Learning from performative mid-century enclosures: Kahn's Weiss House

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ABSTRACT: Important features often accompanying mid-century modernism were solar control devices, included in work of leading architects as well as main street practitioners. Although the application of solar devices was largely intuitive, the Olgyay brothers published a book in 1957 called *Solar Control and Shading Devices* that related theory to projects utilizing mathematical and graphic analysis. Prior to this point published studies of solar design principles focused on generic massing strategies and did not relate solar design to specific architectural details or aesthetics. By uniting the art and science of architecture, and not utilizing examples that are primarily functional, the Olgyays sought to inspire other architects. This approach is similar to most contemporary case-study books that select examples from designers of high aesthetic reputation. After air-conditioning became standard in the US in the nineteen-fifties, use of overt solar design devices waned. When interest in solar design reinvigorated during the energy crisis of the seventies, the aesthetics of solar design were folky and peripheral to mainstream architectural culture. Interest in vernacular buildings accompanying the revival. Reprinted editions of Victor Olgyay's *Design with Climate* and Reyner Banham's *The Architecture of the Well-Tempered Environment* enjoyed cult status. It would take another couple of decades for interest in environmentally grounded architecture to return with a broader focus on materials and engineered systems. Despite the beautifully rendered book, *Lessons from Modernism: Environmental Design Strategies in Architecture, 1925-1970* published in 2014, there has been little recent historical research on mid-century solar design. A result has been a loss of the benefits of historical solar design knowledge. Abandonment of valuable knowledge is consistent with a larger culture of obsolescence and fashion. Rapid movement from one style to another has complicated comparisons requiring extra effort to harvest fundamental knowledge. A corollary is a lack of critical attention to building projects that fall short of promised performance but are valuable for comparison. Shift to high-tech building products and systems have eclipsed the value of performance of older buildings where the shape of building elements is central to performance. This paper revisits examples of mid-century solar design that have evaded comprehensive history books and are largely unavailable to contemporary architects. At the center is a house designed by Louis Kahn and Anne Tyng in the late 1940's for the Weiss family that exemplifies how modern design can support human needs through an innovative widow wall system that mediated light, privacy, ventilation and thermal comfort with integrated adjustable panels, horizontal louvers, and heating elements. Aspects of the system translated to sliding panels that control light and views at perimeter study carrels in Kahn's Exeter Library, one of his later works.

KEYWORDS: Modernism, Performance, Solar Control, Privacy

1.0 INTRODUCTION

Louis Kahn is associated with a monumental approach to architecture that relied on fundamental shapes, symmetry, and use of heavy materials including brick and concrete. This is clearly visible in his later institutional work including the Salk Institute, Philips Exeter Academy Library and the Kimbell Art Museum. Works prior to the Yale Art Gallery addition, considered his first masterwork, are less well known. The obscurity of Kahn's early work reflects numerous anonymous modernist works of the post-war era. A key characteristic of buildings of this era were designs that were responsive to the sun with strategic glazing strategies and solar shading devices. Kahn' solar details are important because they combine

performance with aesthetic acumen in a manner that is exceptional but underappreciated due to the focus of the visual aspect of his later works.

Buildings designed by Kahn in the period prior to the Yale Art Gallery warrant greater appreciation although their attributes are difficult to reduction to a fundamental parti. Among them, the Weiss House located in the outskirts of Philadelphia is exceptionally complex project representing qualities, despite small rooms typical of the era, that escape relevance to only one historic period. The house is site and program responsive, is expressive of structure, reflects Kahn's interest in craft and material, and is responsive to local solar conditions. Most importantly, it includes an innovative window wall system that mediated different conditions by allowing alteration between passive and active control of light and views. The goal of this paper is to provide context for the window wall system while fostering greater appreciation for a complex design that is difficult to understand due to eccentricities.

1.1 Background

After graduating from the University of Pennsylvania in 1924, Kahn's career as an architect included a series of employments and collaborations that led to little built work until the end of World War II. His greatest direct influences were Paul Cret, a French-American architect who practiced a streamlined classicism, and George Howe who collaborated with William Lescaze on the design of the Philadelphia Savings Fund Society tower. Howe, Kahn formed a partnership in 1941 and Oscar Stonorov joined in 1942 focused on addressing wartime housing challenges (Leslie 2005). The collaboration produced the Carver Court housing project in Coatesville, Pennsylvania completed in 1944. The stark forms and surfaces of the International Style, and the raised living quarters derived from Le Corbusier, can be seen in the Carver Court project as well as the use of wood cladding which Walter Gropius had used in earlier projects as an ode to regional influences (McCarter 2009).

