

The Frame as a Catalyst for an Architecture

PATRICIA KUCKER
University of Virginia

"The frame has been a catalyst of an architecture, but one might notice that it has also become an architecture, that contemporary architecture is almost inconceivable in its absence."

— Colin Rowe

The concept of the structural frame pre-dates twentieth century modern architecture, yet Colin Rowe's remarks serve to illustrate the fundamental relationship that the development of iron and steel construction technology had on modern architecture. However, the primary division between the structural frame and the exterior cladding that would become central to the vocabulary of a modern architecture is evident in Gothic architecture, Paxton's Crystal Palace and the vernacular architecture of the Japanese house and Semper's Cariah hut. And although the austere and progressive buildings of the Chicago frame rose in the late 1800's, the formal and spatial ideology of the modern frame did not become codified until Le Corbusier's iconic drawing of the 1914 Domino house. The structural frame is a constituent element of Le Corbusier's "Five points of a New Architecture" (1920), and the frame's formal and spatial role in this new modern vocabulary is revealed through his four villa compositions (Villa La Roche, Villa Stein, Villa Biaseau and Villa Savoye). His system of "Five Points" elevated structure to the role of art and made the concrete frame into an instrument of societal change. Implementing the grid as a major compositional device underscores Corbusier's belief that all men in the progressive industrial society are equal, with fundamental needs, regardless of their cultural levels.² Le Corbusier's "Five Points" harkened a new architectural spatial morphology for a culture and society that was rapidly changing. This new spatiality relied on the constructional logic of the frame as well as a new ideology of the frame, which drew from the practices of cubist painting and the premise of a geometric construct, from which a fluctuating multivalent spatial morphology could emerge.

BUILDING CONSTRUCTION PRACTICES

The constituent elements and processes of building construction were forever changed during the industrial revolution of the nineteenth century and subsequent developments in the early twentieth century. This change was facilitated by the introduction of new



Fig. 1: Shinmei-gu, near Matsumoto Shinto Shrine

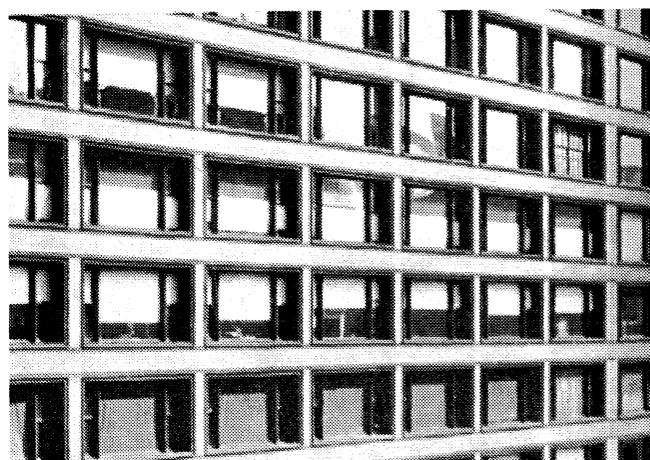


Fig. 2: Sullivan: Carson Pirie Scott

building materials and the development of new building systems: In Europe, reinforced concrete developed through the work of Françoise Henebique and August Perret. In the US, iron and steel frame construction fueled the building boom in Chicago and the work of William LeBaron Jenney and the Chicago School. The functional economy of frame construction soon liberated architecture from a solely mass based construction. Frame construction has become a contemporary building reality and companion layered wall construction, with the development of internal specialized components, continues to be one of the single most significant and on going construction technology developments of this century.³

For the developers and merchants of the late nineteenth century Chicago, the new frame buildings offered light filled space with increased rent-able floor area which was captured from the use of a more slender structure. And significantly, more floors of space as the steel framed building climbed higher than its masonry counterpart.

In America, the skeleton structure, conceived to be of utilitarian value...but in Europe...it was given a logical form only by the sustained volition of architectural intelligentsia...The frame became something other...not an answer to a specific problem, office building, but (rather) to the universal problem, architecture.⁴

In Paris, the development of concrete frame construction reflected Perret's philosophical allegiance to the principles of French rationalism exemplified by the writings of Viollet-le-Duc. Through Perret, this rationalist's philosophy was transferred to Le Corbusier under Perret's guidance. Corbusier's study of Viollet Le Duc and Choisy laid the foundation for his pursuit of an architectural language appropriate for modern society. This language would be the equivalent to the elements underlying the great styles of the past. (The parallel between the *five* classical orders and Le Corbusier's *five* elements of architecture is a poignant coincidence.) At a passage in Corbusier's copy of *Dictionnaire raisonne'* where Viollet describes the form of the Gothic flying buttress as a perfect structural expression, the young Jenerret inserted a note: "these lines show how this whole art lives by its carcass now Auguste Perret has told me, hold on to the carcass, and you will have the art."⁵

ART, THE GRID AND FRAME

The Italian Futurists, Russian Constructivist, and the French Cubists were all influenced by industrialization and its technological advances and their art attempted to capture these changes. For the Italian futurist Boccioni, this space was the result of movement—revolutionary speed—afforded by the new modes of transportation, which collapsed the conventional notions of space over time.⁶ Cubist painters introduced a fluctuating and multivalent spatial construction based on the phenomena of transparency and structured by the presence of a new kind of compositional grid. The cubist grid dismantled the conventional notions of Renaissance space by diffusing the centrality of perspectival vision with a non-hierarchical grid that simultaneously allowed for multiple view-

points and multiple spatial conditions. This uniform grid sectioned the canvas surface into a matrix of faceted planes that both flattened the volumetric spatial qualities of conventional painting and fractured space into dynamic layers. This produced a compression of distance into an abstract layer of shallow space existing between the actual surface of the painting and the construction of planes and volumes in the implied (deep) spatial layers. In this new spatial condition, several layers of visual reality exist: ranging from the flat and shallow space within the uniform grid and the deep space constructed by *chiaroscuro*, fluctuating figure / field reversal of recessing and advancing oblique planes.⁷ The use and geometry of the cubist grid and the introduction of the steel and concrete structural frame simultaneously transformed the classical spatial planning attitudes in architecture. The effect of this new

