



FORMING **AND** CENTERING

Foundational Aspects
of Architectural Design

Kenneth M. Moffett

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Kenneth M. Moffett, AIA
Bullock Smith & Partners Inc., Knoxville,
TN, USA



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INVESTOR IN PEOPLE

For Marian

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Kenneth M. Moffett

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INTRODUCTION

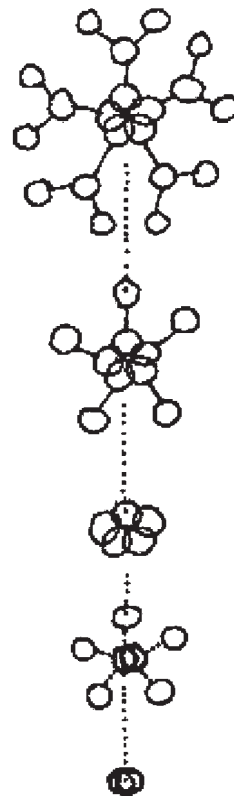
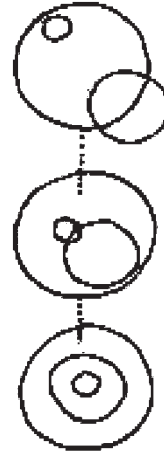
The design of buildings, even in this age of headlong technological change, is a process that can seem shrouded in mystery. It is a difficult art, as one might infer by the labored nature of much recent built form. It's an art—and a profession and a business—of many parts. Architects are steeped from their school years in the primacy of synthesis, of the need to put all the disparate pieces of the puzzle together systematically toward the final goal of the building in place and in use. But somewhere in this establishment of concepts and resolution of practicalities, certain elemental aspects of how architecture is comprised have never quite been elucidated. They sit in the background, almost as if too self-evident or prosaic to merit closer examination. Hidden in the “hindbrain” of the design process and buried in the multitude of factors competing for attention, these primal aspects remain rather vague and ill-understood, contributing to a sense of enigma. This discussion will focus on these aspects alone, dusting them off, lighting their dark corners and revealing their own internal sets of interrelationships.

“Forming and Centering” refers to architectural issues, although these terms can also evoke something of a new-age flavor, as in efforts to “center” one's life or psyche. Such pursuits, which may involve the paring away of life's complications in a search for irreducible meanings, actually do have fitting parallels: in the following discussion, much material normally considered basic to architectural theory

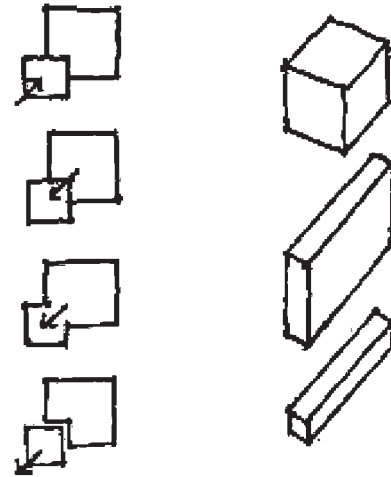
and practice has been set aside to help reveal some innermost fundamentals. The title may suggest yet another implication to anyone who has worked with clay and a potter's wheel, wherein "centering" is the specific skill of locating and keeping the clay on the center of the rotating wheel-head. Again, there are relevant implications for architecture, both in terms of this process of centering and in the act of forming in general: of taking an amorphous medium and giving it shape and structure.

I believe there is a discrete number of basic approaches to forming in architecture, and an exploration of this assertion is the subject of Part One. The less explored world of centering in architecture is examined in Part Two. The main thesis of this book is that forming and centering—the process of giving shape and the organization which gives it focus—together comprise a sort of elemental foundation or armature for the multitude of other ingredients involved in built form.

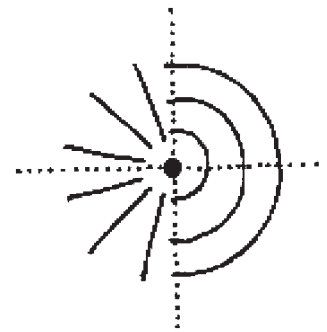
Architecture arises from a remarkably diverse, conflicted and confusing mix of factors. Building systems, materials, color, the site, light and orientation, vista and sequence, public safety, physical and sociocultural context, program, budget, sustainability, fashion, hubris, politics—not to mention the well of confusion called, for lack of a better word, "aesthetics"—clearly such a complex, interwoven mesh of issues must be synthesized with skill to achieve works of merit. The arguments which follow seek in no way to diminish the significance of these factors, but to retreat past them—to unlearn, in a sense, the taught compulsion to investigate architecture as a palimpsest or network of interrelated factors—in order to arrive at a clean slate upon which to examine the issues that remain. The arguments herein seek to support a view that these remaining primal issues are those that I have called forming and centering, preceding all the other aspects of detail and circumstance. This is not to assert that these issues arise first in the course of design: on the contrary, design is generally a complex iterative process from which a project's "form" and "center" recognizably emerge only at some intermediate point. The exercise of reversing this order and paring the scheme back is necessary to reveal or distill these underlying modes of the design process.



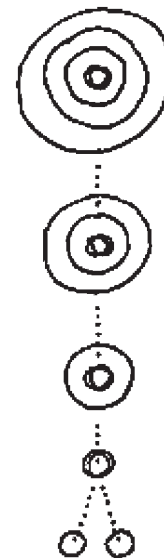
“Additive” and “subtractive” form, familiar topics in analyses of architecture’s fundamentals, will be visited in this discussion, but in terms of the multifaceted inner structure that characterizes these deceptively basic means of forming. And they have a place in a *larger order* of forming methods, the subject of Part One. Far from simple models for form, addition and subtraction are complex subsets of this larger interrelated series of approaches, capable of elucidating much of the broad gamut of built form. Issues of “dimensionality” supplement this examination of formative modes, leading with discussions of form that is dominantly volumetric, but proceeding to “planar” and “linear” form and the implications of the formative modes as manifest in works that embody these dimensionalities—and their combinations.¹



In like fashion, a continuum of approaches to the center—to a work’s focus, hub or heart—will be developed in Part Two, which likewise finds a place for many if not most works within the full pantheon of architectural form as presently understood. In the spirit of this search for ultimate essentials, illustrations are honed to the simplest format that will directly communicate the issue at hand, while still affording a general sense of form and scale. Most figures vary in scale as required to adequately make their point, though in a few cases sets of figures are adjusted to the same scale for the sake of pertinent comparisons. A benefit of our times is that further information in the form of narratives, photographs, delineations, and contextual views of most of the projects referenced here is readily available online.



This paired distinction of forming and centering arises in part from the immiscible nature and purpose of these processes, despite their intimate mutual involvement both spatially and temporally during the design process. As the last step in “paring away” the veiling effect of design’s multitudinous factors, the thesis here is that these two remaining primal matters must in turn be disentangled from each other to reveal the nature of each in fullest clarity. Ironically, given the symbiotic nature of the two processes, they must be treated separately to be explained most effectively. Some case studies



1. Talk of planar and linear form may seem paradoxical or counterintuitive, but these terms are used informally; they refer to basic distinctions of proportion.

will be addressed regarding forming, some regarding centering, and some both—which is as it should be, all cases submitting in theory to both issues.

While projects and phenomena on the scale of urbanism are invoked when they contribute to the issue at hand, the scope here is generally that of architecture—of individual buildings or closely related building groups in their immediate contexts. And while the “era of modernism” is the resource for many of cases discussed, care has been taken to mine the breadth of built form throughout history. Many of these examples will be familiar, both in general terms and having served as subjects of other typological studies: they reappear here in the service of the hopefully fresh take of this narrative’s arguments. Some others will be less so, including cases of vernacular form, and works that are not widely known but are notable for their contributions to the discourse. An honest effort has been made to avoid the procrustean flaw of selecting examples that best suit the case at hand (or of passing over those that seem to apply less well). In some cases it has seemed justifiable to build on the particular matter at hand, resulting in “mini-essays;” others may be briefly cited, depending on the illustrative diagrams to demonstrate the issue.

Case studies range widely among styles, scales and times, and the discussions are indeed generally brief, consistent with the intent of focusing on the elemental issues at hand. Thus each section is readable as a related narrative, but the effort as a whole may come to seem repetitive if consumed in large bites: I have chosen to cover a lot of bases for the benefit of broadly elucidating the arguments, and this is sort of an inevitable consequence. That said, it is hoped that the broad scope and accessible format of these thoughts, presented as an equally weighted interplay of discussion and diagram, will render them of interest and value to students, practitioners, scholars and enthusiasts of architecture alike, and lift at least a corner of the veil of mystery.²

2. Unless otherwise noted, illustrations are by the author. Drawings or diagrams that are uniquely characteristic of their source and constitute interpretive redrawings thereof are so credited.

PART I: FORMING

I don't think of form as a kind of architecture.
The architecture is the result of the forming.
It is the kinesthetic and visual sense of position
and wholeness that puts the thing into the
realm of art.

– Roy Lichtenstein

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Chapter One

UNITARY FORM

Consider the following an appendix-up-front. A particular architectonic family precedes the very issue of form development, for these are works not subject to a formative strategy as such but which stand on their own, unaltered. They hold a fascination for their irreducible geometric nature and their unique impact, recurring down through history, with forms arising from immutable rules of geometry rather than evolving morphological processes. Their benefit is a striking, iconic simplicity; their price an inflexible rigidity in terms of fit to function or context. And in reality, very rarely is purity of form maintained, given the exigencies of portals and other secondary tweaks that generally come about in order to render them habitable. This is a glance at a selection of unitary forms, arranged by type and comparative scale: familiar ground, perhaps, but an important prequel to the examinations of formative modes that follow.

Polyhedral Basics

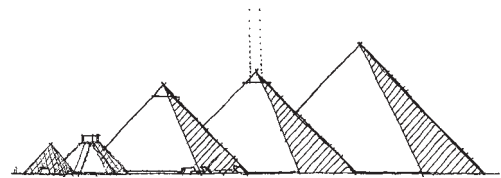
The Platonic solids—the five regular polyhedra—comprise a well-known family of such forms. In the world of built form, the tetrahedron with its four equilateral triangular faces is usually bypassed in favor of the square-based pyramid.¹ The Egyptian pyramids

1. Not a regular polyhedron itself, two such figures mated at their bases become one: the octohedron.

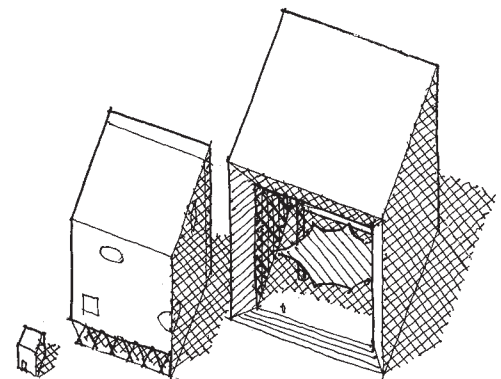
with their enigmatic combination of massive scale and focused profile were joined much later by the pyramids of Mesoamerican civilizations (1.1). These precedents have inspired modern-day homages at Memphis, Tennessee, Las Vegas, and elsewhere. Pei's audacious glass pyramid in the forecourt of the Louvre attempts the delicate balance of providing a focal point without imitating or upstaging the landmark complex surrounding it: the iconic form renders its status as the entrance unmistakable, evokes the enduring focus of its forebears, and defuses possible attendant pomposity by being rendered transparent. Oscar Niemeyer sketched an ambitious inverted pyramid scheme for a Caracas art museum that was never realized.

The mute and unresponsive cube lacks the pyramid's focused profile, but its arresting static quality has been an appropriate choice for symbolically important applications, ranging from Makkah's stone Kaaba to Paris' *Grande Arche de la Défense*. (1.2) Although the cubic form of von Sprechelsen's winning competition entry for a "modernized *Arc de Triomphe*" was subtractively altered so that the spatial axis begun at the Louvre pyramid would be both marked and continued, its geometric essence remains. The freestanding elevator shafts and tensile canopy, while dramatic, are secondary to this dominant gesture. Another Paris project, Koolhaas' unbuilt entry in the Library of France competition also incorporates a subtractively altered cube, but with flamboyant volumetric removals arrayed within and barely hinted at on the exterior. So among its applications, despite its "mute" qualities as a Platonic solid, the cube appears variously as an iconic focus, an axial collimator, and a mysterious sheath for bizarre interior voids.

The remaining regular polyhedra, the dodecahedron and icosahedron, are two halves of a coin: by connecting the centers of the dodecahedron's twelve pentagonal faces an inscribed icosahedron of twenty triangular faces results. The figures remained rather



1.1 I. M. Pei: *Pyramide du Louvre*, Paris, 1989; Castillo Temple, *Chichén Itzá*, Mexico, c.1000 AD; Rosser Fabrap: Pyramid Arena, Memphis, TN, 1991; Veldon Simpson: Luxor Resort, Las Vegas, 1993; Great Pyramid of Khufu, Egypt, 2540 BC.

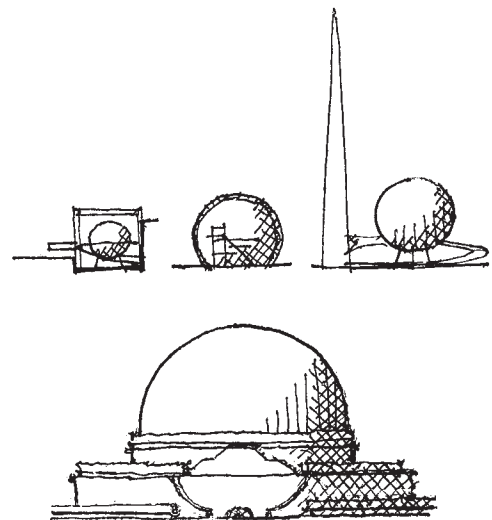


1.2 Kaaba, Makkah, Saudi Arabia; OMA: *Très Grande Bibliothèque* competition entry, Paris, 1989; Johann Otto von Spreckelsen: *Grande Arche de la Défense*, Paris, 1989.

obscure curiosities until R. Buckminster Fuller co-opted their geometric properties for geodesic structures, developed through added facets to enclose large volumes of space with efficient and lightweight means. Their architectural merits vary with the application: memorable at Expo '67's U.S. Pavilion; less successful in rustic counterculture shelters also dating from the '60's. The polyhedral basis of these domes' geometry doesn't admit very gracefully to truncation, and the omnidirectional nature of their faceting, with no particular ground plane or datum reference, can be disorienting.

When the number of facets approaches infinity, this element becomes a sphere, the purest and most haunting of the unitary figures (1.3). It's well known that spheres fascinated the neoclassicists Boullée and Ledoux—who experimented with pyramids and other iconic figures as well—but their visionary projects remained unbuilt, and the featurelessness and structural impracticalities of the purely rendered form continue to assure its rarity as a primary form in architecture. Unfaceted domes such as Saarinen's Kresge Auditorium at MIT constitute truncations of spheres, as do countless partial spheres serving as domical caps for neoclassical buildings. The Trylon and Perisphere theme structure of New York's 1939-1940 World's Fair housed an influential exhibit in a spherical structure, and Polshek's Rose Center for Earth & Space offers both a sphere *and* a cube, the former within the transparent housing of the latter. Here for once the omnidirectional nature of the sphere finds a fitting architectural application, representing the sun to scale with surrounding planetary models while housing a use that suits its shape.

So on the evidence, the essentially unarticulated and non-directional nature of all these “unitary” forms demands highly unusual programmatic and contextual conditions to achieve merit as architecture. A review of these cases reveals that, regardless of how closely the built structures may adhere to the idealized forms



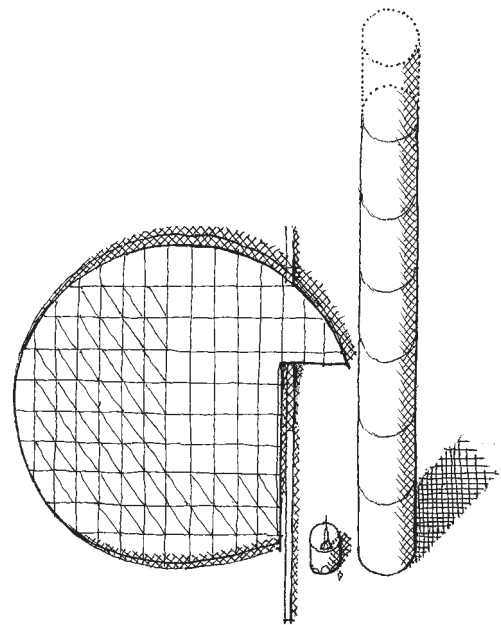
1.3 James Polshek: Rose Center for Earth & Space, Manhattan, 2000; Buckminster Fuller: USA Pavilion, Expo '67, Montreal, Canada, 1967; Wallace Harrison & J. Andre Fouilhoux: Trylon & Perisphere, New York World's Fair 1939-40; Étienne-Louis Boullée: Cenotaph for Sir Isaac Newton (project), 1784.

on which they are based, they exist of necessity in some sort of context which influences their perceived formative role. By definition, truly convincing unitary form is difficult to achieve in reality.

Basics Altered

Some Platonic figures may be altered to produce further unitary forms, as in the case of cylinders or cones developed by the rotation of square or triangular planar geometries. The plan-based cylinder's focus—both vertical and inward—has inspired realizations such as Saarinen's chapel at MIT (1.4). The broad cylindrical volume of Snøhetta's Bibliotheca Alexandrina sports a slight rotation into the ground plane, ostensibly responding to solar issues but clearly also adding a dynamic dimension to a static form. In both cases the choice of geometry suitably enhances a sense of protective enclosure for something precious. Nouvel employed an extreme attenuation of the cylinder, seeking something of an opposite impression, in his unbuilt *Tour Sans Fins*. Its conceit of gradually fading away toward the summit embodies the grandiose image of indefinite continuation if one could but see that far into the heavens.

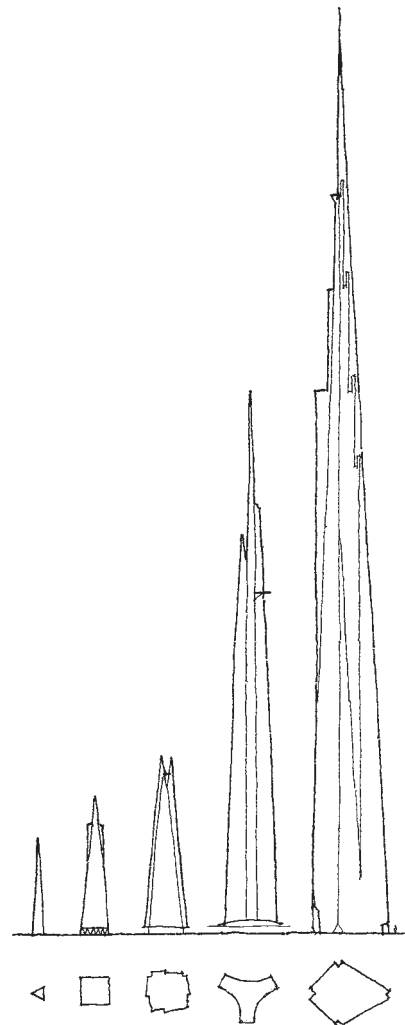
The trylon was an attenuated tetrahedron, and a stretched half-octohedron forms the armature of San Francisco's Transamerica Pyramid. (1.5) Piano's London "Shard" obfuscates its origins as a square-based pyramid with fractured interventions, the result being midway between pyramidal and conical in expression. Its tilted and foreshortening facets, eroding before reaching a summit, seem a bit irresolute as a result, the scheme being a very tall and intrusive example of neither fish nor fowl. Jeddah's Kingdom Tower is based on a sort of equilateral triangular base, and despite a variety of articulations, gives a strong impression of another impossibly stretched pyramid. An inspiration for that project may have been Wright's mile-high proposal for Chicago, based on a quadrilateral plan, which deserves note for its grace and audacity despite



1.4 Snøhetta: Bibliotheca Alexandrina, Egypt, 2002; Eero Saarinen: MIT Chapel, Cambridge, MA, 1955; Jean Nouvel: *Tour Sans Fins* (unbuilt), Paris, 1989.

issues of impracticality and—sharing this caveat with so many other more recent towers—the utter lack of any need for buildings remotely that tall. Excepting the trylon, these stretched pyramids feature interventions that, for issues of practicality or effect, interrupt the purity of the form. The emergence of Transamerica’s elevator cores constitutes a salutary reminder of vertical anchorage, while the lack of any such reminder of the vertical at the shard renders it oddly insubstantial and unrooted in its context. The master of prairie horizontals is more convincing in his audacious exercise by virtue of vertical faceting that complements, enhances and anchors the overall taper.

The sphere has also been altered, as in the quasi-prolate spheroid of Foster’s London “Gherkin,” and the “oblate ellipsoid” of TEN Architectos’ unbuilt convention center for Guadalajara. And as for alterations of the cube, a vast range of rectangular solids of varying dimensions and proportions populates the modern era, for good and for ill. Cases of the cube’s extreme vertical attenuation would include Viñoly’s midtown tower, the least grotesque of a plague of super-slender towers that have sprouted in Manhattan and elsewhere for the mega-rich. The skyscraper in general has undergone a plethora of attempts to craft variations on these unitary forms—“pleated” shapes with origins in the squared tower, asymmetric faceting recalling the attenuated pyramid, irregular curved profiles as outgrowths of the cylinder— some freshly inventive, others displaying no sign that a desire for the self-consciously odd will abate any time soon.²

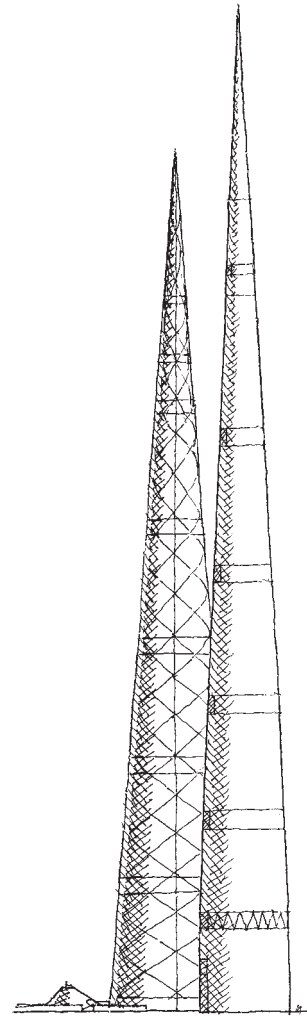


2. A “complete set” of orthogonal transformation is commonly visualized as beginning with a “non-dimensional point”—or arbitrarily small cube—which if stretched either vertically or horizontally becomes a “one-dimensional” or linear figure. These may then expand along a second dimensional axis to become either vertical or horizontal “two-dimensional” planar figures. A final expansion results in a range of three dimensional figures, of which the cube is the most basic. Conferring some measure of cross-sectional dimension to the intermediate figures renders them-archetypes for thin tower or slab designs.

1.5 Trylon; William Pereira: Transamerica Pyramid, San Francisco, 1972; Renzo Piano: The Shard, London, 2012; Adrian Smith + Gordon Gill: Kingdom Tower, Jeddah, Saudi Arabia, 2019 (est.); Frank Lloyd Wright; The Illinois (project), Chicago, 1956, adapted from Frank Lloyd Wright, *A Testament* (New York, Bramhall House, 1957), p. 248.

The cone also fascinated neoclassicist visionaries and has also reappeared in modern times (1.6). Predock's American Heritage Center features a tweaked and truncated cone as its centerpiece, its imagery referenced as an "archival mountain."³ As with the pyramid, there have been radically attenuated conical proposals, including Foster's Millennium Tower for Tokyo and SOM's theoretical "(a)Spire" tower, its hollow shaft being the cone's tallest proposed extremity to date. One may suggest that these very tall, thin cones and pyramids arise from the same storming-the-heavens motivation as the *Tour Sans Fins*, here applying false perspective and appearing to disappear at the pinnacle, seeming so high as to be out of sight.

Such skyscraping forms clearly embody more than a normal proportion of symbolic content and hubris, which can be said to some degree for most cases of unitary form. They serve as an irreducible and often cautionary baseline case: if forming is visualized as a continuum between two extremes, this is the extreme of consolidation. Perhaps the other limit would find an entropy of dispersed, separated elements, a single function or purpose for each, scattered in all directions. Between these limits lies the large body of architecture and urbanism, as addressed in the following chapters, wherein initiating forms are combined or reshaped by one or another formative measure in the struggle to address aesthetic, contextual and functional demands.



1.6 Antoine Predock: American Heritage Center, University of Wyoming, Laramie, 1993; Norman Foster: Millennium Tower (unbuilt), Tokyo, 1989; SOM: (a)Spire (theoretical project), 2011.

3. Joseph Giovannini, "Myth and Spirit," *Architecture* 82 (Dec. 1993): 51-61

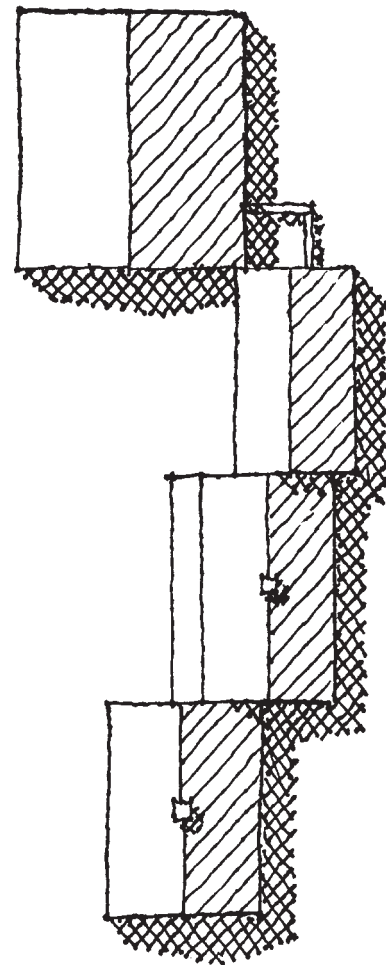
Chapter Two

ADDITION

Logical, intuitive, and inherent in urban and rural building from earliest times, addition is the dominant mode of architectural forming: groupings of functions give rise to corresponding elements or volumes, which are brought together into a multifaceted assemblage by one or another of a related variety of additive approaches. The additive organizations of vernacular townscapes and farm compounds have been strong influences on twentieth century architecture (2.1). But in contrast to the incremental growth over time that characterizes these precedents, modern day decisions involved in joining discrete volumes are deliberate, generally taking place as a single coordinated design effort.¹

Additive form presupposes a generative “force” that brings the parts together, which may or may not be consciously expressed in some way by the designer. Binding forces of nature, such as magnetism or gravitation, are useful analogies, but each architectonic assemblage arises from a complex mix of causative forces: centripetal and centrifugal, practical and abstract, intended and unconscious. The purpose here is not to deal with the nature of these forces, but

1. The distinction pertains to additive strategies in a particular project designed and constructed with integrated forethought. Of course, “incremental growth over time”—or certainly *change* over time—eventually returns to be the rule rather than the exception over the long haul.



2.1 Connected farm complex in Maine, adapted from Thomas C. Hubka, *Big House, Little House, Back House, Barn* (Hanover: University Press of New England, 1984), p. 7.

to analyze the several specific ways in which they are manifest in additive form—approaches which make up a sequential series of types.²

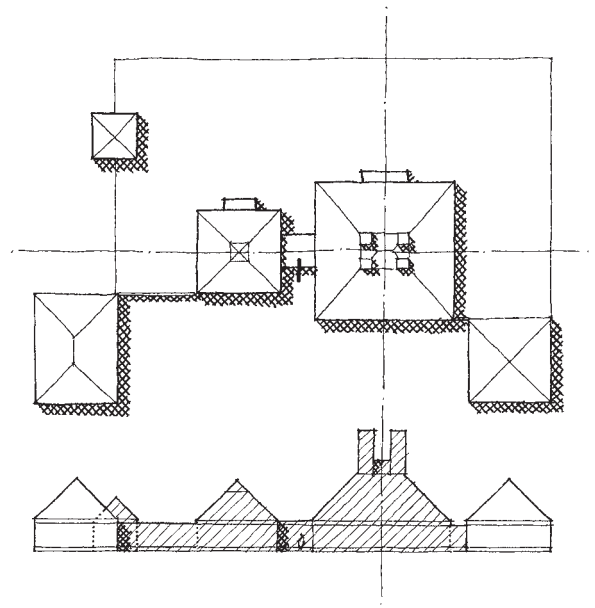
Adjoining

One end of this series comprises an initiating case: architectonic volumes that adjoin each other in close enough proximity to be perceived as an ensemble, but which are not linked by any means other than a shared ground plane or other datum. The situation represents a minimized extreme: any less content and addition is not manifest. As one embodiment of the approach, Jacobsen's Waddell House is a constellation of squares in plan: notwithstanding some linking structures, its conception of separated pavilions is clearly expressed (2.2). The design imparts a sense of accretive force, both by an increase in size and a reduction in separation as units approach the central, largest element.

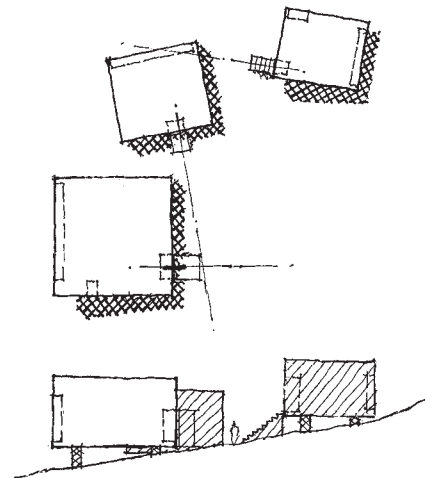
In contrast, Rick Joy's Desert Nomad House arrays separate rectangular-solid volumes in a spare, skewed composition with no particular sense of central focus, floating slightly above the undisturbed desert landscape and oriented to distant vistas (2.3). Both houses demonstrate that connective relationships among such elements can be inferred even where there is no physical link: adjacency, scale, proportion, and orientation permit a surprising breadth of expression within the austerity of the approach. Ultimately the poetry of architecture as a composition of separate parts goes hand-in-hand with an acceptance of its issues of impracticality.³

2. Some graphic conventions will be used when applicable throughout the following chapters: A single bold hatch denotes a main entrance in a plan diagram. Lightweight axes of alignment, symmetry or connectivity are shown when they appear to feature significantly in the design. Arrowheaded figures assist where suitable in expressing convergent, divergent or lateral "movement." Most elevations or axonometrics feature a scale figure to aid in scale definition.

3. Again recalling the long history of vernacular farm architecture, connectivity is a logical outcome of climate. While harsh conditions cause a typical linkage of buildings in Canadian farms, compositions of separated buildings, sometimes serendipitously picturesque, are the norm in more southern climes.



2.2 Hugh Newell Jacobsen: Waddell house, Long Island, 1988.

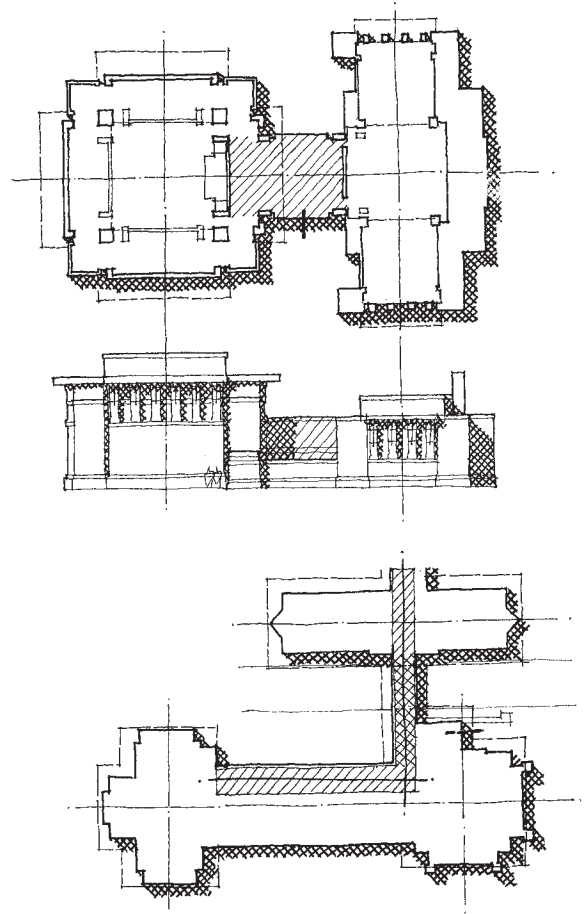


2.3 Rick Joy: Desert Nomad House, Tucson, 2005.

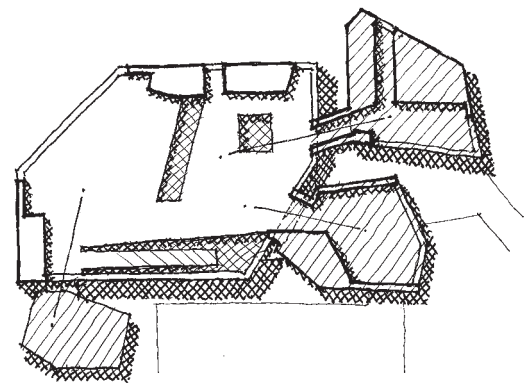
Linear Linking

The most “diagrammatic” approach to additive form employs linear connections that link up volumes in a variety of ways, recalling the ball-and-stick diagrams of molecular chemistry. The parallel is apt: in both disciplines the balls represent the elementary units of a certain kind, the links being the binding attractions between or among them.

- The most basic such diagram consists of two linked elements, a binuclear scheme: the linear joining structure, whether open or enclosed, binds two otherwise largely independent volumes into a single architectonic whole. At Wright’s Unity Temple, the narthex forms a link between the otherwise bisymmetrically independent volumes of the auditorium and the Sunday school (2.4).
- The original configuration of his Hillside Home School goes a step further by connecting the central building with two subsidiary structures, the gymnasium and the lab/art building, via linear links—one an enclosed bridge over a driveway.⁴
- From more recent times, Adjaye’s D.C. branch library features three elevated subsidiary volumes linked to the main building by short bridges (2.5). The project’s departure from orthogonal rectitude affords a clear expression of its central/radial organization, with the disparate shapes and locations of the linked elements dictated in part by limitations of the site.
- TAC’s Johns-Manville headquarters—now Lockheed Martin’s—involves the *elongation* of a central volume to become a spine for the composition, joined by linear links to secondary



2.4 Frank Lloyd Wright: Unity Temple, Oak Park, IL, 1908; Hillside Home School, Spring Green, WI, 1902 (subsequent additions not shown).



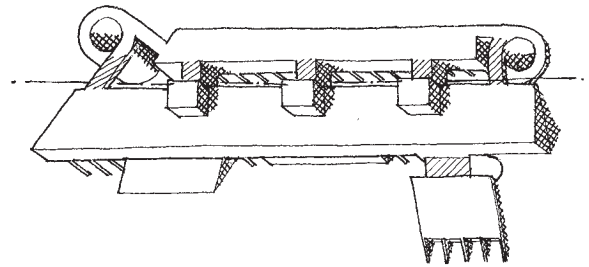
2.5 David Adjaye: Willam O. Lockridge/ Bellevue Library, Washington, D.C., 2012.

4. Later renovations and additions converted the school into the Taliesin Fellowship Complex, most notably the drafting studio appended to the lab/art building in 1932.

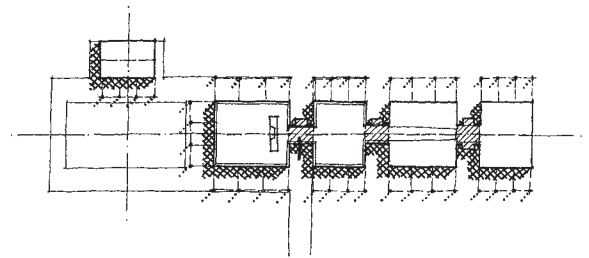
building masses and helical ramps for rooftop parking (2.6). One intuitively perceives this as a different type of formative order, but with respect to the way linear links have been employed to achieve an additive composition, the case is again radial in organization: the links are not sequential but again connect individually to the central element.