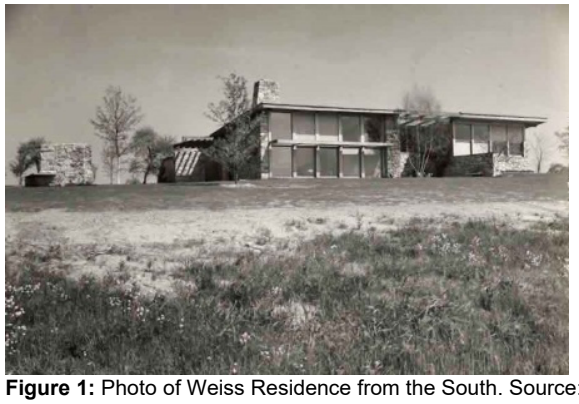

Figure 1: Photo of Weiss Residence from the South. Source: (University of Pennsylvania Archives)

After Howe left the practice in 1942, Kahn and Stonorov continued to practice together until 1947. The two most notable projects to emerge out of the partnership were entries for the Hotel for 1944 competition and the Libbey-Owens Solar Home competition in 1947. Illustrations for both entries represent rational planning, particularly the revealed structure of hotel tower block, and the form of the solar housing proposal that responded to the sun. Kahn brought David Wisdom who would be a key contributor, and Anne Tyng with whom he had a strong working and romantic relationship to the practice. Both of them would remain with Kahn after his partnership with Stonorov dissolved and he became a sole practitioner. In the period after, Kahn designed housing and institutional buildings that reflected modern experimentations of the prior collaborations, and a separate inclination toward qualities of buildings that predated immediate trends. The output also reflected a futuristic oriented academic approach brought by Tyng who completed advanced studies at Harvard.

The Weiss House (Fig. 1) is the third house designed by Louis Kahn after he formed his solo practice. It represents various influences on Kahn and reveals how he work through them toward a clear personal philosophy and approach to design that would mark his mature period initiated with the Yale Art Gallery Addition. Although his later work represents a clear monumental impulse, his earlier work, while less clear, is in many ways more complex. The facades, which are significantly different on each elevation, reflect this complexity. They mediate conditions between the interior and exterior base on programmatic and environmental impacts. The primary facades also are dynamic, and operable, allowing occupants to tune the building toward their immediate experiential preferences.

1.2 Project description

The Weiss House rests at the crest of a gently sloping hill, thirty-five feet above Whitehall Road. In plan, the parti is comprised of three rectangles, each containing spaces with related function. An enclosed corridor connects two of the rectangular masses that house the main living functions. Because they share a common roof, the two living masses present the appearance of a singular volume in elevation. A covered walkway links the third volume that contains a garage to the largest mass. The garage pavilion is spaced slightly further away from the other volumes signaling a support role as a non-habited space. A stone chimney located at the center of the western volume corresponds with a large stone exterior fireplace approximately twenty-feet away from the building.

The approach to the house is from a drive that passes the house to the east. It wraps the house turning west and terminating in a pad to the north of the living quarters in front of the garage. An effect of the approach is to leave the landscape to the south and west of the house an open field into which a stone pad extends. A direct result of the approach is that primary entry is at the back of the house, opposite the living room and master bedroom, creating a sense of privacy and permitting unencumbered views at the primary exposures. An open walkway from the car pad parallels the covered walkway from the garage, with the former terminating at the formal entry door and vestibule between the living and sleeping wings. None of the four exterior doors of the main portion of the house is particularly prominent. For example, the southern door is located to the side of the living room in a recess between volumes.

Figure 2: Schematic Plan. Source: (University of Pennsylvania Archives)

Grouping different functions of the house and distinguishing them in similarly shaped, but different, proportioned volumes contrasts with Kahn's latter approach of fitting nuanced program elements into singular volumes. A rectangular zone in plan connects the sleeping wing to the living wing within a clear rectangle that penetrates the bedroom volume in plan (Fig. 2) and extends into the living volume. It contains service, circulation, and specialized functions including a large fireplace with a depressed seating area. The sequestering of support spaces in the center zone, and the distinction between the garage and main part of the house, foreshadows Kahn's served and service relationship that became a defining aspect of his later work (Gast 1998).

