted the promise of being a “universal” material that can serve and address a range of architectural interests. The seduction of glass, as classified by the authors, is divided into three categories:
1. CONSTRUCTION. FORM FREEDOM
spanning, networking, hanging

2. SPATIAL TRANSPARENCY
open and flexible use of space
integration of interior and exterior

3. BIOCLIMATIC SOLUTIONS
the potential of advanced material,
construction, and analytical techniques
- harvesting solar energy
- light
- coupling with other systems for control
- Organic metaphor - the skin and systems working together...Glass has
the potential to become multi-functional and intelligent.

There is a notion that glass will continue to fulfill our myriad wishes for it until it
becomes the ultimate material: self-bearing, translucent insulation.

The infatuation with a “universal” material that can “do it all” lends itself to the
idea that’s its a good choice in most situations. That glass can have changing
surface and structural properties evokes the sense of design freedom and
flexibility, even if the design process is prescribed by any number of factors.

As of 2008, one might argue that this sense of “do-it-all” possibility has morphed
somewhat into a more defined interest in material specificity, one aspect of which is
multi-valent performance, the other is based on human perception. These themes
are present in Engineered Transparency, proceedings from a conference on glass
in contemporary architecture at Columbia University, featuring perspectives from
James Carpenter, Kazuyo Sejima, Beatriz Colomina and Elizabeth Diller.

Therefore glass architecture of the future should be able to speak
even more strongly about the sun
and the light, demonstrating more
openness and at the same time
flexibility with regard to the weather,
the seasons, and the different
conditions of climates. It will be a
brilliant, ecological and fantastical
glass architecture.

Georg Reinberg,
Krampen and Schempp, 1999

Werner Sobek, Glass House,
Stuttgart, 2000
Southwall.com

This experimental house by engineer Werner Sobek
is situated on a hill slope and it is intended to
provide unencumbered views of the city while also
being a sustainable tour de force: zero energy, zero
carbon emissions, and zero waste. It utilizes triple-
glazed panels, thermal storage, and solar panels
to offset electricity use. It is also designed to be
easily assembled and dismantled while also being
recyclable.
MATERIAL AND PERCEPTION

The discussion of SANAA’s Toledo glass museum is typical of emerging ways of thinking about the promise of glass, which is perhaps why it is one of the only projects featured in nearly all new books about glass architecture. The central goal of the project is to bring unrelated functions or processes into new relationships (in this case glass-making and galleries). Glass walls are physical barriers and visual connectors, but the curved form of the glass makes the dynamics of light present. The effect is a blurring and softening of views. SANAA assumes a Miesian “skin and bones” minimalism in their attitude toward glass, but the Toledo museum is not about bringing outside in or inside out, but being “suspended in the view” according to Beatriz Colomina.

Colomina discusses glass as an act of communication; “the relentless quest for greater fluidity between inside and outside is no longer simply a drive toward transparency. The glass box has become something else altogether.” There seems to be a return to the experience and perception of the user to highlight specific relationships, although it is still an experience based on sight.

As James Carpenter states, “transparency is too glib a word to describe the variables that glass expresses.” As he prefers, glass “reveals discreet information possessed by light” His work walks a fine line between art and theatricality for its own sake, and functional architectural integration. Defining the promise of glass in this way opens up the domain of transparency to other materials, such as colored or dichroic glass, aluminum and steel, screens, plastics, and layered, lensed or textured panels. Carpenter often combines glass
with reflective or colored metals.

Carpenter’s collaboration with David Childs/SOM on the 7 World Trade Center facade is the most high-profile example to date. The objective was to invert Miesian notions of revealing structure, by way of literal transparency, by showcasing the material character of the glass itself. For Carpenter, the glass box is about revealing and accentuating dynamic movement through the intentional manipulation and “calibration” of its optical properties, testing the angle, color, dimension, and texture of reflective elements. To enhance the sense of light emanating from the tower, Carpenter designed a curved, diffused stainless steel spandrel panel that laps under and projects through the low-iron, highly transparent curtain wall lites. The effect is to continually reflect the blue color and the local sky conditions, replacing the conventional, opaque spandrel band.

*I came to an understanding of glass as a substrate for light information...I came to understand the cinematic potential of glass as it interacts with light in the environment.*

Tracing the iconographic image of the glass box through books of contemporary glass architecture is a fascinating exercise. Each author selects buildings according to the way they understand the legacy or prevailing interests of glass buildings, and there are very few shared examples. It seems that the icon itself is fading away, even though qualities of “glassiness” and “boxiness” are still pervasive.
A number of projects for public galleries and performance spaces play on transparent materials and the manipulation of light for a phenomenal effect. Steven Holl’s Nelson Atkins museum in Kansas City is, along with the Toledo Museum, the other glass projected widely cited in current books on innovative glass architecture. In this project, Holl uses glass to “hold” light rather than to transfer it. Low-iron translucent channel glass filled with translucent insulation creates a curtain of light. A second interior skin of transparent single-glazing creates a cavity for services, including thermal regulation and fluorescent lighting that illuminates the wall.