A basic distinction arises when moving beyond the elemental case of two connected volumes, which is the choice between the central organization of the above cases, and linear organization, a distinction inherent in all variations on the theme of additive form:

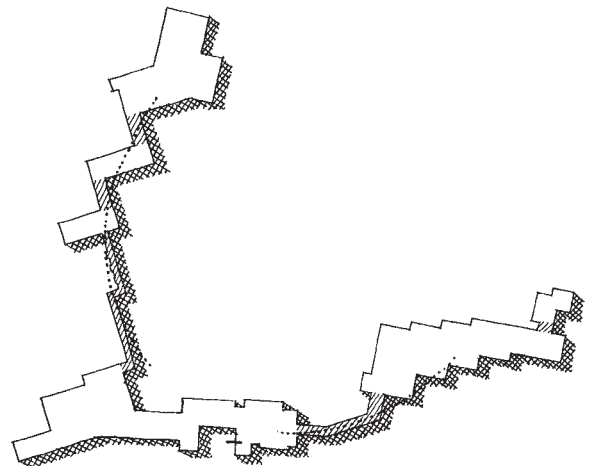
- In the linear case, an extension of the basic linked pair becomes a chain of three or more connected in series, as at Jacobsen's Zamoiski house: its rigidly aligned row of nearly identical gabled volumes is spaced apart by short links, a small pool house being the only departure from this pattern (2.7).⁵
- If this diagram of elements on a chain is given more freedom of alignment, varied manifestations appear, such as allowing a linear sequence of links to rotate in a consonant direction. Denmark's Louisiana Museum embodies this, while also demonstrating the aptness of the linear link in museum design: contents of the various gallery groupings and additions achieving autonomy from each other via the contrasting experiences of the intervening glazed links overlooking the landscape (2.8).
- Aalto's Paimio sanatorium readily appears to be another case of elements linked in a consonant array. But there is sufficient ambiguity as to the "vectors" of linking forces that the complex of



2.6 The Architects Collaborative: Johns-Manville Headquarters, Denver, 1977.



2.7 Hugh Newell Jacobsen: Zamoiski house, Maryland eastern shore, 1983.



2.8 Bo & Wohlert: Louisiana Museum, Denmark, 1958 (subsequent additions not shown).

5. Although presented here to help illustrate the complete derivation of linkage types, such an open-ended linear sequence foreshadows a discussion to come in the formative taxonomy of *replication*.

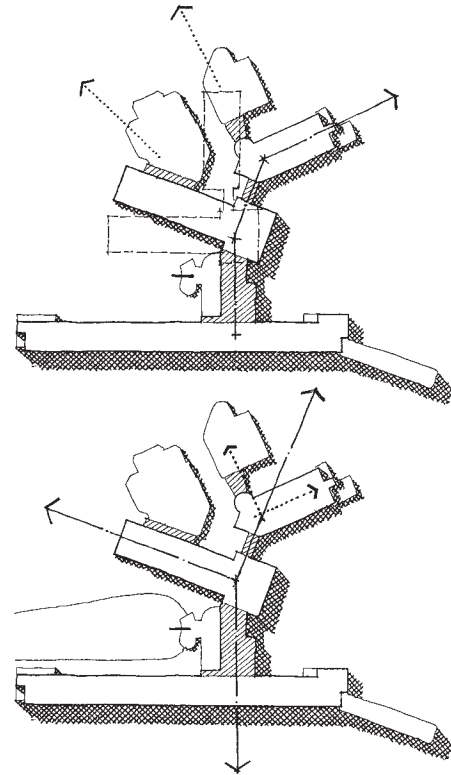
buildings can also be perceived as fundamentally radial or central in organization (2.9).

- Were such cases of consonant curvature to continue and return upon themselves to connect full circle they would become “toroidal” or courtyard schemes, encapsulating an inner zone of exterior space. Such was somewhat the case at Johansen’s sadly demolished Mummer’s Theater, its three object buildings circumferentially linked by pedestrian bridges and mechanical piping at the main circulation level. But at the lower level the elements appear to strain apart, tethered *radially* to an open central circulation deck, also featuring radiating access bridges: thus six links diverge from the center, in diametric contrast to the circumferential order above (2.10).

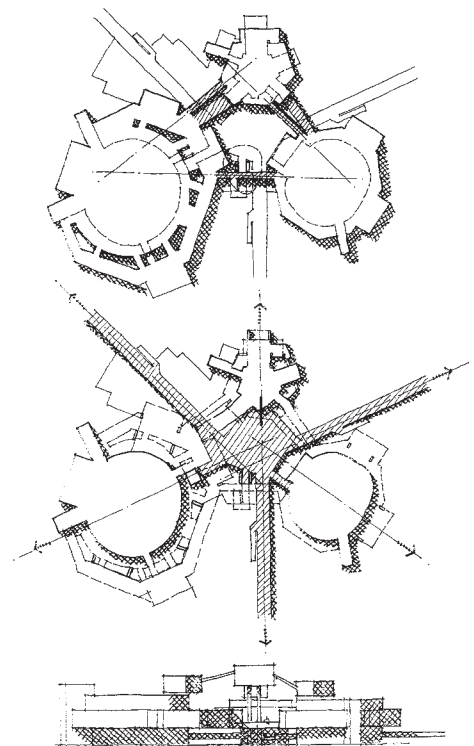
A final overview sums up this sequence of possibilities inherent in addition by linear links (2.11). Once an initial binuclear linked pair is joined by a third, there is a division into two geometries, the axially linear and the nonlinear. Further links lead to another division, between radial and circumferential orders. The radial geometry then has the option of a return to axial linearity in the form of the spinal approach, though morphologically retaining its radial nature. The circumferential geometry may resolve into the finite completion of a ring, but there is also the option of extending into the indefinite expansion of spiral geometry.⁶ Hubs and links are their own diagram; they are elementally and directly expressive of relationships.

Matrix Embedding

There are a limited number of additive design strategies for engaging discrete elements while retaining some perception of their separateness and individuality. The use of linear links lies at one extreme, employing the greatest economy of



2.9 Alvar Aalto: Paimio Sanatorium, Finland, 1932: consonant and radial interpretations.

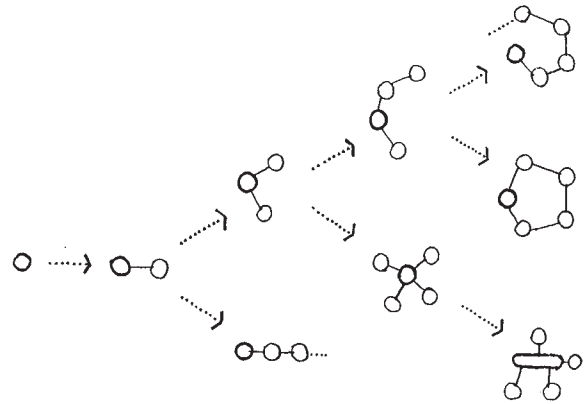


2.10 John Johansen: Mummer’s Theater, Oklahoma City, 1970: upper and lower levels (demolished 2014).

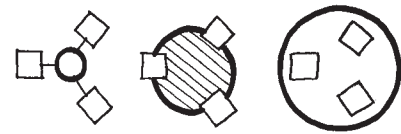
6. This duality of radial and circumferential geometries becomes a central theme of Part Two.

spatial means, while at the other extreme the focal point of radially related links can be visualized as expanding to encapsulate the entire region of the adjoining volumes, becoming a macro-scale volume housing the entire original group within it. Of more immediate interest is an intermediate point on this expansion: here this connective tissue neither takes scale predominance nor fully swallows up the original volumes, but acts as an embedding or *poché* medium, gluing the volumes in place without otherwise substantially altering them (2.12). It affords visual and physical connection among them while typically preserving their outer facades unencumbered. Seen in another way, the negative space defined by the grouping of volumes is encapsulated with new outer walls bridging between the volumes. In some cases these binding walls seek minimal surfaces, as in the behavior of soap films, while in others the newly enfranchised binding element is more assertive, extruding outward to add new material to the periphery of the aggregate form.

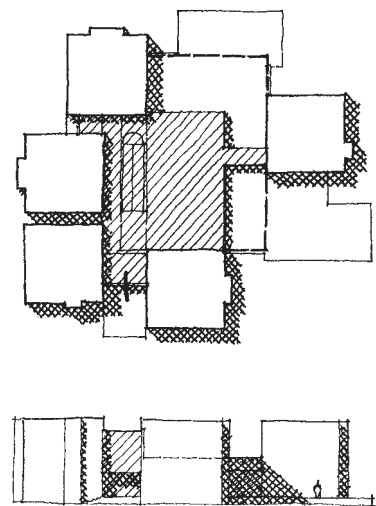
- A house by Franzen employs the approach with clarity in that the central living pavilion—the “matrix”—contrasts with a surrounding village of taller masonry cubes that engage it to varying degrees (2.13). Nearly identical as volumes, they house a variety of domestic functions. One is appended by a linear link: such importation of nonconforming devices is often employed for functional reasons or simply to vary the composition. The unassertive and open-sided nature of the centerpiece is characteristic of the approach, setting it apart as of a different faith and order than the elements that engage it.
- While such a family of identical engaged elements can be appropriate and effective, a freer approach offers other possibilities, as at Taft Architects’ Houston YWCA: one element drifts at an angle, while a second is stretched into a shape so elongated that it is hardly recognizable as one of the three basic building blocks of the design, and



2.11 Sequential tree of linear link geometries.



2.12 Matrix embedding in an additive sequence of expansion.

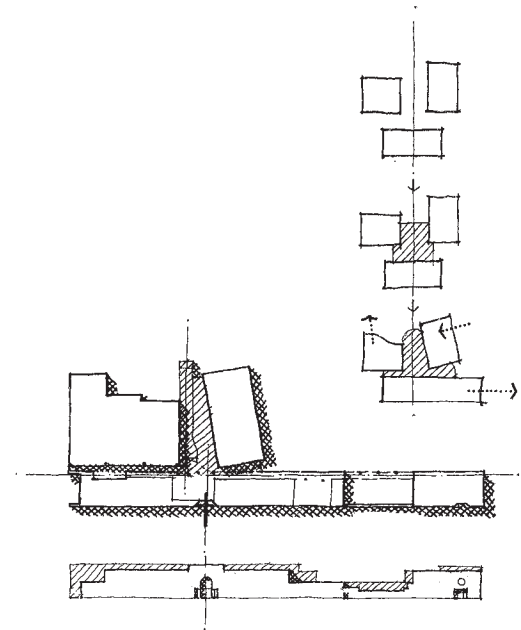


2.13 Ulrich Franzen: Dana House, New Canaan, CT, 1964.

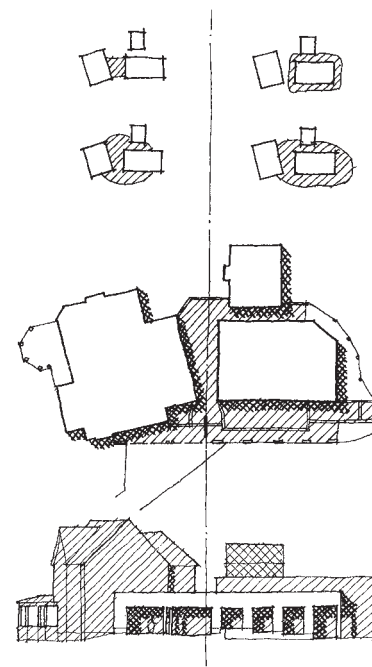
the matrix material of the connective circulation space not only fills the interstices but begins to extrude between and beyond them (2.14). The impression of forces at work is one of a mutual attraction among the elements, causing them to compress the *poché* material. The building, now demolished, was an example of “postmodernism” which stood out with some confidence among considerable ill-advised work under that banner.

- In a YWCA by Kliment and Halsband, the discrete new and renovated elements are also disposed in an informal manner, but the intervening spatial medium extends beyond the interstices to a greater degree and spreads out in front of these elements, there to solidify into “new” facades of its own (2.15). Or an alternative reading of “*intumescence*” sees this new material as originating in one of the elements and expanding from all sides. In both functional and architectonic terms, the extensive matrix material serves to help bind up and unify the quite different elements of the project.

While the preceding cases feature a matrix fabric held deferentially below the eave height of the elements they engage, the volumetric roles may be reversed with the matrix assuming a dominant central expression, as seen in Johansen’s “greenhouse-house,” or in Gehry’s Cabrillo Maritime Museum (2.16; 2.17). The Johansen house begins with a hub linked to satellites, as at his Mummer’s Theater, but then superposes a glazed volume which knits these elements together into a contiguous interior, while also rising up to dominate the profile of the design. In the museum, a transparent membrane is likewise superposed over a building group to effect a physical and visual synthesis, but here the medium is chain link fencing, erected in an array of ghost volumes. One such construct acts as the centerpiece matrix element, linking the surrounding building volumes and transmuting the central plaza into a phantom modernist nave of space.



2.14 Taft Architects: YWCA Masterson Branch, Houston, 1979 (demolished 2011).

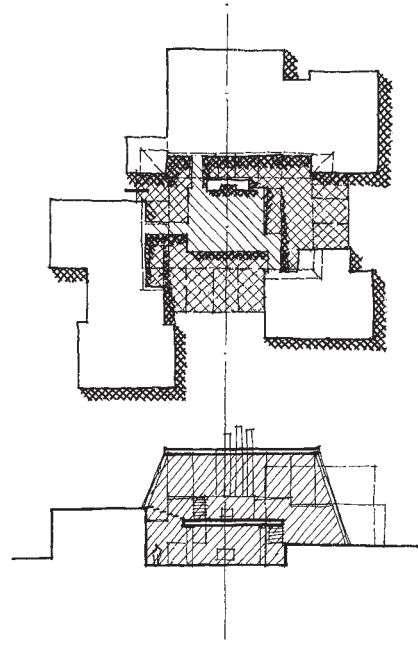


2.15 Kliment & Halsband: YWCA, Kingston, NY, 1978. n, 1979 (demolished 2011).

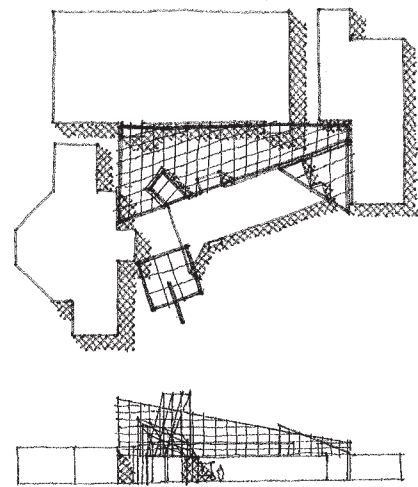
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As with linear links, the matrix approach is found in serially as well as centrally organized designs. The former are less common since the connective material often assumes a somewhat “molten” character in its space-filling role, thereby expanding more plausibly in a radially than an axially extensive way. These are a further variation on the theme of the spine, the elongated matrix assuming that role with subsidiary elements embedded along its flanks:

- The elements of a house by Moore and Oliver are bound together in this way by a matrix of generous circulation space, although the scheme derives much of its interest by deliberately breaking some unspoken rules: two volumes abut directly, another floats off at an angle, and a third gets in the way, obliging the connective material to tunnel through it (2.18). The concavity of the matrix perimeters evokes an internal negative pressure as if volumes were pulling loose or trying to stretch out into an even more linear array, yet despite these vigorous idiosyncrasies the conceptual nature of the design remains clear.
- Superficial similarities appear in a house by Barnes in that it also features a roughly Z-shaped distortion of a linear array, a mixture of square and oblong volumes, and an informally varying connective matrix. But here the linking fabric is not volumetric but simply an extensive outdoor deck, engaging the volumes at ground floor level: were this matrix material to dwindle any further it would disappear altogether, the scheme devolving to a case of unconnected adjoining volumes. It is minimized in another respect by sitting on the verge of becoming single-loaded, for the matrix material is not entrained in an inner area defined by these volumes but creeps in an ambiguous way from one externally exposed flank to another.



2.16 John Johansen: Private residence, Connecticut, 1976.



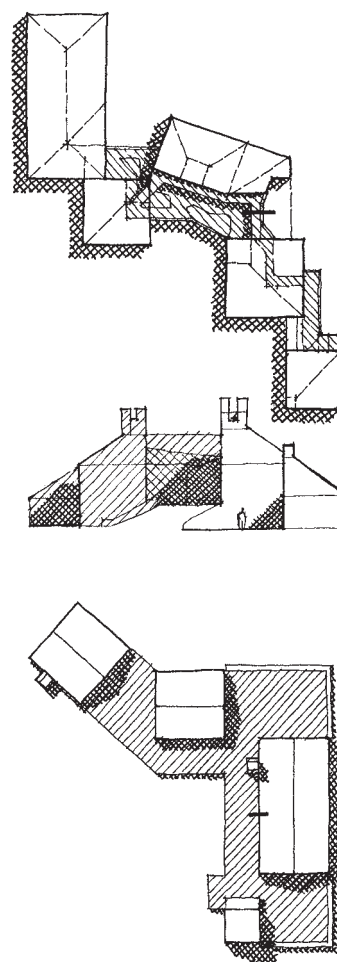
2.17 Frank Gehry: Cabrillo Marine Museum, Wilmington, CA, 1981 (subsequent additions not shown).

- Another example of the linear type is, paradoxically, both analogous and opposite to the approach of the Barnes house in terms of the nature of the matrix. Hollein's Municipal Museum Abteiburg appears conceptually similar when the public terrace is taken as the datum: the two-dimensional membrane extrudes across the bridge, insinuates itself among the assortment of building shapes, and exits via a second bridge (2.19). But when the museum levels below the terrace become the vantage point, the assemblage is seen as a system of caverns: the hollow volumes, inserted into the substrata of the hilltop, are unified by what appears at first to be the decidedly subtractive notion of a hollowed-out burrow. The true matrix here is a solid-made-hollow, as opposed to the planarity of the terrace. Its diagrammatic nature is not basically different from the preceding cases: we are seeing it from the interior rather than as a volume in space, and it is primarily surrounded by earth rather than air, but this connective space has again encroached plastically to bind up the surrounding discrete elements.

While not of this “linear type,” a truer version of solid *poché* as matrix is found at Aalto's Säynätsalo town hall, where the earth itself rises up to bind discrete volumes together (2.20). The manmade hill is tamed and incorporated as the floor of a negative space, the intimate central courtyard. The pronounced contrast between the two- and three-story masses on the external periphery and the low-eaved one-story cloister of the courtyard illustrates the power of this simple device: a pile of earth as a binding and focusing medium.

Touching

With both linear- and matrix-linking, an intervention is imposed on a composition of volumes to achieve a resolution of forces—physical, functional, or conceptual—while preserving the original



2.18 Charles Moore & Richard Oliver: House near New York, 1976; Edward Larrabee Barnes: Hecksher house, Seal Harbor, Maine, 1974.

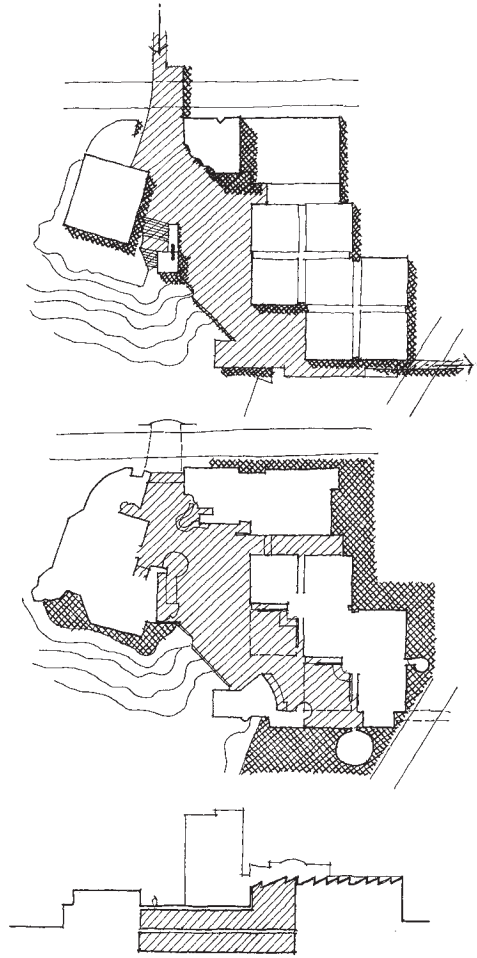
composition of elements. But instead of adding such new connective material to the composition, existing elements may themselves be brought together and “added to each other.” The intervention becomes the addition of energy to effect the compaction of the composition, rather than the addition of material to link it.

One version of minimal intervention lets the chips fall where they may, wherein a flotsam of discrete elements piles up against obstructions and each other in what may seem a helter-skelter assemblage, characterized by corners of volumes touching faces of others. Each iconic element of Stirling and Wilford’s *Wissenschaftszentrum* grazes the next in scarcely maintained equilibrium, with parallel relationships avoided in preference to face-to-corner junctions (2.21). Subtle cheating typically comes into play in such ensembles, either as slight overlaps or tiny links, to effect the necessities of physical passage.

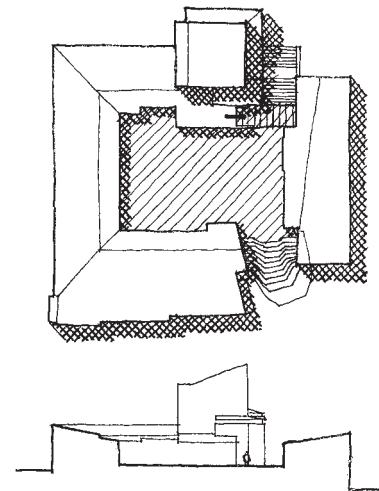
Corner-to-corner relationships are even more uncommon due both to issues of visual instability and the functional limitations involved, and the cases that appear are typically near misses, again involving slight overlaps as a concession to these issues. Asplund’s Snellman House dares to remain free of orthogonal rectitude, its elements swinging free as on a pin stuck through the slightly overlaid corners (2.22).

* * *

It comes as no surprise that elements are often arrayed about or attracted to a central focus. Graves’ proposed Vassar Art Department project employs a drum rotunda to resolve skewed geometries, link existing and new construction, and buffer several independent functions (2.23). The utility of the drum as a hub to resolve dissimilar geometries was known to architects of past eras, its magic having to do with the unvarying, totally dependable relationship of circles to abutting elements. As a volume without corners, it relates to adjoining volumes in a manner midway



2.19 Hans Hollein: *Städtische Museum Abteiberg*, Mönchengladbach, Germany, 1982.



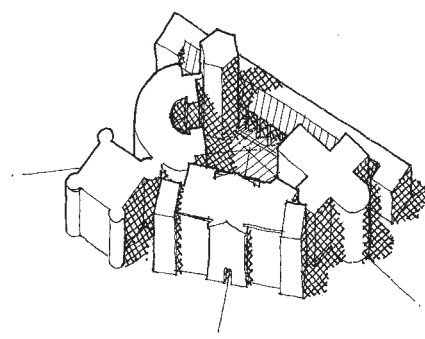
2.20 Alvar Aalto: *Säynätsalo Town Hall*, Finland, 1951.

between face/corner touching and enfacing surfaces, with the outboard volume approaching ever closer to its theoretical point of osculation. The drum is the ultimate spatial centerpiece, both the antithesis of the amorphous matrix and its perfected resolution as a binding force for peripheral elements.

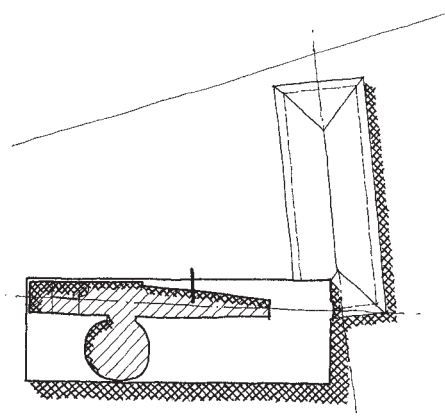
Asplund's Stockholm Public Library presents another powerful cylinder, here amalgamated with a U-shaped receptor in complete contrast to the divergent axes of the Vassar project (2.24). Notable similarities appear at Stuttgart's *Neue Staatsgalerie* by Stirling and Wilford, the U-shaped vessel of its exhibit building composed with an assortment of specialized forms in addition to the hollow drum, barely touching in a trance of spatial tensions. Both designs owe a debt to the earlier precedent of Schinkel's *Altes Museum*, the hollowed rectangle of its gallery building holding a domed rotunda while the full-length portico suggests the receptor form of its successors (2.25).

It is difficult at best to elucidate a building's fully-formed reality in a two-dimensional diagram, and all but impossible in the case of some of Kahn's mature works. The task at hand, however, remains not a description of the reality but a highly reductive analysis of its formal basis. Kahn's Assembly Building at Dhaka brings together an assortment of elements in a tour de force of corner-touching relationships: the ring of peripheral elements recalls the link-joined ring schemes, but with its prisms and drums drawn together such that corners touch adjacent faces (2.26). The central volume of the assembly hall extends the approach by establishing a near-touching relationship with four of the surrounding elements. Light- and air-wells occupy some of the negative-space interstices remaining in this not-quite-closest packing composition.⁷

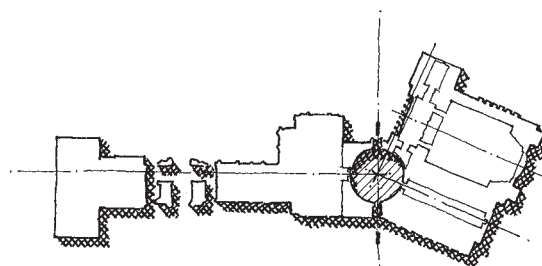
7. Such a scheme, its central volume surrounded by appended elements, is reminiscent of the matrix approach, but there are clear distinctions to be made between the two types. The present cases are groups of clearly defined elements in unambiguously touching relationships, while the matrix is an often amorphous interstitial volume which expands



2.21 Stirling & Wilford: *Wissenschaftszentrum Berlin für Sozialforschung*, 1988.



2.22 Erik Gunnar Asplund: *Villa Snellman*, Djursholm, Sweden, 1918.



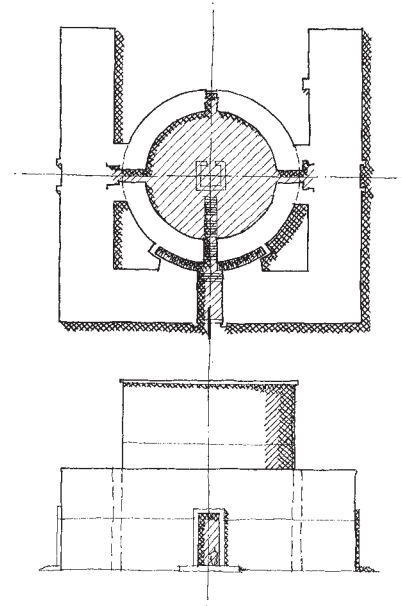
2.23 Michael Graves: *Art Department and Museum* (project), Vassar College, 1981.

Enfacing

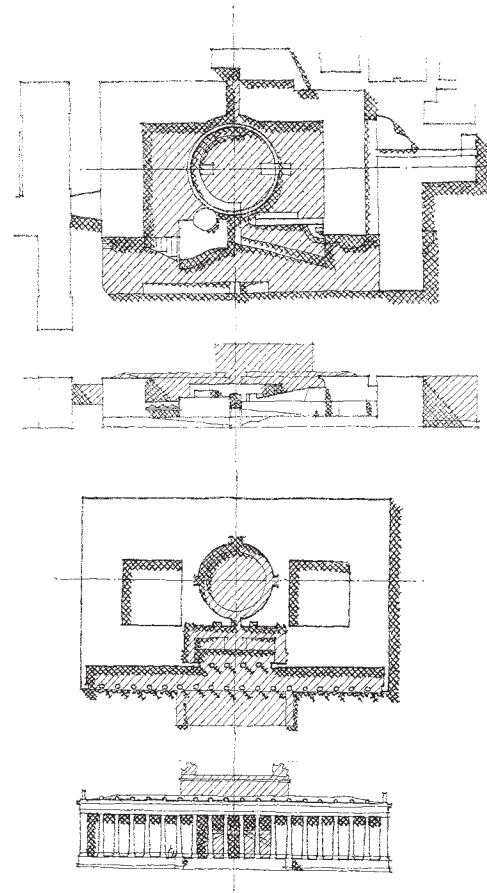
The approach of freezing a composition at the point of corners-touching-faces is exotic, with massing that can appear unstable and unsettling. At the expense of some of its apparent and perhaps rather easy drama, a more typically resolved composition results when a gathering of objects is allowed to settle into enfacing junctures. Superficially this would seem basic and archetypal: rooms adjoining rooms via common walls in a conventional fashion. But fully-formed expressions of this type are not as commonplace as one might expect, due to the diluting effect involved when several approaches hold sway simultaneously. The uncompromised expression of this type involves readily identifiable elemental forms abutting face-to-face, such that no further shifting seems called for, with the components in repose:

- The variegated elements of France's Fontenay Abbey abut each other sequentially, the outer periphery varying freely according to need while also surrounding and enfacing its central cloister (2.27). The assemblage of cloister, church, and other rectangular and square footprints, although arising from functional adjacencies, forms one of the more artful compositions of that era. The elements were placed to permit expansion over time without mutual interference.
- Back in modern times, the rectangular elements of an elementary school by Hisaka are likewise sized and enfaced as a function of program, adjacency, and composition. Despite a rigid planning grid, no two footprints are alike, and site conditions allow the outer periphery to vary freely and to accommodate future expansion, just as at Fontenay. A central element, here a

to engage the other elements of the composition. It is typically of a different nature and expression than the elements it engages, while the touching compositions, though they may incorporate differing geometries, are more clearly a grouping of volumes of which one happens to be central.



2.24 Erik Gunnar Asplund; Public Library, Stockholm, 1928.



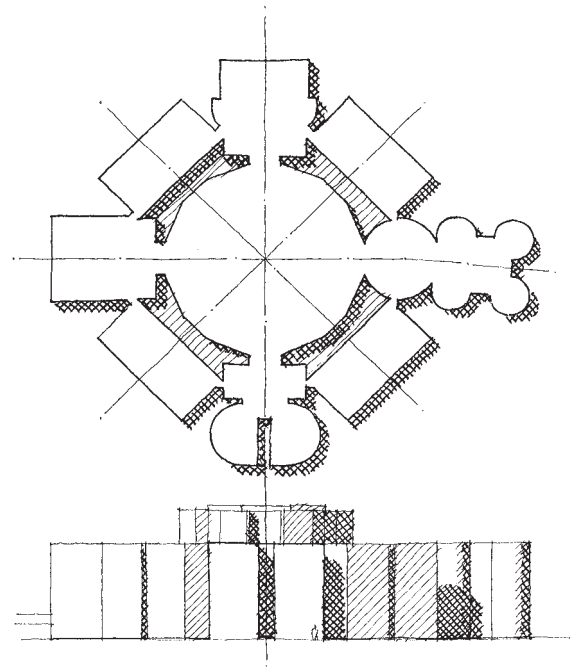
2.25 Stirling & Wilford: *Neue Staatsgalerie Stuttgart*, 1984 (subsequent additions not shown); Karl Friedrich Schinkel: *Altes Museum*, Berlin, 1830.

volume as opposed to a defined open space, again serves as a hub for surrounding elements, and the connections may be extensive and contiguous due to the fully enfacéd junctures.

- Gehry's Winton guest house has no volumetric continuities of either roof plane or outer periphery, and in contrast to the above cases its six volumes are heterogeneous in material as well as form, such that there is no tendency among them to meld (2.28). Plus, the design demonstrates that face-to-face junctures by no means necessarily entail an orthogonal plan. Although the bold juxtapositions of form imply the violence of collision, the volumes are in fact precisely enfacéd. The organization of the plan is also surprising, for while casual views of the exterior communicate an enigmatically assembled jumble, it is a simple and direct "pinwheel."

A series of houses by Jacobsen demonstrates some variants on a more linear, sequential order, recalling the precedent of his Zamioski house with its linear links, but in the present context of enfacéd elements (2.29):

- The Putterman house applies strict alignment to one side while varying freely on the other, its gabled volumes of identical section but varying length joined en suite via short subsidiary elements.
- An additional degree of freedom is found in the Jacobs house, with irregular variegations occurring on both sides of the enfilade array, but it remains quite linear with a longitudinal axis extending full length through the interior of the sequence.
- It falls to his earlier Blumenthal house to employ a fully non-aligned, "concave" linearity, as at the Louisiana museum, but with its volumes enfacéd. They feature a self-imposed limitation in that all gable roof forms again have the same orientation.

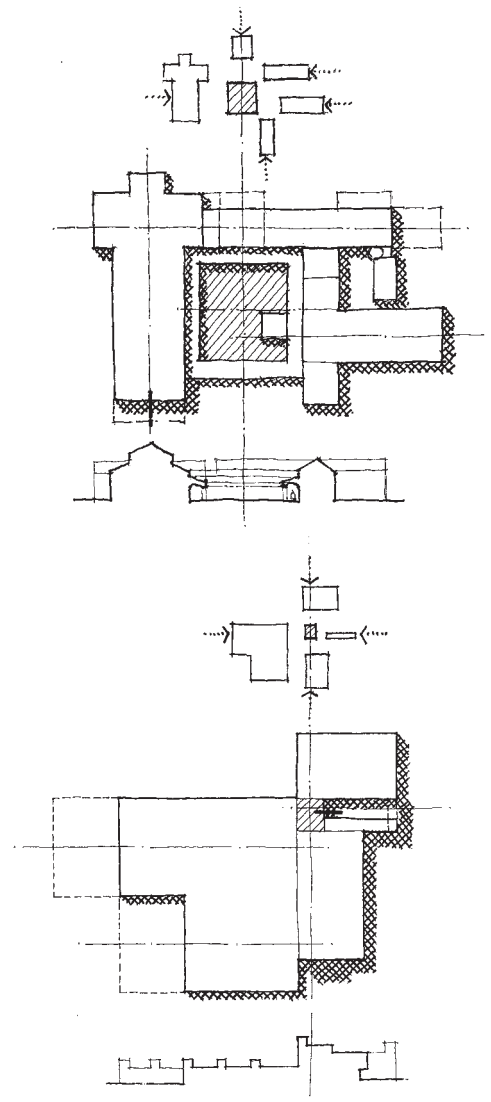


2.26 Louis I. Kahn: Citadel of Assembly, Dhaka, Bangladesh, 1974.

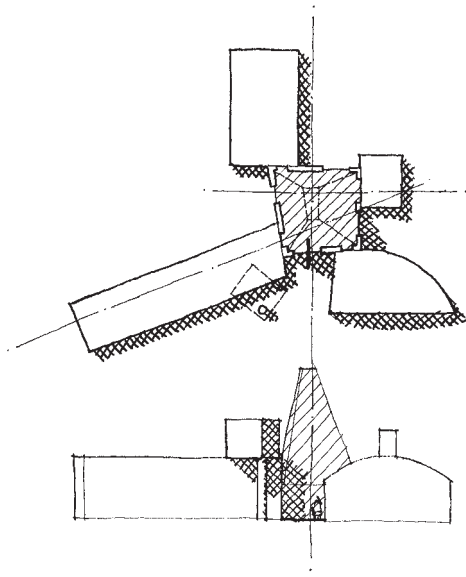
Multifamily housing, while it often generates enfacéd cellular designs of this linear type, is of a different order of magnitude from these cases; the discrete elements are not singular rooms or functions, the nature of whose connectivity informs the design, but entire dwelling units which have no spatial continuity with their neighbors. The impression of continuity is nonetheless often one of the goals of multi-unit designs, as at MLTW's Sea Ranch Condominium, wherein many of its ten units are visually joined beneath a contiguous shed roof (2.30). The plan, its concavities recalling the Blumenthal house, reveals the actual discreteness of the square condominium units, deceptive in their simplicity: the adjustment of their linkages, horizontally and vertically, facilitates the resulting architecture of the whole. By slippages of adjacent party walls as well as linking elements in some cases, a plan fundamentally based on volumes enfacéd in linear series evolves into a richly indeterminate form, its sequentially enfacéd volumes going beyond linear expression to become a complex interplay of picturesque form.