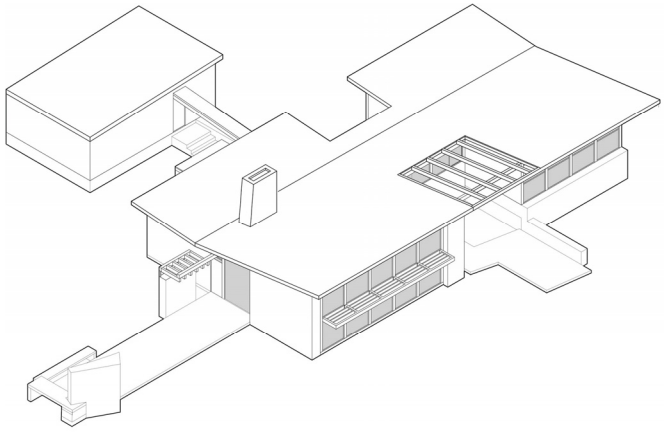

Figure 3: Axonometric drawing of the house. Source: (Author 2018)

Instances of the building are traceable to Frank-Lloyd Wright, the Bauhaus and Le Corbusier. For example, irregularly shaped fireplace is a pivot point from which spaces extend, including to the exterior fireplace. A butterfly roof defines the cross-section of the building, an invention of Le Corbusier. The highpoint of the butterfly roof is parallel to the south elevation permitting high ceilings and maximum façade area on the south face of the building where the living room and main bedroom are located. At the north face of the building, the façade is lower than living side resulting in a low point that is off-center, and lower ceilings in the kitchen, dining space and auxiliary bedrooms. This project was not the first time Kahn was associated with a butterfly roof. In 1942 when Kahn was in partnership with Stonorov, an unrealized housing project for Washington, DC included a butterfly roof superimposed over pitched roof (McCarter 2009). After the Yale Art Gallery, Kahn's residential projects had flat roofs.

1.3 Elevation character and materials

The nuanced elevations of the building reflect the interior functions in a more direct way than Kahn's later more monumental works. For example, taller windows occur in the more public areas of the house, and favor views into the landscape away from the driveway. The most prominent part of the elevations apart from the roof, and associated trellises, are large sections of repetitive ganged glass units situated between robust trim that conceals structure. They appear in three locations, at the living room, master bedroom and guest bedrooms. The windows at the southern side of the living room are taller and include a louvered overhang at the middle that divides the lower panes of the window system at the living room in two, and corresponds in depth to the eave extension (Fig. 4).

A shallow field of stone exists between the bottom of the windows of the main bedroom, the maid's room, and the guest room that doubled as a study (Fig. 5). Clearstory windows at the south side of the central corridor provide additional privacy. The end elevations are punctuated by smaller openings on the east side where restrooms, reflecting the general orientation of the building toward the high points of the butterfly roof. The western end of the main structure has

a thin framed glazed section that supports a visual connection between the fireplaces. The majority of the building is clad in wide wood boards vertically oriented with the exception of strategically used stone. End walls of the living masses from which the butterfly roof is evident are clad in stone where not glazed. Their thickness evident at the ends where the meet the main elevations. The modulation of the lager windows are regular in width and made of exposed timber framing which runs in line with the windows.

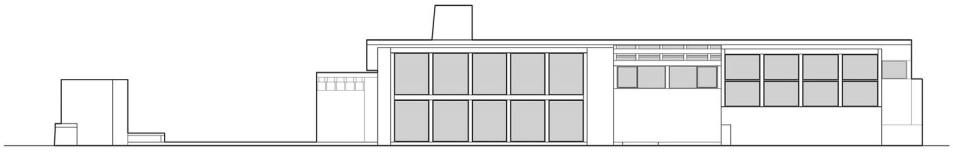

Figure 4: Drawing of south elevation. Source: (Author 2018)

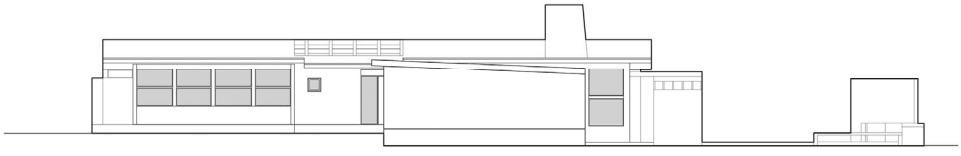

Figure 5: Drawing of north elevation. Source: (Author 2018)