Herzog and de Meuron also use a double-layered facade system with little fully transparent glass in the Laban Dance Center, in London, but the facade looks as if it records the dynamic changes of light and movement that it is subject to from without and within, as if it is a part of the performance. The facade uses transparent or translucent interior glass panels, which are placed based on view, and colored semi-translucent polycarbonate cladding panels, which are punctuated by large, reflective clear windows that catch the surrounding green landscape. Lime, turquoise and, magenta dyes for the polycarbonate are arranged compositionally. Interior photographs available are less compelling, the translucent panels creating a uniform, potentially glaring backboard.

Summary

Zumthor’s Kunsthaus in Bregenz is a glass box in which the glass is a translucent outer shell, like a rainscreen, for an opaque inner box containing an art museum. The objective of the museum is to represent the intersection of art and architecture that opens itself to cultural change.

*From the outside, the building looks like a lamp. It absorbs the changing*
light of the sky, the haze of the lake, it reflects light and colour and gives an intimation of its inner life according to the angle of vision, the daylight and the weather.”  — Peter Zumthor

The theme of layering and translucency that creates magical “glow” seems to be the fashionable counterpoint to the apple store and commercial facades aiming for the most transparent, thin, and pure clear facade possible.

The materiality of glass is often emphasized when used to contrast with an existing structure. There are several different kinds of interventions. Three important methods are: disrupting the existing facade, inserting new volumes, and re-defining new spaces from existing volumes.

Disrupting a facade can heighten the character of the building while signaling new use, often defined by light. In the Kuppersmuhle Museum of Modern Art in Cuisburg, Germany, Herzog and de Meuron chose to reinforce the scale of the relatively classical and uncomplicated but large brick building by filling in the existing windows and replacing them with slices of new glazing.

A similar device is used at arthouse in Austin, Texas by LTL Architects. Here, green glass blocks are lodged into the brick facade in a random pattern, the density of which is meant to signal spaces requiring more or less light. From the outside, the protruding glass blocks turn the wall into a dynamic art piece. From the inside, the nature of the existing brick wall is set off by the strange glass inclusions.
Inserting is another intrusive innovation that happens at a more inhabitable scale. Bad examples of this strategy are the crystalline growths that some historical buildings have acquired. But inserting a new glass volume into an existing framework can highlight the existing structure and show how that it has been transformed and adapted to new uses. The Town Hall in Utrecht Netherlands provides one example for inserting.

Finally, the planar quality of glass can be used to delineate new spaces formed out of existing walls. Renzo Piano’s Morgan Library is a good example of the use of glass to indicate a new mode of circulating through and inhabiting an existing set of buildings.
I have come to understand the promise of the glass box on two basic levels. The first is purely semiotic and aesthetic with roots in modernist notions about a minimal, essential architecture equated with innovation and modern transformation. A search through iconic imagery and modern theory and criticism shows that the “modern look” has numerous resonances and is capable of redefining itself according to the limits of technology.

Central to the symbolic power of glass is its ability to unsettle human expectations of mass and gravity that are based on our reliance on vision.

The second way to understand the seduction of glass relates to the human benefits of dissolving boundary conditions that are often used to justify the glass, including seamless spatial continuities with the outside while staying protected, a phenomenal relationship between spaces or to light, unencumbered views, and access to daylight and the sense of time, weather and orientation that comes with it. This set of claims can be said to be “functional” but not necessarily “measurable.”

The dilemma of the glass box is the ability to conflate and confuse these functional claims with the aesthetic or expressive desires of glass. The challenge, then, is to conceive of a glass box in which its functional achievements (programmatic openness, connection to nature or between public and private) reveal themselves, by using glass in a way that heightens specific relationships.
2. JOURNAL OF LOCAL PROJECTS

Glass is very interesting because the viewer’s impression of it changes not simply because of his or her relationship to it, but in conjunction with other factors...for example, glass changes dramatically if it is positioned in front of a very bright surface or a dark surface, a shallow space or a very deep space. Exterior glass is also influenced by the sun’s position.

Kazuyo Sejima, from Matter in the Floating World 2011

My interest in looking at local projects was to understand how the iconic notions of glass played out in normative practice and smaller scales that I could visit. I identified five concrete themes in the claims made for the glass: presence of the outdoor environment, either 1) nature, 2) the presence of sky, 3) view and prospect; 4) a modern “look;” and 5) material counterpoint to an older, usually masonry structure. The idea of visiting the projects was to build a connection between the claims made, and the material properties that came to the fore when visiting the completed project. During my visits, I focused my observations on optical clarity, orientation, sources of light, and containment, relationship of the glass to ground and mass, and the assembly and structure of the glass.