Collidive Embedding

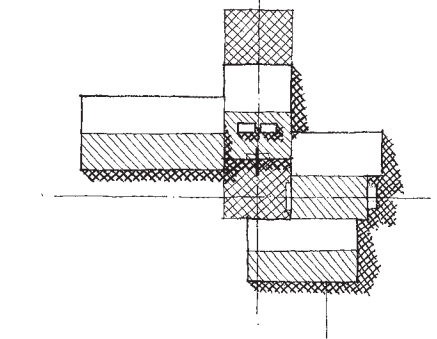
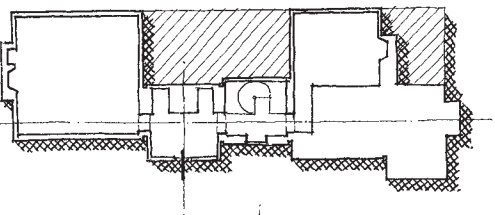
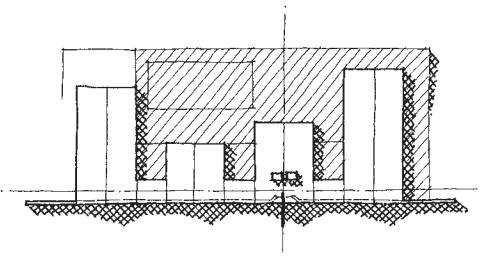
The visual instability of elements touching at corners becomes, with some additional "implosive energy," the related but distinct approach of volumetric collision or embedding. While lateral drift or centralized gravitational attraction seem the appropriate analogies when elements touch face to corner, more urgent forces are evoked when the elements invade each other's envelope: they are theatrically arranged to give the impression of masses joined in zones of overlap. Typically such juxtapositions are illusory, either with interior space flowing continuously through a breach corresponding to the zone of overlap, or with one volume taking precedence and walling off its share of the jointly claimed space. A Bermuda house by Venturi, Rauch and Scott Brown virtuosically brings



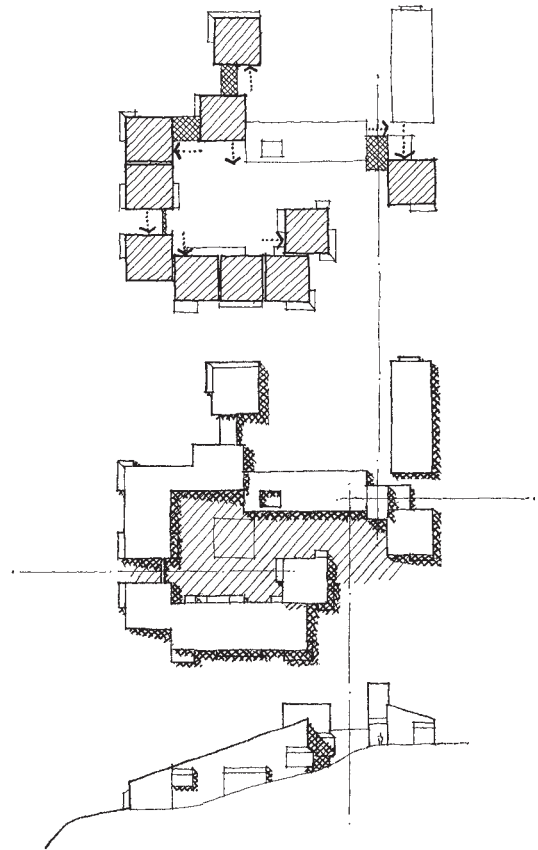
2.27 Cistercian Abbey of Fontenay, Bourgogne, France, 1147; Don Hisaka: Liberty Elementary School, Columbus, OH, 1976.



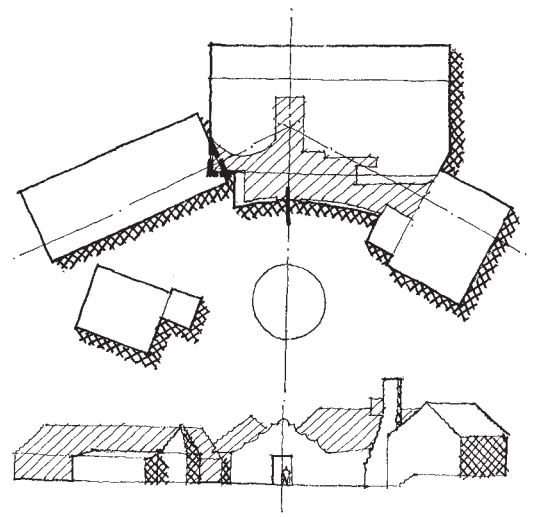
2.28 Frank Gehry: Winton guest house, Wayzata, MN 1987 (since moved to Orono, MN).



2.29 Hugh Newell Jacobsen: Putterman house, Central Pennsylvania, 1980; Jacobs house, Meadowbrook, PA, 1988 (garage opposite not shown); Blumenthal house, Eastern Shore, Maryland, 1974.



2.30 MLTW: Sea Ranch Condominium, Sonoma County, CA, 1965.

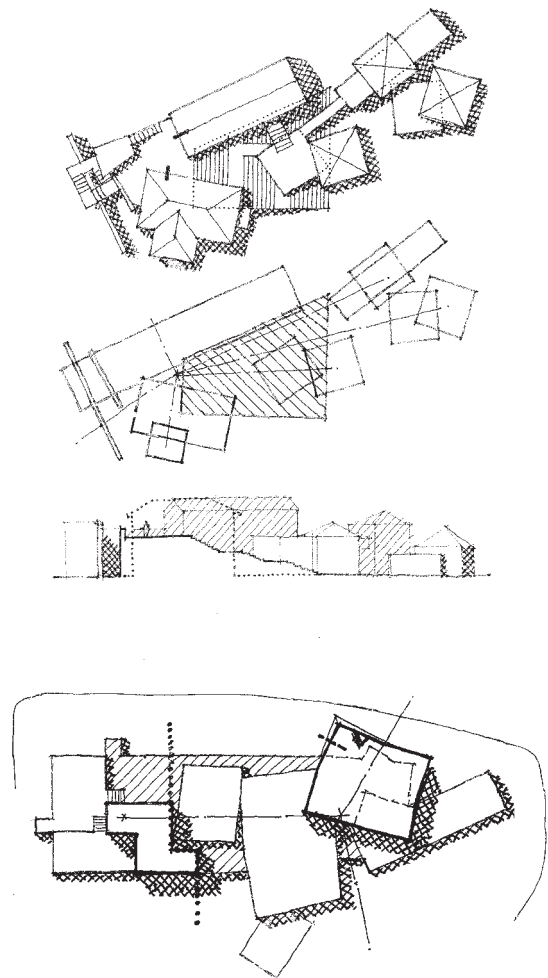


2.31 Venturi, Scott Brown: House in Bermuda, 1976.

into play separated and en faced volumes, a central matrix, and a single very discreet collision, the device benefiting from such sparing use in concert with others (2.31).

While this house deals with several similar central pieces and a scattering of dissimilar outbuildings, the approach is reversed in a house by Quigley where collision is given freer rein (2.32). Two dissimilar primary elements are joined collidively by the anomaly of an overscaled wedge of steps, with other collisions and linear links joining the bedroom outbuildings that are dispersed as if scattered by natural forces. Free disjunction reigns among the many angular plan relationships, the whole saved from chaos by the familial nature of the cabana-like elements and by the integrative function of the stepped “land form,” the whole reminiscent of Italian hill towns as precedent. Although the narrow site imposes an elongated proportion on the ensemble, its organization is more central than linear or spinal, the various elements informally deferring to an origin point at the top.

Some curiously notable collidive similarities define the completely different scale and purpose of Herzog & de Meuron’s Walker Art Center Expansion, a plinth extension of Barnes’s original building affording the context for an assortment of skewed and collided sort-of-rectilinear volumes. Site issues again result in an elongated ensemble. The original building reads as a sort of anchorage for the progressively more skewed and disconnected elements of the addition, the largest with its tin-foil-like cladding conspicuously raised and tilted as if losing its tether. How best to deal with such major additions, whether to buildings from a century ago or a decade, will always be a conundrum, with slavish imitation very likely to diminish the original while drastic contrast can be an exercise in nose-thumbing, a worthy middle ground ever remaining a difficult choice both to make and to successfully achieve.

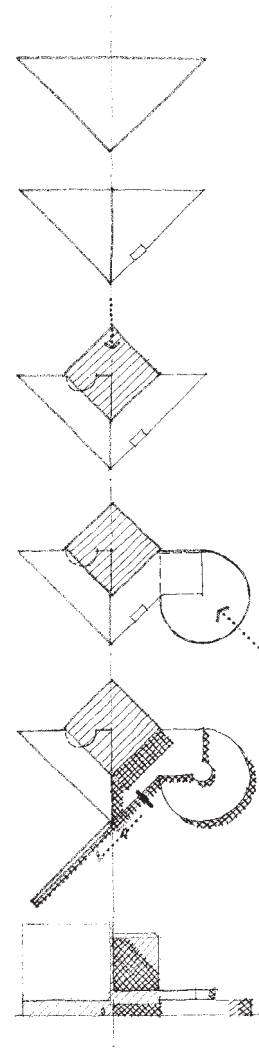


2.32 Rob Wellington Quigley: Jaeger beach house, Del Mar, CA, 1983; Edward Larrabee Barnes (1971); Herzog & de Meuron (2005): Walker Art Center, Minneapolis.

A particular *order* of collision often informs the perceived history of an assemblage process, as with Pei's Kennedy Library (2.33). Here the basic armature of a 45° triangular prism is first excised to form a low plinth, and then the arrival and collision of the dominant glass cube is an occasion for give-and-take, the prism regaining dominance at upper floors. A second collidive appendation is less clearly expressed, for the squat cylindrical auditorium mass, in colliding with the acute corner of the plinth, seemingly deforms it into an intermediate elbow that transitions between the two disparate geometries. A third intervention adds an element to the composition while simultaneously implying its partial removal: the screen wall extending from the entrance, anchored precariously at the point of the triangle, appears to have slid aside like a barn door to reveal the void of the entrance.

Gehry's Los Angeles Aerospace Museum presents a less resolved case of orthogonally collidive form, its three dissimilar shapes sharing a plinth and ambiguously commingling about a common central area (2.34). The skylines of the two opposed forms are carved back in readiness to receive a fourth form from above—a dark, vitreous wedge which cascades into bent planes of glass filling the gaps between the forms below. This arrival driven into the assemblage on the "Z axis" could be considered the expressive source of much of the near-violent energy evident on the exterior, the outward splay of the polygonal volume seeming a response to the force of this collision. The impact of these large-scale form relationships is enhanced by a second echelon of additive forms, informally linked and pinned to the main assemblage rather than added by collision, with exit stairs, penthouse forms, a metal ball and a jet fighter flying off in various directions.⁸

8. Although reminiscent of matrix embedding, the project again demonstrates a sometimes elusive but important distinction: its elements are related directly by mutual collision, as opposed to works such as the Cabrillo Museum with elements separated in space and joined by a dissimilar intervening matrix medium.



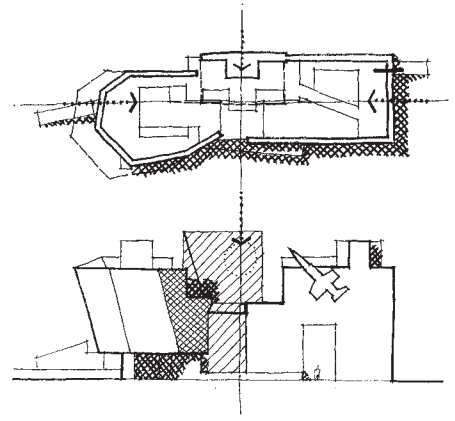
2.33 I. M. Pei: John F. Kennedy Presidential Library & Museum, Boston, 1979 (subsequent additions not shown).

Superposition

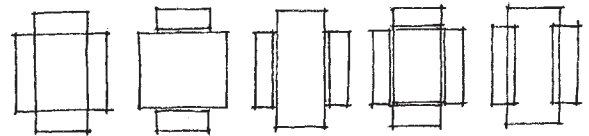
The ultimate case of collision comes about when two or more forms are so fully collided—superposed—that lateral movement in any direction would reduce this sense of maximum conflation. In the orthogonal case, collision may not be readily perceived, simply because alternative readings involving enfacéd forms usually dominate: a disposition of the volumes in three dimensions, their respective integrity clarified by a vertical shift, is required for a collidive interpretation to be convincing. Wright proposed such a scheme in his 1902 Yahara Boat House project for Madison, Wisconsin, its raised central axis affording a reading of two fully collided volumes (2.35; 2.36).

If one begins to rotate or skew the relative axes of such overlaid elements, the reading of collision can be made more readily, but the extreme angles of incidence which result can be difficult to resolve into practical realities—difficulties that can evidently become an attractive challenge to self-justify the novelty of the extreme angularities. In the case of a house project by Ames, the overall footprint represents two nearly identical bars crossing at a small angle, the actual house being a compact volume at the crossing with the dilemmas of the acute angles relegated to the outlying garden. A reverse of this strategy is employed in Moore's Stern house, its skewed crossing boldly stated in by two linear circulation axes with use areas falling outboard into the interstices (2.37).

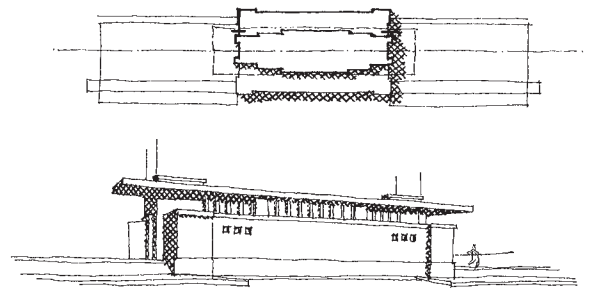
When the angle of incidence between two collided form systems is increased to 45° , the result is often one of ambiguity. A health center by Hardy Holzman Pfeiffer overlays a system of linear skylights and related building features at this angle onto a square footprint with sub-enclosures within allowed to conform to either orientation (2.38). It's a tricky balancing act, bordering on disorientation, which is characteristic of the 45° overlay and its lack of dominant orientation.



2.34 Frank Gehry: California Aerospace Museum, Los Angeles, 1984.



2.35 Superposition: alternative readings.

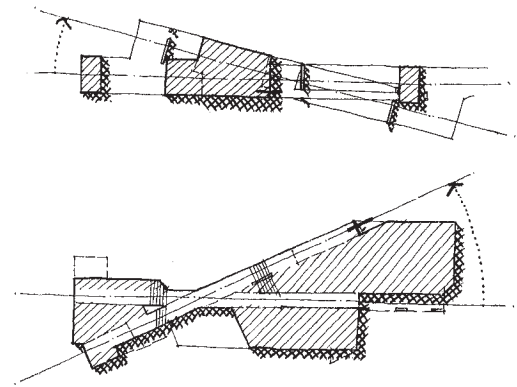


2.36 Frank Lloyd Wright: Yahara Boat House (unbuilt), Madison, WI, 1902. Built from the original design as Fontana Boat House, Buffalo, 2007.

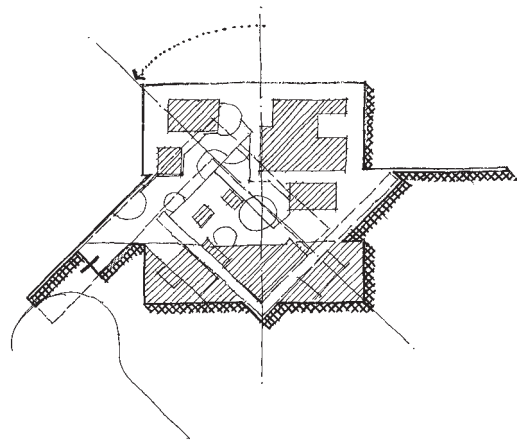
Cohesion of such overlaid elements may be enhanced by increasing the angle of incidence yet further, as in Morphosis' Laurence Residence, conceived as a collision of two volumes at slightly less than 90° (2.39). The elongated element's skew has the practical benefit of consolidating usable exterior space on the tiny site, while the gable-fronted crossing piece anchors the scheme, referring both in form and alignment to its conventional residential surroundings. Its transverse shear, as if cleaved by the collidive force of the skewed piece, has both an aesthetic effect of obfuscation—adding complexity to an otherwise rather simplistic concept—and a practical result of further concentrating exterior space at the two corners.

A final increase of the collision angle to 90° results in the more commonplace orthogonally opposed relationship—a perpendicular crossing of axial elements—that has precedents reaching back through history (2.40):

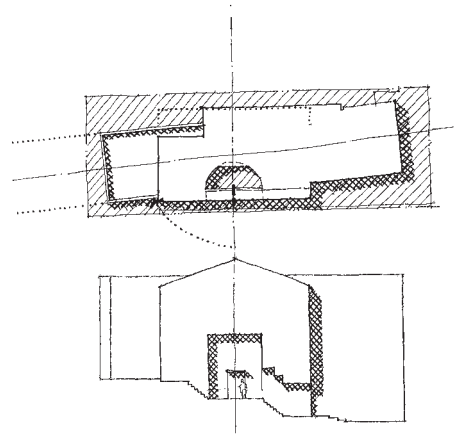
- Salisbury Cathedral is instructive with respect to its unusual feature of two transept crossings: while the massive crossing tower divides the elements of the primary crossing into nave, choir and transepts, promoting an impression of assemblage, a reading of perpendicular collision prevails at the second crossing (2.41).
- Not only the absence of “distractions” such as the Salisbury tower but specific positive clues are required for such a reading of collidive superposition to be unmistakable. Miami's raffishly configured Palace Condominiums incorporate three such clues, which also characterize the above Morphosis and HHPA projects: the two differ in surface cladding, finish or articulation; one element overreaches the other in the vertical plane; and the crossing is an off-center one. Two images contrast the massing as built with that of an earlier design study (2.42).



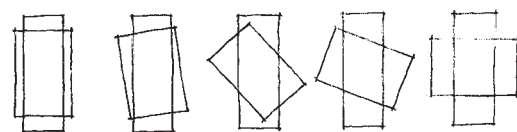
2.37 Anthony Ames: Villa Chang (unbuilt), Augusta, GA, 1980's; Charles Moore: Stern House, Woolbridge, CN, 1970.



2.38 Hardy Holzman Pfeiffer: Cummins Occupational Health Center, Columbus, IN, 1977.



2.39 Morphosis: Lawrence house, Los Angeles, 1984.



2.40 Superposition: sequence of collidive angles.

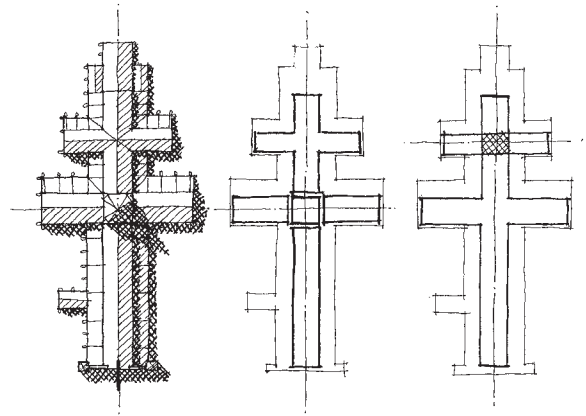
- Wright often used the same device in his early work: the Barton house on the extensive Buffalo campus of his Martin House presents a direct expression of one- and two-story elements crossing collidively at 90° (2.43).

Encapsulation

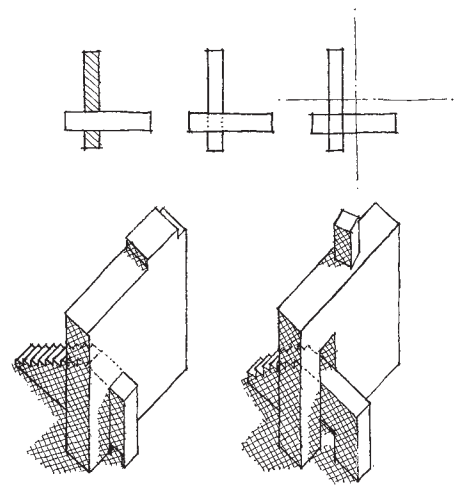
The sequence of additive modes has thus far seen separate elements move closer together to touch, embed and superpose. The common parti of a dominant central element involving subsidiary peripheral elements illustrates the sequence.⁹ But as noted earlier, the sequence can continue a step further, the central element expanding such that the others end up not only embedded or superposed but completely encapsulated within (2.44):

- Moore's Orinda house, with two miniature pavilions over which the house volume proper seems draped like a tent, demonstrates one degree of encapsulation, the three elements being mutually engaged at the top (2.45).
- The case is more definitive at Moore Grover Harper's Jones Laboratory, its 19th Century shell serving as a container for small lab modules that are fully freestanding within due to a requirement of structural isolation: a truer case of encapsulation (2.46).
- At Koollhaas' French Library competition entry, the audacious assortment of encapsulated elements—spirals, eggs, diagonal axial volumes—are freed from the ground plane to float within the encapsulating cube, though sometimes sheared off where they enface the cube's boundaries (2.47). The conceit of containment is itself turned on its

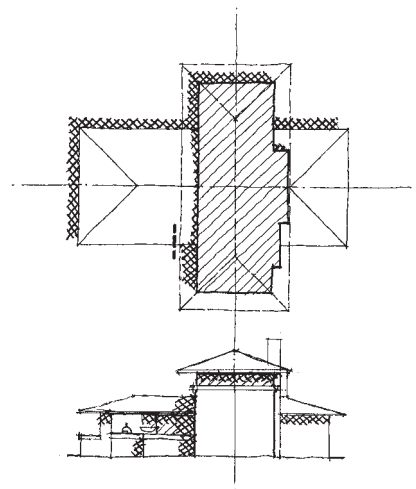
9. The term "parti"—the invariably shortened version of "parti pris"—is generally understood to mean the basic scheme or concept of an architectural design, the term probably having originated at the French École des Beaux-Arts. Lacking many synonyms for this useful term it will reappear with regularity in this narrative.



2.41 Salisbury Cathedral, England, 1288.1981.



2.42 Arquitectonica: Palace Condominium, Miami, 1981.



2.43 Frank Lloyd Wright: Barton house, Buffalo, 1904.

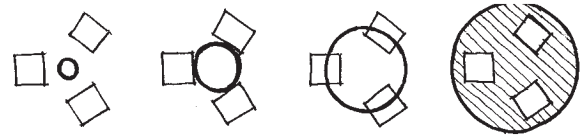
head as these elements are now voids, housings of specialized functions excavated within the “solid” poche infill of bookshelving. While the Orinda house evinces some familial resemblance between the miniatures and their enclosure, the library scheme hews to an opposite extreme wherein its variety of void elements bears no resemblance to the unitary enclosure.

- OMA’s Seattle Public Library reverses the order yet again (2.48). The several boxlike volumes housing the project’s functions are stacked, shifted laterally in four orthogonal directions, and finally lifted to open a gap between each (a foretaste of some of the cases to follow below). Then an encapsulating membrane of glazing “shrink-wraps” the entire assembly, accommodating the volumetric shifts with a contiguous and disorienting array of crisp-edged polygons. In contrast to the pre-established unitary enclosure of the French library scheme, this wrapper is entirely consequential of the contained ensemble, featuring a number of rather wince-inducing taut and skinny convergences. While praised for its light-filled and exhilarating interiors, the resulting exterior is disturbing in its almost threatening morphology, and makes little effort to accommodate to its urban context.

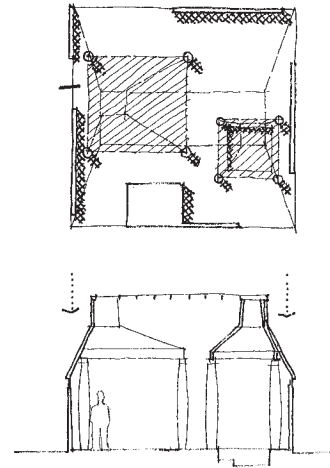
“Z Axis” Cases

The above additive variants are, in general, developed with respect to plan orientation, but there are a multitude of options. The aerospace museum, for example, presented an intervention that clearly incorporates a vertical collidive axis, offering a foretaste of some “Z axis” cases: here a continuum of relationships revisits some of the foregoing additive modes, but now as a function of *vertically* related adjacencies (2.49).

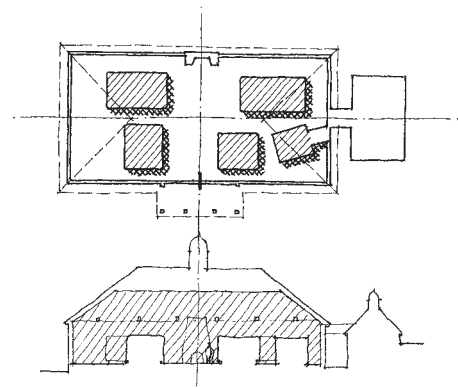
Hadid’s Rosenthal Center offers a predominant impression of vertical collision, involving elongated beam-like shapes stacked in an informally collided



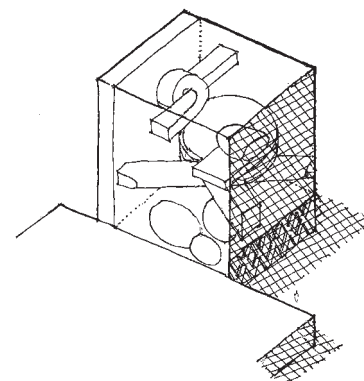
2.44 Encapsulation in an additive sequence of expansion,



2.45 Charles Moore: Moore house, Orinda, CA, 1962.



2.46 Moore Grover Harper: Jones Laboratory, Cold Springs Harbor, NY, 1975.

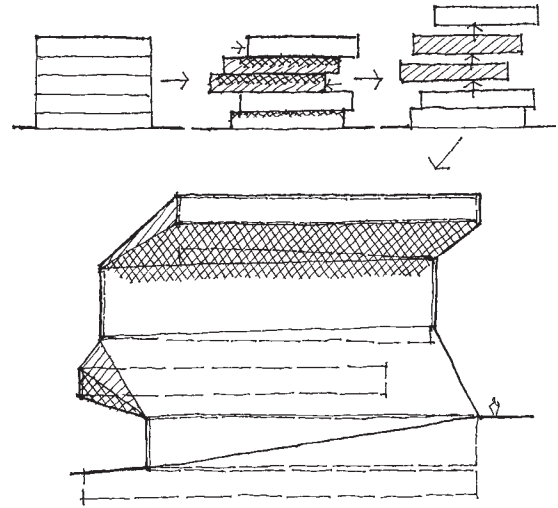


2.47 OMA: *Très Grande Bibliothèque* competition entry, Paris, 1989.

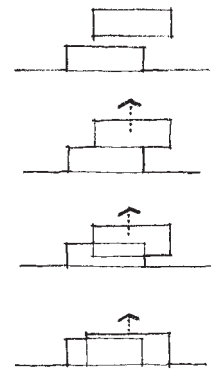
array. In some cases they directly reflect interior conditions, while in others they are more in the nature of a tailored stage set to foster this image (2.50). The treatment is consciously variegated—some volumes retain a space between, infilled with recessed vision glass as if actually spaced apart; one has an upturned elbow; and all strain to break the constraints of right-angled plan terminations—but in sum the building is a conservative effort in the architect’s oeuvre, with the collided-beam volume image predominating. The choice of this formative mode is fitting because the volumes evoke the tight vertical assemblage of the interiors, exploit the expressive potential of the corner site, and suit their urban context as a foreground composition without undue showiness.

If withdrawn vertically, such volumes would adjoin to define *enfacing* relationships:

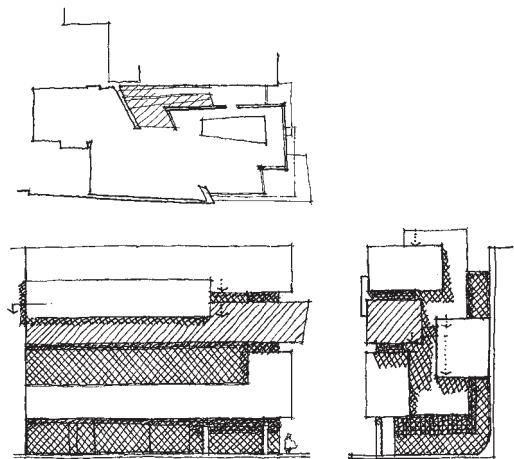
- At Manhattan’s New Museum, a stack of rectangular solids is willfully slid to one side or another with this expression in mind (2.51). The slips sometimes serve practical purposes, accommodating terraces or skylights, and while a different metal cladding for each box was originally intended, budgetary constraints led to the uniform metal mesh cladding that ultimately seems an appropriate foil for this rather flamboyant massing.
- Arquitectonica’s earlier North Dade Justice Center carries the stacking approach a step further, for while each of three shapes is radically different, sharing only the convention of flat roof planes, the conceit of an upper volume bearing with precision on the lower two is clear (2.52).
- A celebrated orthogonal version of this approach is again provided by Wright, in that although the volumes of the Robie House are complex in their articulation, a plausible interpretation of their geometry sees its two partially enfaced “ship’s hulls” as surmounted cross-axially by the



2.48 OMA + LMN: Seattle Public Library, 2004, adapted from California College of the Arts Blog.



2.49 Z axis reversal of additive sequence.



2.50 Zaha Hadid: Contemporary Arts Center, Cincinnati, 2003.

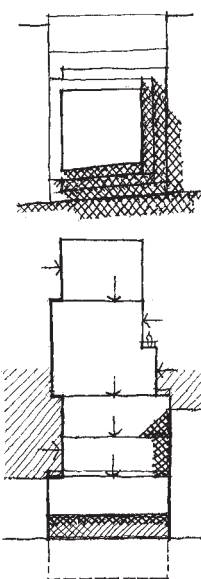
overlapping bridge of the bedroom floor (2.53). The reading is not fully consistent—the top level extends in a sheer drop to grade as a rooted mass on the entrance side—but from street exposures the top level reads as a volume en faced transverse to those below, anchoring the lateral movement of which they are so expressive.

With identical building blocks disposed in a more complex and extensive array, a scheme such as Safdie's Habitat in Montreal can result, and Rudolph's project for Married Student Housing at the University of Virginia—eventually realized in altered form in New Haven—is a further variation on this theme of dominoes stacked at successive right angles in plan. Although the Habitat units are slightly engaged and the housing units slightly gapped, the conceptual intent is clearly one of en faced stacking (2.54).¹⁰

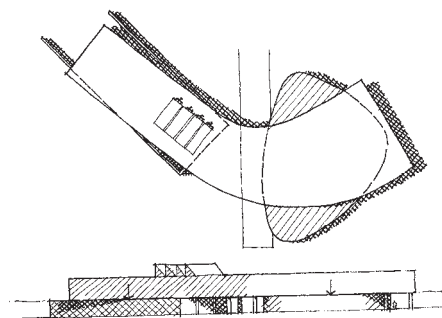
The final step in this progression of Z axis withdrawal finds superposed elements fully disengaged, as at Hedjuk's Wall House II, its three domestic functions housed in elements hovering one above the other. At the urban high-rise scale, Manhattan's Lever House is a classic modernist expression of superposed floating volumes. The voids below the shaft and below the base help minimize visual weight and massiveness, and the base is punctured by a light well to enhance the impression of immateriality, plus the cantilevers of the shaft and base further reinforce a sense of near-weightless equilibrium. Their opposed orientations prevent the two masses from seeming similar parts of an overall system, but more as ships passing in the night (2.55; 2.56).

* * *

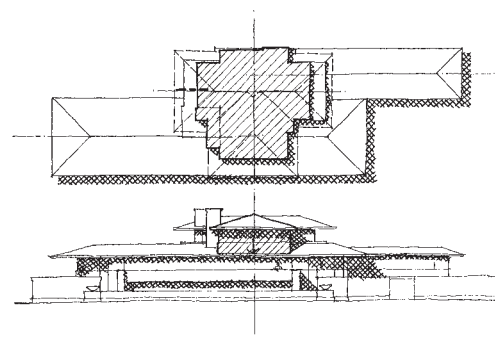
10. If the building blocks were both identical and precisely superimposed, the characteristic slab-sided column of multiple floors would result, a trivial case of sorts in the realm of additive design strategies wherein individual floor elements fuse to become the undifferentiated shaft taken as a whole.)



2.51 Sejima + Nishizawa/SANAA: New Museum, Manhattan, 2007.Cincinnati, 2003.



2.52 Arquitectonica: North Dade Justice Center, Miami, 1989.

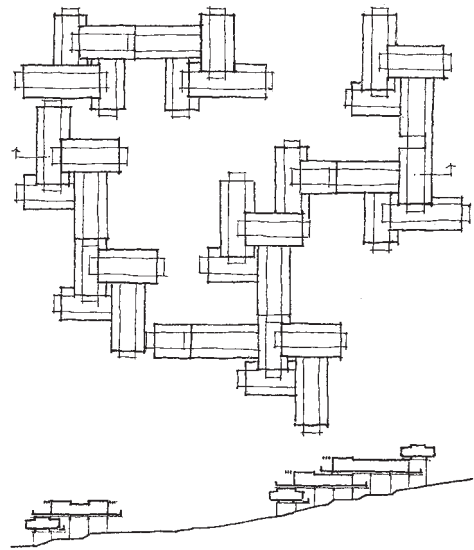
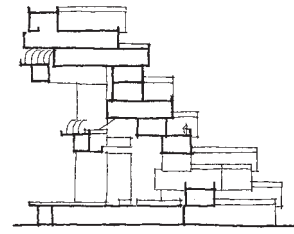


2.53 Frank Lloyd Wright: Robie house, Chicago, 1910.

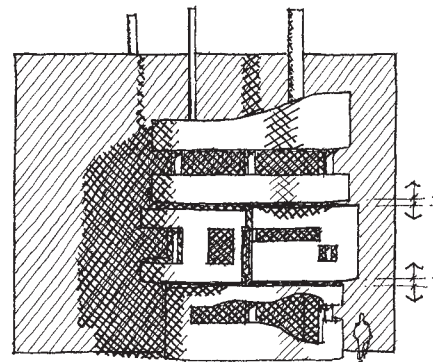
The most elemental Z axis case reaches beyond the confines of the additive approach altogether to one of the most basic possible versions of forming, that of the singular mass floating in reference only to the datum of the ground plane itself. While the romantic image of extension over open space has been indulged in many times by resorting to extravagant cantilevers and spanning elements, this ultimate case would disconnect visually from the ground altogether. Mies' Farnsworth House seeks this goal (2.57). While its conception is popularly conceived to be two superposed, floating horizontal planes, with a third offset plane as a lower terrace, it can also be read volumetrically due to the precisely alignment of the planes and to the worldly realities of reflections, drapes and interior partitions, plus the screens that originally enclosed the covered upper terrace. Its level floodplain site stretches beneath without interruption, and steel columns bypass rather than visually support the planes, appearing as much to tether down the house as to support it. Any sense of functional connection with the ground is also scrupulously minimized, with step treads made to float just as willfully as the floor planes, and plumbing connections descending inconspicuously in the shadows.¹¹

An equally famed icon of early modernism may seem at an inexperienced glance to be a more fitting example of the lone floating volume. Le Corbusier's Villa Savoye possesses a more apparent and intentional solidity of volume, and its thin columns have even less visual continuity with the volume they support (2.58). But some views tend to minimize the presence and materiality of the enclosed ground level, for although deeply recessed on three sides it is vertically contiguous with the main volume at the rear, tying the "floating volume" unambiguously

11. The installation of hydraulic lifts is hoped for as a costly means to save the house from further periodic flooding at this writing. A controversial option of relocating the house is also being considered.



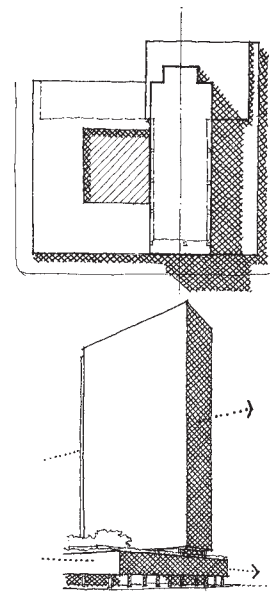
2.54 Moshe Safdie: Habitat 67, Montreal, 1967; Paul Rudolph: married student housing (unbuilt), University of Virginia, Charlottesville, VA, 1968.



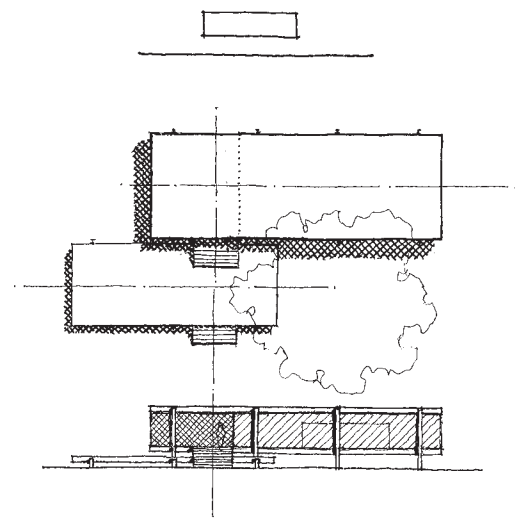
2.55 John Hejduk: Wall House II/Bye house (unbuilt), Ridgefield, CT, 1973. Built, Groningen, Netherlands, 2001.

to the ground plane on that exposure. The roof features further dilute the impression of levitation, for although there is little true vertical continuity at the exterior among the three levels, there can be a rough general impression of central anchorage rising from grade to emerge as roofscape. The fact that, in reality, these grade level and roof level elements have no physical alignments in common save those of the ramp and stair is but one of the conundrums which help impart the strange charm of the villa. Further, the shearing-back effect of the car on its path to the garage in conjunction with the vertical continuity at the entrance exposure argues persuasively that the first floor configuration is a reductive rather than additive one, and the “excision” of the *piano nobile* to form the terrace lends additional weight to this subtractive aspect of the scheme. In short, the Villa can appear from a distance as a singular floating element, from a superficial closer inspection as a case of vertically collided elements, and on more careful examination as a primarily subtractive composition, leavened by the artful ambiguities of the roofscape.