1.4 Window system and details

In anticipation of Kahn's use of heavy materials later in his career, the primary wood window system appears substantial despite large glass lights centered at five-foot-four-inch intervals horizontally. Despite material robustness, an overall effect of lightness exists on the main facades due to the juxtaposition of the wood framing to the adjacent to stone. The outer face of flat vertical window casings are approximately seven inches wide, a dimension matched at the top and bottom rails. With the exception of one section, each of the vertical sections of the primary window system is composed of three different layers, an outer fixed insect screen, operable glazed sashes, and operable inner and outer sashes. The function of the sections resembles a double-hung window although one of the sashes is glazed and the other plywood infilled. Another difference is that the sashes slide past each other (Fig. 6). The result is that window sections can be opened at the top or bottom, and can have a solid panel at either the top or bottom. A subtle nuance between the sections is that some of the glazed units are in the outer plane, some in the inner plane, and visa-versa.

In section, the windows conceal the structure embedded in them. The robust window and panel frames are deep, two-and-a-half wide and almost two-inches deep. They are set in a similarly robust hardwood frame and casings that conceals a parallel pair of heavy wood six-inch deep studs that support the roof. Notches in the frames receive the sliding wood panels biased toward the exterior. The insect screen is set in a frame inserted into the flat outer trim in-line with the outermost face of the window trim. Correspondingly, a four-by-six spans between the studs horizontal below the roof.

Horizontal solar control elements are located at the large living room windows at the mid-point between the upper and lower sashes. The exterior louvers extend thirty-six inches out and contain three angled wood strips to form louver blades. A result is shading from the southern sun at the lower portion of the window assembly by the shading device, and upper portion from the eave. The exterior louver corresponds with a two -foot deep interior shelf assembly of the same depth. It includes lighting elements that wash the ceiling and radiant heating imbedded in plaster concealed by a wood panel and trim. The result is a highly tunable system that provides optimal light under different external conditions and interior desires (Fig. 7).

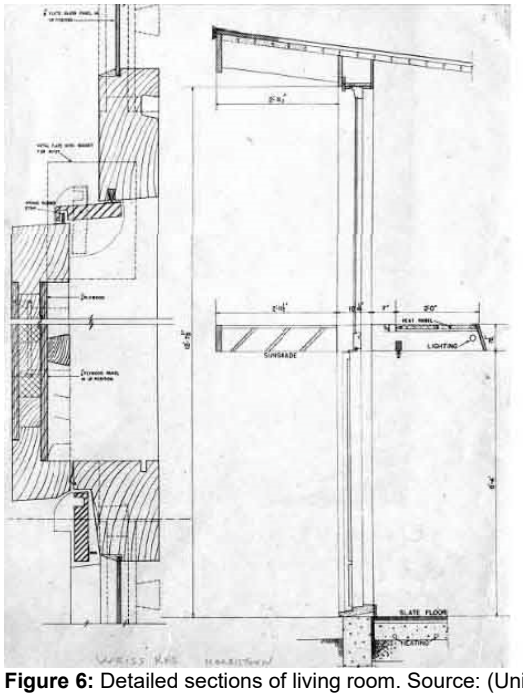

Figure 6: Detailed sections of living room. Source: (University of Pennsylvania)

Kahn is famous for clear identification of structure, use of infill to contrast with the structure, and highly resolved detailing. An emphasis on legibility of the frame contrasts with a solid bearing wall and heaths what Kenneth Frampton in his essay Reflections on the *Scope of the Tectonic* described as stereotomic, often possessing a tactile quality (Cava and Frampton 2005). The notion of the tectonic relates to frame and infill construction that is lighter and embodies tension between components. Kahn's use of material, particularly the heavy rusticated walls in the Weiss project, would have been unusual for the period and contrasts with the weightlessness of many early modern structures. The balance of the Weiss House contains a reading of structure through the window frames with the exposed roof beams in the larger spaces. Kahn resists a loss of legibility and time that occurs in stud walls by obsessing in the details of the window system and casework.

1.5 Solar control and user control

Overt solar control devices were a notable part of mid-century design until the ascension of air-conditioning in America during the post-war period. Shading had been incorporated in pre-modern vernacular architecture such as the shaded porch and breezeway of the dog-trot house in the American Gulf region, and the overhangs of early modern houses such as those built by the Greene brothers of Pasadena. However, Le Corbusier's invention, and promotion, of the brise-soleil instilled overt shading devices as an expressive component of mid-century modernism. The earliest examples of the utilization of shading devices derived from Corbusier's visions were in South America during World War II when building in the United States was limited due to the diversion of resources toward the war effort. After the war, building resumed with modernism as the defining aesthetic largely due to its visual encapsulation of progress through technology, an important component of the victory.