For two projects, The Exploratorium at pier 15-17, and the Branson School Student Commons, I was able to collect additional information from the designers about how the functional and expressive ideas of glass were prioritized and negotiated through the design process.
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- **ORIENTATION + CONTAINMENT**
- **RELATIONSHIP TO GROUND + MASS**
- **ASSEMBLY + STRUCTURE**
Although not an example of current practice, the conservatory was included as a book-end to the historic legacy of glass buildings. It was one of the only sites where it was difficult not to be conscious of being inside a glass building as opposed to a building with a very transparent facade. For one, there is continuity in materiality and scale between the wall and vaulted roof. The building is also unapologetic about the material nature of glass. The scale of the framing retains a delicateness despite how much framing there is. The white wash on the glass, not original to the design but typical for conservatories, is roughly 75% opaque, it does not totally diffuse the direct sun, which is nice, but there is virtually no visual transparency, except at entrance ways. Given that the purpose of the building is to transport its visitors to an exotic natural environment, a removal from the nature outside, this makes sense. Interestingly, this building is the most glazed and also the most contained. Running water, humidity control, air movement from ceiling fans, and colored sprites from the stained glass ribbon accentuate the "refuge" qualities of the building.
The Ideal glass box in this case is not about views and visual transparency but about the material of glass. The stated goal was to create a daylight and natural ventilation-infused, flexible and inspiring studio space for glass and sculpture students. At the scale of two stories, and supported by a low-profile 4” wide flange frame set off from the building structure, the facades don’t read as glass block at first. The building is set on a concrete plinth, exempting itself from the un-level ground plane. Unlike a plane of clear glass, the glass block transmits and reflects light such that interior and exterior sources of light are easily differentiated, so the dimension of the interior volume is in a sense easy to define from the outside even though interior forms are heavily blurred.
An extremely thin and transparent glass box caps the central entrance court of a small mausoleum. The building is organized by square atria that flank this central court and it is entirely sky-lit. My impression of the glass box clerestory, set off from the thick walls, was that it created a very serene interior space and under direct sunlight acted like an inverted oculus, elevated enough so that visitors are protected from the angling sun but offering the perception of being in close contact with the sky. The space felt naturally cooled by the mass of the walls but could have been air-conditioned. The scale of the glass is such that very little steel support was needed and the insubstantial feel of the glass is convincing. Structural glass mullions 6” wide and connected with brackets beyond the ceiling plane helps achieve this feeling of ethereality.
On their web site, Jensen Architects describe the vision for the rooftop sculpture garden as “an oasis for art.” The project features an extremely clear, thin and flat panoramic low-iron, single-pane window that replaced the entire back wall of SFMOMA’s 5th floor galleries. The stated goals for this glass facade were to achieve a very minimal, modern look, and to provide an elevated view of the garden, as if “a landscape painting inside the gallery.” Support for the large structural glass system had to be hidden below the floor and above the ceiling, resulting in bands of thickness that were a compromise for the architects. But the precise way that the glass met the floor and ceiling was carefully detailed.

The northeast orientation of the garden is such that sun hits the glass wall only in the early morning, prior to the museum’s opening. For these hours the museum lowers black-out shades to protect the space.
The de Young is included in this study as an inverted use of extensive glass walls to connect inside and outside - the glass splits the building volume into a series of intimate, uninhabited, vegetated courtyards.

Framing and reflectivity of glass as well as its oblique positioning all allow the glass to act foremost as a mirror plane, catching and casting images of outside and inside across each other. Glare from interior overhead lighting and exterior copper cladding both in courtyards as well as silhouetting views out, interfere with a more sensitive connection to light and nature inside.
Even though the CAS is not glass on all sides, the large, rectangular plan and use of glass as a “neutral” fill between the existing masonry buildings and the roof dominates the form. Although the construction is relatively delicate, with very clear glass and thin, tension cable support structure, it has prowess because of its scale and technical look, and thus does not come across as immaterial. From the exterior, the layering planes of glass which include the walls of the glazed, central piazza causes a frenzy of transmitted light and veiled reflections. Admissions are accepted at the plane of the front glazed wall, accentuating the sense that the wall is a decisive threshold between public and private.
Turnbull Griffin Haeslop

GLASS: PPG Solarban 60 (clear)
Solar Heat Gain Coefficient: 0.38
Visible Transmittance: 70%
Reflectance: 11%
Winter U Value: 0.25

The new student cafeteria and lounge takes the place of an open field in a hilly, green suburban neighborhood. Ambitious energy goals led to a design centered around daylight and natural ventilation, and in the architect’s words “having nature present.” For achieving an inside-outside connection, “nothing is better than glass,” according to the architect. The diagram of the building is an entirely glazed, simple shed flanked by two shorter, solid volumes, such that the northeast and southwest facades of the central volume are filled. The glazing is supported by relatively thick wood-capped mullions that alternate with the large wood columns supporting paired trusses that span the shed. Although extensively glazed and designed to literally open large garage-door-sized areas of the facade to the outside, the apparent integration of the glass with the building’s structure differentiates this building from the more ultra-modern-style cases.
The design of the window mullions and structure was to deliberately enhance the notion of transparency - the smaller panes are supposed to create a filigree or screen that softens the sun somewhat and breaks reflections on the exterior, so that the glass surface does not assume a more massive, material appearance.

Having both ends of the shed glazed was important for the kind of transparency desired - from the outside, one is meant to be able to see through the building, dematerializing it as an object.