It may seem an abrupt shift from these villas to the Boston City Hall, but there is a direct parallel. For all its massiveness, Kallmann, McKinnell and Knowles’ building is ultimately another study of relationships between a floating element and the ground plane (2.59). Here the ground plane is mounded up into echeloned brick masses constituting the lower floors of the building, visually tied to the adjoining public plaza by continuity of material. The floating element—the multi-floor cap for the complex—has the reverse-pyramidal shape of a cork, as if it could retract into the pavement, and the attenuation of the intervening piers contributes to this impression, as if they were pneumatic lifts in the process of elevating this massive hatch cover. The stacked and stepped masses of the base afford a further contribution to this kinetic image, drawn up and out of each other and the pavement itself. A crucial gesture helps prevent such imagery from becoming banal: the ceremonial suites depend from the lid—visually suspended by virtue



2.56 SOM: Lever House, Manhattan, 1952.

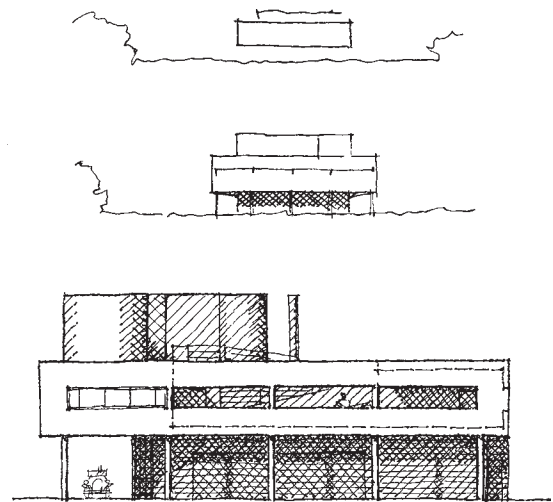


2.57 Ludwig Mies van der Rohe: Farnsworth house, Plano, IL, 1951 (original porch screen enclosure shown).

of a suppressed floor—and protrude, their assertive modeling dominating the composition. Thus the ensemble of volumes presents an *hierarchical* example of the case of vertically spaced elements, wherein the main mass is levitated above the ground plane and the secondary masses suspended therefrom in turn.

The piers which engage and support these elements are massive components of the composition, bearing no resemblance to the thin columns of the Farnsworth House, but the void which they occupy is nonetheless analogous: with the exception of minimal enclosures required by elevators and egress stairs, the only enclosed area below the lid is the glass-sheathed lobby, the remainder being a rather windswept, gloomy and aimless exterior podium. The main disappointment of the building lies here, where the grand lobby steps seem to direct one back outside to a rather claustrophobic and anticlimactic composition of lightwell, hoods and skylights, especially given that it is the physical hub of the composition. The sensation is abetted by the fact that to continue the walk means a perambulation down further elaborated steps, returning full circle to the place where one entered. This brings home the surprising lack of focus in a building so massively self-centered. The base is of the ground plane, and thus secondary; the lid is a loft structure and a super-scale cornice, and thus secondary; there is a void between, and the lobby is expressively a means of getting elsewhere than itself—thus these are secondary as well; and the ceremonial volumes are dependant from and thus secondary to the lid. So in a peculiar circularity, all parts are subservient to all other parts, although in actuality the ceremonial volumes—predominantly the council chamber—have the strength to stand in for the daringly absent *piano nobile*.¹²

12. The Boston City Hall was hailed as something of a masterwork at its inception, whereas decades later there are calls from high places for its demolition. There are few better examples of the fickleness of perceived architectural merit. One hopes it will survive the slings and arrows, its merits clearly outweighing its flaws.

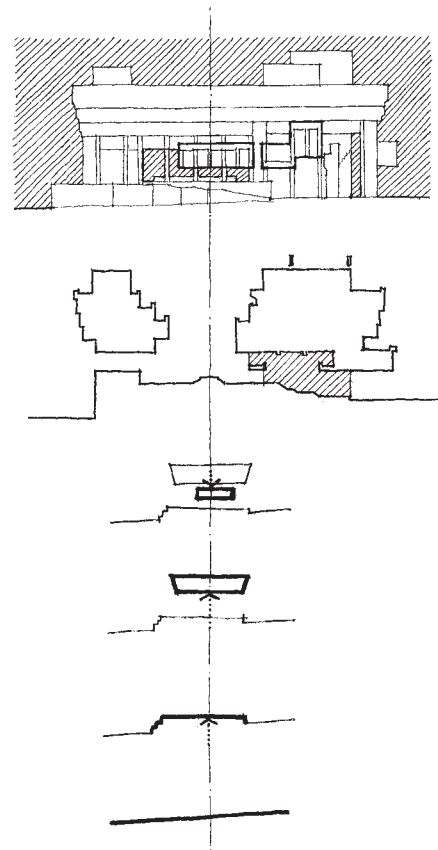


2.58 Le Corbusier: Villa Savoye, Poissy, France, 1931. Adapted from Francis D. K. Ching, *Architecture Form, Space, and Order* (New York, John Wiley & Sons, Inc., 1996), p. XIV.

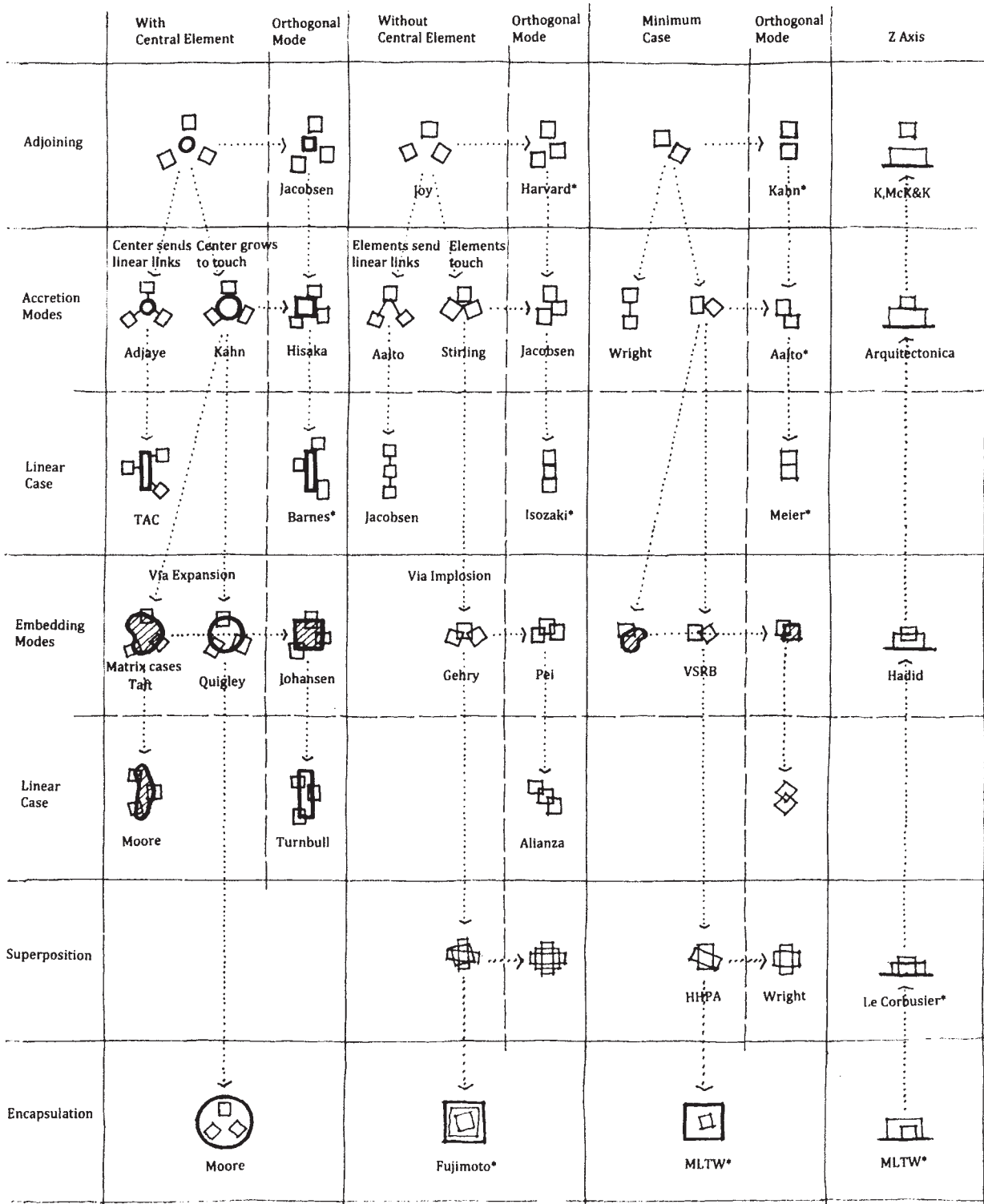
* * *

These final Z axis cases serve to close the additive typological circle, for in diagrammatic terms they recall the initial plan-oriented examples of elements in spaced-apart ensembles. By way of a review of the sequence that then ensued, two processes are underway: in the case of the matrix, a connective system reaches out to link up discrete parts, whereas in the accreted and embedded cases, the discrete parts themselves join together to form the greater whole (2.60). In the former approach the connective medium often dominates the composition, the subsidiary elements radially disposed in some way as if drawn by the “gravitational pull” of the central mass. The second case may or may not demonstrate a clear centerpiece, coming about through the mutual attraction of the several parts. There is a choice of connective modes for either approach: a central element may reach out to others via linear links, or the parts may come together to touch or collide. When a well-defined center is lacking, there may be a tendency for the elements to form aligned arrays with an identifiable axis, and a centered composition may also achieve a more axial order by stretching into a spine with appendations.

The series of types is a continuum, their elements drawing ever closer to touch, collide, and superpose before the final involution of encapsulation: the opposite extreme to the linear link. The Z axis sidebar unfurls much of the same continuum in reverse and upwards. It’s important to note that while these orthogonal sequences have served as an armature for discussion, a boundless variety of orientations and mutual vantage points is available in three-dimensional space for additive modes to exploit, not to mention the unlimited formative variety of the elements themselves—subject of course both to real world limitations and the challenges of judgment.



2.59 Kallmann, McKinnell & Knowles: Boston City Hall, 1968.



2.60 Taxonomy of addition types. Asterisks indicate examples of types that, while consistent elements of this sequence, will be discussed in the context of other additive modes or formative dimensionalities in subsequent chapters.

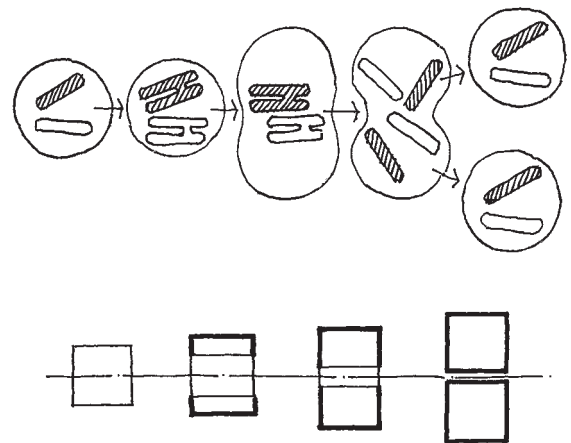
Chapter Three

REPLICATION

In the taxonomy diagram at the end of the preceding chapter, the “minimum case of encapsulation” is represented by a single element fully enclosed by a single larger element. When these are morphologically equivalent or similar, the result may be considered a case of singular regression: an element subsumed within another of like kind at a miniature scale. It represents one of a family of formative types that, while having familial ties to additive form, comprises its own paradigm: replication. As opposed to addition, replication doesn’t involve the bringing together of discrete and differing elements: as the term suggests, an initiating element gives rise to new ones in its own image. An analogy of cellular mitosis is pertinent (3.1). Some designs evoke more disturbing images of endless and repetitive growth.

The approach has its own interrelated structure of discernible subtypes, governed by choices involving dimensionality, degrees of freedom, scope, and scale. These types make up a widely employed but less widely understood modus operandi of forming in architecture, one both rich in its possibilities, yet risky in a seductive potential for misapplication.¹

1. “Forming” in this context does not enter into an analysis of highly design-specific aspects of proportion, composition, program and the like. The discussion concerns more elemental issues—the strategic basics and subtypes—availed by a given formative approach.



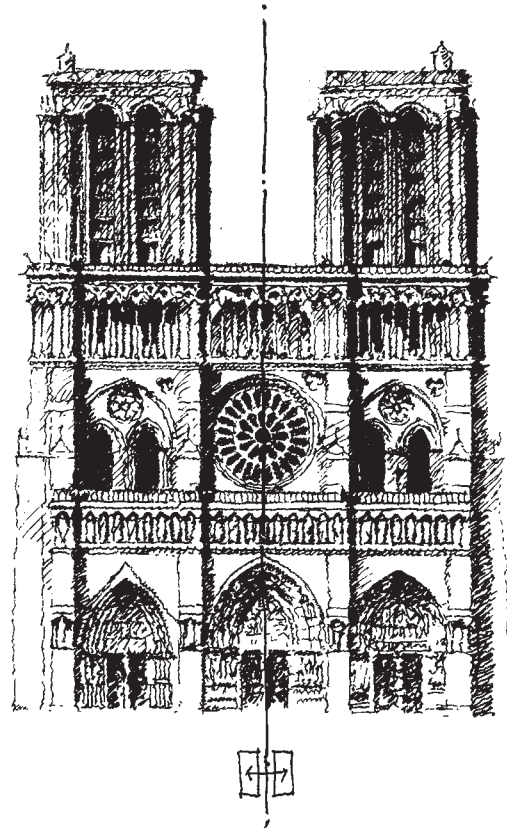
3.1 Diagrammatic sequence of cellular mitosis; diagrammatic sequence of singular duplication.

Singular Duplication

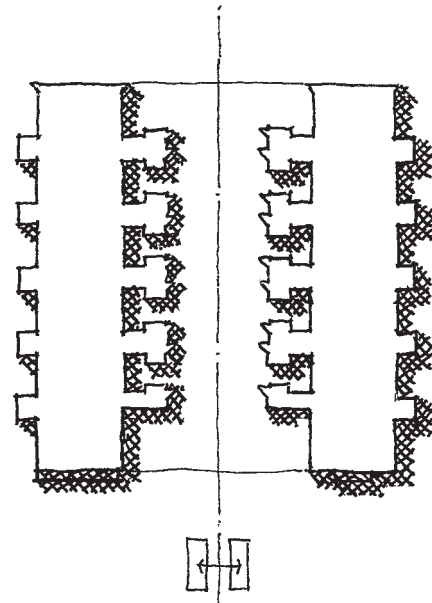
The simplest replication mode, *singular duplication*, deals with twinning—with one element becoming two:²

- At its most direct, mirror-symmetry prevails, and an initiating element comes face-to-face (or side-by-side) with its duplicate. The cathedrals of Europe are a magnificent precedent, their west fronts typically flanked by towers that are identical. The result of this pairing and flanking is a heightened definition both of entry and of axis, emphasizing the aspects of passage and linear procession that are central to the worshippers' experience (3.2).
- Twinned elements are a recurring motif in more recent times, as at Kahn's Salk Institute, the identical lab buildings facing each other across its axial court (3.3).
- Such congruence is not always the case, for as long as they embody an overall sense of volumetric duplication, such a twinned pair can display substantial differences. Pei's Mellon Arts Center develops two quite different forms, primarily by subtractive means, but their remnant corners mark the boundaries of the initiating twinned square volumes (3.4).
- Conversely, Giurgola's Music Building at Swarthmore imposes the differences from within, its twin side-by-side dominant interior volumes tailored for differing functions (3.5).
- Or the pair can retain its equivalence but acquire a more dynamic spin via two-fold mirror-imaging,

2. Again, while replication as a forming mode has clear similarities to addition, its dynamic is distinctly separate: rather than bringing together an assortment of elements, the approach embodies the reproduction of an originating element. To further the arithmetic terminology, replication could be considered "multiplication" in form development terms.



3.2 Notre-Dame de Paris: sketch by author.



3.3 Louis I. Kahn: Salk Institute for Biological Studies, La Jolla, CA, 1965.

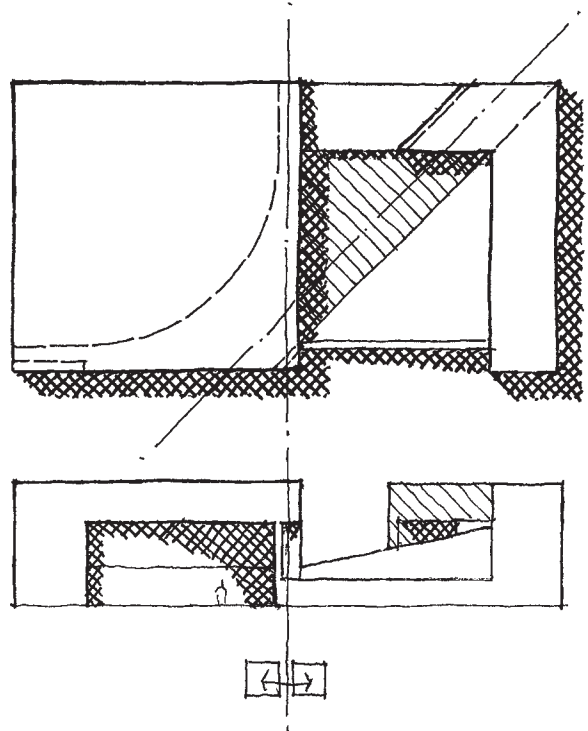
as at Le Corbusier's Carpenter Center, its two curved studio volumes reading as diagonally opposed duplicates (3.6).

- A further means to differentiate twinned pairs involves an “opposites attract” approach of solid-void juxtaposition, as in Meier's Smith, Douglas and Shamberg houses. They all employ an order of paired volumes ganged in tandem and of roughly equal size, yet one appears solid while the other is transparent and defines a single contiguous open space (3.7).

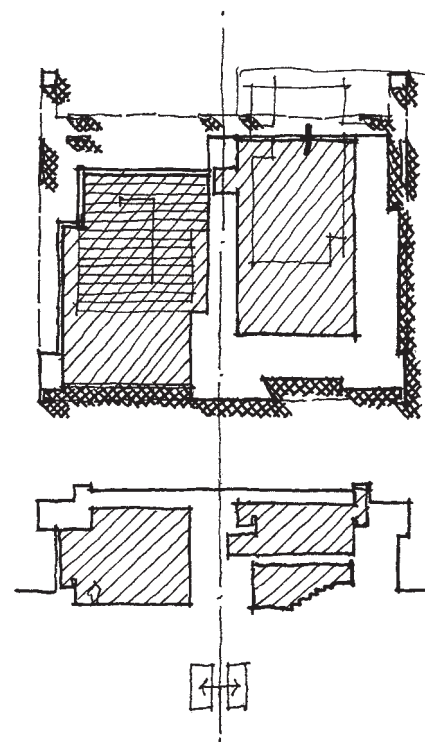
These cases of duplication—of one becoming two—can transform a static element into an ensemble expressive of axially. The charged space between twinned volumes, as with paired church towers, can evoke a sense of gateway or passage and endow a static volume with the sense, if not the form, of a *linear* order. (That said, the Meier houses represent an axis of passage, marked by entry bridges in those cases, *perpendicular* to the axis of pairing.)

But such a progression suggests a further dimensional step, jumping from the static point of the initiating element to “singular *planar* duplication” (3.8). By this arithmetic, one now becomes four, at least within the limits of an orthogonal grid: four duplicates now tend to imply and define the cross-hairs of axes intersecting at the point of initiation (3.9):

- At Meier's Museums in Frankfurt and Atlanta, four duplicates mark the corners—the High's skewed auditorium tweaking its diagram—and define cross axes in the variously infilled territory between them.
- Pei's Everson Museum shifts its four elements successively off center into a pinwheeled sequence around the central atrium, blunting the sense of axial crossing as it adds an aspect of rotational movement.



3.4 I. M. Pei: Paul Mellon Arts Center, Choate Rosemary Hall School, Wallingford, CT, 1972.



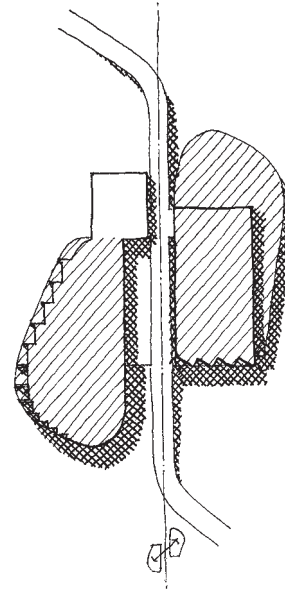
3.5 Mitchell/Giurgola: Lang Music Building, Swarthmore College, Swarthmore, PA, 1973.

- Eisenman’s hypothetical House X employs outboard excisions suggestive of centrifugal outward movement. (The more neutral order of the Frankfurt museum, a proto-grid suggestive of potentially indefinite extent, is a bridge to a further level of planar form replication to come.)

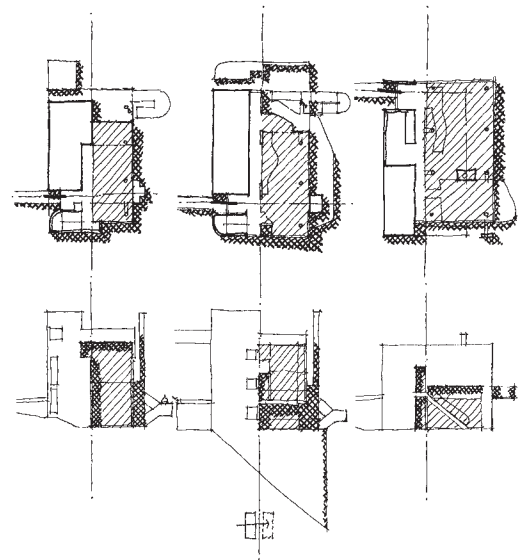
Singular Regression

A graphic summation of the transformative continuum giving rise to singular *regression* would begin with the trivial case of identity: two identical volumes, precisely superposed. Rotation of one volume makes its presence apparent as a case of superposition, as with that mode of addition. Once a shrinking process is initiated, as the term regression implies, a special case is soon reached when the shrinking element is precisely circumscribed by the parent volume—a specialized version of corners-touching-faces. With further reduction the specific case of singular regression is reached (3.10). The filiality of the two becomes less plausible as further reduction occurs, the difference in scale becoming a broad gulf, and eventually a point is reached when the inner volume is more readily perceived as solid form than space-defining volume, as in the case of the chimney masses anchoring the hearts of Prairie school houses. Before passing from sight altogether, the regressed element is a spot marking the center, or some other interior point—an element on the scale of furniture rather than architecture, and the limits of formative replication by singular regression have been reached.

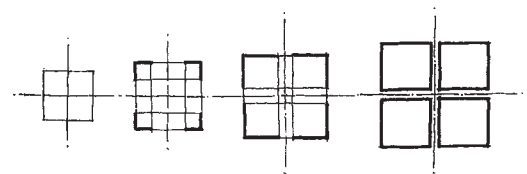
- Singular regression is embodied by a one-to-one relationship between outer and inner elements, as at Rome’s Saint Peter’s, the pseudo-volume of the baldacchino at its crossing locating the altar and the tomb of St. Peter (3.11).
- Modern times offer the pair of unitary volumes of the Rose Center for Earth & Space, a sphere hovering concentrically within a glass cube



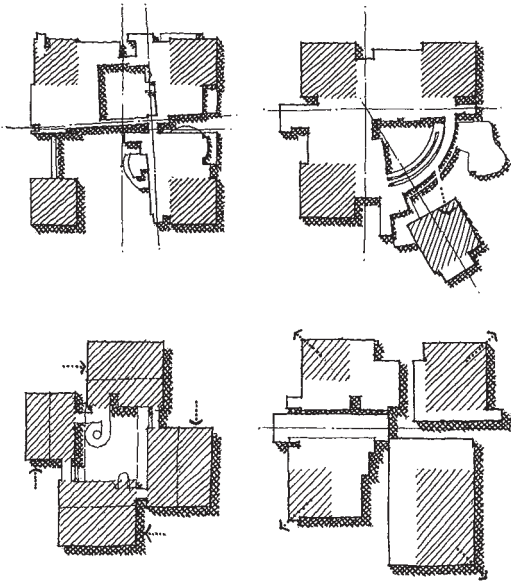
3.6 Le Corbusier: Carpenter Center for the Visual Arts, Harvard University, 1962.



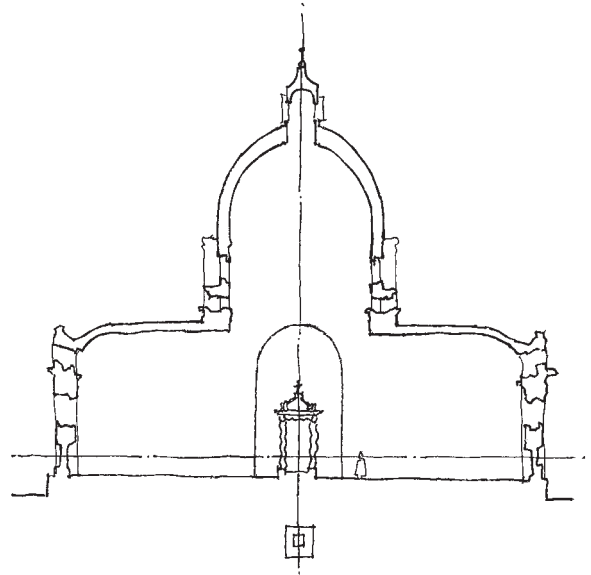
3.7 Richard Meier: Smith house, Darien, CT, 1967; Douglas house, Harbor Springs, MI, 1973; Shamberg House, Chappaqua, NY, 1974.



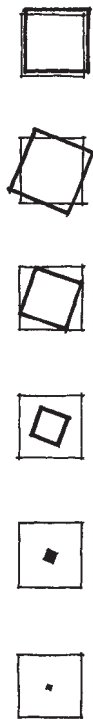
3.8 Diagrammatic sequence of singular planar duplication.



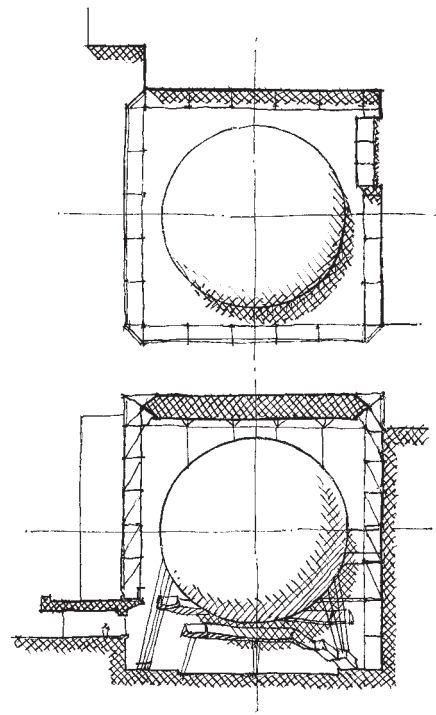
3.9 Clockwise: Richard Meier: Museum of Decorative Arts, Frankfurt am Main, 1984 (incorporating Villa Meltzler, 1803); Richard Meier: High Museum, Atlanta, 1983 (subsequent additions not shown); Peter Eisenman: House X (unbuilt), Bloomfield Hills, MI, 1982; I. M. Pei: Everson Museum of Art, Syracuse, NY, 1968.



3.11 Peter's Basilica, Vatican City, 1626: transverse section.



3.10 Reductive sequence: singular regression.

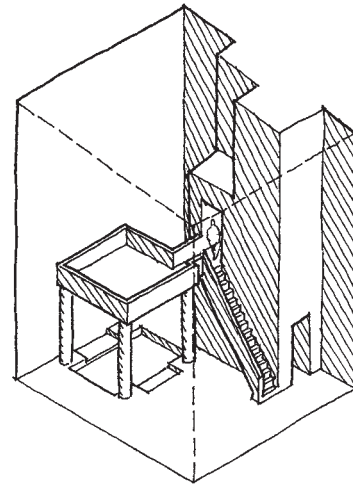


3.12 James Polshek: Rose Center for Earth & Space, Manhattan, 2000.

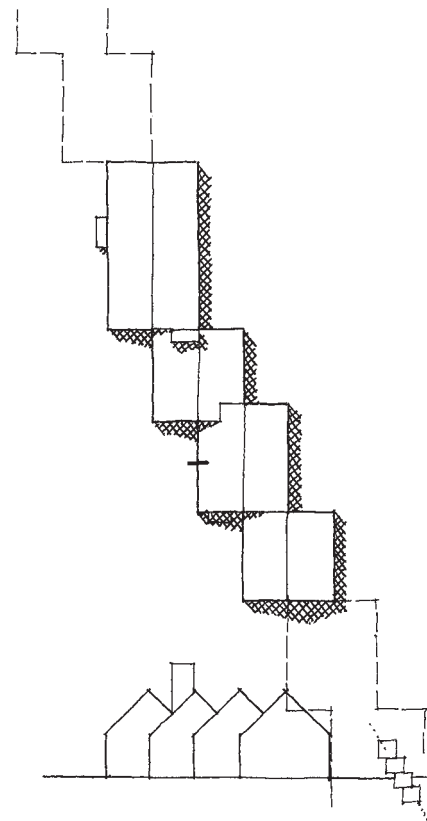
(3.12). Hardly a case of literal duplicates given the differing geometries involved, there is nonetheless a striking and very literal expression of concentrically nested elements, evocative of singular regression.

MLTW's Sea Ranch Condominium features subsidiary service elements expanding inward from the outside wall of each condominium interior, mediating between the outer volume and its singular ghosted miniature (3.13), Moore's "four poster" with its sleeping platform capping a seating group. The "efflorescent" service element bellies inward and fractures down from the ceiling plane as it approaches the central area to eventually meet the scale of the pavilion miniature with a short bridge. This wasp-waisted link emphasizes that, while mediation between the two scales is the goal, they still exist in two different spatial orders. The pavilion piece with its variety of placements in the condominiums suggests a superscale card table from childhood fantasies of indwelling. But there is still enough isomorphism between the four-poster and the condominium for a strong sense of regressive relationship between the two. It seems in some sense truly a miniature of the larger, presenting an unusually clear expression of one-to-one singular regression, but without the kitsch attendant on a greater degree of self-conscious reduplication. The charged energy of the seating group defined by this pavilion arises in part from this palpable miniaturization, as if a primal sense of shelter has been boiled down and concentrated in the process. Its role as the focal point of the life of the house seems marked by radial lines of force implicit in the geometry of miniaturization, its off-center placement contributing further tension to the composition.

A distinction should be made between such cases and the ultimate *additive* step of encapsulation. They are kin in the world of formative relationships: the Jones lab perhaps a second cousin, its several miniatures bearing no resemblance to its encapsulating volume,



3.13 MLTW: Sea Ranch Condominium, CA, 1965, adapted from Charles Moore, Gerald Allen & Donlyn Lyndon, *The Place of Houses* (New York, Holt, Rinehart & Winston, 1974), p. 37.



3.14 Hugh Newell Jacobsen: Dreier-Barton house, Washington, D.C., 1977.

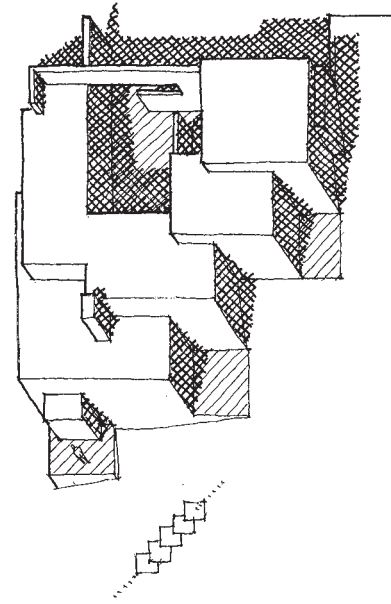
with the Orinda house more of a first cousin, its pair of miniatures bearing a closer morphological kinship with the house itself. But singular regression clearly evokes a reduced-scale version of the element within which it is housed—without somehow feeling the need for a close correspondence of appearance—in a one-to-one relationship.

Linear Duplication

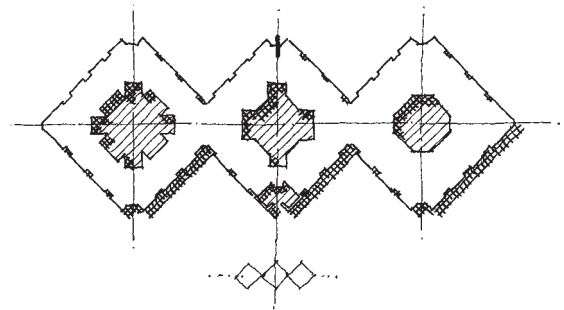
Looking back at singular duplication, its linear implications in the sense of flanking and defining an axis have been noted, but such pairings also suggest axiality in terms of a one-two sequence, as in the Meier houses. And where one becomes two, two can become three and so on in indefinite *linear duplication*, as in the Zamoiski house. Among many possible variants on such a chain:

- Jacobsen's Dreier-Barton house employs the specific case of similar volumes en faced end-to-end with a lateral shift at each juncture (the sketch dashing in the implied potential of indefinite extension) (3.14).
- Alianza Architectos' Kress house employs corner-to-corner embedding in a similarly shifted sequence, plus a stepping down in succession (3.15).
- Kahn's Erdman Hall dorm employs the rarified additive mode of corners touching corners—resorting to requisite overlaps—in its linear sequence of three nominally identical elements (3.16).

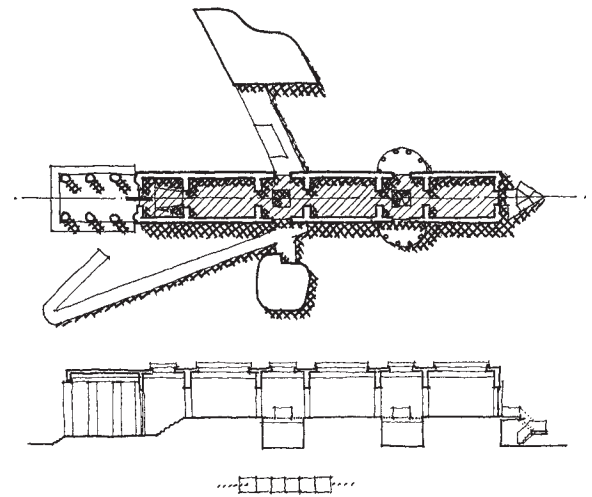
The most graphically simple case of linear duplication would sequence rectangles or squares in perfect en faced alignment, an enfilade of one room or volume leading to another. While museums often feature galleries *en suite*, as at Stirling's Staatsgalerie, such an ensemble is typically subsumed into a more complex whole. But the “trunk” of Isosaki's Okanoyama



3.15 Alianza Arquitectos: Kress residence, Albuquerque, NM, 1981.



3.16 Louis I. Kahn: Erdman Hall Dormitories, Bryn Mawr, PA, 1965.



3.17 Arata Isozaki: Okanoyama Graphic Art Museum, Nishiwaki City, Japan, 1984.

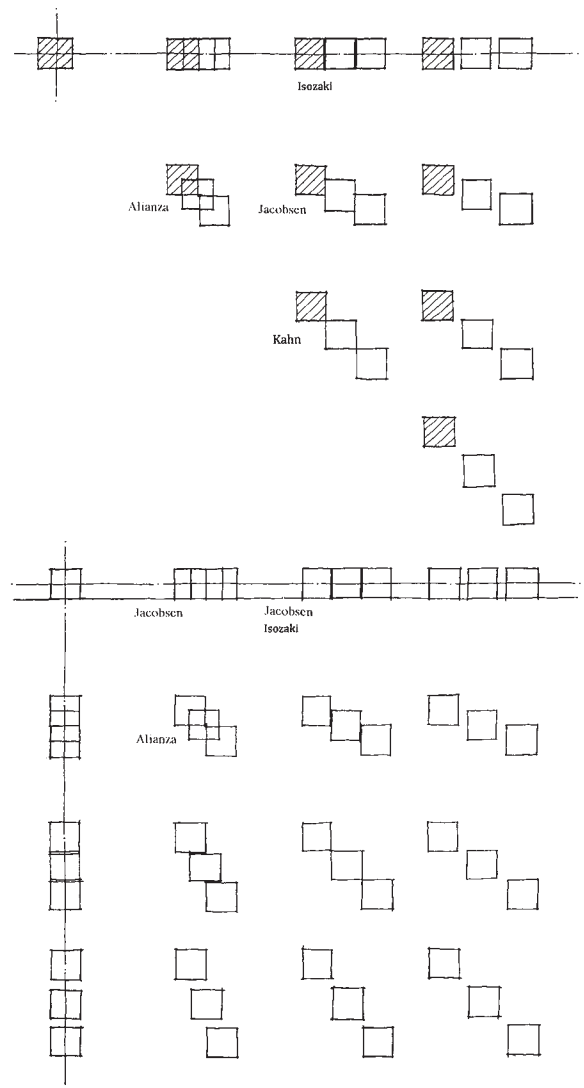
Graphic Art Museum is truly an enfilade, its en faced and alternating gallery and circulation elements having the same cross section and joined in exact alignment to accrete as one contiguous elongated form (3.17). The image of a train is said to have been a thematic subtext for the architect.³ While significant nonconforming support elements append its flanks, the primary gesture of discrete elements replicated in sequence predominates. One qualification: the Okanoyama museum involves varying façade treatments that signify its nature as an en faced series. If the flanks were treated monolithically, its legibility as a case of linear duplication would not be at all apparent—except in terms of the interior experience of sequential passage. That said, the latter normally is, or should be, of first importance.