Modernist architects were motivated to adopt shading strategies largely due to the promises of better heath and comfort through rational architecture. They were influenced by Le Corbusier's visionary work, and modern South American architecture. Many of the South American examples were introduced to an American audience in a 1949 Progressive Architecture article written by Richard Neutra. In addition to reporting on South American

advances, Neutra was a leader in incorporating solar shading into his designs including adjustable vertical louvers for the Kaufman House (1947) in Palm Springs. Another factor playing into solar shading was fact that North American homes and commercial buildings were not typically air-conditioned before and after the war. Solar shading was a way to maintain comfort near glazed areas of non-conditioned buildings where breezes were not adequate.

The best example of scholarship on shading of the post-war era is Victor and Aladar Olgyay's 1957 book titled *Solar Control and Shading Devices.* The first half of the book is dedicated to explaining the Olgyay's techniques for understanding how location relates the amount of sun available at different times including during the day and across the years. They relate the sun to local temperature, the sun's potential to heat different orientation of building, and the effectiveness of different types of shading relative to the different conditions. The second part of the book provides case studies of modern buildings that exemplify many of the techniques. What distinguishes the book from most case studies is that the Olgyay's connect the examples to the analysis presented earlier in their book. Among the building presented was the Radbil addition to the Philadelphia Psychological Hospital (1953) designed by Louis Kahn in Philadelphia. The prominent horizontal shading devices on the building are inconsistent with Kahn's signature work, but not out of place among the other architectural works of the period presented by the Olgyays

The hospital was not the first work by Kahn that included solar devices. Horizontal shading appears in Khan's 1943 visionary proposal for an apartment building created for a city planning booklet titled, *You and Your Neighborhood*. The solid projections represent an extension of the floor plate and provide the primary articulation on the otherwise vertically oriented block. Another earlier project that included solar shading was Kahn and Stonorov's 1946 proposal for a solar house competition that Anne Tyng contributed to after joining the office. She studied under Walter Gropius and Marcel Breuer at Harvard where she gained the technical rigor reflected in the house design. For example, extensive shading diagrams represented the impact of the suns influencing the building's form. Louvered solar projections are evident mid-level up the façade at the three orientations with southern exposure.

Similar considerations factored into the Weiss massing that welcomes the southern sun with the highest glazing to solid wall ratio of all of the facades, and large extent of glass made possible by the butterfly roof. Overhangs are a natural extension of a sloped roof and are an integral part of traditional pitched roof, and more contemporary butterfly roofs. Solar shading is inherent in roofs with eaves provided glazing is close to the overhang. The louver system in the Weiss Residence is in the tallest glazing section and balance in the middle of the wall. Limits to fixed geometries are compensated for by movable panels that are adjustable under different solar conditions that particularly uncomfortable when the sun is low on the horizon.

Further control occurs in the building with integrated opaque panels that allows for tuning to user preferences under different scenarios similar to the visors in an automobile windshield. Views are also augmented by the panels that when situated lower, allow for privacy, light and views toward the trees and sky above. When in the lowered position, the panels provide allow for views toward the immediate landscape. The panels provide visual variety that signals the operative modes prompted from interior desires. Kahn's interest in a tactile architecture recognized human agency in the architectural experience making architecture more than visual.

Comfort in architecture when acknowledged, typically points to thermal comfort which is physical and psychological. Thermal comfort is largely a factor of temperature, with humidity, air-movement, and radiant heat also playing a significant role. Physical comfort is largely considered objective and is represented in psychrometric charts that provide the basis for interior comfort standards that have been codified. Recognition of physiological differences, including gender, along with psychological comfort have gained greater credibility as different cultures have been studied revealing different reactions to environmental factors based on local experiences and tendencies. The Weiss Residence was built when most homes did not

have air-conditioning and the idea of environmental consistency was not expected. Mitigating immediate environment conditions with active and passive building elements offered a corollary to modifying clothing.