The most interesting compromise between the building’s initial diagram and the final design was the filling in of clerestory level windows above the flanking solids so that the shed could be read as truly independent. The daylight was not necessary and so the extra cost of glazing this band couldn’t be justified.
Detailed Case Study:  
EXPLORATORIUM AT PIERS 15-17  
SAN FRANCISCO, 2013  
EHDD Architects

The architects debated the glass box proposal early on in the project, since they knew it would not be the most energy-efficient option - but ultimately it was an idea that “everyone fell in love with.” The simple glass form, designed to house exhibits about optics and view, would be set off from the existing historic pier building, acting as an aesthetic and material counterpoint. It would provide visitors a different relationship to the bay from within the exhibits, and provide passersby a compelling view from the Embarcadero.

The two most important factors effecting the ultimate detailing of the glass were the project’s strict zero-energy goals, and the large number of interested parties involved in the design: 30 groups in total. Early on, it was determined that the best insulated, spectrally selective glazing system would not be sufficient to manage heat gains. Because of the driving aesthetic of the building’s simplicity, the client decided against external louvers, as they would appear to residential and busy,

“the funny thing about glass is that it’s supposed to be invisible. Obviously, it’s not.”

Rick Feldman, EHDD Architects

GLASS: Viracon neutral low-e VNE63
Solar Heat Gain Coefficient: 0.29
Visible Transmittance: 62%
Reflectance: 10%
Winter U Value: 0.29
and obstruct views. Exhibit designers insisted that a clear view out was necessary, leading them to select a 40% light grey frit pattern to balance reflectivity and visibility. It is graded on the second floor panels to retain a clear band at view level in the exhibit space. This grading was decided despite the architects’ and lighting consultant’s efforts to convince the exhibitors that a continuous frit would be easier for the eye to edit out and look more monolithic. A clear band was also retained in the clerestory level to increase daylight levels.

The exact pattern and color of the frit was tested in several iterations in physical model and full-scale mock-ups under different lighting conditions. The decision to go with frit limited available products, however, since it had to be placed on the #2 surface of the glazing unit along with the low-e coating, and set on tempered glass. This narrowed available products to one.
In 2008 the city of Emeryville purchased a 30,000 ft² factory building, located directly behind City Hall, to house a new integrated arts center. The center is the latest step in an ongoing strategic plan to bring greater regional focus to the old industrial city, which is both isolated from its more populous neighbors while being ideally situated. The 1940s building originally housed the United Stamping Company, and until recently it was an operational factory, manufacturing products such as accelerator pedals for military transport vehicles and brackets for medical monitoring equipment.

In 2011, Emeryville recruited five emerging local architects to transform an existing one-story factory building into an innovative arts space that was to become a “focal point for the arts in Emeryville and a regional attraction.”

The panel selected the submission from Jensen Architects, featuring a three-story glass theater at its centerpiece. In the drawings, the simple yet dramatic formal and material intervention casts an inspiring newness to the block without de-facing the brick relic of Emeryville’s industrial past - instead, this past is honored and rehabilitated.

The proposal responds to the values put forth in the competition brief of community integration, artistic innovation, and the desire for a visible landmark for the city of Emeryville. At its essence, Jensen proposed a simple, intervention to join the inherent spatial and historic value of the open-plan factory building with the surrounding public space. The proposal preserves all but the two inner-most bays, converting one into the 35-foot glass theater, and the other into a courtyard that links Hollis street and the back parking lot.

The Jensen proposal exemplifies many of the historic themes of the glass box so far discussed: functionalism, modernization or transformation, programmatic openness, and ecological thinking, specifically, the ability to dynamically respond to changes in spatial and environmental conditions. Most importantly, it has the “glow” factor, the ability for the building to be a physical manifestation of an idea that acts like a sign for the arts center and an icon for the city.

In the list on the facing page, the claims that are present in the submission are pulled out from the long list of desires and ideals that have historically been associated with glass generated in the first chapter. Altogether, the boards are composed to illustrate how connectivity between the public street and stage are achieved through the simple formal move and use of glass.
**FUNCTIONAL CLAIMS**

**STRUCTURAL**
- Structural Efficiency
- Structural Freedom

**SPATIAL**
- Programmatic Flexibility
- Spatial Re-Interpretation
- Freedom of Movement
- Revealing Interior Activity
- Making Space Legible
- Display
- Light Activating Space

**ECOLOGICAL**
- Presence of Outdoor Environment
- Presence of Sky
- Unencumbered View, Prospect
- Dynamic Interaction with Light, Sun
- Maximize Daylight
- Cleanliness, Health

**SEMIOTIC & AESTHETIC CLAIMS**
- Explicit + Implicit

**Seamless Connection**
- Openness
- Honesty
- Connectedness
- Pure Space
- Essentialized Space
- Simplicity
- Neutrality
- Structural Expression
- Factory Aesthetic/Utilitarian
- Material Contrast
- Innovation
- Transformative
- Advanced Future
- Novelty
- Discovery
- Modern Look
- Sheen

**Images: Jensen Architects**
In the proposal’s verbal description, Jensen makes three explicit claims for a glass theater:

1. **The “RADICALLY OPEN” STAGE**
   The stage as a “continuous field,” linking stage, building and city, facilitating “unconventional relationships between inside and outside...artist and audience.”