Ultimately any linear organization involving nominally repeating elements represents a case of linear duplication, and a family of these variants can be assembled into an array or matrix representing all the configurational alternatives in plan and elevation—here within a diagrammatic convention of orthogonal limits—of linear duplication (3.18). Were such a sequence of duplicates to continue in like fashion beyond the project limits, the replication would continue indefinitely at an unvarying scale, an endless enfilade or staircase of formative repetition.

Linear Regression

While singular regression deals with a single level of reduced replication, there remains—recalling the relationship of singular to linear duplication—the potential for each regressed version of an element to beget its own miniature, in theoretically unlimited *linear regression*. This image recalls “the limit” as employed in the calculus, with reference here to the ever closer yet unreachable point of the infinitely small. Although it may proceed through a theoretically infinite number of ever-smaller iterations,

3. Martin Filler, “Orient Express,” *Architectural Record* 174 (May 1986): 106-115.



3.18 Linear duplication: plan cases - array symmetrical about 45° and 90° axes; Linear duplication: elevational cases - array symmetrical about 90° axes.

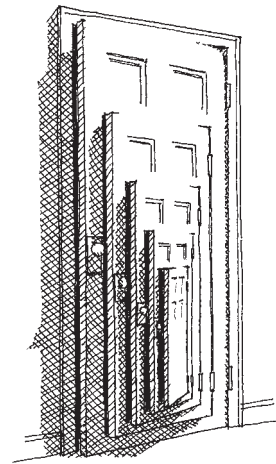
linear regression in architecture must be afforded the convenience of an identifiable limit point in real space toward which it is headed (3.19; 3.20).

Two dimensions/direct

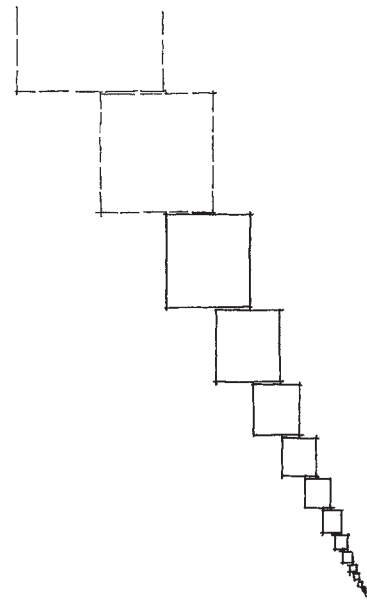
There are several subtypes of linear regression, of which the most intuitively logical might be called *two dimensions/direct*, or 2d/direct for short. The terminology does not refer to planar dimensionality, but rather indicates that both of the two dimensions illustrated in a given plan- or elevation-oriented case change scale at each iterative step of regression, and in direct proportion: i.e., in a true 2d/direct sequence initiated with a square, each step is a smaller square. Arrays in plan and elevation of such cases again illustrate the basic variations of the mode, arising from the continuum of different possible limit point locations either within or outside the figure (3.21).⁴ (In the ultimate case of the latter, the limit point is at an infinite distance, and the case degenerates to linear duplication as discussed above, with all its iterations at the same scale.) The following cases employ 2d/direct regression concentrically in plan:

- While the Rose Center attains singular regression of a sort in both plan and elevation, it is not normally in the nature of buildings to achieve *linear* regression in receding miniature, each iteration suspended within the last. But Kahn's library for Exeter Academy seems almost an attempt to achieve that very aim (3.22). In plan, a "thick wall" of masonry alcoves encapsulates a doughnut of use areas, overlooking the central void in turn, while the same center is marked in

4. Two sets of arrays are shown, for plan and elevation cases. But architectural configurations are conventionally defined by three dimensions, and it is true that to full illustrate all configuration cases, a second elevational array would be required. To fully define any particular case, however, two are sufficient. Once a plan configuration is chosen, for instance, the implications of two dimensions are known. It remains for a second selection to be made from the single specifically entailed "stack" of possibilities in the elevational array to fully define the configuration.



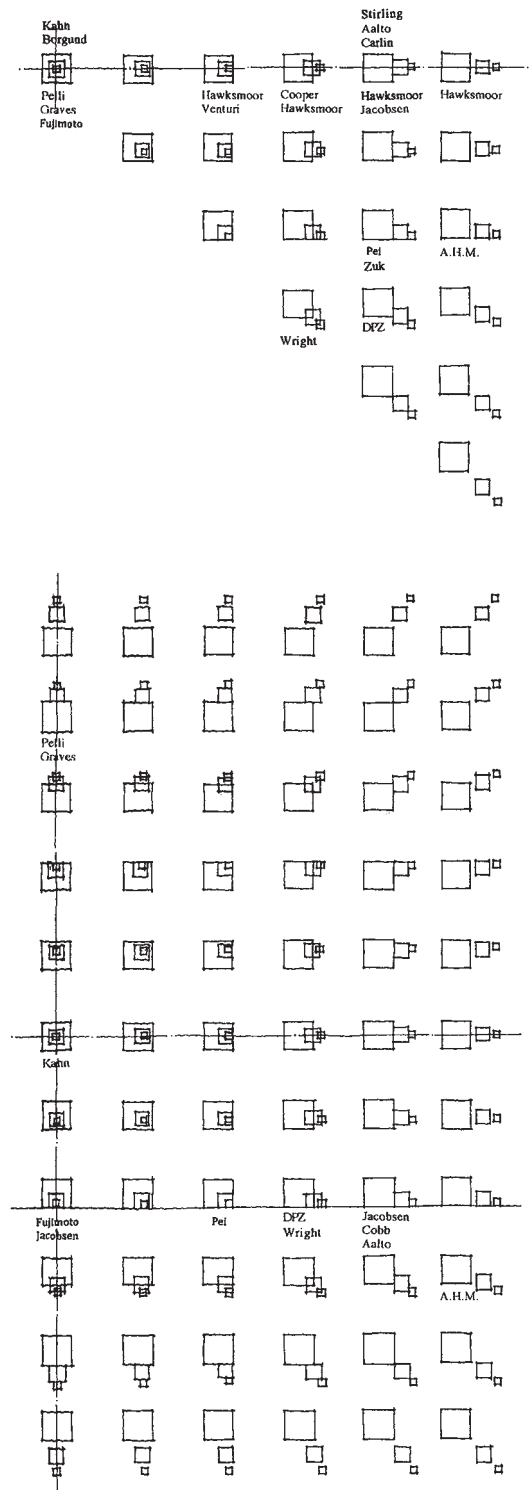
3.19 "Door-within-a-door-within-a-door-within-a-door." Redrawn by permission of SITE Architecture Art Design, adapted from photograph of original art piece found at <http://siteenviropdesign.com>.



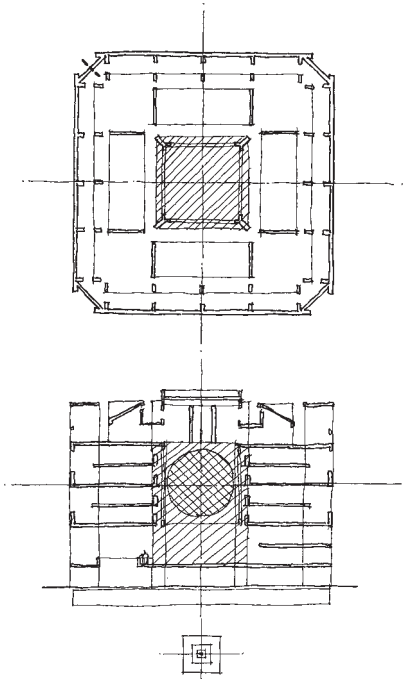
3.20 Linear regression visualized: compare with Drier-Barton house as linear duplication.

section by circular cutouts, likewise surrounded by layers of architectural fabric.

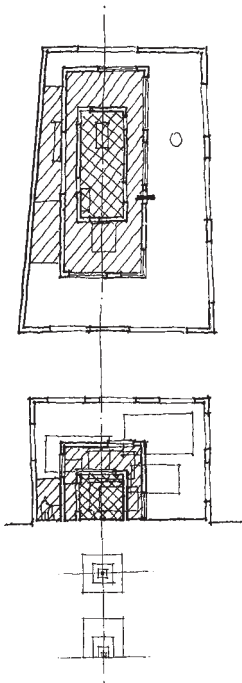
- Even the “ground plane” situation with regressing elements sharing the same base datum yields few examples beyond singular cases, such as those at St. Peters or the Sea Ranch. Further iterations require a special hat-trick sort of effort, such as Fujimoto’s House N wherein three nested boxes successively afford increasing levels of enclosure. Large punched openings—some glazed, some open, in walls, ceilings and roofs—foster a deliberate sense of ambiguity (3.23).
- The case of regressing elements en faced vertically recalls the “wedding cake” profile seen in urban architecture of the interwar era (3.24). Stepped both in response to zoning requirements and simply as an expressive gesture, earlier applications such as Manhattan’s Paramount Building tend to be the purest expressions, while the Ritz Tower of the same period demonstrates the profile’s adaptability. Pelli’s unbuilt Miglin-Beitler “skynedle” returns to a more literally configured, albeit highly attenuated, version of the approach.
- As a holdover from early tall-building design practices as well as a response to the realities of building volume efficiencies, many high-rise designs retain the distinction of base, shaft and cap with the result that a stretched intermediate iteration of this approach forms the main body of the building. Graves’ Portland Building presents a telling interpretation of the type, the limitations of site and budget resulting in a massive and bulkily proportioned intermediate step (3.25). As designed, the necessarily efficient cube of office floors is layered below by the rather squat expanded layers of the base and above by correspondingly regressed penthouse levels.



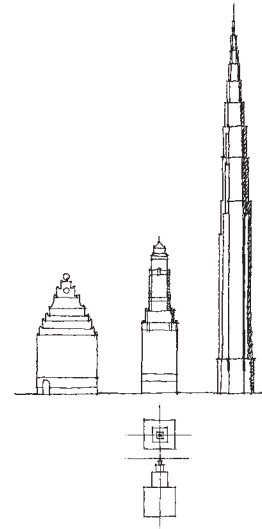
3.21 Linear regression, two dimensions/direct: plan cases—array symmetrical about 45° and 90° axes; Linear regression, two dimensions/direct: elevational cases.



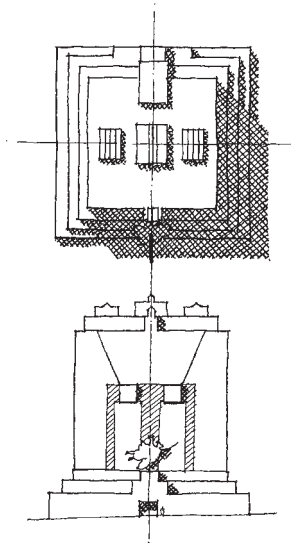
3.22 Louis I. Kahn: Phillips Exeter Academy Library, Exeter, NH, 1971.



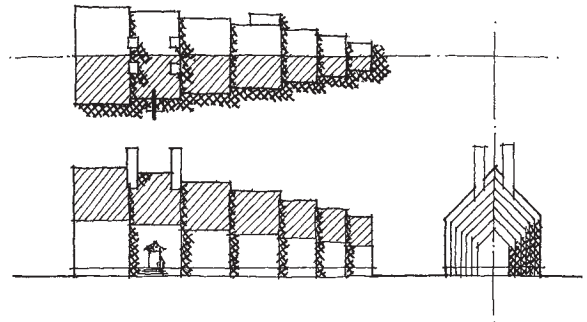
3.23 Sou Fujimoto: House N, Oita, Japan, 2008.



3.24 Rapp & Rapp: Paramount Building, Manhattan, 1926; Emery Roth: Ritz Tower, Manhattan, 1927; Cesar Pelli: Miglin-Beitler Skyneedle (unbuilt), Chicago, proposed 1990.



3.25 Michael Graves: Portland Building, Portland, OR, 1982.



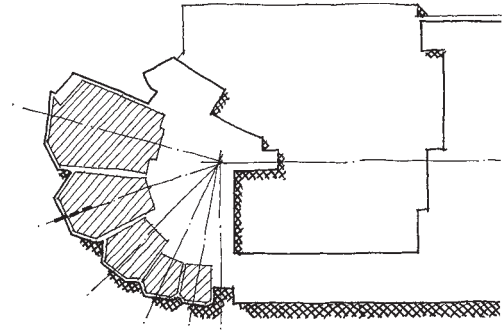
3.26 Hugh Newell Jacobsen: Buckwalter House, Lancaster, PA, 1982.

Turning the wedding cake on its side results in more built architecture, the regressing elements bearing on the ground plane datum and aligned by a longitudinal axis of symmetry:⁵

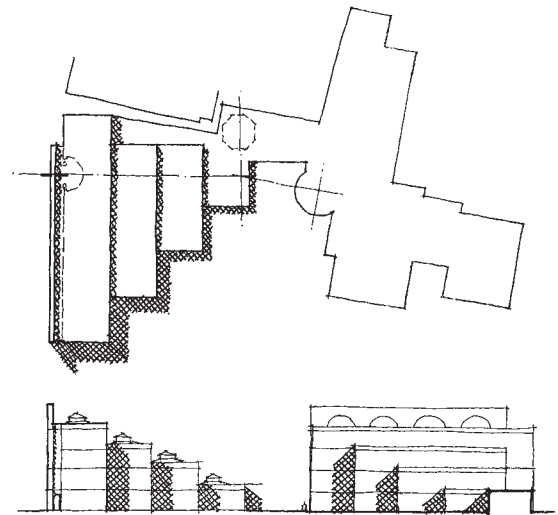
- Jacobsen's Buckwalter house evokes the case clearly, if to excess, presumably derived from the precedent of characteristic incremental additions seen in vernacular residential architecture of the region (3.26).
- The capability of this approach to adapt and to combine with other organizational structures is apparent at Aalto's Wolfsburg Cultural Center, its array of meeting rooms following the same morphological rules while being torqued in an arc around a shared center (3.27). As is characteristic of Aalto, this fan element is mortised with informal abruptness into the essentially rectilinear fabric of the remainder of the building.
- If the approach is halved at the centerline, regression occurring along one flank while the other is aligned into a flushed or sheared surface. The Pei office's Portland Museum arrives here by seeking to accommodate a variety of large and small gallery spaces all based on multiples of a cube module (3.28). The museum courts the dilemma shared by many such horizontally regressing schemes of a need to cut off the expansion at some point—an abrupt and difficult aesthetic condition. The assertive hard edge of its street-front facade attempts to address the issue by becoming an appended billboard-wall remnant of the next larger scale of iteration, with large cutouts against the sky making the gesture hard to miss.⁶

5. Seen from the "big end" and viewed as a series of concentric receding voids, the approach recalls the forced perspective of the Renaissance theater, or of allées and stairs such as Borromini's Palazzo Spada colonnade and St. Peter's Scala Regia, ingeniously bringing the far distance within the realm of a buildable domain.

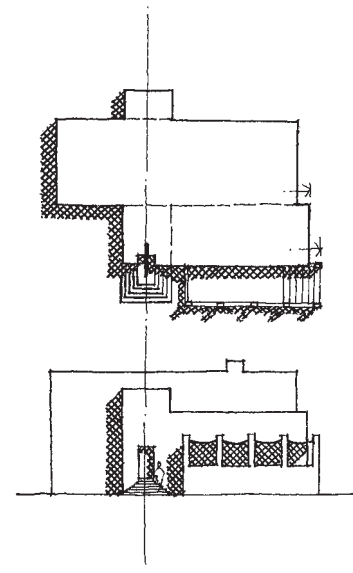
6. Morphologically, the Portland museum is "quasi-regressing" in that the characteristic inward and downward steps are equal and modular rather than proportionally decreasing. The progression is a simple step-



3.27 Alvar Aalto: Wolfsburg Cultural Center, Germany, 1962.



3.28 Henry Cobb: Portland Museum of Art, Maine, 1983 (an addition to existing buildings).



3.29 Duany Plater-Zyberk: Hibiscus house, Coconut Grove, FL, 1981.

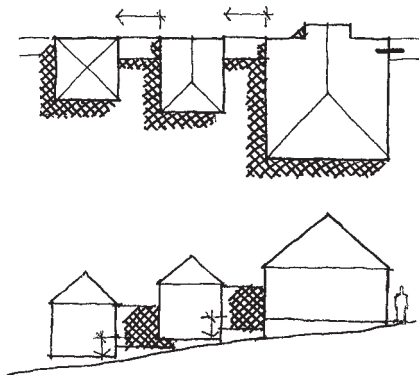
More rarefied options among the many that are theoretically available for 2d/direct regression are sometimes employed. In DPZ's Hibiscus House, each element extends laterally beyond the last as it reduces in scale, resulting in a reading of several rectangular elements en faced along planes of slippage but which are morphologically independent. Suggestions of a transverse axis afford a measure of anchorage for the scheme's potentially uncomfortable disconnects (3.29).

Regressing forms may also be pulled apart longitudinally rather than slipped sideways, the successive shifts away from a concentric order finally bringing about not one building but several—recalling the “adjoining additive” discussion—ordered by this relationship. At Amsler Hagenah MacLean's Wharton house, while its reducing progression of living pavilion, guest house and porch are connected by linking corridors, individual roof forms dominate and emphasize the spacing of the elements. The scheme also departs from a flat datum plane case in that, on this rural hillside, the pavilions fall away not only in size but in elevation. This is but one manifestation of the amenability of these and other forming modes to ramifications of site and context: While presented in terms of their internal forming relationships, the important aspects of site, among so many other influences on an architectural scheme, are manifest in the versions of forming that have evolved for the cases discussed (3.30).

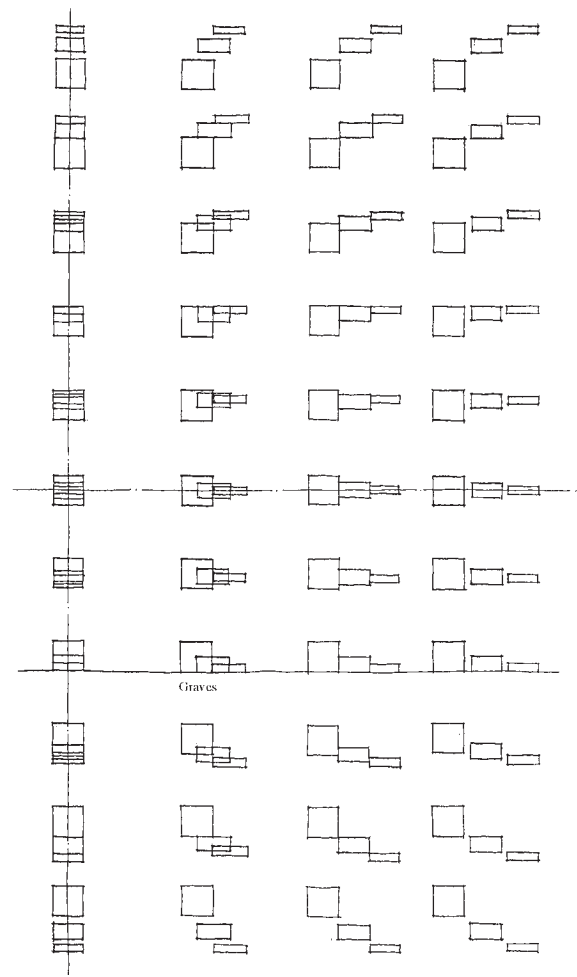
One Dimension

- A second subtype of linear regression might be called *one dimension*, or 1d, meaning regression occurs along only one axis of either the plan or elevational orientation, the other axis remaining constant. *Three* arrays, one for each axis, are now

wise development in which the module does not reduce, and its limit is reached in a short and definite set of iterations. This modular nature makes the case pertinent as a link between subtractive and replicative forming strategies.



3.30 Amsler Hagenah MacLean: Wharton house, Nottingham, NH, 1985.

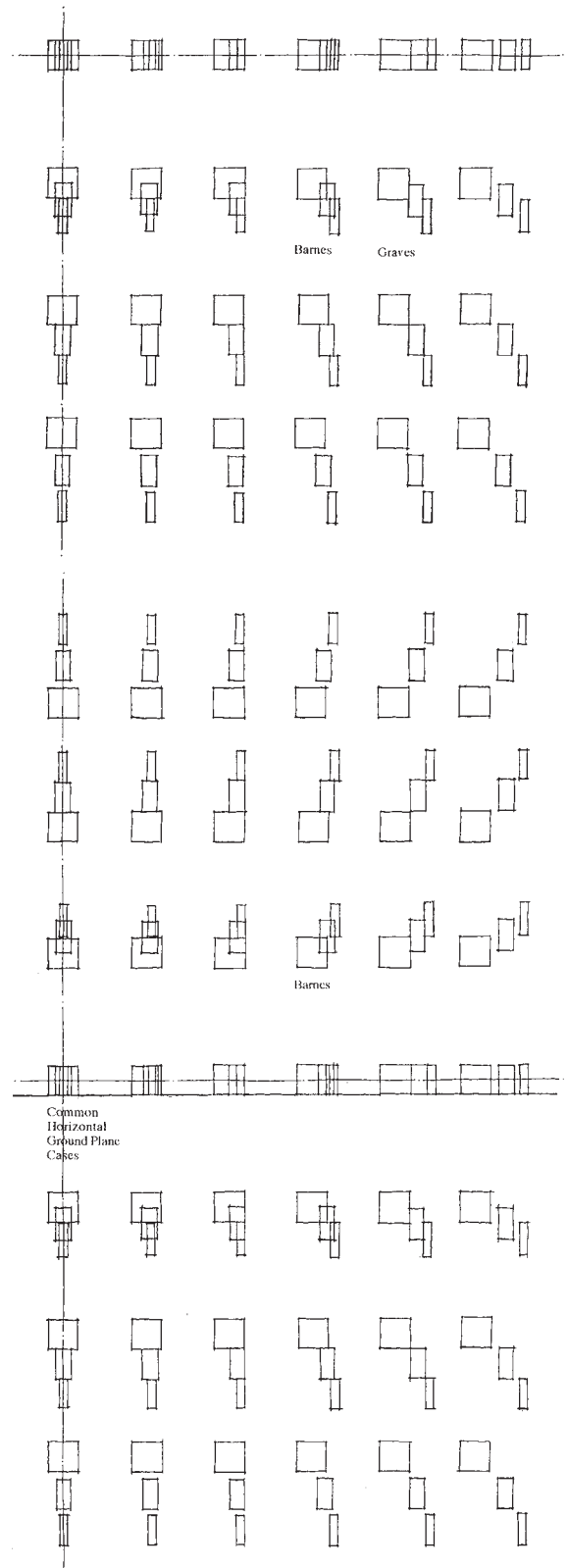


3.31 Linear regression, one dimension: elevational cases- regression in y axis.

required to fully illustrate the plan- and elevation-oriented variants (3.31; 3.32).

- Barnes' Crown Center offices exemplify the case, the overlapped Ls which are evident in plan becoming shorter and shorter along one axis while remaining constant along the other (3.33). The elevation echoes this relation as it steps up the sloping site,⁷ for just as with 2d/direct cases, 1d regression can also occur on a vertical axis.
- At Graves' modest Schulman House, the overlapped elements of the original house, the addition, and the garden wall step down in progressively reducing *elevational* sequence, but with no corresponding reduction in width (3.34). As a theatrical gesture, horizontal siding becomes wider in forced perspective fashion as the elements step forward, in contrast to the progressive reduction in height. Here the polarity of regression is *reversed* from the elevational case, with lower walls stepping progressively further forward (dashed profiles again demonstrating the consequences of further iterations).
- Demonstrating the worthy role of inconsistency as an intentional outcome of *combined* regression modes, Turnbull's Zimmerman house wraps an irregular living volume with a squared-up outer skin of light-filtering wood lattice, featuring overscaled punched openings, while a central "light tower" extends full height to a continuous translucent shed roof sheltering the whole ensemble (3.35). These inner and outer "tubes" establish the rudiments of 1d elevational regression. But the intermediate living volume is held both inboard from the lattice and below

7. While 2d/direct regression has an infinitesimal point as its ultimate reduction, the limiting case of 1-d regression is a volume of consistent height but "infinitesimal thinness." To avoid this conundrum, the Barnes project is based on an elbow-shaped unit whose variation is taken up in one leg but not in the other, with reductions made in increments modular to the column bay: regression can't continue indefinitely as it ends when the last column bay of the variable leg is cut.



3.32 Linear regression, one dimension: plan cases- regression in x axis; Linear regression, one dimension: elevational cases- regression in z axis.

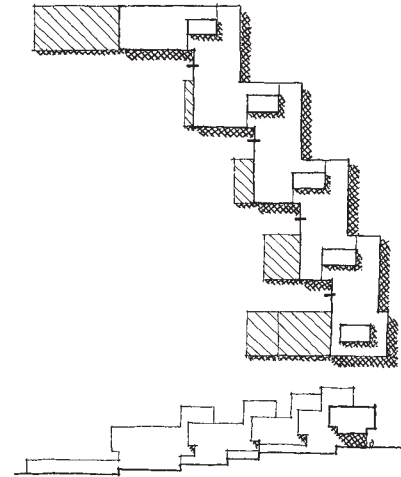
the roof, initiating a *2d/direct* sequence with the outer periphery. The conceit of the design, an aggregation sheltered between the tall inner and outer limits, represents a hybrid—while still within the formative mode of replication—of these two elevational sequences.

Two Dimensions/Inverse

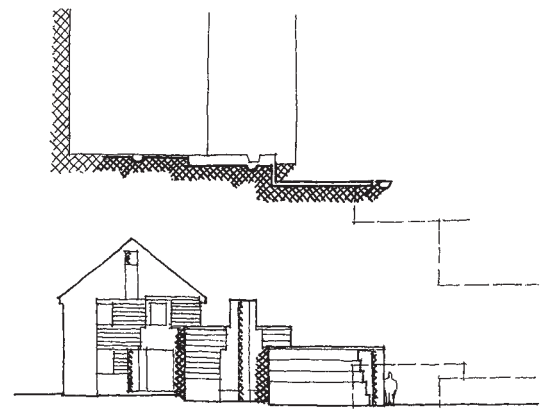
The several foregoing arrays of duplication and regression cases can be linked in a somewhat intimidating transformational sequence that illustrates their evolutionary order as it leads to a final variant (3.36).⁸ These arrays form a logical sequence, leading from 2d/direct regression, to 1d regression, to “0d” duplication. To achieve a transition from the 2d case to 1d, a dimension of regression must be removed. If the transverse or “y” regression component is eliminated, the iterations stretch to remain the same width, while regressing to infinite thinness in the longitudinal or “x” axis direction. But if the longitudinal regression component is removed, the elements stretch in that x dimension to remain the same length, while becoming ever narrower in the y axis. Thus there turn out to be two quite dissimilar modes of 1d regression: the longitudinal and the transverse. (In both modes, as well as in the originating 2d case, the regression can also expand indefinitely in the “back” direction).

In turn, each of these forms of 1d regression presents two modes of *further* evolution. One outcome is 0d duplication, the result of removing the one remaining dimension of regression, in each case, to produce a common result of indefinitely repeating identical units. Another outcome, however, arises from further *extending* the axes of regression, such that they go beyond the equal iterations of the 1d cases and become “axes of expansion.” As a result, in the case where x axis regression remains, the y axis expands,

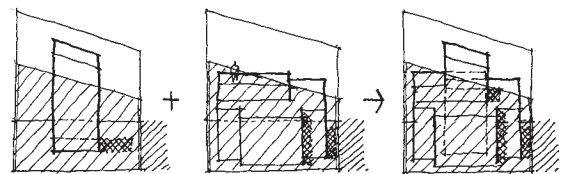
8. For the sake of simplicity, the “wedding cake-in-plan” version is taken as the illustrated case, and the examination of the sequence is limited here to the plan orientation.



3.33 Edward Larrabee Barnes: Crown Center Office Complex, Kansas City, MO, 1971.



3.34 Michael Graves: Schulman house renovation/addition, Princeton, NJ, 1976.



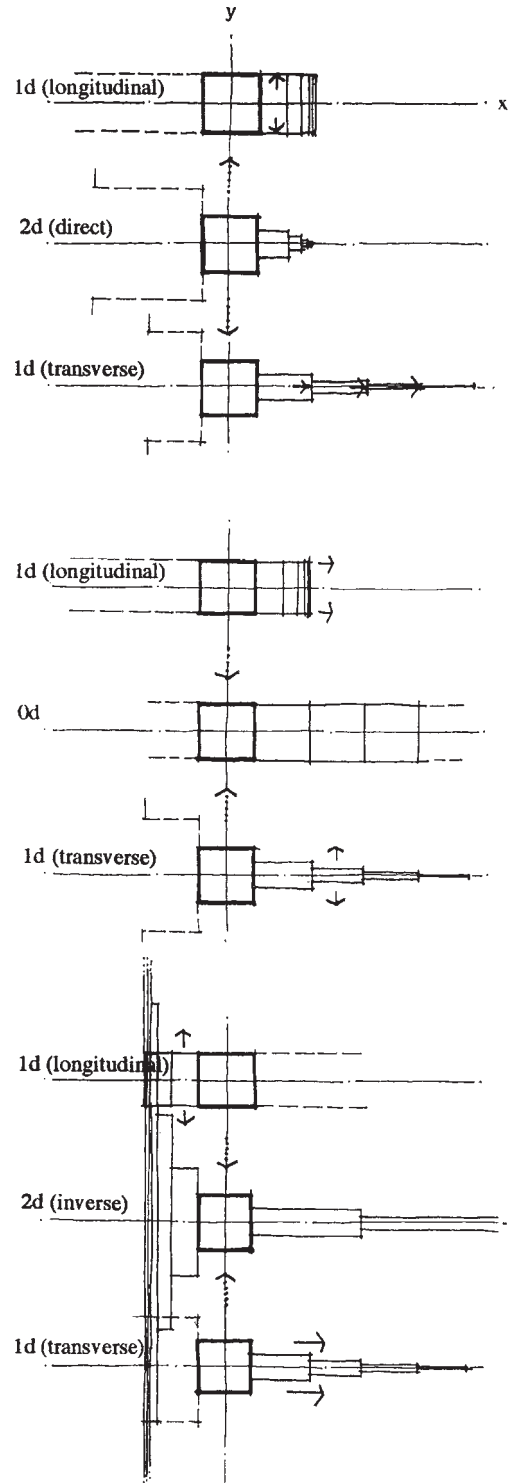
3.35 William Turnbull: Zimmerman House, Fairfax County, Virginia, 1975, adapted from Donlyn Lyndon and others, *William Turnbull, Jr.: Buildings in the Landscape* (San Francisco, William Stout, 2000), p. 125.

and successive units become simultaneously wider and shorter; in the case where y axis regression remains, the x axis expands, and successive units become simultaneously *longer* and *thinner*. A serendipitous fact about these arrays appears when their shape in the “back” direction is also observed: if the above descriptions are reversed, it is the former case which stretches to an infinite line in the x axis, while the latter flattens to a line in the y axis. They are, in short, both the same diagram: they can be superposed if the x axis orientation is reversed in one or the other case. Thus while 1d regression offers four modes of further evolution, these converge to become two ultimate extremes: those of 0d duplication, and this stranger beast, which might be called *two dimensions/inverse* regression.

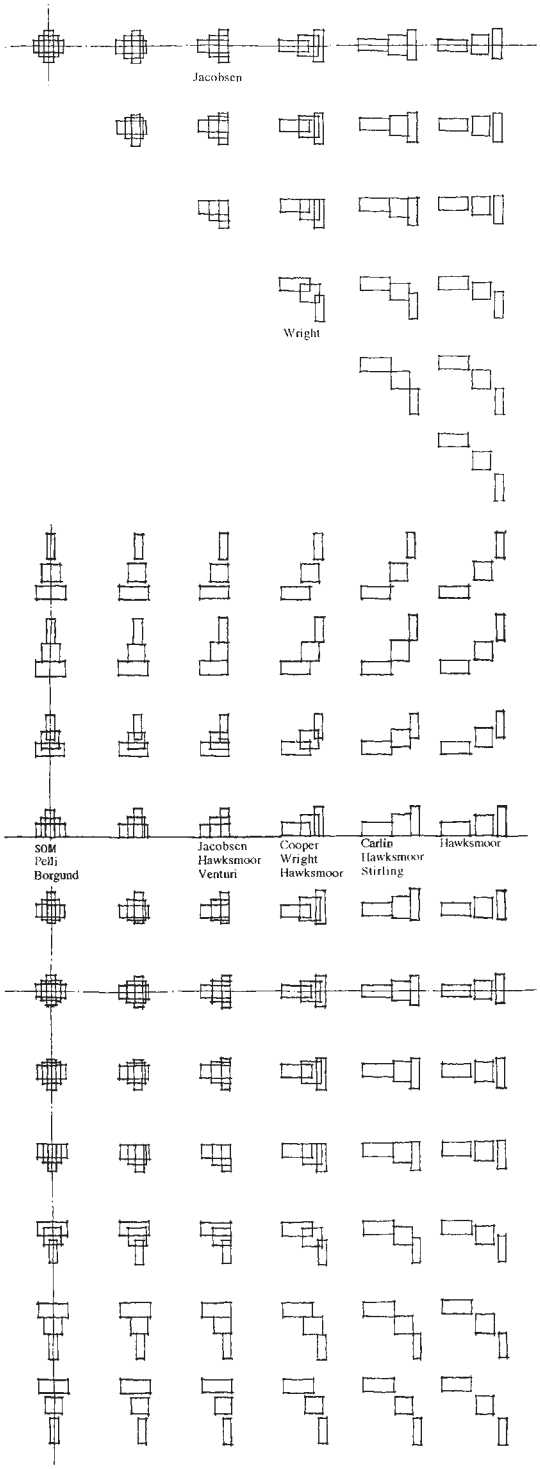
Despite its intuitive oddity, inverse regression can occur in all the orders that have been demonstrated in the 2d/direct and 0d cases, as illustrated by another set of plan and elevational arrays (3.37). The combinations of plan and elevation modes reveal the complexities and limitations of the type. There is, for example, no possible “inverse/inverse” combination.⁹ And it should be apparent that, in contrast to direct regression, the inverse modes have no limit in either direction: iterative extension can continue to the indefinite distance in both the x and y axes in plan modes, or in both the dominant plan axis and the z axis in elevation modes, depending on the combination employed. The inverse plan mode involves a sequential array of volumes, becoming progressively thinner and longer as the dominant plan axis is approached.

The Buckwalter house exemplifies a revealing kinship with direct regression, in that it can be interpreted not only as a row of progressively smaller en faced volumes

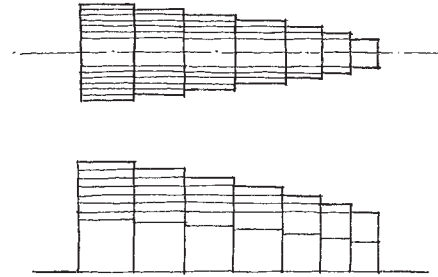
9. If one begins with a given inverse plan mode, it follows that regardless of whatever inverse elevation mode is chosen, the other of its two elevation orientations will inevitably have a direct regression configuration. If, conversely, an elevation mode is first chosen which is inversely regressive in both x - and z -axes, the predetermined y axis plan configuration regresses directly.



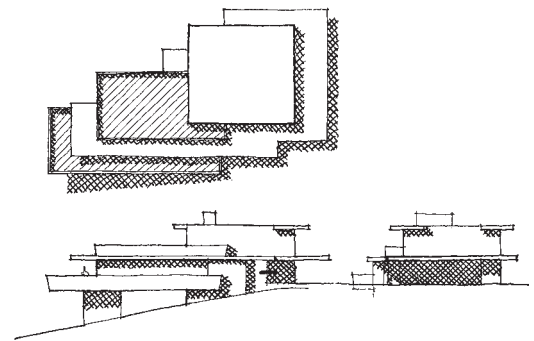
3.36 Diagrams of evolution in plan of linear regression types.