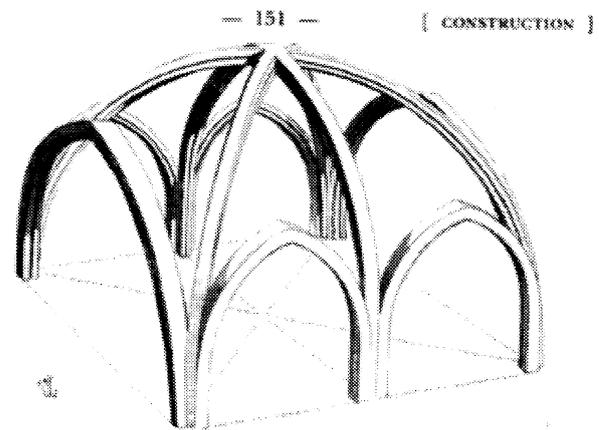


Figure 21

Fig. 3: Viollet Le Duc: *Dictionnaire raisonne'*

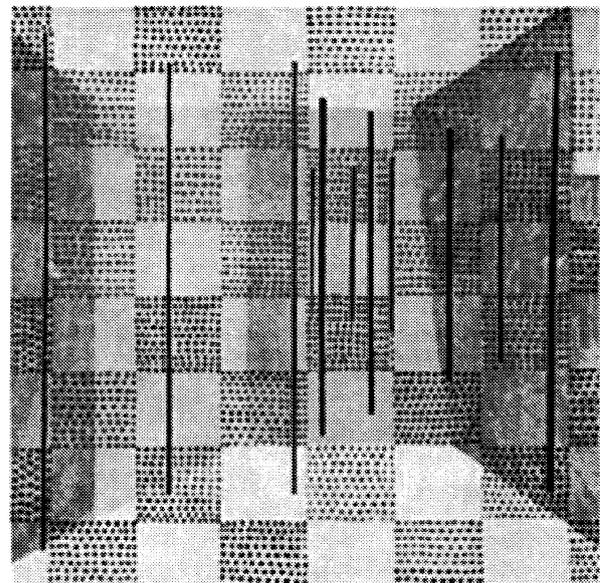


Fig. 4: Klee: *Space diagram*



Fig. 5: Picasso: *Portrait of Wilhelm Uhde*

spirit of art on the realm of architecture resulted in a re-consideration and new representation of a spatial construction that was temporal; based on the phenomenal experience of space through time.

ARCHITECTURAL GRIDS AND FRAMEWORKS

In her essay *Grids*, Rosalind Krauss, ties the space of the grid in modern art to architecture. "Logically speaking, the grid extends in all directions, to infinity...By virtue of the grid, the given work of art is presented as a mere fragment, a tiny piece arbitrarily cut from an infinitely larger fabric. The three dimensional grid (now a lattice) is understood as a theoretical model of architectural space in general, some small piece of which is given material form." Kraus also reminds the artist (and architect) that the power of the grid lies in its mythic quality of paradox or contradiction. The grid is objective science—a coordinate system and a structural frame—while at the same time it provides for a vehicle of illusion and interpretation.⁸

At the Illinois Institute of Technology, Mies van der Rohe imposed a "value-free" or universal grid as an organizing spatial and architectural structure across the campus. Mies' grid is a datum, which perforates free flowing modern space. Here a 24 x 24 x 12-foot

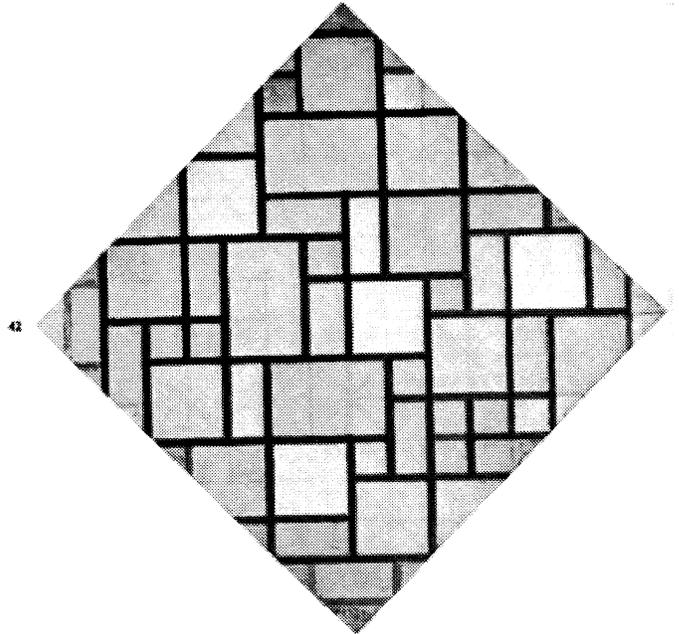


Fig. 6: Mondrian

classroom module prevails. It is proportionally enlarged when applied to the entirety of the campus plan and similarly addresses, incrementally at a smaller scale the building structure, facades, reflected ceiling plans and mechanical systems. At IIT, the grid is the tool through which architectural space is manifested.

Mies refers to the existence of another type of objective and continuous grid in both the Barcelona Pavilion and the Tugendhau house. The chromium clad cruciform columns (of both buildings) imply a coordinate system of space, in which the columns serve as markers of an ephemeral, but omnipresent organization. The coordinate points (columns) provide a formal and physical structure for the dynamic, gravitating walls and panels of the free plan. "The free plan and clear construction cannot be kept apart. A clear structure is the basis of the free plan...the structure is the backbone of the whole and makes the free plan possible."⁹ The grid of universal space and the structural frame are synonymous.