2. **“WORKSHOP ATMOSPHERE”**
   The simple, open plan, and “structural expressiveness” of glass and saw-tooth steel frame is meant to evoke a utilitarianism that honors the existing factory building while also being an inspiring, unencumbered space for creative exploration.

3. **LITERAL TRANSPARENCY**
   Related to this is the desire to act as “built signage” by exposing the program using glass.

Soon, these explicit claims form complex associations with other implicit values and historic precedents. Programmatic flexibility is an essential component of these design goals, both in terms of the ability to literally reconfigure space as well as by challenging the traditional entry sequence of the theater. Meanwhile, the building must be LEED certified according to a city ordinance, and the presence of the outside environment via glass is featured prominently in the Jensen submittal, if not addressed verbally. This includes greenery in the courtyard and descriptions about farmers-market activity in the tree-embellished parking lot, to diagrams explaining how the skin allows for passive heating and cooling and daylight.

These ideas are positive and compelling, and dead on the mark for the competition. However, after the project was selected, the performing arts groups who would be using the space voiced concerns about lighting and acoustic control; these in addition to budget limitations forced Jensen to revise the design to include less glass.

This thesis takes on the challenge of designing a glass theater that addresses the idea of “radical openness” but acknowledges that the theater is not an outdoor but an indoor one, with the need to control light, sun and sound. The insertion must also enhance and draw public attention to the program.
TRANSFORMATION
Illuminating the existing context

“RADICAL OPENNESS”
Stage as continuous field

PRESENCE OF OUTDOOR ENVIRONMENT

DYNAMIC FACADE

“CONTINUE STRUCTURAL EXPRESSIVENESS”

“UTILITARIAN SPIRIT”
FACTORY AESTHETIC
MODERN IMAGE

EXPOSE PROGRAM
“Built Signage”

PROGRAMAMTIC FLEXIBILITY

“UNCONVENTIONAL RELATIONSHIPS”
- Artist and audience
- Inside and outside

SOLAR HEATING
DAYLIGHTING
PASSIVE COOLING

FACTORY AESTHETIC
MODERN IMAGE
3. SITE AND PROGRAM: THE RADICALLY OPEN STAGE

The building has long facades that face SW and NE, and it sits on a busy intersection between a big-box shopping center and high-density residential development to the south, and City Hall and Pixar Studios to the north. The parking lot and alleys behind the building are quiet and pedestrian-scale, with similar one-story industrial buildings that have been converted into small offices and lofts.

The existing building presents exciting opportunities for the design goals of transparency because it stands in unapologetic contrast; an inward-looking, low-rise, generic, brick mass. At the front facade, it is easily missed in the relatively fast-paced, auto-focussed context. Its load-facade with punched windows is an unbroken wall lining the sidewalk, revealing no hint of the entirely open interior space, where wood trusses standing on slender, wood columns support five vaulted bays, punctured periodically by skylights.

In essence, the goal of the design is to infuse this building with new life and reveal this process to the city.
EXISTING PLAN AND SECTION
1/64" = 1'

EMERYVILLE BIG BOX SHOPPING CENTER

40TH STREET
The existing building and ghosted massing of the Jensen proposal as seen from Rudy’s Cant Fail Cafe, at Hollis and Park Avenue. City Hall is directly to the northwest.
The existing building and ghosted massing of the Jensen proposal as seen from Rudy’s Cant Fail Cafe, at Hollis and Park Avenue. City Hall is directly to the northwest.

The approach from the parking lot shows the “back-bay” neighborhood fabric: quiet back streets and other brick factory buildings.

Images: Jensen Architects
The Emeryville Center for the Arts set forth a challenging program that included a full gamut of performing and exhibition arts. The competition brief lists a vision mixing installation art, open studios, small galleries with cutting edge art, a cafe that exhibits drawings, and a bar/dance club with temporary exhibitions and performances. Classes and school programs are central to the program, as is a major gallery space and a theater. As an adjunct to the gallery space, an artist may take residence and set up a studio and exhibition.

The centerpiece is an “unconventional” proscenium stage with acoustical isolation and the ability to darken the room and re-arrange seating. Performances may include acting as well as dance, music and spoken word. The aims of the center are in the spirit of the black box theater, with a loose, informal flexibility in how the performers set up a relationship with the audience.

The “radical open-ness” of the proposed venue depends on the stage being an indoor yet “public” space, the existing building getting broken open and infused with the natural creative life that exists in Emeryville. This idea is wedded to the idea of an essentialized, utilitarian space where architecture and performance inform each other, rather than architecture providing a kind of precious, or perfect performance space. This resonates with emerging interests in site-specific, pedestrian performance, in which conventional notions about the “space” of the audience versus that of the performer are challenged.

These themes have historical links to modernist mythologies of utilitarianism and open-ness ascribed to glass buildings that have been challenged. To discover how a glass wall may be called in service to these aims, it is worth exploring the quality of “openness” with respect to a theater specifically.