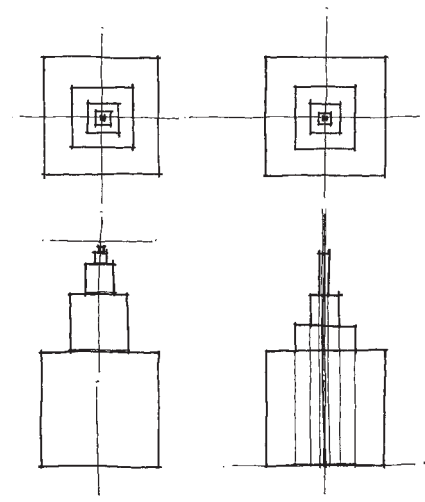
3.37 Linear regression, two dimensions/inverse: plan cases;
Linear regression, two dimensions/inverse: elevational cases.



3.38 Buckwalter house as 2d/inverse.



3.39 Frank Lloyd Wright: Pew House, Madison, WI, 1940.



3.40 Plan/elevation diagrams of 2d/direct and 2d/inverse cases compared.

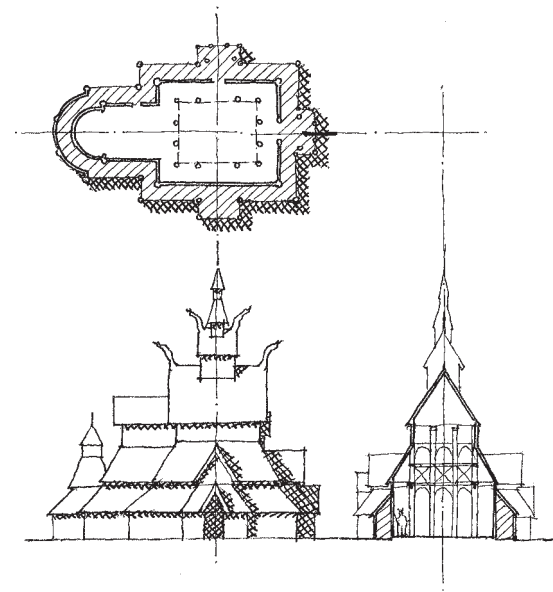
but also as a collided set of volumes which elongate in the inverse manner (3.38).¹⁰ This ambiguity of interpretation depends on secondary clues in the architecture: in the above case the alternate reading is supported by the illusory penetration afforded by reflective glass in the interstices. Such ambiguity is not an issue if exact alignments are avoided, by virtue of embedding or of a full separation of elements. Wright's Pew house achieves this by employing a partial collision along a plan diagonal, its elements transitioning from the thin, elongated deck structure to the upright, foursquare two-story volume (3.39).

Another diagrammatic comparison reveals the kinships and differences of regression direct in plan and elevation, vs inverse in elevation and direct in plan (3.40). The latter has been exploited more extensively than in the above cases, affording a rich variety of building forms and types:

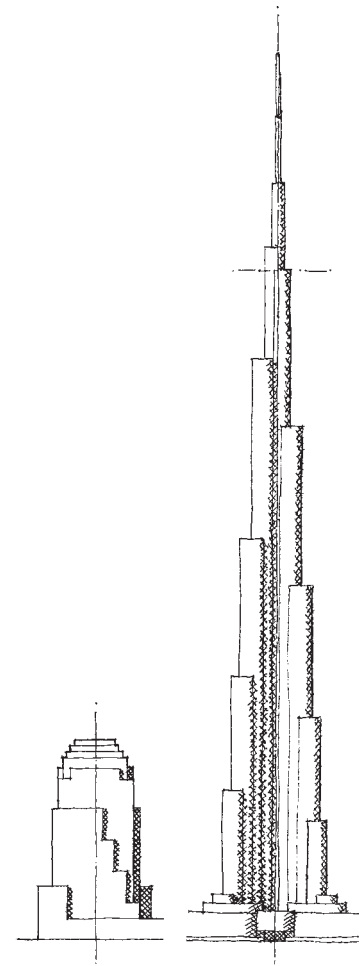
- Precedents are found in centrally planned churches such as Borgund, Norway's stave church, where ambulatory, aisle, nave, clerestory, belfry and cupola form the successive nesting and attenuation (3.41). Although there is less of a sense of penetration by the upper elements, which are superposed on the roof and not visible from the interior, the lower three habitable elements penetrate each other in section and encapsulate each other successively in the form of the inner ring of columns, the wall of the aisle, and the wall of the ambulatory. The experiential effect of increasingly protected yet increasingly lofty sacred space is clear.¹¹

10. The kinship is an informal one: the increment of extension is progressively smaller, rather than the sequential increase the relation theoretically calls for. This latitude for the spirit rather than the letter of the device applies in several of the following cases.

11. The Borgund church actually embodies a hierarchy of two regressions: the chancel and apse masses following behind repeat this inverse relation in progressively reducing scales, forming in turn a 2d/ direct elevational sequence.



3.41 Stave Church, Borgund, Norway, 1250.

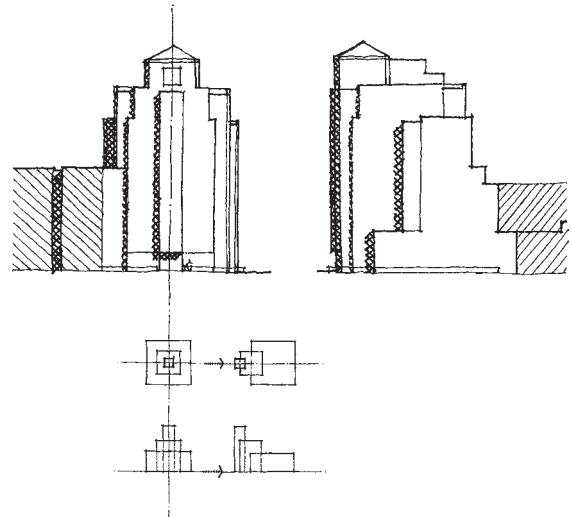


3.42 César Pelli: Four World Financial Center, Manhattan, 1986; SOM: Burj Khalifa, Dubai, UAE, 2009.

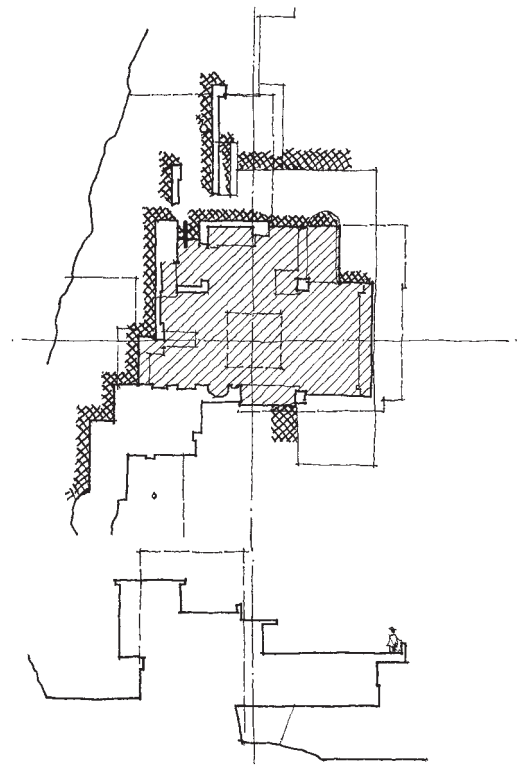
- The four towers of Pelli’s World Financial Center are a more assertive expression of the direct/ inverse relation, sharing an approach of multi-step inverse elevational regression (3.42). The lowest, outermost shell forms a plinth that rises to engage the towers, and the next layer’s massively scaled asymmetrical steps more fully manifest the project’s image of concentric shells, revealed by successive stepwise “erosion.”¹² The true body or shaft of the tower follows, notched at its top corners to reveal a final concentric volume, topped in turn by a different cap configuration on each tower.¹³
- Although four times taller, Dubai’s Burj Khalifa is an analogous case, and in fact more literally expressive of the inverse relation. The triadic plan steps back in alternating increments as it rises, with revealed upper segments steadily *lengthening* in height. Articulation of the topmost portion begins a second set of lengthening increments, eventually ceasing to house habitable space as it skinnies down to the uppermost pinnacle.
- While these examples of inverse elevation/ direct plan regression evoke concentric layers of material—the central column being the tallest and most resistant, the outer layers successively lower by virtue of “erosion”— a lateral shift from concentric to collided elements is accompanied by a shift in formative image. As seen in Cooper, Eckstut’s early scheme to replace NYC’s Hotel Margaret, the image becomes one of a more kinetic emergence, the thinnest, tallest element

12. The removal process implied by these stepped and notched profiles signals a hybrid symbiosis at work. While the scheme’s primary nature is replicative via inverse regression, this is clarified by the secondary clues of subtractive erosion.

13. It should be clear that such high-rise form articulation is typically skin-deep, the floor plates encompassing little or no expression of the concentric volumes implied on the exterior and the center consumed by vertical circulation, restrooms and utilities. The WFC development as a whole depends on its glazed “winter garden” as a focal point of public space.



3.43 Cooper, Eckstut: Margaret Hotel (unbuilt), Manhattan, 1986.

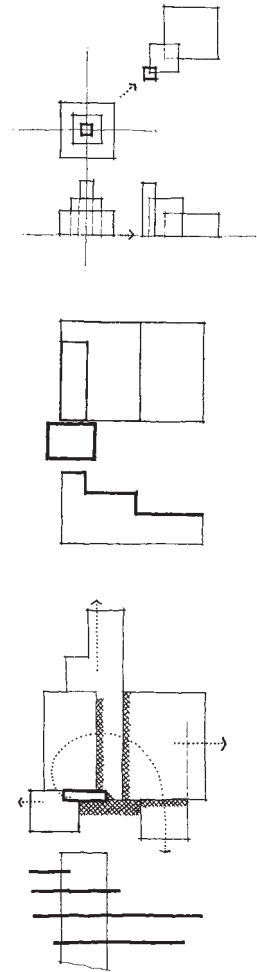


3.44 Frank Lloyd Wright: Fallingwater, Ohiopyle, PA, 1935.

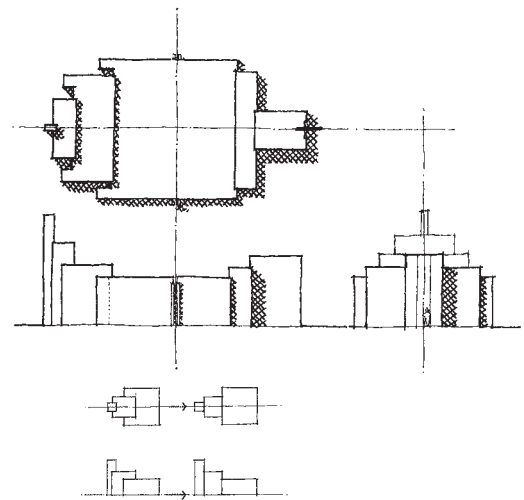
emerging frontally from secondary and tertiary layers as if in the process of shucking a series of overcoats (3.43).

Wright's Fallingwater is a related case, with regressing elements engaged by the collision of adjoining *corners*, but the house reveals no clearly and consistently applied sequence of transition (3.44). While there is a strong general sense that the form of the design proceeds from its origin at the tall, narrow masonry mass to the opposite pole of the broad, thin, cantilevered tray of the living room, its genius lies in the suppression of overtly apparent transitional steps between these extremes. Although the conceptual basis seems clear—an archetypal contrast between rooted rock chimney mass and levitating planes—the mortising of the layers and volumes intervening between these extremes saves the scheme from unduly obvious melodrama and constitutes one of the secrets of its status as a masterwork.

Another is the fact that this is but the first of at least three ordering partis which, superposed, contribute to the complex whole of the house's design structure (3.45). A compelling stairstep cross-section through the three stories constitutes the second, an extruded form cloaked in a camouflage of extended parapets. The third takes the terraces back into account as contiguous portions of the spatial experience, revealing the ultimate basis for the non-obvious nature of the composition—a characteristically Wrightian three-dimensional spiral or helix, originating at the chimney mass and rotating clockwise as it descends. The successive elements of this spiral sequence take the form initially of stone volumes, which gradually dwindle to become stone Ls, walls, and piers, freeing a contrasting vocabulary of planar elements to a greater and greater extent in the process. Once the corner is turned away from the uphill side the planes are essentially freed from the masonry elements, extending into space in three directions with a palpable burst of directional energy. The lowest plane completes the downward spiral progression in the



3.45 Fallingwater: diagrams of three partis.



3.46 Earl Carlin: Mount Zion Seventh-Day Adventist Church, Hamden, CN, 1965.

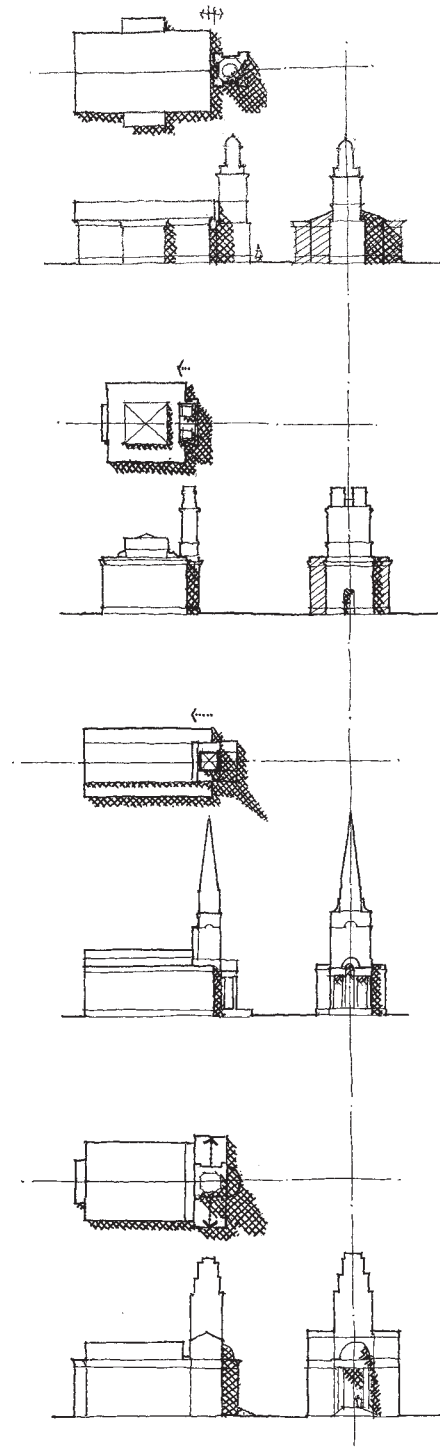
form of the terrace that points downstream from its vantage point directly over the falls. Not the least of the drama at this terminus lies in its very proximity to the stone anchorage where the 270° sequence began.

While Fallingwater exemplifies a collided geometry, a further step in the linear displacement of elevational inverse cases will bring the regressive volumes into *enfaced* relationships. So clear when plan and elevational sequences are both 2d/direct, this situation presents a wholly different and compelling peculiarity with its relation of plan direct to elevational inverse. Successive elements rise each above the last but shrink in width to reveal wider flanks preceding, emphasizing the slippery, barely engaged nature of the juncture. A church by Carlin embodies the case in spare concrete block volumes, a design that also duplicates itself about its transverse centerline (3.46). Thus a high, narrow narthex leads via an intervening step to a low, wide nave, leading in turn to a higher, narrower chancel and yet higher and narrower baptistry. In this rather literal-minded composition, dual high points compete for dominance, the main nave volume seeming somewhat broad-beamed in comparison.

* * *

The simplest possible version of the case—in theory a return to *singular* regression but now embodying 2d/inverse geometry—is an opposed pair of contrasting parts, tall and thin juxtaposed with short and broad. It recalls one of the most ubiquitous of form archetypes, the hall church with frontal tower. Hawksmoor’s London churches provide an object lesson in their range of approaches to this difficult adjacency, while demonstrating the tendency of the visually unstable tower to become collidively subsumed (3.47):

- At St. Alfege, the tower is fully revealed from the nave by a short neck, whereas the flattened tower mass of St. Mary Woolnoth is slightly embedded in the body of the building.



3.47 Nicholas Hawksmoor: St. Alfege, London, 1714; St. Mary Woolnoth, London, 1727; Christ Church Spitalfields, London, 1729; St. Anne’s Limehouse, London, 1727.

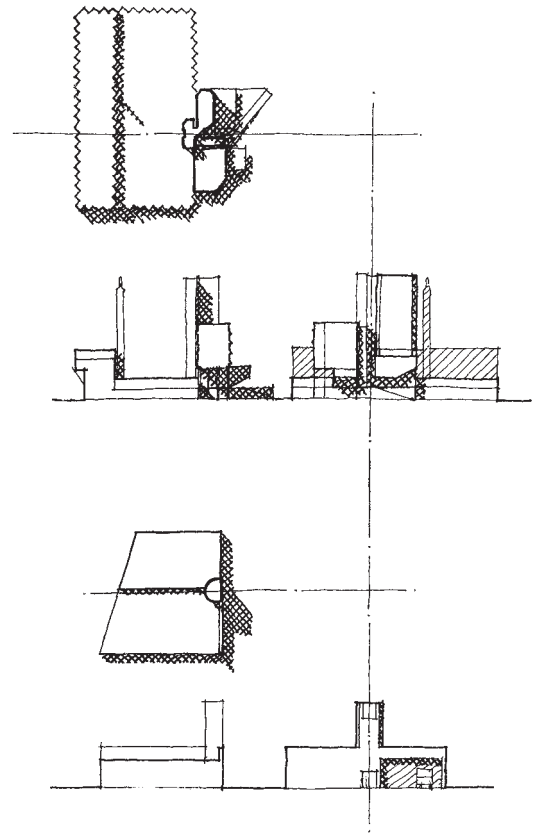
- At Christ Church Spitalfields, the tower mass is stretched to match the width of the nave, its footprint now largely subsumed by the main building mass.
- Ultimately, at St. Anne's Limehouse, the tower incorporates itself even more fully by sending out cross-gabled masses to enfront the full width and height of the building.
- Back in modern times, Stirling's Leicester Engineering Building and Venturi's Columbus Fire Station are secular temples of the modern era that demonstrate the continuing fascination of this elementally contrasting juxtaposition (3.48).

Finally in what may seem an anomalous version of this case, Le Corbusier's Legislative Assembly at Chandigarh encapsulates the *two* object volumes of the assembly hall and the council chamber (3.49). They appear to have punched upward, and evoke the above examples in their composition of contrasts. But as opposed to 2d/inverse regression, the fact that there are multiple elements actually renders the result a special case of encapsulation.¹⁴

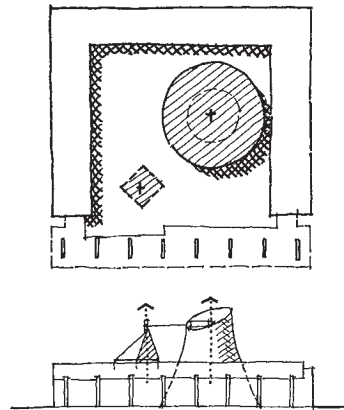
* * *

A partial recap of the taxonomy of addition types from the end of the preceding chapter reveals that some versions of formative replication are embedded here and there in that fabric, illustrating some morphological links between those two formative modes (3.50). In some cases these are due to having introduced the so-called "linear cases" in order to complete the array of options available to linear links, and in some others due to having entered the realm of regression as a consequence of including encapsulation in the additive taxonomy. But these links don't demonstrate any particular

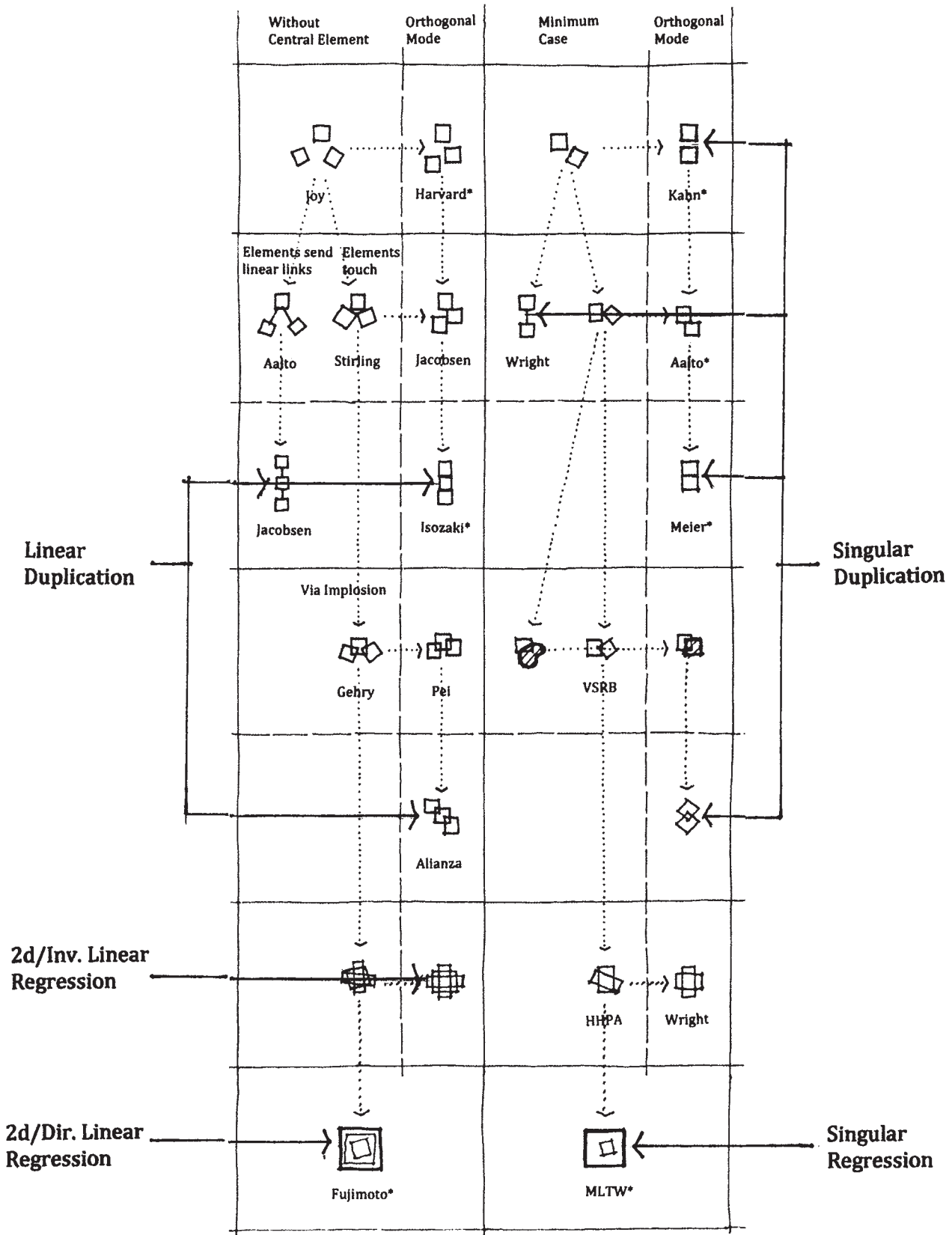
14. The council chamber aside, its plan order of an enclosing U with a round element of focus in the space within recalls corresponding aspects of the Stuttgart museum and the Stockholm library.



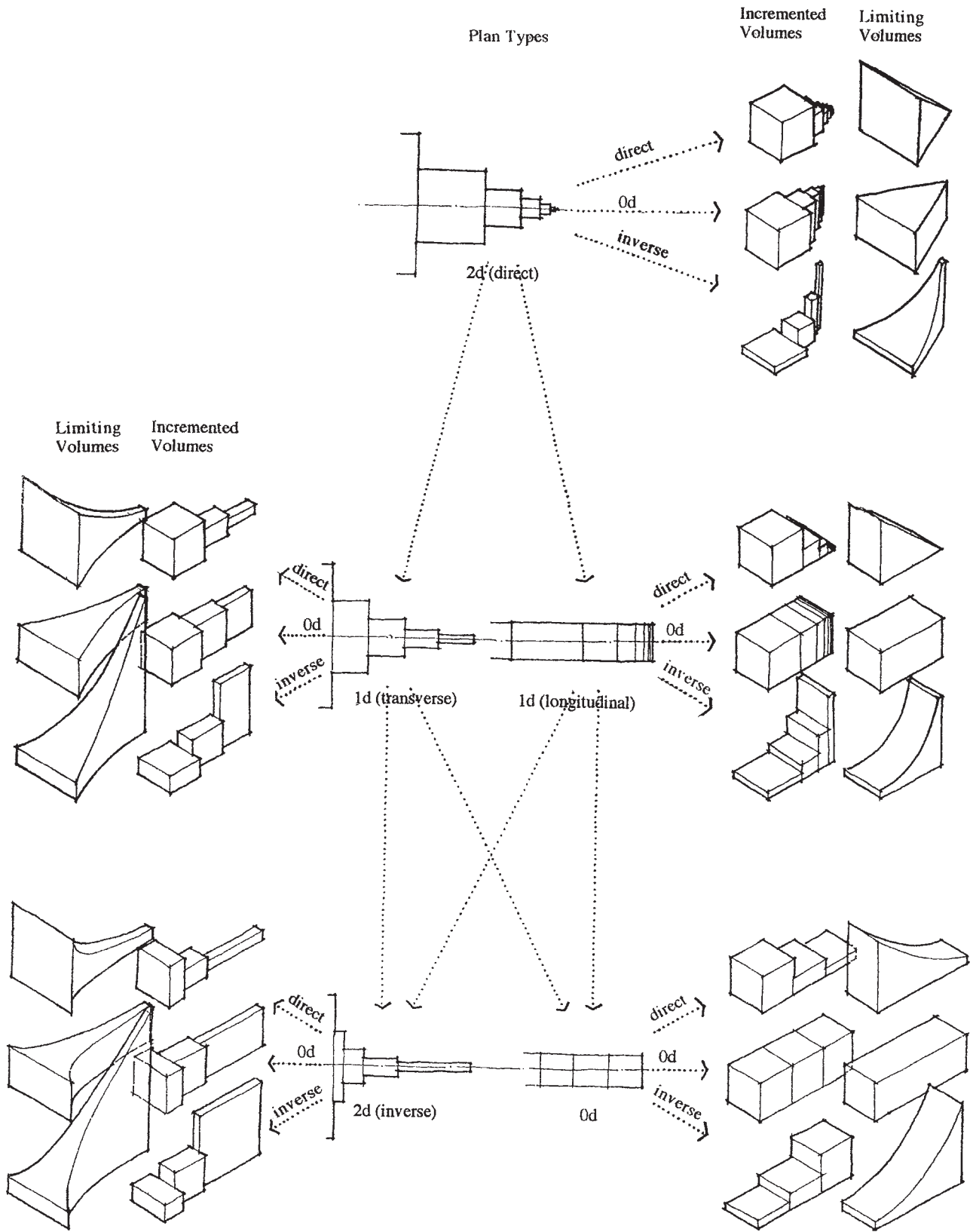
3.48 James Stirling: Engineering Building, Leicester University, England, 1959.



3.49 Le Corbusier: Palace of Assembly, Chandigarh, India, 1963.



3.50 Annotated excerpt: taxonomy of addition types.



3.51 Volumetric evolution of linear duplication and regression types.

transformational continuity between the modes of addition and replication: replication has a typological sequence of its own, completely different from that of addition. The crucial distinction remains: while addition deals with the assembly of parts into a whole, replication deals with an initiating whole that becomes an assembly of parts.

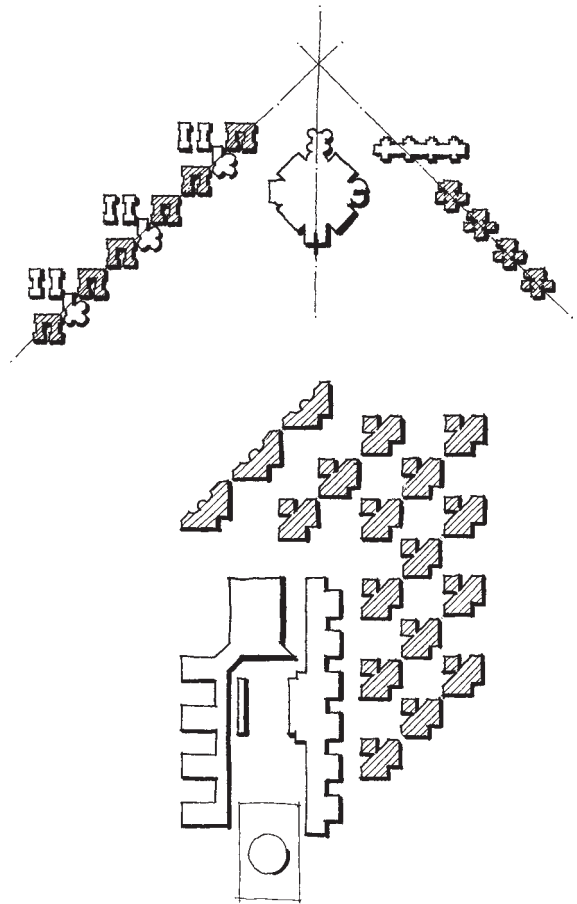
* * *

The above dozen or so variations on linear duplication and regression in architecture represent a few of the permutations possible in plan and in elevation, and the ones most amenable to architectonic expression. An expansion of Fig. 3.36 (“Diagrams of evolution in plan of linear regression types”) to take elevational options into account will hint at the scope of possibilities (3.51).¹⁵ Each of five plan-oriented modes of duplication or regression is combined with each of three elevation-oriented modes, resulting in fifteen possible three-dimensional configurations within this case alone. These incremented volumes suggest, in turn, the limiting geometrical solids which they approximate—some architectonic, others more evocative of the abstract realm of descriptive geometry. Thus by pursuing the various modes of linear regression to their limits, one comes full circle through the realm of replication to the iconic simplicity of the singular volume.

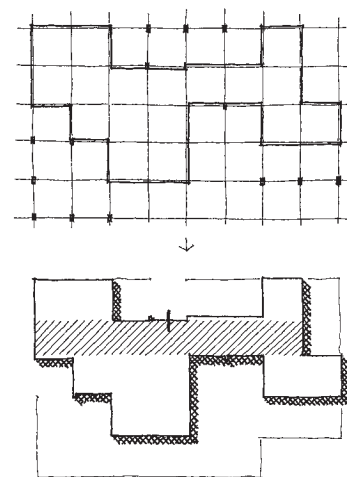
Planar Duplication

While the configurations of linear duplication extend in indefinitely repeating one-dimensional order, an added degree of dimensional freedom expands the scope to the unlimited two-dimensional extent of the datum plane. (The variant of singular duplication near the beginning of this chapter, wherein an initiating

15. For simplicity, the figures again are limited to this one element of the total structure. The breadth of the scope of possible options is seen in the fact that this represents the “enfacing” configuration (one of six possibilities), of the symmetrically-arrayed plan alignment (one of six possibilities), of the “ground plane” elevational configuration (one of eleven possibilities).



3.52 Louis I. Kahn: Citadel of Assembly, Dhaka, Bangladesh, 1974; Institute of Public Administration, Ahmedabad, India, 1963.



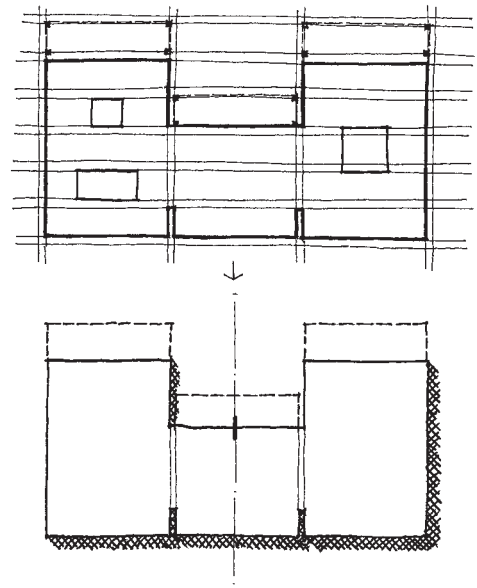
3.53 Philip Johnson: First Boissonnas House, New Canaan, CT, 1956.

element replicates omnidirectionally to become four duplicates, was a foretaste of this case.) An initiating element may now be replicated in many directions at once, the origin point's identity sometimes lost in a democratic sea of identical units.

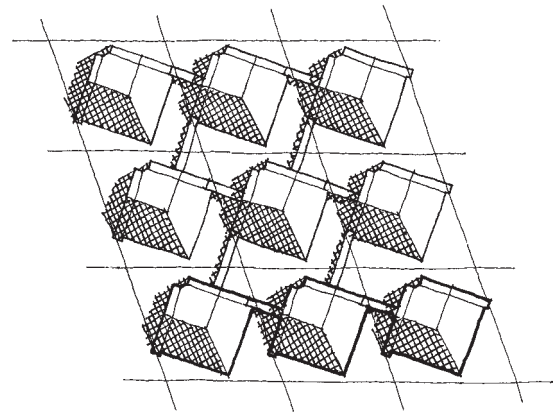
Kahn's works in Bangladesh and Pakistan offer a concise diagram of the distinction (3.52). At the Citadel of the Assembly, the diagonal rows of hostels flanking the assembly building are linear duplicates, the units repeated in indefinite sequence without signification of beginning or end. The dormitories at Ahmedabad, however, extend out in a space-filling swath of solid-void alternation, resembling the Bangladesh rows but shifted and repeated. While this body of units has a distinct overall shape and orientation—almost as if the central school complex were casting a broad shadow—there is no appreciable tailoring of the perimeter: the increments are essentially equal in their tic-tac-toe grid.

The indefinitely extensible grid, a recurring theme in theories and schemes of urbanism, is also employed in architecture, but this does not necessarily signal a case of planar duplication:

- Johnson's first Boissonnas house may appear to comprise an irregular agglomeration of square elements inserted into an indefinite grid, but is ultimately a case of spinal additive order, its forms made to fit the grid as a *secondary* ordering gesture (3.53).
- Kahn's Kimball Art Museum may also appear to represent the grid approach, comprised as it is of one volumetric type aggregated in both planar orientations, but this rigid structural tailoring tends again to obscure its essentially additive basis. Here it comprises a linear en faced sequence, rigidly aligned and closed along one exposure while opened and varied in depth along the other (3.54).



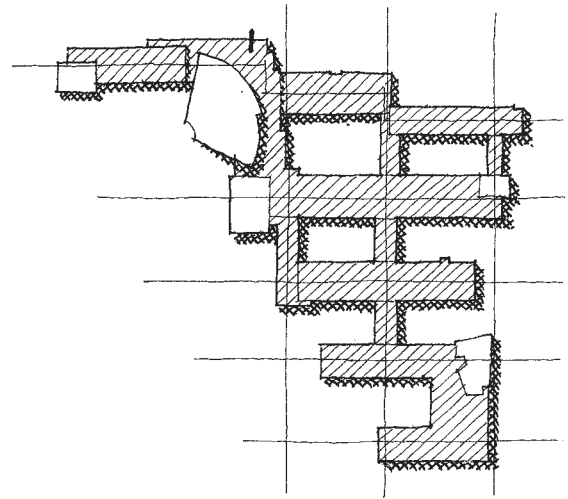
3.54 Louis I. Kahn: Kimball Art Museum, Fort Worth, Texas, 1972.



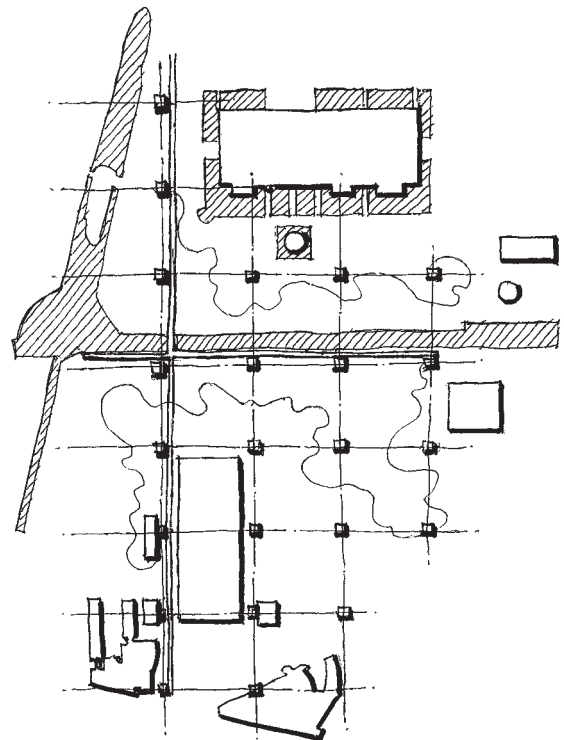
3.55 Roche-Dinkeloo: College Life Insurance Company Headquarters, Indianapolis IN, 1972.