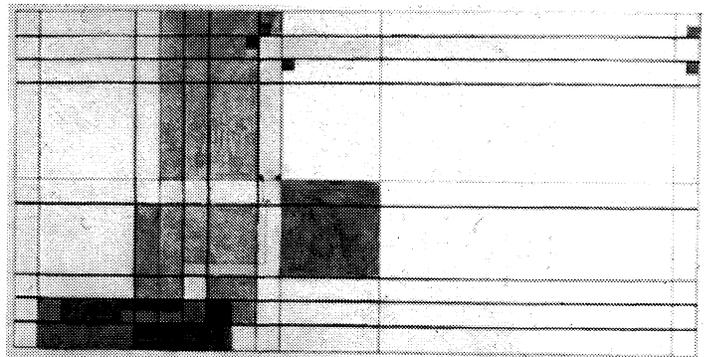


Fig. 7: Hanah Verner: *Graduate Studio*

In contrast, Bernard Tschumi deploys a continuous 120-meter grid across the Parc de La Villette site to begin the construction of a complex architectural organization. 10 x 10 x 10-meter three storey steel framed follies, occupy the coordinate points of the grid. This grid matrix is one of three superimposed systems providing an organizational order for the large park. Through superimposing autonomous and logical structures, each structure's capacity for order is questioned, yet their coincidence provides situations of reciprocity when elements reinforce each other: situations of conflict through opposing elements; moments of indifference when there is a low proximity of unrelated elements. Tschumi proposes a new model for the park "that could be conceived as one of the largest buildings ever constructed—a discontinuous building, but nevertheless a single structure."¹⁰ In Tschumi's park, the grid framework serve to systematically promote conflict over synthesis, fragmentation over unity, providing a dispersed and differentiated reality.

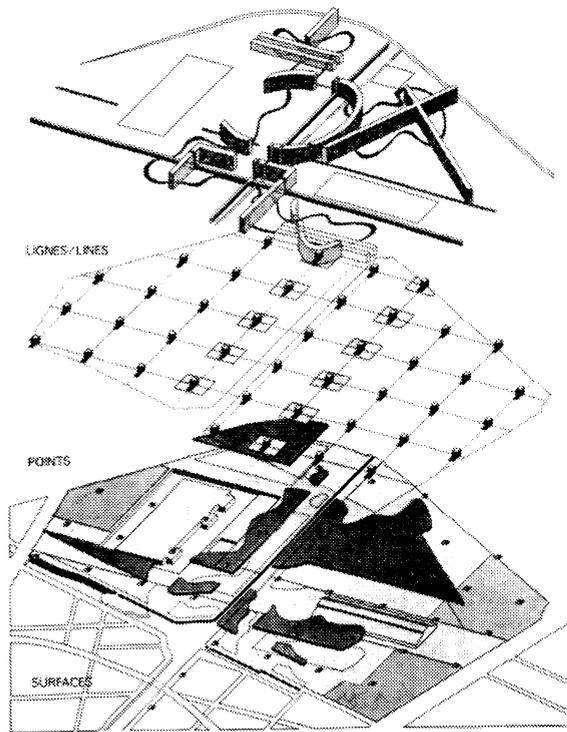


Fig. 8: Bernard Tschumi: Parc de La Villette

The global Mercator grid provides a coordinate system and geometric subtext for Morphosis' Crawford Residence in California. The building's structural frame, Mercator grid and boundary wall co-exist in a complex geometric framework, but not a geometry of Miesean purity. Tom Mayne sees the arithmetic progression of the house's grid matrix as a highly structured order set in place to be eroded and carved away in order to generate a deliberate tension between the systematic and the idiosyncratic elements of space, structure and the site.¹¹ In addition, the architects propose the house's constructional framing devices as central to its spatial character:

"These geometries together create a house made of totemic pylons constructed of concrete, exposed steel T-frame structures and

*walls of stucco and redwood. The progression of these solid elements is reversed in the character of the negative spaces. Ultimately the relationship between center and periphery is inverted, forcing the life of the house to the periphery, where it comes into contact with those issues of site, context and connection that form the underlying pattern of the project"*¹²

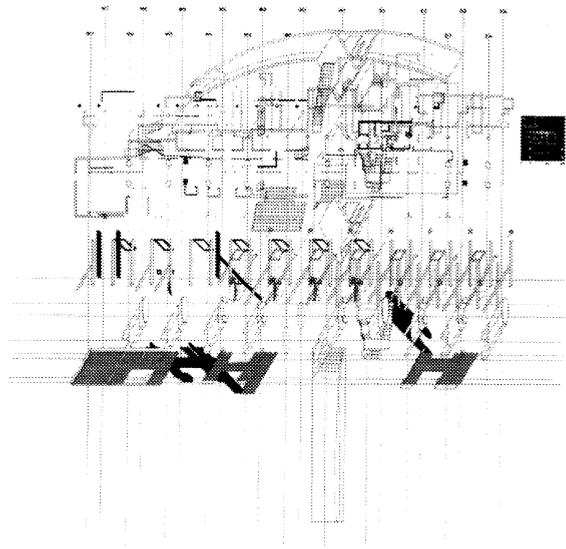


Fig. 9: Morphosis: Crawford Residence

A hybrid structural framing system of steel T elements on an 8-foot module, concrete pylons on a 16-foot module and conventional wood platform framing (a 16-inch module) further embellish the geometric matrix of the house.¹³ The wood framing is largely concealed except where the "negative spaces" of the light monitors occur. The rectangular light monitors, and the light itself, serve to erode away the layers of building construction revealing the rhythmic language of the structural framework.