The “openness” of a theater is not a new design question. The theater is a fascinating venue for considering glass since it is one of the only programs in
**GALLERY 10,000 ft²**
- flexible wall system
- light, thermal and acoustic control, UV protection
- immersive environments and performance
- loading dock and shop

**ARTIST RESIDENCY/ARTTEK LAB 1000 ft²**

**WORKSHOP SPACE 1000–1500 ft²**
- for visual and performing arts, K-12 classes, natural light

**THEATER (200–250 seats)**
- non-traditional proscenium
- flexible seating
- acoustical isolation from street
- rental sprung dance floor
- loading dock and shop

**PUBLIC ART** on Hollis and 40th street facades

**CAFE and CLUB** (100–150 people)
- 8-person music ensemble
- light and acoustic control

**CATERING KITCHEN**

**GIFT SHOP**

**OFFICES and CONFERENCE ROOM** for 15–20 people
which “openness” can mean the complete removal of architectural signifiers or connectedness with context, in order for the audience to immerse completely in the environment set by the stage. This is the black box idea, which emerged in the 1960s to replace the heavily ornamented and prescribed proscenium stage. The black box challenged the relationship between the performer and audience, opening the way for thrust, transverse, and in-the-round staging arrangements. Regardless of the arrangement, performances with stage sets are often about transporting the viewer into an imagined setting. Alternatively, they may attempt to strip away all setting and rely purely on the body and light to convey drama. On the other end of the spectrum, some contemporary performers - often through dance - subvert conventional ways of thinking about the body in space, or the “stage” versus the “audience,” using the existing architectural context. Rather than the context for the performance being carefully prescribed, action becomes a “happening” on a site.

George Melies’s glass film studio provides an interesting precedent for the idea of the glass theater. It is the “essential,” primitive hut of theatrical production, designed to maximize sunlight while protecting sets from wind and rain. Paradoxically, like the conservatory or the crystal palace, the glass is not about connecting inside to outside but rather about controlling indoor conditions in a specific way in order to immerse the visitor by manipulating visual and spatial effects using light. Whether intentional or not, glass can manipulate the visual, lighting and thermal conditions of the spaces on either side, and this potential can be brought to bear in a theatrical environment. Rather than ignoring or controlling these conditions of glass, a radically open theater would embrace them.
The mythological glass box also addresses the heart of the unresolved question of a theater’s integration with the site. Typically, the theater is a large, conspicuous opaque box, mediated by a front face that provides a portal for the public. Any attempts at redefining that box to become anything more permeable or variegated redefines conventions of how performers conduct themselves. Highly transparent glass facades are popular for the front facade of the theater space. In SANAA’s De Kunstlinie Cultural Center in Almere, Netherlands, and OMA’s Wyly Theater in Dallas, this conspicuous opaque box is pushed to its purest expression, with a band of glass welcoming the public into the volume. While neither project is about glass, both are about re-thinking the arts through simplicity of form. In the case of De Kunstlinie, the design is supposed to provide similar spaces to a diverse range of programs, eradicating hierarchies. At the Wyly Theater, the traditional theater is turned on end with back-of-house in the upper floors, and the whole building working as an elaborate system for reconfiguring and supporting the stage.

The idealized glass wall has also been a common means of transforming the art gallery throughout the 20th century, including some of the most iconic glass buildings. A comparison of these buildings, however, reveals the diversity of theoretical and stylistic attitudes regarding the function of glass as a mediator between the public and the interior program.

For example, the recent glass pavilion at the Toledo Art Museum has been compared to the pure minimalism of Mies van der Rohe. Like the glass pavilion, Mies’ New Berlin National Gallery, built in 1968, is a single-story, platonic glass
volumes in general form, with a sense of a simple, open, pavilion-like plan. Both designs exploit glass for its pure, optical transparency, but in the case of Mies, the glass is used to make the walls as irrelevant as possible, so that the large steel slab hovers improbably over the street; whereas in the Toledo museum, the building is about the glass itself, and more importantly, the visitor’s experience of glass, making the dynamics of light present. Neither gallery uses glass to bring focus to the art contained within. As icons, they are more about the relationship of the visitor to the building.

The diagram below demonstrates the ways in which the arts programs at the Emeryville Center’s set up a set of relationships with the public.

The art space that is truly “open” or flexible should acknowledge the diversity of ways in which art can be revealed to the public, and in which subject and audience occupy space. Most likely, the neutrality and singularity of a glass volume would be more customary than radical. With the glass box, values of “open” and “closed” can be easily conflated with other dualistic criteria that relate to program. Some describe fluid spatial qualities (like “light” and “dark”) while others are descriptive and definite (like “private” and “public” access). “Transparency” and “opacity” describes a threshold between spaces, not a space. These complex and dynamic criteria inform how I understand the opportunities and liabilities for transforming this site and program using glass.
4 Design

If the material dictates architecture, we overlook the importance of human beings.