True cases of planar duplication employ one or another of the additive modes, but as a secondary characteristic to the indefinite tessellation of the plane with repeated elements:

- Thus Roche and Dinkeloo's design for College Life Insurance employs the mode of adjoining elements in a master plan with no structured beginning or end. Like the Ahmedabad dormitories, it is a piece cut from a wallpaper pattern that could continue indefinitely in all directions (3.55).
- At Aalto's Otaniemi Technology Institute, the network of classrooms and offices reverses that figure-ground order, its series of rectangular light court voids defined by the contiguous grid of structure. It serves as a matrix backdrop for characteristic additive signature elements, which brings definition and focus to the complex (3.56).
- Tschumi promoted his competition design for Paris' Parc de la Villette as a system of "lines, points and surfaces."¹⁶ But the points—the grid of red steel "folly" buildings—are, of course, volumes: variations on a theme, cubes subjected to a variety of additions and subtractions to accommodate the programmatic requirements of snack bars, play structures, information booths and the like (3.57). Aside from existing site features, the lines and surfaces are arguably less clearly expressed and less significant to the impact of the park as built. It is the widely spaced grid of folly volumes that finds its place in this narrative, recalling the rigid grid of College Life but miniaturized to "dots," superimposed onto the varying conditions of the extensive site to give it orientation and order. A plan of boldly rigid but actually useful layout is the intent—though in



3.56 Alvar Aalto: Otaniemi Technical University (Now Aalto University), Finland, 1964 (subsequent addition not shown).



3.57 Bernard Tschumi: Parc de la Villette, Paris, 1987.

16. Andreas Papadakis, Ed., *Deconstruction in Architecture: An Architectural Design Profile* (London, Academy Group Ltd., 1988), p. 35.

reality the follies seem to be locked up more often than not.

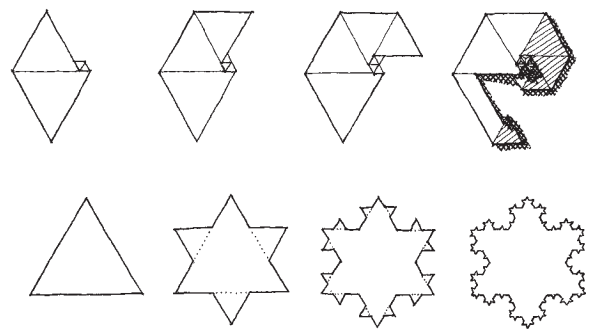
Planar Regression

Once past the first few iterations, these cases of planar duplication expand by simple one-to-one replications of their elements. Such is not the case with planar *regression*, which could be aptly termed “fractal” regression. Configurations of fractal geometry replicate themselves recursively at ever smaller scales, each small segment of a figure defined by fractal characteristics proving under close examination to have the same shape as the parent form, et cetera ad infinitum. As compared to linear regression, having one point of singularity toward which the chain of regression uniquely recedes, fractal geometry ultimately possesses an *infinity* of such points.

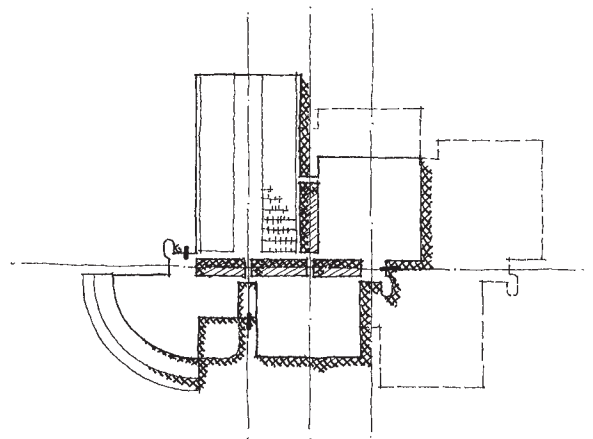
By way of comparison, Radoslav Zuk’s Ukrainian church is based on linear 2d/direct regression, torqued from its originating plan geometry into a tight spiral. Each triangular segment has a central tower and each appends the next in sequence, the cluster of towers also stepping up in elevation to form a corresponding three-dimensional helical spiral in the center. The counterpart formative process of *planar* regression is illustrated by a so-called “Koch Island” figure, likewise based in this case on equilateral triangles. The initiating triangle reappears at 1/3 scale at the center of each face, and this same operation repeats indefinitely. Subsequent steps rapidly become disappearingly small, building up a fuzzy penumbra that constitutes an infinity of iterations (3.58).¹⁷

These aspects don’t apply all that directly to architecture but serve as an analogical basis on which to understand a class of designs they suggest. In a rudimentary way, many buildings possess these characteristics: a complex edifice may be made up of several wings or segments, each of which is

17. Benoit B. Mandelbrot, *Fractals: Form, Chance, and Dimension* (San Francisco: W. H. Freeman and Company, 1977), pp. 36-37.)



3.58 Radoslav Zuk: Holy Trinity Ukrainian Church, 1977; Benoit Mandelbrot: “Koch Island” sequence.

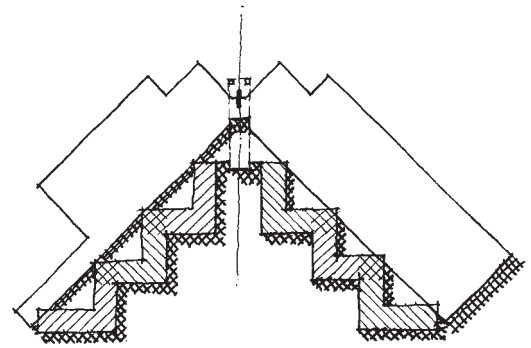


3.59 KPF: AT&T Long Lines Regional Headquarters, Oakton, VA, 1980.

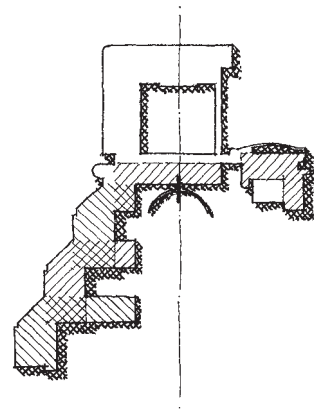
itself an amalgamation of circulation, service and usable area zones. Each of these in turn comprises an arrangement of discrete rooms or zones, which may then be incremented at yet another level of scale reduction by furnishing elements. This is, of course, to state the obvious about the typical nature of buildings; a more deliberately structured or idiosyncratic architectural gesture is required for fractal regression to be made manifest as a conscious gesture. AT&T's Long Lines Headquarters by KPF exemplifies the use of a rigidly diagrammatic concept as an armature for fractal regression, its three office wings and cafeteria element alternating on both sides of a central galleria spine (3.59). But each wing in turn is ordered by its own spine of service areas, with rows of office modules forming its ribs. Finally each of these rows—a trunk and branches comprising flexible partition components—forms the ultimate level of the regressive series. Again, the general “normality” of the architectural vocabulary tends to mask the fact that fractal regression forms its basis.

When more distinctive forms are employed, the presence and nature of fractal regression are more explicitly manifest:

- HHPA's Pingry School employs an L shape toward this end: the major L of its armature building, housing large gym and assembly functions, is repeated at one-fourth scale by the sextet of small appended classroom Ls, assembled as two zigzags (3.60). This is the regression limit in this case, as indeed it is generally: with elements multiplying in numbers as the scale is reduced, singular fractal regression is simply the normal limit of practicality in architecture. Also of note, here the miniaturization is not an internalized subscale feature of the original body, as at Long Lines, but an exfoliation along one periphery.
- Mitchell & Giurgola's Volvo Headquarters also employs the L in this way but with less diagrammatic rigidity, the reduction now at half



3.60 HHPA: Pingry School, Basking Ridge, NJ, 1984.

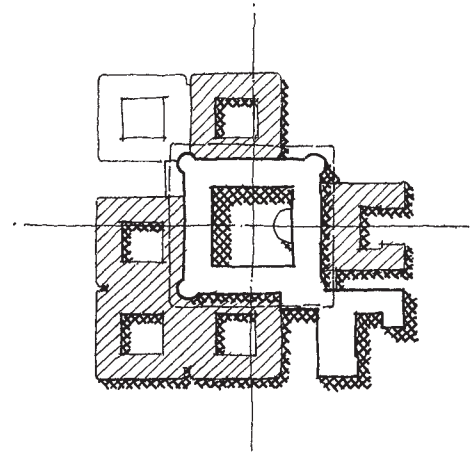


3.61 Mitchell/Giurgola: Volvo Corporate Headquarters, Gothenburg, Sweden, 1984.

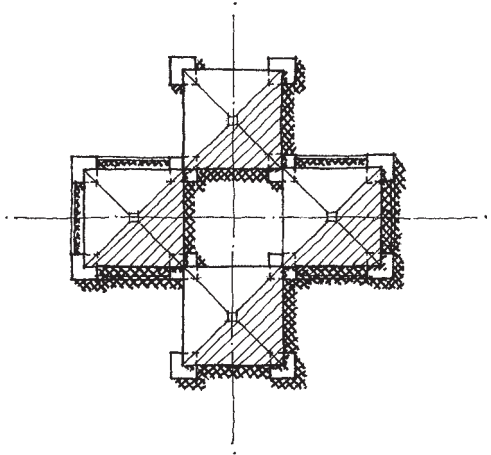
scale: the smaller increments attach themselves informally to the initiating element, as well as replicating themselves in a linear-duplication chain (3.61).

- Such idiosyncratic forms are not always necessary for fractal regression to be apparent: the square has been employed, distinctive by virtue of its iconic simplicity. Kurokawa resorts to a hollow square as the regressive form for his National Museum of Ethnology, wherein a modest reduction finds miniatures of the central element clustered at its periphery in a manner that varies informally, recalling the architect’s metabolist leanings (3.62).
- Kahn’s Trenton bath house employs squares in both regressive and non-regressive replications, for while the plan is based on identical roof units in a chessboard grid, their duplication limited here to a simple cruciform, small servant volumes in the corners multiply the square motif at a much reduced scale (3.63).

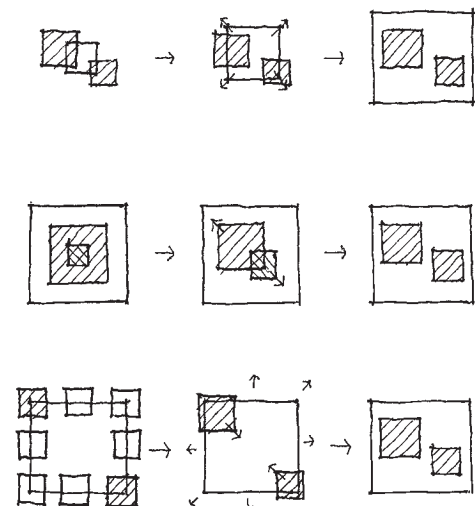
What is the minimum scope of involvement necessary for fractal regression to become legible in a design? A look back at Moore’s Orinda house, with its two smaller pavilions tucked within the house itself, reveals some interesting conundrums when it comes to “minimum scope” interpretations (3.64). At one level, we have seen this house as a case of additive encapsulation, the two pavilions engulfed by a third that grew to enclose them. But it is also possible to see a somewhat disarrayed case of linear regression, given the difference in size of the inner elements. With regard to planar regression, it seems reasonable to require a minimum of two reduced-scale elements among the many possibilities, which bear significant morphological resemblance to the main form and relate to it directly rather than serially. And this is the case at Orinda, if the scale difference of the pavilions is *not* accorded significance. Thus, depending on the vagaries of interpretation, the house could be said to exemplify additive encapsulation, linear regression,



3.62 Kisho Kurokawa: National Museum of Ethnology, Osaka, Japan, 1977 (subsequent additions not shown).



3.63 Louis I. Kahn: Trenton Bath House, 1955.



3.64 Charles Moore: Moore house, Orinda, CA, 1962: comparative interpretations as encapsulation, linear regression and planar regression.

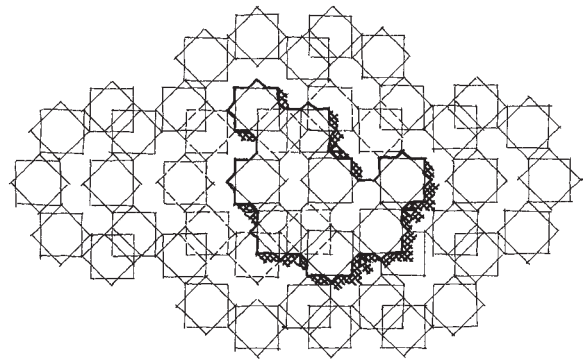
or planar regression, rendering it another link of sorts between the modes of addition and replication. The scheme also reminds us that, as with linear regression, the miniatures need not be externalized. Indeed, wide arrays of adjacency variants analogous to those of linear regression are also available for planar regression.

Volumetric Duplication and Regression

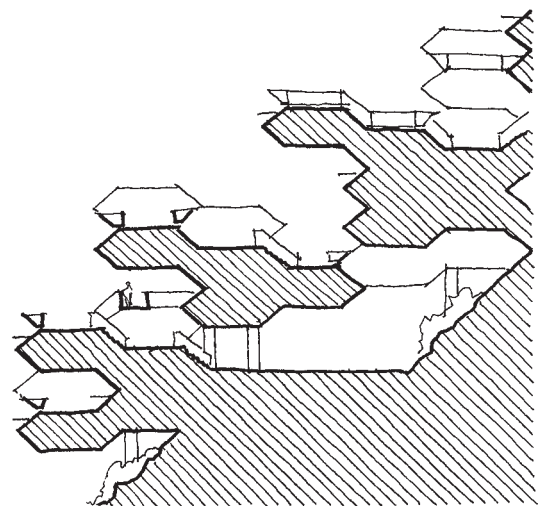
The seductive complexity and highly divided, incremented patterns of ever-repeating polygonal tessellation have ties both to age-old Islamic tilings and, in a shift to three dimensions, to polyhedral geometry, crystallography and molecular chemistry. The latter evoke a final elusive step to *volumetric* replication in architecture. Such precedents can promote an indulgent literalism of form, in which the joint fascinations of an intricate labyrinth and of a beehive’s repetitive order are given free rein:

- The “field theory” designs of SOM’s Walter Netsch impose complex elaborations of space and structure onto generally conventional building programs, as in the indeterminate plan of the University of Iowa’s Bowen Science Building (3.65). But by virtue of being grounded primarily in polygonal rather than polyhedral patterning, the approach ultimately devolves to another case of planar duplication.
- Safdie has been a well-known exponent of more truly three-dimensional architectonic tessellation—volumetric duplication—his various early “habitat” designs representing functionally configured portions of theoretically limitless space-filling polyhedral structure (3.66).

Soleri’s arcology fantasies don’t emulate such geometrically evolved space-filling approaches, but some may come as close as any built form thus far imagined to an expression of volumetric regression. Their imagery is by turns naive and visionary. These

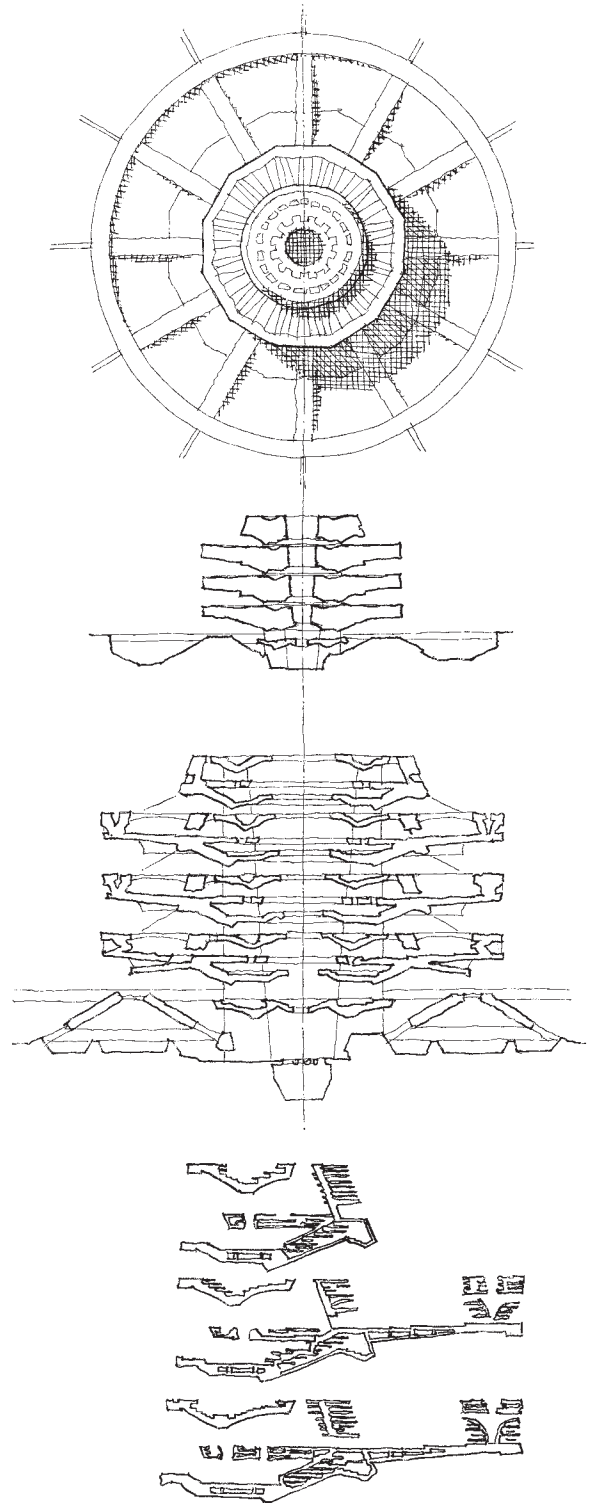


3.65 SOM: Bowen Science Building, University of Iowa, Iowa City, 1972.



3.66 Moshe Safdie: Habitat (project), Puerto Rico, 1968.

one-structure cities comprise major forms, such as the rings of “Babel IIB,” made up of a network of ribs or other subsidiary forms, which are in turn hollowed out into warrens and laminae of habitable space (3.67). These different scales aren’t literally self-similar in the fractal sense, but the designs do possess a sense of fully developed form at each level of scale hierarchy, the succeeding micro-development arising in a surprising yet seemingly unforced and inevitable way. Only in the realm of science fiction, and some would include Soleri’s work in this category, are comparable hives of construction conjured, unfettered and extensive in three dimensions. Ultimately, realizations of true space-filling architectures will, for the foreseeable future, be limited by the realities of gravity and technology, at least so long as architecture is of this earth.



3.67 Paolo Soleri: “Babel IIB,” hypothetical design.

Chapter Four

SUBTRACTION

While additive form begins with a number of elements and connects them to achieve a single aggregation, subtraction begins with an initial form and develops it by selective removals. In both cases, the initiating elements are simple and usually irreducible; if not, there are probably one or more steps that could be taken to undo some pre-existing formative operations. While the complexities imparted by the additive process arise from junctures among the assembled forms, those of subtraction are due to excise or erosive removals from the initiating form, which usually serve to increase its morphological complexity as they reduce its volume.

Analogies for subtractive forming may be grandly scaled, as in allusions to the erosive effects of wind and water on the land, or mundane, as in the effect of a kitchen knife on a vegetable. A surgeon's procedures are similarly apropos—at least in terms of the “removal of what is not fitting”—and a dentist's work can be a suitable analogy wherein removals are made and dissimilar materials inserted and manipulated, subtractive and additive operations thus both contributing to the final result. Although plastic sculptural media such as clay permit accretion and deformation, it is their readiness to be easily sheared or excised that pertains to subtractive form in architecture. Wood or stone carving, involving

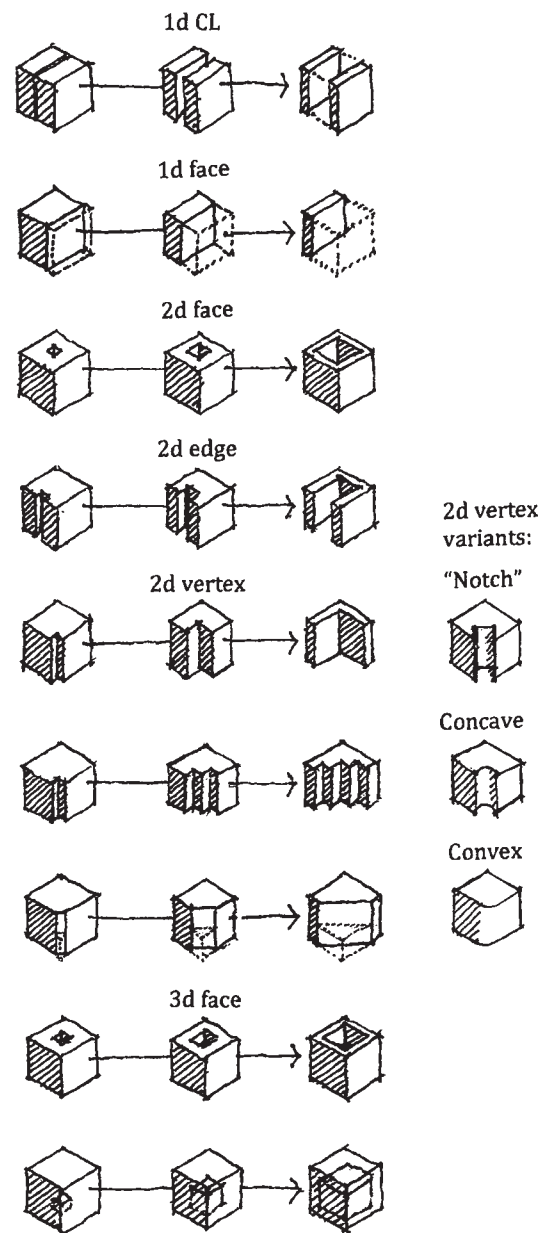
monolithic rigidity and an irreversible removal process, also have parallels.

While the general idea of subtractive removal is a simple one, it's also clear that many different approaches to scale, morphology, consistency, and orientation are employed in its application. In the face of the multitude of variants resulting from the interactions of these aspects, one goal of this discussion is a typology that lays out approaches systematically, reducing them to essential basics while building up an overall pattern of interrelationship underlying cases of subtractive form. This effort will be based on some boiled-down observations about subtractive interventions:

- They are predominantly oriented to either plan or elevation;
- they employ one, two or three dimensions of subtractive alteration;
- they are face-, edge- or vertex-centered (using a specific “base case” context of initiating volumes as rectangular solids);
- and, more subjectively, they evoke metaphors of removal: slicing; extruding; eroding; carving, polishing.

The above may seem unduly limiting with its syntax of orthogonal geometries, but it is simply an armature for discussion that can accommodate a wide variety of *non*-orthogonal approaches to subtraction in architecture. As with addition and replication, architecture's complex multiplicity of design-specific issues and their interactions are not the immediate concern of this discussion, which is limited to the variants of forming at their most diagrammatic and elemental.

For the sake of simplicity, subtractive approaches are organized here in terms of two taxonomic “families:”



4.1 Family of plan-oriented subtraction types.

first those most apparent in plan or overhead view (4.1), and later those in elevation or side view. The iconic cube with its faces, edges, and vertices has been called upon to stand in for the many variations on how subtraction is configured. Within each family, there are subsets concerning whether one, two or three dimensions of variability are involved, and each individual case appears as a sequence of three to illustrate the potential range of subtractive intervention. Pertinent excerpted figures from these families will accompany each example to follow.

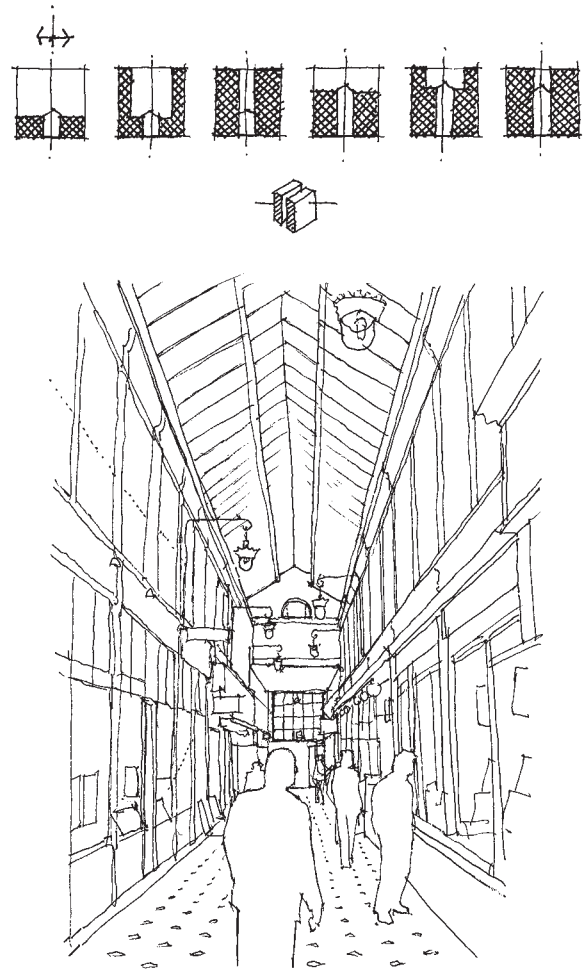
Plan-Oriented: One Dimension of Variability

This initial section concerns the plan-oriented family, its subset of one dimension of variability, and a first variable *within* that subset: face-centered subtraction:

Face Centered

A line, the one-dimensional figure, marks the centerline of the top face. But while a line is infinitesimal in all but length, it is perceived for our purposes as extending through the thickness of the building mass below, shearing it in two. Potential movements *outward* from this centerline toward either outboard face constitute the “one dimensional” nature of the case, for only this one dimension of variability is availed, the length and height aspects being fully sheared. As the two inner-facing surfaces move apart, the initial mass of the figure is consumed and the gap between the halves grows from a hairline to a significant separation between what are now two volumes. (Such a division of one element into two recalls the earlier case of singular duplication, and in fact the presence of clues is necessary for one-dimension subtraction to be the preferred reading.)

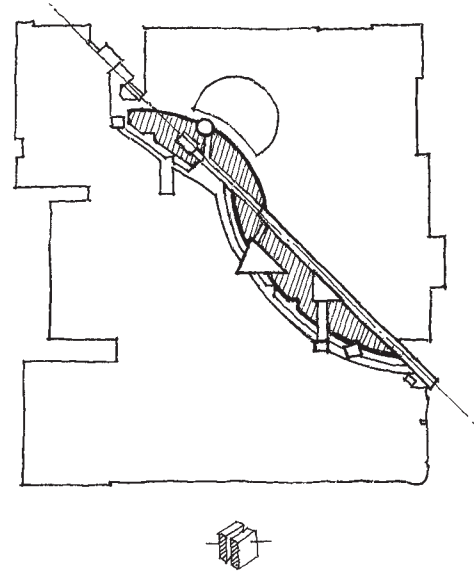
- Streetscapes and alleyways, with their diverse facades and proportions, don't typically evoke such a breach as their origin. But urban arcades such as those of Paris and London, with their elongated footprints, tall proportions and often



4.2 Cross-section variants on European Arcades, excerpted and adapted from Johann Friedrich Geist, *Arcades* (Cambridge: MIT Press, 1983), Fig. 57, p. 94. Sketch by author of Parisian arcade.

continuous toplighting, do offer a convincing manifestation of the case. And since they are embedded within dense urban fabric, this reading of subtraction is more plausible than the option of singular duplication (4.2).

- Their historicism is transmuted into postmodernism at Jerde's Horton Plaza, where a linear inner void of public spaces also has a tall, canyon-like cross section (4.3). Its polychromed inner facades aid in calling out these faces as having a special nature, more of a part with each other than with the outer facades of the development. As a further defining characteristic of the design the twisting shape of the path is evocative of erosive stream meanders, as if this manmade canyon were a metaphor of natural erosive forces, offering another clue that the gesture is subtractive rather than one of duplication.

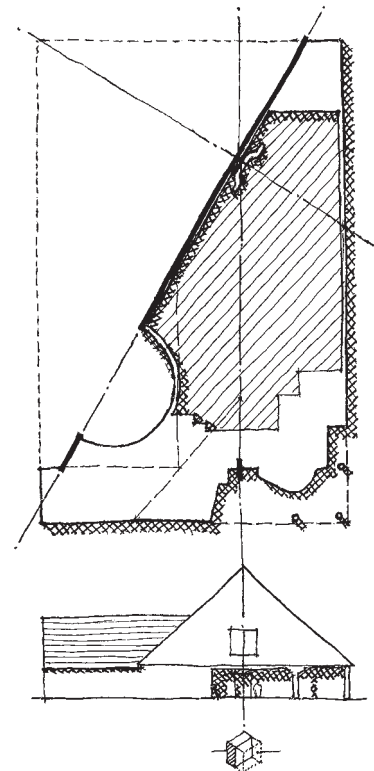


4.3 John Jerde: Horton Plaza, San Diego, 1985.

Edge Centered

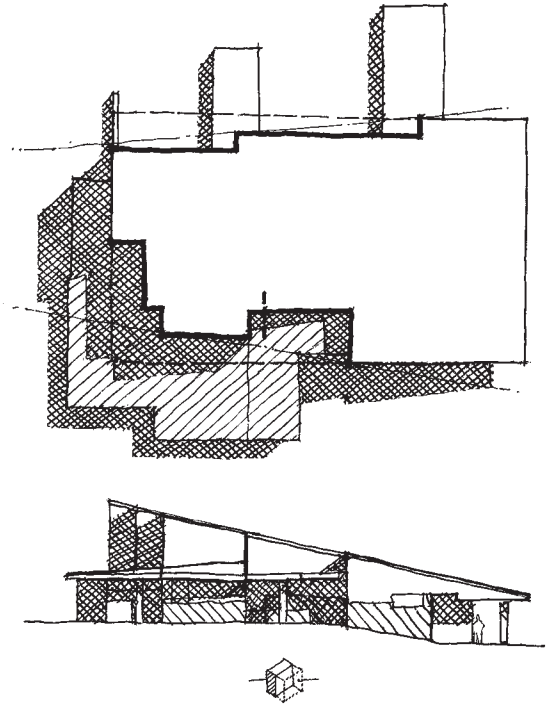
One-dimensional removal now moves to one of the edges of the architectural figure as seen in plan. Again, the consequences of the gesture shear fully through, there being only the one plan-oriented dimension of variability:

- At Bohlin Powell Larkin Cywinski's Girl Scout Center, the activity lodge undergoes a slice-like transection that transforms what might have been a conventionally gabled form into an intriguingly non-Euclidean interior (4.4). Secondary clues are again needed, and here the bias orientation, in conjunction with dissimilar facade treatments, serves to make the gesture clear. Such an angled cut, resulting in a trapezoidal sort of footprint, requires either compelling site constraints or convincing design ideas to be credible as a formative choice.

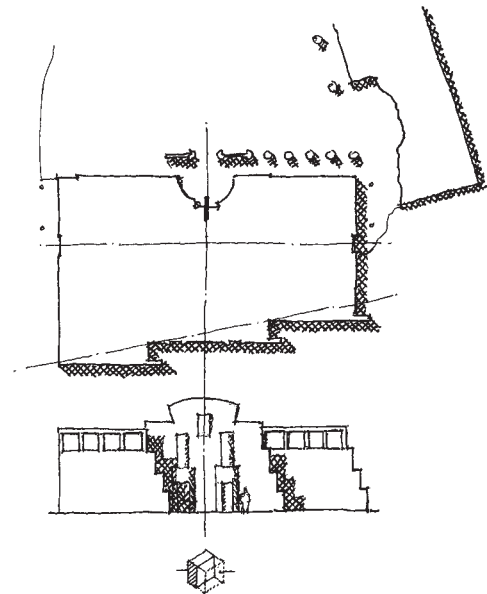


4.4 Bohlin Powell Larkin Cywinski: Activity Lodge, Shelly Ridge Girl Scout Center, Manayunk, PA, 1982.

- As a revealing comparison, at Aalto's *Maison Carré* the basics of these form relationships and the "order of events" are both reversed (4.5). The initiating form is the overall wedge, its compelling slanting profile pre-existing in elevation as opposed to intervening in plan. Here the subtractive gesture takes the form of irregular erosive toothing of the side facades, affording a beneficial effect of simultaneous contrast: the continuity of the shed renders the toothed profile more legible, while the latter enhances the drama of the diagonal form.
- These two removal approaches that seem so dissimilar—the erosive, toothed configuration and the diagonal cut—are often conflated into one design operation. The result is a characteristic gesture of sequential steps used as a tailored response to eccentric pressures from interior or exterior. While reminiscent of linear duplication in terms of iteratively repeating and shifted form elements, the subtractive reading dominates in these cases, due in part to continuities of boundary surfaces and materials. Graves' unbuilt *Kalko residence* not only erodes the rear facade in two re-entrant steps, but also emphasizes the erosive motif further with stepped-down blade walls extending from the corners (4.6).



4.5 Alvar Aalto: *Maison Louis Carré*, Bazoches sur Guyonne, France, 1960.



4.6 Michael Graves: *Kalko residence* (unbuilt), Green Brook, NJ, 1978.

Plan-Oriented: Two Dimensions

Next, while the removal again shears fully through the initiating form, two dimensions of extent may vary:

Face Centered

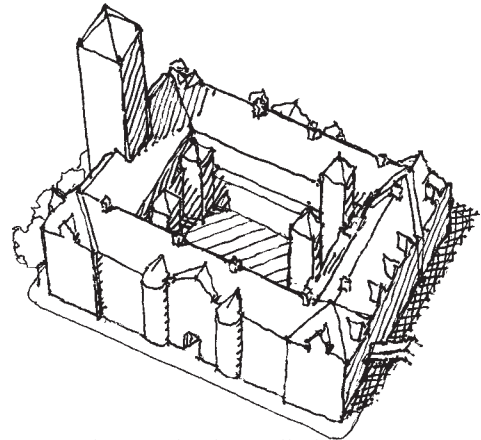
When the plan case is two-dimensional and face-centered, the intervention extrudes down through the central portion of the building form resulting in a configuration characteristic of a central atrium or light well. The type is not intended to represent the "doughnut" morphology of a more conventionally resolved courtyard scheme, as at Richardson's

Allegheny County Courthouse, to pick but one worthy example (4.7). There the central void is developed in a manner consistent with the outer periphery, such that the initiating figure is read as toroidal—a genus 1 figure in topology: its inner court does not represent itself as the result of a subtractive intervention. The present case again requires clues such as inconsistent cladding or configuration, or compelling scale aspects, to inform a reading of secondary modification. Portman’s Atlanta Hyatt Regency, the building that spawned an era of introverted hotels, is arguably of this category, the building reading as a massive volume within which we are surprised to find the full-height void or removal (4.8).

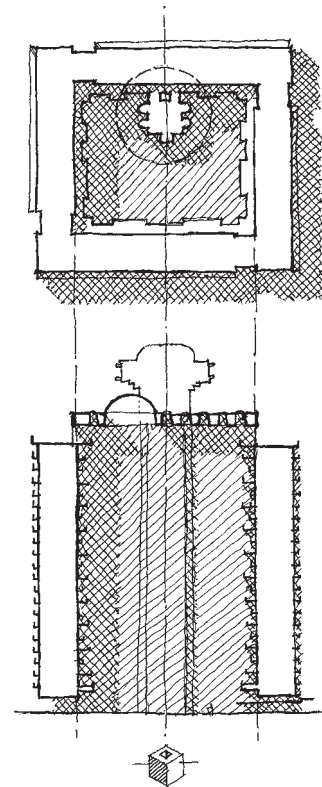
More convincingly, Stirling’s influential but unbuilt design for the Northrhine Westphalia Museum embodies the case with the smooth, cylindrical shape of its voided light court (4.9). While the gesture recalls his later Stuttgart museum, the two differ in conception: at Stuttgart the central cylinder reads ambiguously as a solid form from the exterior while the Dusseldorf design involves a more conventionally voided solid. Characteristically, the scheme as a whole is far from conventional, the architect seeming to have incorporated the plug removed from the building as a freestanding element left behind on the forecourt, but saved the idea from banality by rendering it a hollow cube rather than a cylinder, casually dropped on the skew: the idea of a solid-void pairing is there should one wish to see it that way but not insisted on.