The woven compositional grids of Frank Lloyd Wright also exhibit an inflected modularity tied to the building's physical structure and spatial volumetrics. Wright explains:

*All the buildings I have ever built, large and small, are fabricated upon a unit system—as the pile of a rug is stitched into the warp. Thus each structure is an ordered fabric. Rhythm, consistent scale of parts, and an economy of construction are greatly facilitated by this simple expedient—a mechanical one absorbed in the final result to which it has given more consistent texture, a more tenuous quality as a whole.*¹⁴

A tartan or simple quadratic-planning grid is evident in Frank Lloyd Wright's architecture. The modular dimensions of this grid vary, ranging from a basic two way three-foot grid of the mid-western, "Forest Period" to the sixteen-inch square grid of the California "textile block" period.¹⁵ The three-foot tartan grid of the DD Martin House in Buffalo orders the interior spatial volumes, building structure, placement and size of window openings as well as

modulates the expanding landscape surrounding the house. Although his modular and resulting grid matrix varied by local circumstance, for Wright, the grid was a logical companion to the rising practices of industrialization and mechanization: the grid was as much an economic, democratic labor saving device as it was a framework for architectural space making.

Rosiland Kraus cites the grid as an emblem of modernity declaring "modern space is both autonomous and autotelic." The modernity of space is that which is rooted in an order of pure relationship, divorced from the "natural world". The grid in its overall regularity provides a matrix of relationships which is pure and final. It is a ubiquitous form in the art (and architecture) of this century. Kraus further notes that one has to search a long way back into the history of art—to the period of the renaissance and the inscriptions of a perspectival matrix on space—to find the presence of "grids" in art.¹⁶

Colin Rowe's analysis of Palladio's Villa Malcontenta and Le Corbusier's Villa Stein in the essay "Mathematics of an Ideal Villa" illustrates the genetic character of the grid when he compares the renaissance and modern grid in architecture. However, for all that is common with respect to the organizational grids of both of these buildings, remarkable spatial differences result from Corbusier's masterful ambiguity drawn from the principles of analytical cubism in contrast to Palladio's consistent volumetric clarity inscribed by the framework of renaissance proportion and perspectival systems. Palladio's spatial composition is legible from a glance at the building's façade. In contrast, The structural grid of Villa Stein provides an orthogonal three-dimensional datum to register the fluctuating spatial character, which is perceived through diagonal circulation. Once ascending to the second floor (the piano nobile), dramatic diagonal circulation across the living area and toward the dining room and garden façade slices through several spatial layers. Thresholds striate the gridded volume of space with surfaces, real and implied. The spatial layers are confronted obliquely and slipped through, much like the cubist canvas where oblique planes referring to deep (perspectival) space are emerging or dissolving against an orthogonal grid of the flattened canvas.¹⁷

GRIDS, SPACE AND SURFACE

Le Corbusier' did not produce ambiguity for its own sake, but rather to encourage a reconsideration of the true nature of space, spatial representation and the experience of spatial sequence afforded within the spatial and tectonic character of the frame. This is particularly relevant to the expression in elevation and the corresponding spatial condition beyond this surface. The elevation, façade and building surface are independent of the supporting members of the frame allowing great freedom of expression. Although Corbusier's five points of architecture include the ribbon widow alluding to the remarkable non-structural role of the buildings surface. The term *free-façade* proposes set of yet undefined opportunities for the frame's bounding or clad surface.