Takaharu Tezuka, from Matter in the Floating World 2011

Glass is just one architectural tool of many to achieve a sense of openness, flexibility or visibility; in fact, other tools might be better. Furthermore, in terms of material properties, glass is not the only material that can be brought to bear to transmit or reflect light and view. Diffuse plastics, metal, ceramic, paper or wood screens, or reflection of light off of matte opaque surfaces can all be used to manipulate how light reveals space or activity. Furthermore, glass often achieves adequate thermal or visual control only when layered with another material or a second skin of glazing. At a certain point, confining the project to glass seems limiting and arbitrary. On the other hand, at some level the desire for glass must be taken at face value, because it’s impossible to unravel all of the layers of meaning that have been associated with it.

This proposal starts by taking the glass box at face value, but responding to the basic need to be able to control light and sound in the main theater. Rather than enclosing the theater directly, the glass forms a sheltered isle that provides extra theater capacity, auxiliary gallery space, and a sun space in the winter. Sliding doors allow the theater to open into this space. This circulation zone marks a
change in the programmatic use of the north and south parts of the building, and links them. In this case, very clear, structural glass is used to define a transient zone that connects, buffers, and propels movement, rather than a single threshold. The literal transparency is accentuated by the fact that the space behind is narrow, more consistently lit, and activated by people moving close to the edge. On the east and west sides, support spaces for the theater (back-stage, loading, set shop, sound booth, vertical circulation) also occupy this band, exposing the back-of-house, which is less sensitive to privacy, directly to the public.

Although the theater might at first read as a single glass volume from the street, the four facades are treated as independent planes, with specific attitudes about the public spaces they face. In the back, the glass becomes a surface for rear-projection, able to transform the “back bay” parking lot into a plaza. The glass box intrudes on and envelopes a piece of the parking lot, which is raised three feet above the ground level. The volume borrows this ground and brings it into the stage. An adjacent back entrance is called out by the protruding back-stage and excavated to the level of the street. This entrance primarily serves theater-goers attending a more “formal” performance, and they enter into the main theater lobby.

On the west, a permanent frit pattern and space for rotating applied signage turns the glass front into a billboard and sun screen. The front plane aligns with a jog in the existing building, inviting the sidewalk on Hollis to enter the building.

Upon entering the building, the sense of a singular volume breaks down, and a visitor finds herself in a field of planes of varying opacities, oriented to reinforce a sense of permeability to vision and movement parallel to the main axis of the building. Translucent glass and screen act as devices for revealing adjacent programs, as if sliding past each other in space. Depending on the source of
light, the glass protects and separates the art display and performance spaces, while preserving an awareness of the activity on the other side. For example, from the gallery

From Hollis, the visitor slips in off the street past a central reception desk, theater circulation and soundbooth, and is immediately drawn to the light of the courtyard, at which the glass peals away into the rest of the building and orients the visitor to the different programmatic areas: a cafe and small stage beyond, a gallery across the courtyard, and a stair leading past the back stage, up to the upper level isle gallery and terraces.

In fact, the way that the glass is not organized as a singular volume at all; rather, walls of varying opacities are deployed to reveal program by designing carefully for movement and view.

The earlier local case studies demonstrated that aesthetic and functional outcomes of glass are contigent in part upon the situation of glass with respect to programmatic volume, mass and ground. For example, the 5th avenue Apple store is rendered pure by its particular situation among surrounding towers, and above the subterranean retail space.

To create a “radically open” stage, this design uses glass to set up a range of containment conditions in which multiple venues can be imagined and multiple events can be staged. The degree of containment is determined by the degree of control called for by each programmatic area and by the nature of thresholds people encounter as they move in from the street.
View towards Hollis through isle gallery, with view to courtyard and theater.

View to courtyard from entry, with sound booth revealed.

View back to courtyard from cafe with back-lit gallery revealed
Conclusion

Jensen’s central claim for the glass box was that it would become (and symbolize) a radically open stage, one that is continuous with the public space. This proposal acknowledges the diverse set of ways that audience and subject occupy space and aims for a multiplicity of spatial conditions that can be re-interpreted, and “staged.”

This design does not put forth an alternative singular vision to counter Jensen’s glass box proposal. The design proposition is the setting up and resolution of particular moments where performance and display can be staged, and moments where this staging breaks apart the brick facade of the existing building to draw people in. The process for considering glass in this design was to take each moment (the form and expression of the theater, the role of the courtyard, the placement and intersection of other programmatic areas), and ask “if glass were used in this particular condition (for example, to enclose a theater), what material and programmatic relationships would be necessary in order to realize specific experiential benefits particular to glass, while minimizing its liabilities for the adjacent areas? Thus ultimately, the design was not about the glass, but proceeded with a simultaneous consideration of the contextual architectural conditions.
READINGS
THEORY AND CRITICISM OF GLASS BUILDINGS


Exposes Bauhaus ideas as fundamentally “expressionist,” and talks about the tendency to re-write (i.e. Arthur Korn) the modern movement as being one of reason, a “skeletal history, with all the Futurists, Romantics, Expressionists, Elementarists and pure aesthetes omitted.” Respectable genealogy of the “glass legend” from two sources: 1) Hermann Muthesius, DeutscherWerkbund, and. 2) SigfriedGiedion, Bauen in Frankreich, 1928.