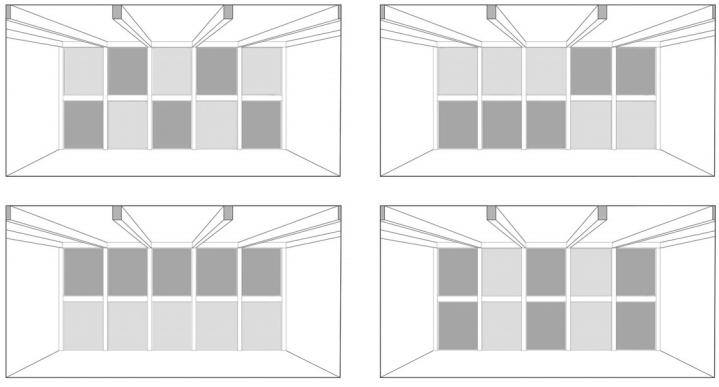

Figure 7: Diagrams of possible window panel arrangement. Source: (Author 2018)

1.6 Privacy

Passive privacy control is integrated into the architecture of most well designed houses. However, active control occurs with furnishings such as curtains. The Weiss House integrated active privacy control in a manner that few architectural have. Control of access to our inners selves is a universal human concern affected by developments in environmental factors such as densification, and technological capabilities that allow institutions to collect and manage information about individuals. At the heart of the concept of privacy is according to philosopher Adam Moore.

> A right to privacy can be understood as a right to maintain a certain level of control over the inner spheres of personal information and access to one's own body, capacities, and powers. It is a right to limit public access to oneself and to information about oneself.

Privacy and control is a necessary condition for healthy individuals and social relations. Without it intimacy, friendship, and love are difficult to cultivate. Similar to function of garments, the building blocks of buildings are important elements to maintaining privacy and control (Moore 2003).

In addition to enabling relationships Joseph Kupfer find privacy necessary for the existence of an autonomous self, free thinking and self-determination. It also, gives individuals room to make mistakes. (Kupfer 1987) Although access to light and openness has been identified as a fundamental objective of early modern architects who sought responses to pathologies associated with the modern city with openness to light, exemplified by the glass curtain wall, transparency runs counter to privacy and control. In private residences curtains, shades, and blinds impede flow of natural light into building interiors and views to the outside

It is possible to develop a definition of privacy that operates between philosophy and sociology and law. In her book *Configuring the Networked Self*, Julie Cohen see privacy as part of a power relationship that allows for different levels of self-expression (and concedes that individual relations privacy depends on cultural conventions). Notions of self-expression and play are interchangeable in this context. When describing privacy in the context of a home, it "furnishes room for a critical, playful subjectivity to develop" (Cohen 2012). Kahn design preceded this analysis, but qualities of play and environmental control of woven into the enclosure of the Weiss Residence. Occupants could mediate the light and views, and change the aesthetic of the architecture as a form of play and expression.

The spirt of the arts and crafts movement pitted the individual against industry that threatened individuality and expression. Karsten Harries in his book *The Ethical Function of Architecture*

draws a line between John Ruskin and Louis Kahn. Ruskin sees self-alienation in the rationalization of the industrialization that has no time for architecture and decoration. Harries sees Kahn as a counter force to an entirely rational architecture. In this paradigm, symbolic representation, cultural continuity, and humanism are consistently present (Harries 1997). Artistic craft and acknowledgment of the humanity of the individual user was resonant in the Weiss Residence and carried through to Kahn's later institutional work. The study bays at the perimeter of the Philips Exeter Academy Library in Andover, New Hampshire, have small movable shutters that allow the individual to modify lamination levels and views.

CONCLUSION

Louis Kahn's career prior to the Yale Gallery of Art is formative and work includes characteristics of his later buildings, but lack resolution compatible with expectations of the monumental. However, associations with the monument has overshadowed exceptional qualities of Kahn's less monumental work. Expectations most applicable to institutional commissions of cultural significance are less relevant when assessing residential architecture. Although the overall form of the Weiss House is less holistic than later work, the components are well integrated and the building rooted to the landscape in a manner that is consistent with Kahn's concept of timeless. Anchored to the site with local stone and detailed with wood that represented craftsmanship.

Kahn's experiment with panelized window system that allows for use control of sunlight began with the unbuilt Parasol House and realized with the Weiss House. The essence of the system was use soon after in the Pincus Annex to the Philadelphia Psychological Hospital and toward the end of Kahn's career in Andover. In all cases, the system was confirmation of Kahn's interest in placing the human activity at the center of his buildings and that control of light was a key component of setting the stage for experience. Light and views balanced with control of privacy another human need.

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