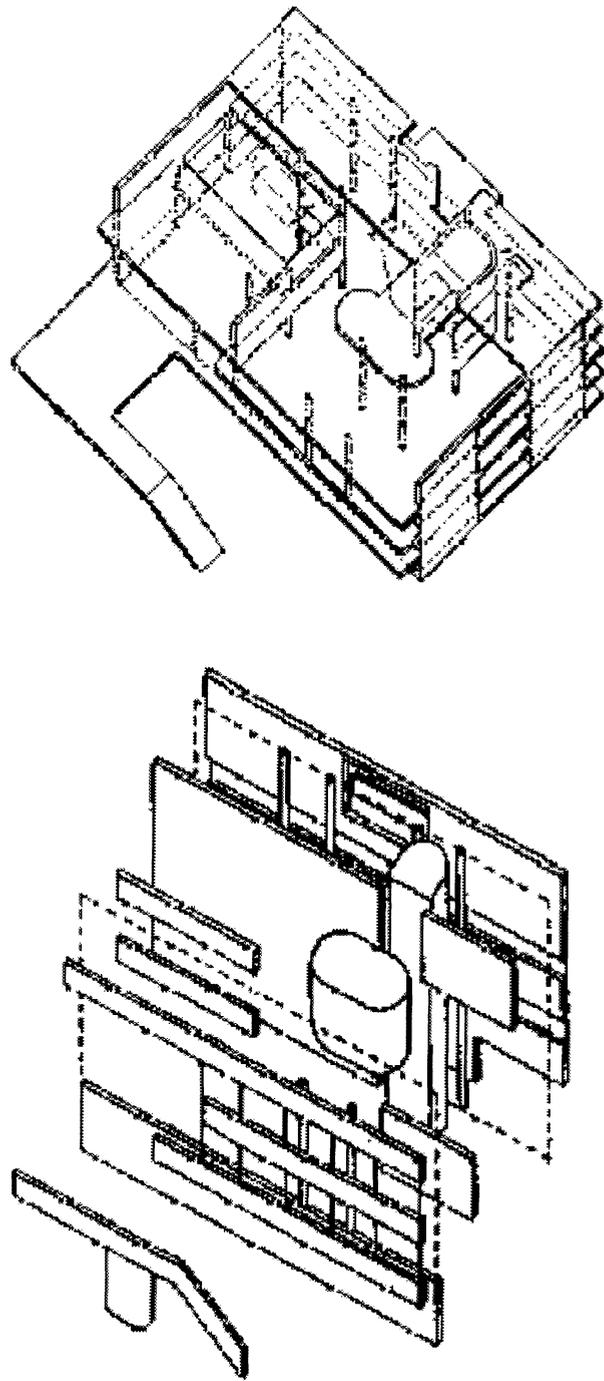


Fig. 10: Villa Stein at Garches

In the example of Villa Stein there is a provocative yet perhaps inconclusive reading of the façade as it may relinquish or embrace its ability to telegraph interior spatial intentions. In contrast to the architecture of Palladio, the interior spatial disposition of Villa Stein does not directly telegraph to the façade. Yet, upon analyzing the interior space of the building itself, fluctuating correspondences emerge between the order of the elevation and plan, the front elevation and rear elevation and the interpretation and appropriation of space. For example, the symmetry of the front façade, established by the main entrance and the service entrance serve to advance a notion of centrality and axis. This axially is in reference to the major space of the piano nobile. However, the presence of this significant space is denied by the expression of several floors of ribbon windows on the front façade. Yet this opaque façade with banded widows is a formal inversion of the garden façade, which although similarly layered is more transparent, than solid surface. This inversion speaks to the transition of city to garden, public to private, which transpires as one moves through the house toward the garden. This is a way of spatial ordering and surface design stands in contrast to making elevations or surfaces as simple representations of the sectional space beyond, or considering elevations as somewhat neutrally ordered. The introduction of the structural frame and framing, the independent nature of the boundary surface, modern architecture's phenomena of fluctuating spatial conditions and an interest in a phenomena of multiplicity significantly altered the relationship between space and enclosing surface.

All building facades exist as a structured physical boundary and visual plane separating and connecting interior and exterior views and space. Throughout history, the exterior wall has had the ability to translate or obscure interior spatial developments, to convey or deny constructional form and to serve as an armature for cultural ornaments. The dialogue of frame and cladding is central to the work of Patkau Architects. In the Newton Public Library the requisite open spatial character is afforded by a sculpturally dynamic primitive-hut-type frame structure to which several forms of cladding and skins are collaged. With shelter established by the strong roof character, the open and fluid interior space is structured by a central spine of columns while the perimeter is made spatially ambiguous through a conspicuous layering of interior and exterior cladding. The sectional character of the building illustrates the unique dialogue between frame and skin. Between the regular march of a repetitive frame and the layers of cladding which are peeling away or bulking up to become dynamically figural *poche*. The theme of layering is in the service of spatial and perceptual functions, creating and concealing program spaces, while pulling reflected light into the interior and blurring the spatial boundary to the exterior.

SPATIAL FORCES IN THE GRID

As a mediator of a spatial boundary two simultaneous and opposite interconnected forces emerge from the grid, a centripetal force of inward spatial containment and, a centrifugal force of spatial lay-

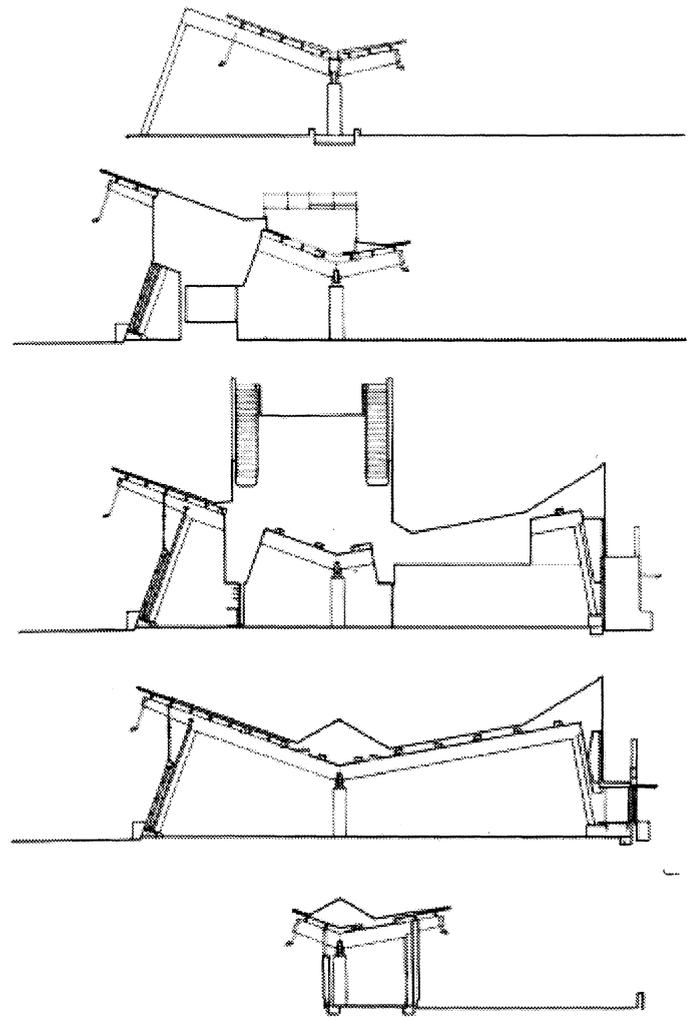


Fig. 11: Frame and cladding: Newton Public Library. Patkau Architects

ers or spatial volumes moving outward from the interior. The force of interiority supports a meaningful disconnect from exterior context in favor of a focus on or re-presentation of the structured interior "reality" and spatial experience. Religious architecture often relies on the force of interiority, as does Adolph Loos' *raumplan* and his development of architectural linings of his interior rooms. In contrast, Mies van Der Rohe's Barcelona Pavilion, Brick Country House and the architecture of Garret Rietveld and the DeStijl artists exemplify centrifugal forces moving outward, and compelling an acknowledgement of the world beyond. The centrifugal forces promote the modern idiom of continuous space defined by the grid continuing to infinity. Moving outward from the interior promotes an architecture of multiple layers and surfaces as an ex-closure of spatial character relative to the grid. The architecture of ex-closure translates interior definition to the exterior, defining spatial boundaries and spatial character, to and through adjacent rooms, toward the exterior of a building façade and even to the bounds of the site. The grid and structural frame both operate as datum for the forces of