A study of the ways in which mass culture - a mass culture which Barthes sees as controlled by la petite bourgeoisie constructs a mythological reality and encourages conformity to its own values. We inhabit a world, then, of signs which support existing power structures and which purport to be natural.


Describes the fraught gender, authority, and privacy issues associated with the Farnsworth House commission and Mies’ aesthetic objectives.


Provides an alternate reading of the Crystal Palace - and by extention all-glass building - as a device of covert social and political control based on the lack of specificity, distracting and multiple lines of sight, and insidious “barrier of the senses” that the expanse of glass creates.


Presents history of “the new architecture” of the 1920s, including the early work of Mies Van der Rohe, the Bauhaus at Dessau and the Weissenhofsiedlung in Stuttgart. Glass is “…the great membrane, full of mystery, delicate yet tough.”

Mumford, Lewis. 1951. “Magic with Mirror.” *New Yorker Magazine*.

Scathing review of the UN Secretariat building, predicts the end of the curtain wall.

Seminal essay establishing a distinction between literal transparency - being able to see through - and phenomenal, which is the ability of a design to facilitate multiple readings of space. The author’s project is to expose the complex and varied ways, beyond glass, in which architecture provides the kind of transparency sought after by early modernists and avant-garde artists of the early 20th century.


“[a new society] only becomes possible if we take away the closed character from the rooms in which we live. We can only do that by introducing glass in architecture.” Scheerbart foreshadows many technologies we now take for granted, including double glazing, heat sources in cavities, electrically heated carpets, self-opening windows, air conditioning and movable glass partitions and night architecture.

Tanizaki, Juni’chiro. 1938. *In Praise of Shadows.*

Vidler, Anthony. 2005. *Architecture between Spectacle and Use* (essays)


Discussions of current technical, perceptual and political topics regarding glass and architecture, including contributions by Sejima, Reinhold Martin, James Carpenter, Beatriz Colomina, Steven Holl and Werner Sobek.

Criticized by Edward Wainwright in *Architectural Research Quarterly* 2008 12(1) as straying too little from superficial properties of glass: “Interrogations of the uncritical use of glass have yet to help develop deeper interpretations of transparency in built projects. Relationship between surface and spatial depth, complexity and critique were notably absent.”


Discussion of structural and thermal advances followed by detailed written case studies of contemporary commercial buildings with dynamic glass facades.


Discusses the history of glass in architecture in terms of the ambiguous and evolving meaning that is ascribed to it: aesthetic, functional and political. Hi calls the “glass culture” of the 20th century a new
philosophy and a new social dimension of architectural practice, the
essence of which was set out by Paul Scheerbart, a society rising to a
higher level with a corresponding obligation to change architecture.

Review 19(10) p 177.

Discusses developments in structural glass since 1960

Perspectives. avedition.

The authors interview architets who design glass buildings about
their concepts and ideas. The theme is that glass is the material of
“possibility” and the authors identify three interests for using glass:
Bioclimatic solutions (e.g. Ambasz, Jourda, Reinberg, Schempp,
Grimshaw, Theilig); Spatial transparency (e.g. Hanzawa, Kikutake,
Kuma, Thom); and Construction freedom (e.g. Behling, Foster,
Charpentier, Fainsilber, Grimshaw, Ingenhoven, LRK, Ritchie, Sobek,
Theilig).


Select contemporary glass architecture projects

London: Laurence King Publishign Ltd.

Select contemporary glass architecture projects with construction
details.

Murray, Scott. Contemporary Curtain Wall Architecture. 2009. New York:
Princeton Architectural Press.

Discusses the curtain wall as a concept and construct, tracks
its technological development, and provides an overview of key
contemporary projects.

Richards, Brent. 2006. New Glass Architecture

Includes case studies, and introduction discussing the seduction of
glass in terms of spatiality, phenomenology, and “dematerialization and
the sublime.” Brent Richards: a practicing architect and director of the
Design Laboratory at Central Saint Martins College of Art and Design.
He is a leading expert in glass technology and principal of Design
Antenna Architects, London.

Broadfiled House in Kingswinford.” Glass Construction. Detail. 2011
Discusses the glass pavilion at Broadfield House “10 years later,” The largest all-glass structure built in 1994 is “the physical manifestation of a recurrent dream: to completely dissolve the building envelope...by the 1990s, glass technology achieved a level in which nothing seemed beyond reach. ...audacious, airy structures....a race to set records. The pavilion had a southwest exposure that required retrofit film that undermined aesthetics. "Once complete transparency was achieved, the fascination with it dissipated." Especially true of spaces in constant use by people. Architect Brent Richards, Design Antenna with Dewhurst McFarlane (also did Victoria and Albert Museum extension).


Comprehensive history of glass manufacturing and glass architecture from ancient times to 1990s. Discusses modern phases: Glazed hall (conservatories, train stations, shopping centers); frames and skins (commercial); and the curtain wall.