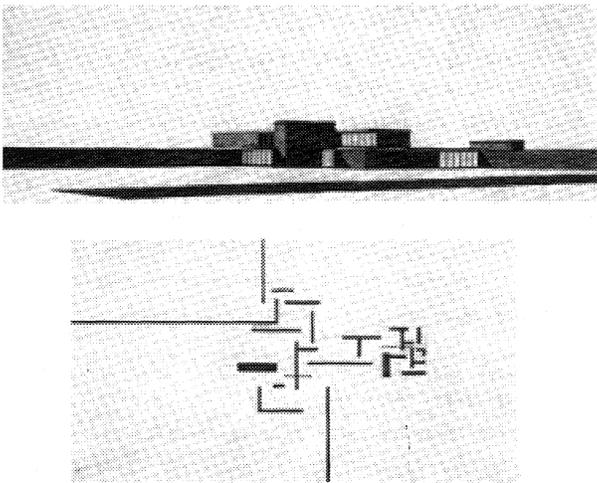


Fig. 12: Mies: Brick Country House

x-closure which is master-fully exhibited in Frank Lloyd Wright's DD Martin House and site planning. At the Barcelona Pavilion, the frame is a force of structural stability, which registers the centrifugal force of the walls. Mies' universal-planning grid at IIT implies an infinite space in which the collection of campus buildings imply a built fragment of a centrifugal force. In contrast, a centripetal force of interiority is present in Wright's Unity Temple where the interior world of the sanctuary is the result of a three dimensional matrix that has turned inward and is mapped back onto the space of the matrix itself.

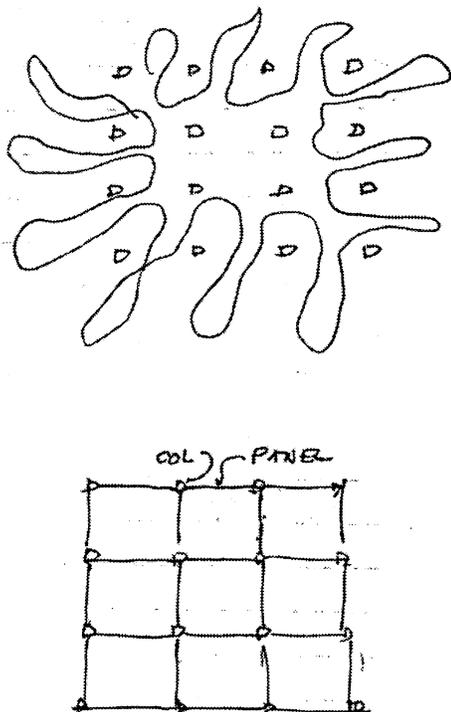


Fig. 13: Hejduk: The nine-square problem. 1954-1963 spatial fluidity and containment

THE FRAME AND EDUCATION

John Hejduk and Robert Slutzky attempted to capture modernism's spatial themes through the educational paradigm of the nine-square grid project, first given to students at the University of Texas in 1954. When Slutzky and Hejduk collaborated, the nine-square project became a pedagogic tool. On one hand, the frame is an abstract datum of pure geometric relationship and yet it has the ability to promote the development of essential constructional, detail relationships. "It is one of the classic open-ended problems given in the last thirty years."¹⁸ Hejduk's drawings of the nine-square exercise recognize a significant spatial polarity: one of fluidity and a centrifugal force moving outward from the center and its opposite spatial condition, that of inward containment. Hejduk writes of the grid project:

*It was always an architectonic problem. Working with the problem the student begins to discover and understand the elements of architecture. Grid, frame, post beam, panel, center, periphery, field edge, line, plane, volume, extension, compression, tension, shear, etc.*¹⁹

The nine-square continued as a fundamental organization for Hejduk's independent architectural investigations, which were completed through a series of house design projects. In these houses and simultaneously in the work of his students, the nine-square grid expanded into a two-storey format and later into a three-storey cage. The Texas houses were started to re-consider "construction at a conceptual level, at a real level; detail, the methodological development of construction conditions: columns, piers, walls, beams, edges and so forth."²⁰

Hejduk's pedagogic framework is described as an organic methodology, which grows from a spatial and formal understanding of the arrangement and consequence of elements within the matrix of the grid, and the elementary tectonics of post and beam construction. The frame as an educational device is a-sylistic; for Hejduk, the nine-square is metaphysical.²¹

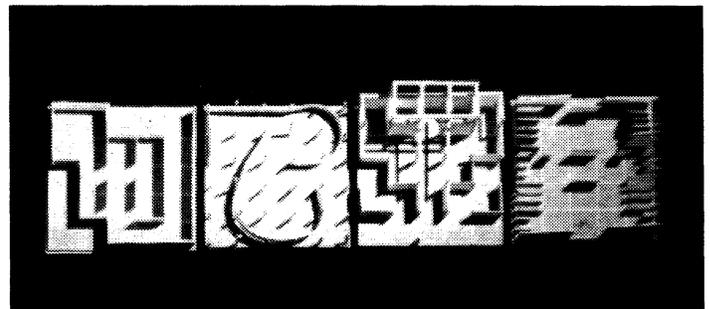


Fig. 14 author: studio UNCC, foundation undergraduate

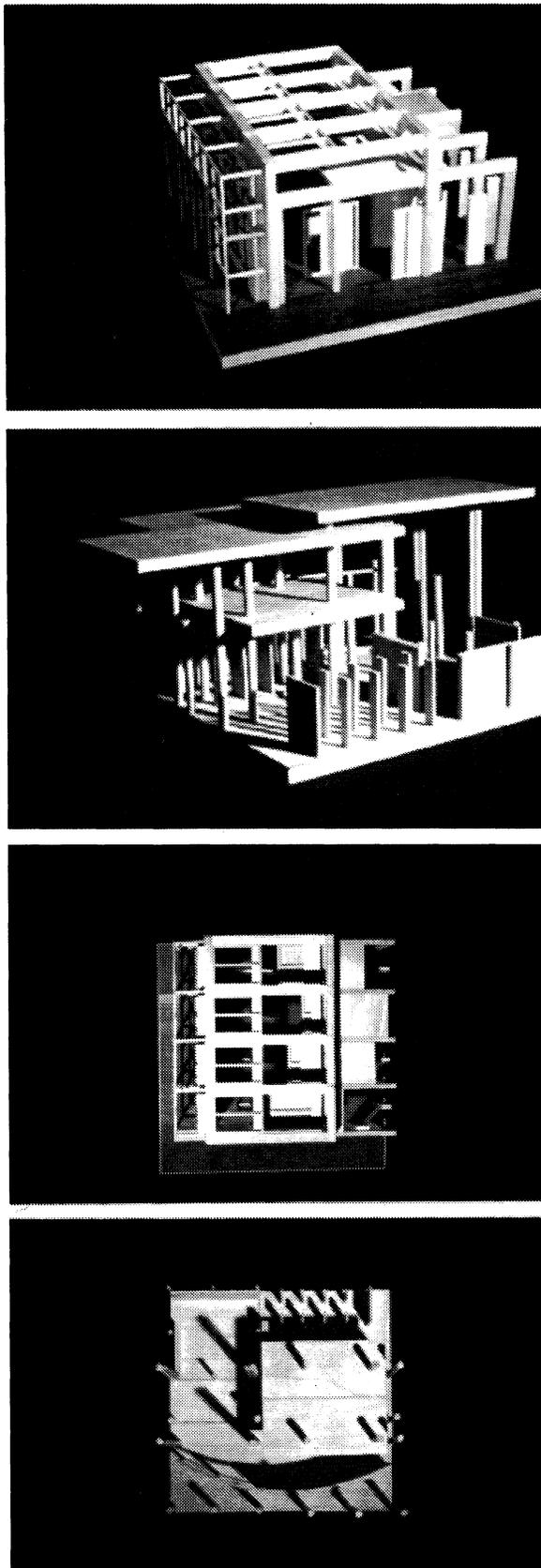


Fig 14: author: studio UNCC. foundation undergraduate

THE STUDIO: FRAME, GRID AND SPACE

The frame as a pedagogical model is a potent catalyst for the beginning student's development of architecture of form, space and materiality. Consciously incorporating the multi-valent readings of grid and frame affords the opportunity to simultaneously engage the abstract and the concrete, the poetic and the practical. As a close to this essay on the powerful and constant appearance and influence of the frame in modern art, architecture and education is a brief review of the author's studio pedagogy which has over time reflected upon and at times incorporated these issues.

The studio pedagogy focusing on the frame as a catalyst for architecture developed over several years and began in response to a foundation studio exercise that was similar to Hejduk's and Slutzky's nine-square project. Focusing on the development of an architectural framework that would be inherently and undeniably spatial transformed the studio work from plan based formalism to a project describing and inscribing spatial volumes with a three dimensional grid matrix through an architectural kit of parts. This pedagogical exercise investigating the frame and space making was again transformed by incorporating a material tectonic of constructional methods and processes that drew from the historical Semperian paradigm and Kenneth Frampton's noted polarities of a heavy stereotomic base: the earth and its compliment the light tectonic frame of carpentry.²²

The tectonic frame is always presented to my students as a repetitious construct of a three dimensional quality. It is modern and infinite, however each student has the opportunity to condition and inflect the geometric lattice. As in several of the architectural works previously discussed, the organizational grid develops a level of complexity, which incorporates both site and architectural constructions. Or rather the site (stereotomic base) and the architectural constructions (tectonic frame) define a reciprocal relationship which is manifest in the geometry of the grid.

A series of linked spatial volumes are described through an architectural framework that includes a complimentary cladding, infill or skin. The condition of cladding, and the definition of a spatial boundary may well be considered as a Semperian opportunity, proposing a rich tectonic fabric or syntactical scrim that can negotiate between the realms of inside and outside by modulating light and views. Coincident with the agenda for cladding and developing the structural framework, is the inclusion of choreographed promenade of circulation, which takes advantage of multiple perceptual and spatial conditions within the student's projects. The promenade begins on the site mass with the development of a sectional and carved landscape and continues a dialogue with the spaces contained within the structural frame.

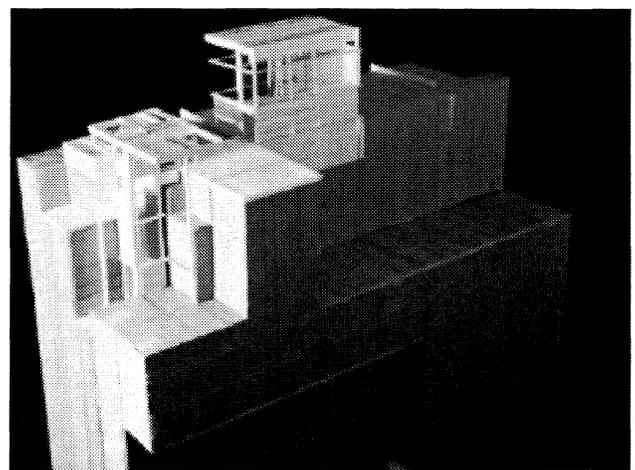
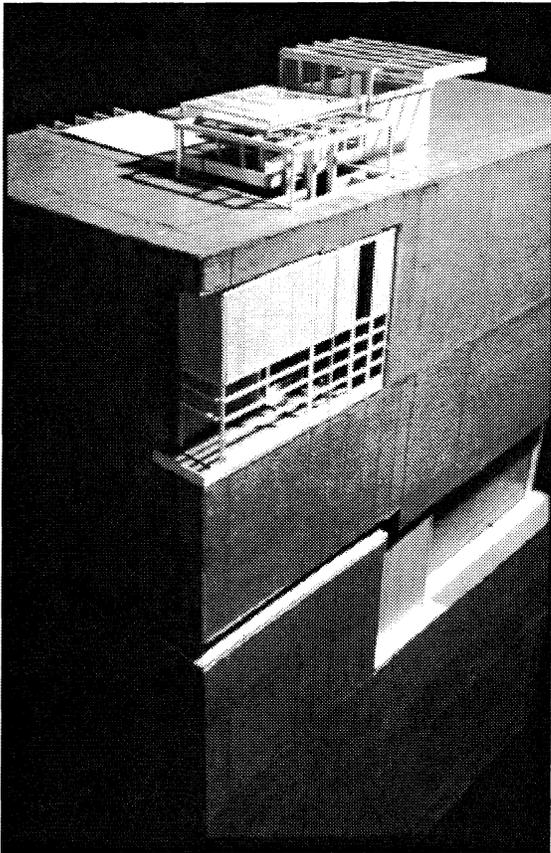
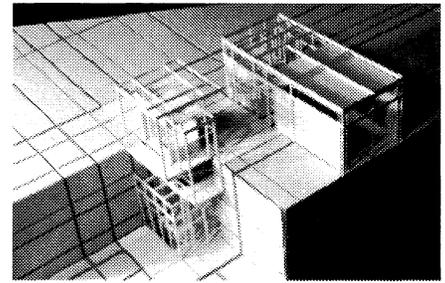
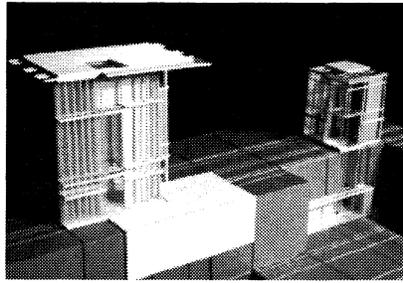
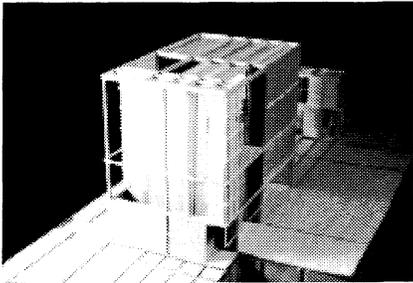


Fig 15: author: UVA graduate: first studio

NOTES

- ¹Colin Rowe, "The Chicago Frame", The Mathematics of an Ideal Villa, (Cambridge: MIT Press, 1982)
- ²Francoise Choay, Le Corbusier, (New York: Braziller, 1960)p. 19: "From an ethical standpoint, Le Corbusier is the spiritual son of the enlightened philosophers of the 18th century, and of the socialist utopians who were their 19th century heirs."
- ³Edward Ford, Details of Modern Architecture, (Cambridge: MIT Press, 1992)
- ⁴Rowe Colin, "The Mathematics of an Ideal Villa", The Mathematics of an Ideal Villa,(Cambridge: MIT Press,1982)
- ⁵Turner Paul, "Rationalism, Romanticism and the Domino System", The Open Hand, R. Walden, ed., (Cambridge: MIT Press, 1977)p. 24.
- ⁶Reyner Banham, Theory and Design in the First Machine Age, (Cambridge: MIT Press, 1994) p. 99-105
- ⁷see John Golding, Cubism a History and Analysis, (Cambridge: Harvard, 1988)

- ⁸Kraus, Rosalind, "Grids". The Originality of the Avant-Garde and Other Modernist Myths, (Cambridge: MIT Press,1986)
- ⁹Christian Norberg Schulz, "Talks with Mies Van der Rohe". L'Architecture d'aujourd'hui. No. 79, p.100
- ¹⁰Bernard Tschumi, "The LaVillette Park Competition.", Landscape: Princeton Architectural Journal, vol.2
- ¹¹Jim Murphy, "Literal Abstraction", Progressive Architecture, No. 11, vol. 72, Nov 1991, p. 56
- ¹²Peter Cook, George Rand, Morphosis: Buildings and Projects, (NY: Rizzoli, 1989)p.173
- ¹³Edward Ford, Details of Modern Architecture, vol.2, (Cambridge: MIT Press) p. 414-415
- ¹⁴Frank Lloyd Wright. "The life-work of an American Architect Frank Lloyd Wright" (New York: Horizon, 1965)p. 57.
- ¹⁵Robert McCarter, "The Integrated Ideal" Frank Lloyd Wright a Primer of Architectural Principles,(New York: Princeton Architectural Press, 1991)
- ¹⁶Krauss, Rosalind, "Grids". The Originality of the Avant-Garde and Other Modernist Myths, (Cambridge:MIT Press,1986)
- ¹⁷Rowe Colin, "The Mathematics of an Ideal Villa", The Mathematics of an Ideal Villa,(Cambridge: MIT Press,1982): "Le Corbusier's Villa Stein is a "continuous dialectic between fact and implication. The reality of deep space is constantly opposed to the inference of shallow space; and by means of the resultant tension, reading after reading is enforced. The five layers of space which through out each vertical dimension divide the building's volume and the four layers which cut it horizontally will all from time to time claim attention; and this gridding of space will then result in continuous fluctuations of interpretation."
- ¹⁸Alexander Caragonne, The Texas Rangers, (Cambridge: The MIT Press, 1994)p. 195
- ¹⁹John Hejduk, Mask of Medusa, (NY: Rizzoli 1985)p. 37
- ²⁰John Hejduk, Mask of Medusa, (NY: Rizzoli 1985)p. 35
- ²¹Alexander Caragonne, The Texas Rangers, (Cambridge: The MIT Press, 1994)p. 195
- ²²Patricia Kucker, "The Semperian Paradigm: issues of tectonics in foundation design". Proceedings:ACSA 84th Annual Meeting (1995)