Edge Centered

Here the full-height excision moves to a perimeter, and the resulting configuration should be a familiar one, mid-rise hotels and apartment houses of a certain age having perennially adopted this footprint to bring daylight to a maximum number of rooms on a constrained site. The windows in the notch tend to look into other windows, but have the advantage of being a bit removed from noisy street exposures: in



4.7 Henry Hobson Richardson: Allegheny County Courthouse, Pittsburgh, 1888.



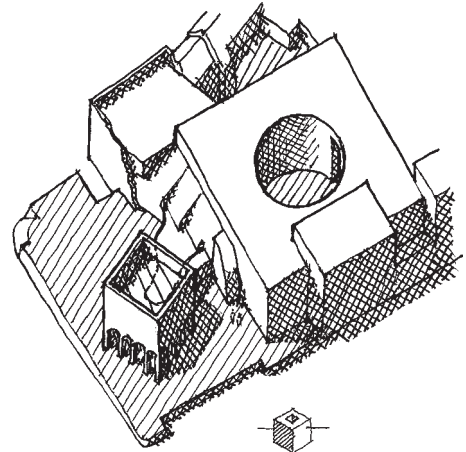
4.8 John Portman: Hyatt Regency Atlanta, 1971 (subsequent additions not shown).

short, the light well has moved to the front to improve its lot. But if the proportions of the notch expand beyond a certain point relative to the overall volume, a thinner U-shaped footprint results, losing its sense of subtractive removal.

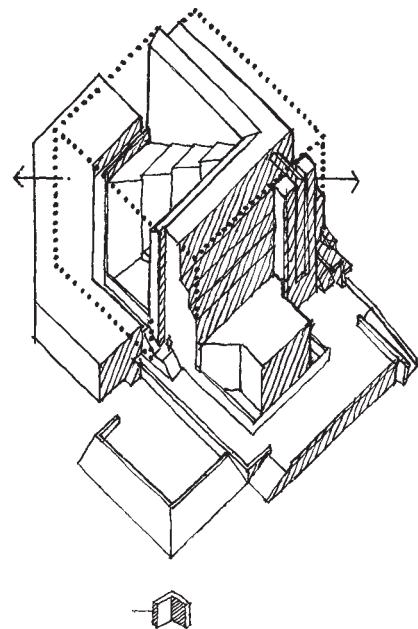
Vertex Centered

With the vertex- or corner-centered case, one enters a rich and complex area of subtractive form. The more open geometry of the corner has encouraged the development of a continuum of removal modes that may be generalized as *concave*, *mediating* and *convex*. The most basic case of concave removal is the re-entrant corner, a characteristic “bitten-out” gesture used to give massing relief, signify entry, or defer to a context condition such as a street intersection. Stirling’s Cambridge History Faculty Building is an atypical version of this case in that the removal exceeds the remainder in scale, leaving behind a wall-like elbow shape or L that requires clues of surface treatment to verify a reading of subtraction (4.10). And in fact, articulated glazed endwall treatments in conjunction with similar facewall and top glazing are suggestive of an intumescent layer of new “bark” at the excision surfaces, indicating that a major removal is central to the formative conception of the building. While the neo-industrial stair and elevator shafts pay homage to his earlier design at Leicester, most of the other gestures in the scheme seem to demonstrate a sort of erosion metaphor, the outboard surfaces of the initiating volume having a benched-back, eroded profile and the more extensive base elements extending outward like talus slopes. This image is most dramatic at the excised orientation, where the fanned volume of the stratified glass roof with lower elements spreading out beyond suggest a sedimentary process engendered by such major quarrying—as well as adding validation to that subtractive interpretation.

The ambiguities attendant on such larger right-angular excisions are reduced if the corner-related “removal” is rotated at an angle to the initiating



4.9 James Stirling: Museum for Northrhine-Westphalia (unbuilt), Düsseldorf, Germany, 1975. Adapted from Robert Maxwell, *James Stirling & Michael Wilford* (Boston, Birkhäuser, 1998), p. 67.



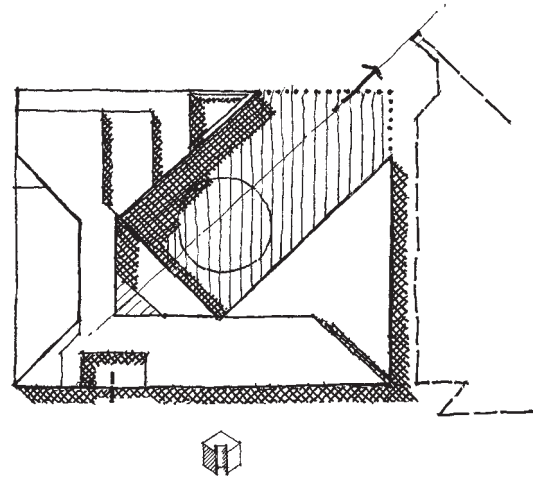
4.10 James Stirling: Cambridge History Faculty, Cambridge, England, 1968. Adapted from Bershire Review online resource.

volume, as at a Student Center by Mitchell/ Giurgola (4.11). Here a subtractive removal to bring courtyard activity and natural light into the heart of the building is rectangular, but its rotated placement and acute-angled junctions with the larger perimeter afford an unmistakable and distinctive sense of excision. A subsequent adjoining addition to the campus adds some desirable containment to the uncompromising aspect of the subtractive geometry.

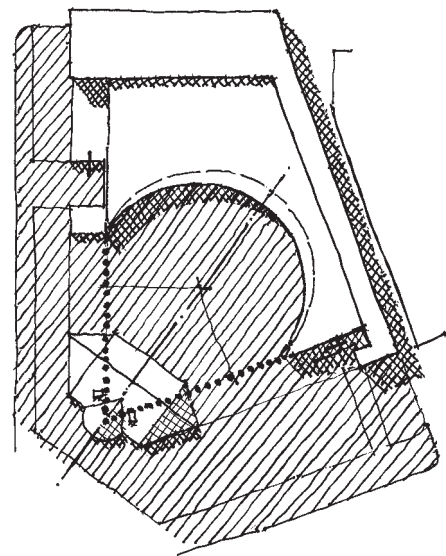
The same firm employed a truly concave excision as the centerpiece of their unbuilt competition-winning scheme for the AIA headquarters, as if defined by a halo or penumbra emanating from the historic Octagon house in its foreground (4.12). Although particularized by the geometry of Washington's L'Enfant grid, the plan can be understood diagrammatically as a quadrilateral with a large corner-centered removal. The Octagon House marks the corner itself, the three-dimensional concavity of the glass screen surfacing the bite beyond seeming a bit self-consciously deferential.

A “mediating” recursive development of the corner-centered case occasions a return of the step-wise or echeloned motif. As with linear replication, the approach can become something of a crutch in that it is a type of automatic writing: although it readily generates form interest, the result can be superficial and arbitrary. Cincinnati's Federated Building by RTKL (now Macy's Headquarters) presents a rather convincing use of such a “pleated” corner erosion, serving to increase the number of corner offices while affording a focus for the exterior design—abetted by a chamfered rooftop face incorporating a skylit termination of the corner treatment (4.13).¹

1. Use of the term “erosion” in such cases seems appropriate when the re-entrants are relatively small, giving the impression from a distance of a roughened or abraded overall texture. When the scale is larger, the image of an extrusion, “die-cut” through the initiating form, becomes more fitting.



4.11 Mitchell/Giurgola: Student Center, State University of New York, Plattsburgh, NY, 1974.



4.12 Mitchell/Giurgola: AIA Headquarters competition winner (unbuilt), Washington, D.C., 1963.

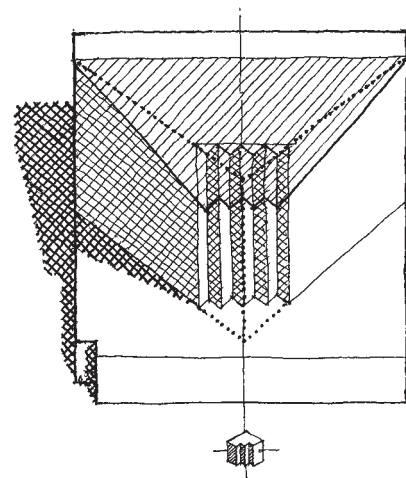
Having begun with the initial re-entrant excision, one may visualize a continuum of corner-related cases evolving toward progressive infill, through further and further echeloned replications and reductions in scale (4.14). Ultimately the modified corner becomes a smooth chamfer: a simple diagonal cut. The progression can then continue beyond this flat cut-off to culminate in a convex form linking the two adjoining side faces, a shape more expressive of erosive forces than of excision. At C.F Murphy's Xerox Centre the transition around the corner is so sleek that the design does not evoke subtraction, but the further re-entries of the rounded forms at the entry and penthouse adds secondary subtractive clues that aid the reading. As to intent, such a seamless wrap can be an elegant resolution for the meeting of two facades of roughly equal weight (4.15).

Plan-Oriented: Three Dimensions

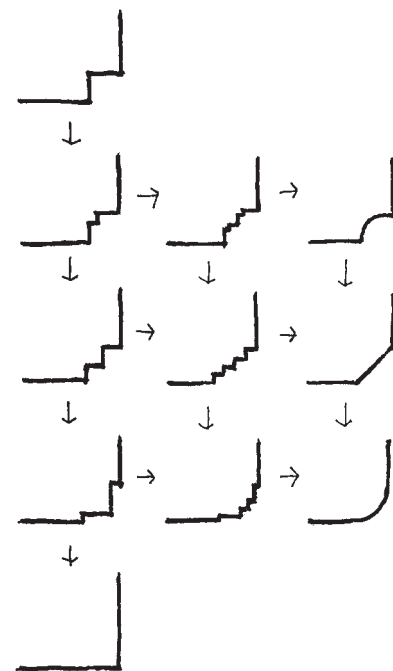
Face Centered

Subtractive gestures varying in three dimensions constitute the richest variety of these approaches, but only two—the top and bottom face-centered modes—are unique to the plan orientation. Consideration of the others, which actually partake equally of plan and elevation, are addressed below in the context of elevation-oriented cases.

While “centered” top recesses are uncommon, an asymmetrical excision of this type constitutes an element of modern movement iconography: the living room terrace of the Villa Savoye (4.16). Here the excision is but a wall's thickness away from opening to the side as well, in which case it would become edge-centered, but this wall is one of the anchors of the scheme, its continuity of window openings providing outlooks from interior and exterior spaces alike and signifying the contained, quasi-internal status of the terrace. The volumetric transition at the switchback ramp serves to further key the negative space into the



4.13 RTKL: Federated building, Cincinnati, OH, 1978.



4.14 Sequential Array of Subtractive Corner-Removal Types.

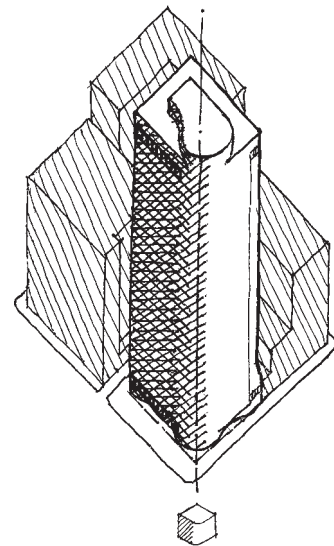
body of the house, as does its spatial extension into the roofed corner terrace.

The opposite case of a ground plane face-centered removal must be regarded as something of a moot condition under normal circumstances, in that interior spaces that are thus fully within the body of a building are not normally perceived as subtractive removals. There would seem to be a need for contiguity with the exterior, as if the excision needed a perceivable “means of removal,” for a subtractive reading to be plausible.

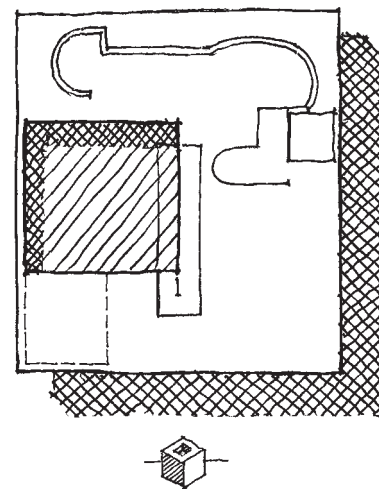
Elevation-Oriented: One Dimension

Moving to the family of cases involving one or more *elevational* faces of the initiating form, an overall array again gives a graphic summary of subtractive types—now of the elevation oriented family—and we begin anew with “one dimension” cases (4.17). The centerline bifurcation is now horizontal in order to affect only elevational surfaces, resulting in a gap between upper and lower layers. While the image of a voided-out *piano nobile* sandwiched partway up the more solid fabric of an initiating form is plausible, it is uncommon; more typically such a relationship is achieved as at the Boston City Hall, its raised horizontal gap an outcome of additive strategies.

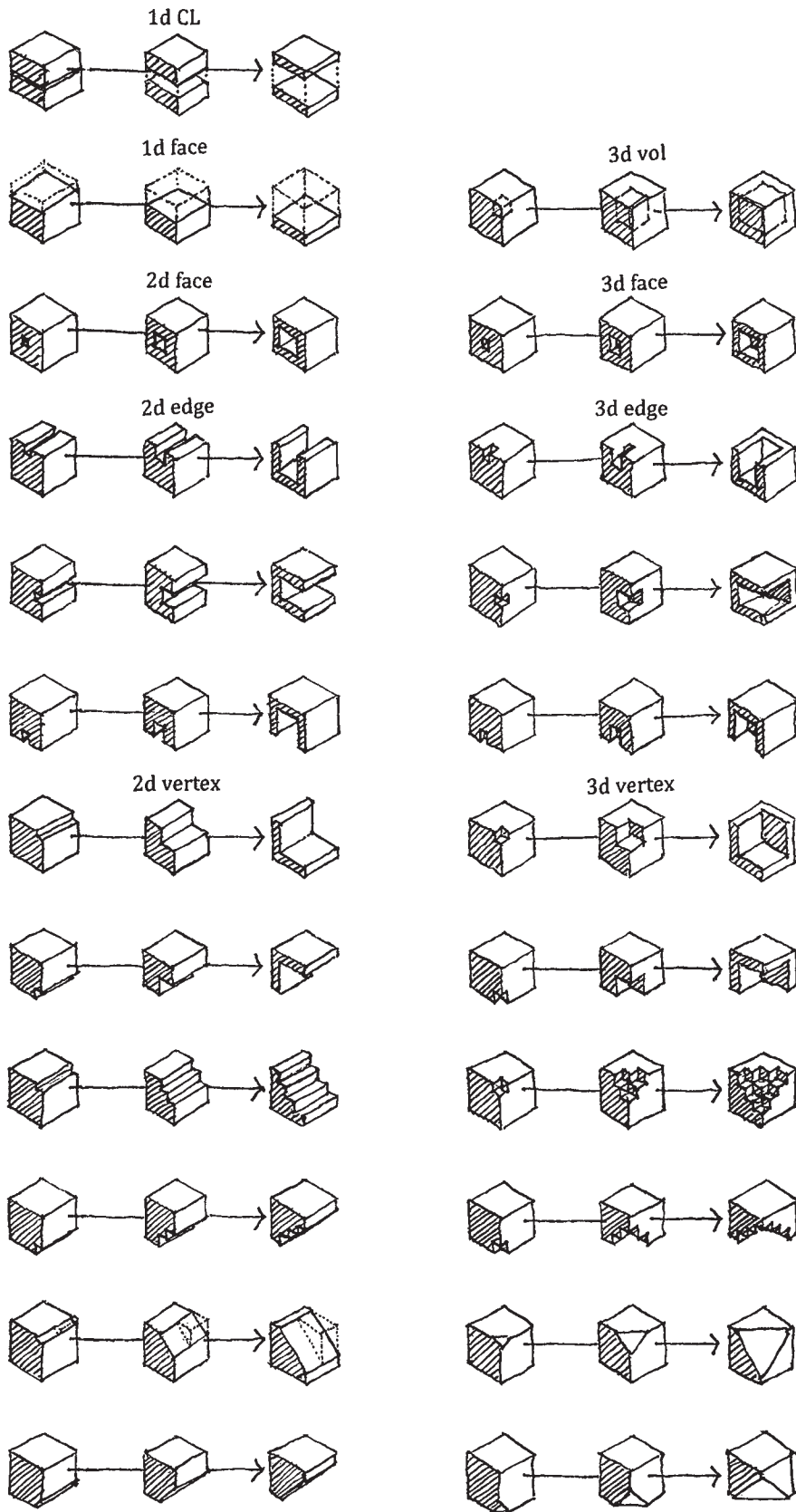
Regarding the version related to the upper face, one application is seen in shallower versions of the iconic gabled house form. The shape suggests erosive forces, as in the case of a mountain ridge, the top surface worn away over time to become the paired slopes of the gable. That such a reading is not immediately apparent—that this house shape tends in its simplest form to seem an *a priori* volume rather than a resultant—has in part to do with its long-established position in vernacular architecture. Roof forms begin to evoke an erosive process when their configurations are more idiosyncratic, mitigating this factor of familiarity. That said, it is arguable whether



4.15 C. F. Murphy: Xerox Center, Chicago, 1980.



4.16 Le Corbusier: Villa Savoye, Poissy, France, 1931: roof plan.



4.17 Family of elevation-oriented subtraction types.

the shaped configuration of the gable would credibly result from one-dimension subtraction in any case.

Flattening the gable to a single plane results in a more plausibly subtractive “clean slice,” but as in the plan-oriented version, a clue of skewed orientation is required. This occurs at the Sea Ranch Condominium, which can be revealingly compared to superficially similar aspects of the Maison Carré (4.18). While the cohesive, singular volume of the latter design leads to the interpretation that the elevational indentations are subtractive gestures, the condominium’s irregular periphery results from the *additive* assemblage of several nearly identical units. In this case the shed roof, cutting diagonally across the grain of these similar en faced elements, leads to the opposite interpretation: that the roof was sliced away as a one-dimensional elevational gesture, subsequent to the initial additive process.

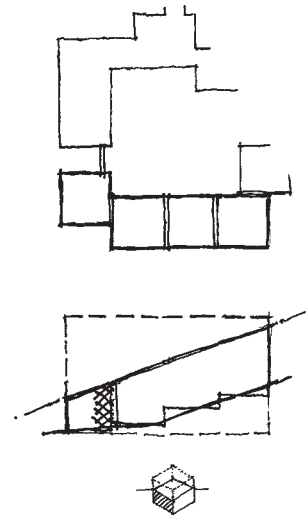
Completing this particular set of cases would mean a discussion of *lower face* one-dimensional removals. But that parti is an implausible one: such configurations may exist, manifest as a canted underside for an elevated volume, but will be unusual efforts. They are more likely to be partial aspects of a larger design, such as the expressionistically slanted lecture room soffits of Stirling’s Leicester Engineering Building (4.19).

Elevation-Oriented: Two Dimensions

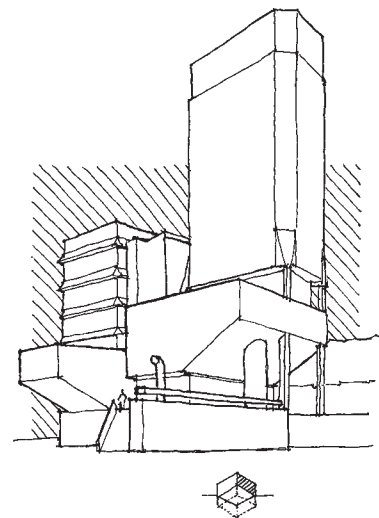
Face Centered

With two dimensions of variability, a face-centered intervention in elevation re-oriens the lightwell into a horizontal puncture through the initiating form:

- The gesture can be a parlor trick of sorts, as at Arquitectonica’s Atlantis condominium: a swimming pool terrace occupies the hole, and the designers couldn’t resist a more heavy-handed version of Stirling’s subtle game at Dusseldorf, the



4.18 MLTW: Sea Ranch Condominium, CA, 1965: partial interpretive plan & section.



4.19 James Stirling: Engineering Building, Leicester University, England, 1959.

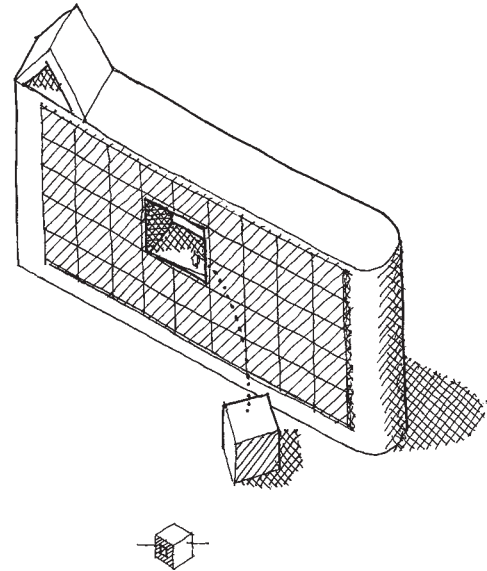
piece that was punched out remaining where it fell to house an exercise room and squash court at grade below (4.20).

- Von Spreckelsen's *Grande Arche de la Defense* arguably exemplifies a massive version of the gesture in removing most of the fabric of a huge cube, as noted in the discussion of unitary cases. The picture-frame shape that remains of the affected elevations is chamfered in from the corners to emphasize the axis of removal, monumental steps forming the portion which transitions from the ground plane.

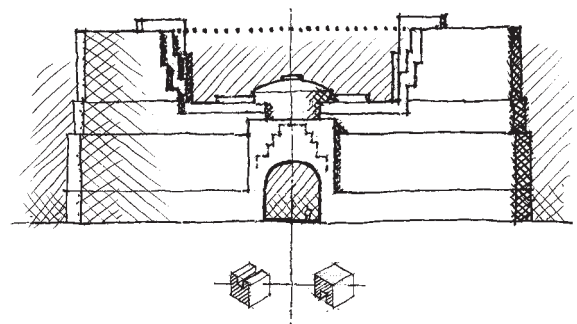
Edge Centered

If edge-centered at the ground plane, this intervention generates a passageway or gateway—a tunnel or an arch, depending on the depth of the volume. SOM's quasi-historicist Rowses Wharf employs both this ground plane case and its opposite number in the same building, as a top edge-centered removal is also incorporated (4.21). The step-wise articulations at the edges of this upper bite attempt to legitimize and "weather in" the unusual configuration while also exposing the bones of the building—the white shapes of the central drum and flanking shaftlike volumes—further identifying the case as subtractive. The scheme even incorporates a ground-plane-oriented face-centered removal—the case that is normally not legible as such by virtue of its burial within the building—in the form of regressed drums above the vaulted crossing.

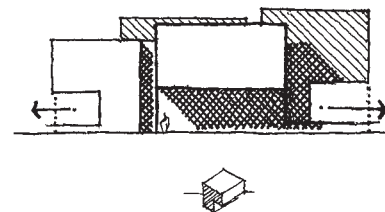
To complete the edge-centered array there remains the case of a longitudinal removal extending across an elevational face at a *midway* point. This calls to mind the useful device of recessing an intermediate floor level, often exposing an outer row of columns for structural expression, to make a distinction between base and shaft while retaining the overall sense of a single volume throughout—though the strategy



4.20 Arquitectonica: Atlantis Condominium, Miami, 1982.



4.21 SOM: Rowses Wharf, Boston, 1987: landside elevation.



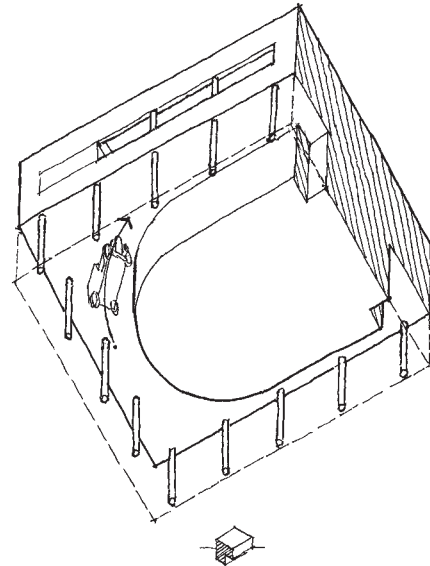
4.22 I. M. Pei: Everson Museum of Art, Syracuse, NY, 1968.

has proven on the evidence to be difficult to pull off convincingly.

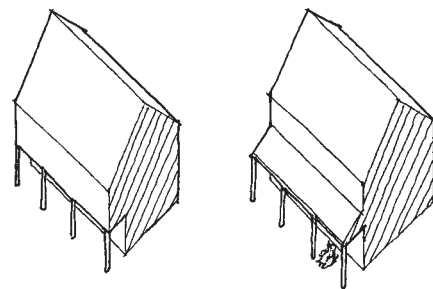
Vertex Centered

Vertex-centered two-dimensioned modes have the same range of cases in elevation as seen in plan, but now the differing natures of *lower versus upper* subtractions must be addressed:

- The upper orientation of the simple excision is sometimes employed, either one-sided or symmetrically, to bench in the upper portion of a vertical building mass for terminus definition. It is also used to conform to urban code setback requirements, permitting an additional floor or two for a project.
- The undercut version of this excision, a whole different look and story, can appear as the hood image of heroic modernism, defying gravity and scale in pursuit of a massive cantilever. Perhaps the defining realization of this motif is Pei's Everson Museum, where four such hoods guard a central enclosed court while housing the main galleries in their upper levels (4.22). Although taken as a whole this is an additive composition, each individual gallery module takes this subtractive mode about as far as it reasonably can in structural drama and reductive simplicity. The monolithic materiality of the concrete surfaces abets the reading of an initial rectangular solid, altered by the excision of the lower quadrant.
- The Villa Savoye features a developed version of this mode (4.23). From the approach side a subtractive undercut at both sides is apparent, and these are smoothly joined by virtue of the kinetic



4.23 Le Corbusier: Villa Savoye, Poissy, France, 1931: worm's eye axonometric.



4.24 Vernacular house porches: subtractive and additive types.

device of the automobile's radiused arrival path into a contiguous three-sided subtractive recess.²

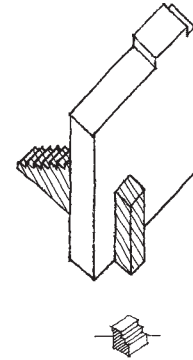
- Finally it would be difficult to find a simpler or more effective pair of manifestations to compare addition and subtraction than two approaches to the front porch of the iconic vernacular houseform (4.24). An undercut excision, distantly recalling a flank of the Villa, exemplifies subtraction, while the more ubiquitous porch as appended shed is the additive counterpart.

* * *

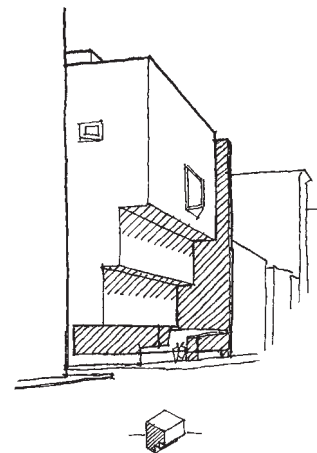
The “mediating” version of the vertex-centered mode is a ubiquitous device, the echeloned motif both alluding to the timeless form of the staircase and serving effectively in the right circumstances as a mass- and scale-reducing device. It makes a flamboyant appearance in the lower element of the Palace Condominium, affording a sort of visual buttress for the taller one (4.25). Its shallow relief more directly evokes the staircase metaphor than an extended version, wherein elongated steps would form an “embankment” of terraced or ridged surfaces. In either case, the step-wise form is highly evocative of extrusion or “die-cutting” as metaphoric procedures for subtractive removal: the accurately repetitive shapes are more suggestive of such machine-tool processes than of a sculptor's individualized gestures.

The lower-corner version can be more acrobatic and unnerving than the single undercut excision of the Syracuse museum, due to its inherent visual instability. At Breuer's Whitney Museum, a sure hand has held the proportion of the outward steps at the limit of visual equilibrium, and then restrained other gestures to minimal ones as well as wrapping

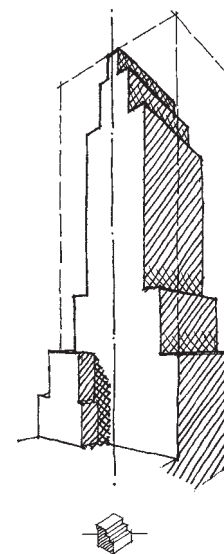
2. The Villa design went through five versions, the second and third strikingly awkward in comparison to the final design. The fourth and final schemes were, in fact, “value-engineered” versions of the first, the result being superior in most respects. But a reduction of the structural grid from 5 to 4.75 meters can hardly have helped the already difficult matter of turning into the garage.



4.25 Arquitectonica: Palace Condominium, Miami, 1981.



4.26 Marcel Breuer: Whitney Museum of American Art, Manhattan, 1966. (Now leased by the Metropolitan Museum of Art.)

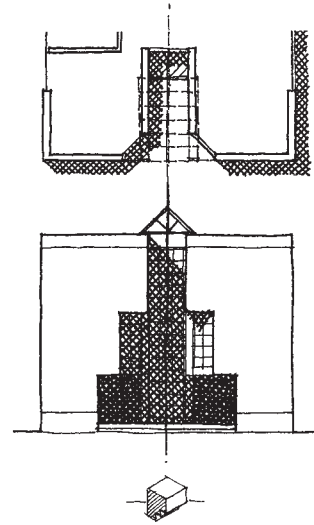


4.27 Raymond Hood; McGraw Hill Building, Manhattan, 1931.

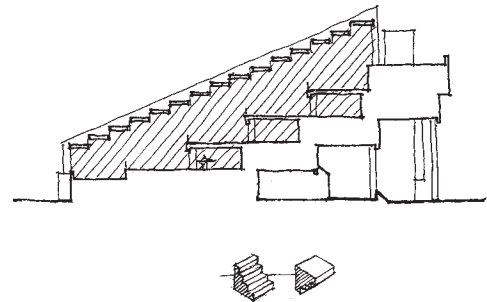
the volume in a monolithic cladding (4.26). These choices astutely defer to the scheme's risky drama and help legitimize it, the design energies of the museum exterior being almost entirely devoted to the generally convincing execution of this one uncommon and difficult gesture. Here the device is not solely an expressionistic motif for its own sake, but provides the benefits of a frontal sunken courtyard and entry bridge, while stepping outward to permit larger floor plates at upper levels. And the largest, uppermost step aligns with the streetwall of the block, enhancing the reading of the indents below as subtractive removals.

These two basic versions of the step-wise echelon expand into a wide range of subtypes through the operations of reflection, superposition and rotation. The up-oriented version, reflected, forms the extruded wedding cake of Hood's McGraw-Hill Building, while one of Botta's Swiss villas confronts the down-oriented Whitney profile with itself in an illusory gesture of extruded bifurcation (4.27; 4.28).

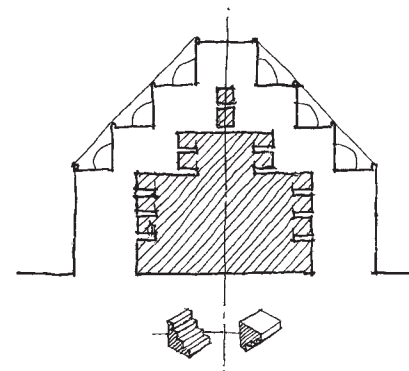
If these upper- and lower-corner motifs are superposed in the same design, the result suggests an open staircase. The appeal of this approach arises from its combination of the initial staircase metaphor with the acrobatic drama of the inverted configuration, and may also be due in part to the elegant economy of its concept, a single sawtooth line summarizing both aspects simultaneously. Andrews' Gund Hall realizes the concept with a gloomy forecourt deeply recessed beneath the overhanging soffits of studio trays stepping out above (4.29). A superposed glazed roof shed pays homage to the modernist infatuation with the industrial glasshouse while it echoes the stairsteps within via smaller iterations. The rationale of this diagonal thrust in its immediate surroundings is questionable, and functional problems inherent in both upper and lower aspects reveal a seductive abstract parti somewhat in search of program and context. Exemplifying the elongated version of a step-wise extrusion, inherently tricky issues of termination



4.28 Mario Botta: House at Pregassona, Switzerland, 1980.



4.29 John Andrews: Gund Hall, Harvard University, Cambridge, MA, 1972: transverse section.



4.30 Araldo Cossuta: Long Wharf Marriott Hotel, Boston, 1982: transverse section.

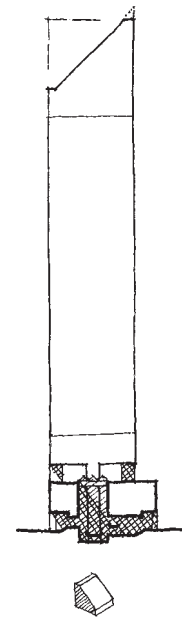
are dealt with by an openly expressed sheared face at the south, while an end cap receives and visually stabilizes the gesture to the north.

If Gund Hall's extended stairstep were reflected about its apex as at McGraw Hill, a sort of terraced berm form results which characterizes Boston's Long Wharf Hotel (4.30). Its extrusion profile entails the significant drawback that its linear public space interior is encapsulated beneath, largely isolated not only from the life of the street, as at Portman's Hyatt, but from natural light as well.

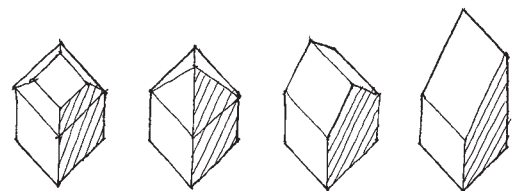
* * *

The chamfer or sliced-off diagonal is the most simplified and direct mode of edge-related removal, and its up-oriented version is an iconic feature of Stubbins' Citicorp Center (4.31). Solar collectors came and went as a functional rationalization for what was ultimately an aesthetic preconception, and the final result was tamed by re-entrant flats at the base and top of the slope. These tailorings also have the result of making the reading more ambiguous and less confident: is no longer a clear cutting-off gesture. One dares speculate that the lower treatment desirably avoids a weak obtuse-angled condition, but that extending the upper treatment to an acute-angled terminus would have been both bolder and more convincing.

If a more modestly scaled up-oriented chamfer is "transitioned" around all sides of an initiating figure, a mansard roof form results, and the process seems a suitable visualization of form development in such a case, the mansard form representing a relatively minor easing of the upper edge of each volume face (4.32). But if a sufficiently large chamfer is involved, the canted surfaces meet at the center to form a hipped or pyramidal shape—or a gabled volume if opposed edges only are involved. While the form generation process in the latter cases is logical, it is not plausibly evoked as the means to this end: such prototypical



4.31 Hugh Stubbins: Citicorp Center, Manhattan, 1977.



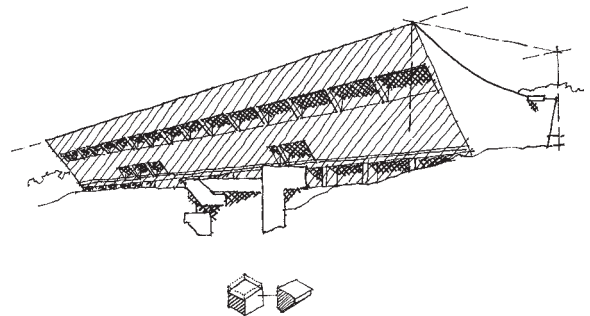
4.32 Diagrammatic roof chamfer variants.

monolithic houseforms have something of the status of initiating volumes—the tops are there to begin with; we don't necessarily feel the need to rationalize their existence as the result of either subtractive or additive procedures. A further roof form, the shed, has been interpreted here both as initiating and subtractive—Maison Carré vs Citicorp—depending on circumstances, and this is indeed the key factor in the reading of all such variations on the chamfer: that clues of form and surface present in each design determine which case is more plausible.

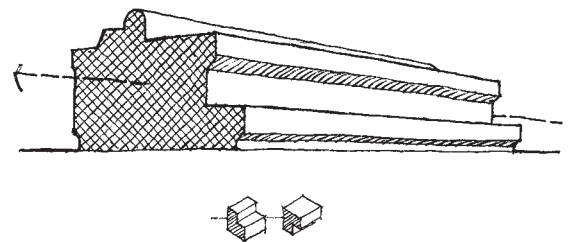
The down-oriented chamfer is infrequently employed due both to its visual and structural instability.³ In his Firminy youth center Le Corbusier did incorporate an outward cant with verve and confidence, although the heroic image of the design seems rather inappropriate for the modest scale of the building (4.33). The volume, legible as a sheared off segment of an indefinitely long linear element, is actually bounded by *two* canted surfaces and a concave cable-supported roof, the outward cant of the downhill facade rationalized architectonically both in response to the inward component of the roof cables and to steeply raked interior seating along part of its length. The canted facades and the roof are all plausibly the result of excisions, even though taken together they obliterate much evidence of a preceding initiating volume. The characteristic texture of the concrete itself, in conjunction with the extremely deep recess of openings on the downhill side, summon up like few other buildings the palpable impression of a solid volume decisively cut to shape.

These various elevation-oriented examples share the characteristic two-dimensional morphology of extrusion, wherein form varies in the two dimensions of the elevation but extends indefinitely without variegation in the depth dimension. The first phase of Los Angeles' Pacific Design Center employs a

3. Stirling's Leicester building comes back to mind, its sloping soffits at least as plausible in this context as a case of lower face one-dimensional removal.



4.33 Le Corbusier: Youth & Cultural Center, Firminy, France, 1965.



4.34 César Pelli: Pacific Design Center (phase 1), Los Angeles, CA, 1975.

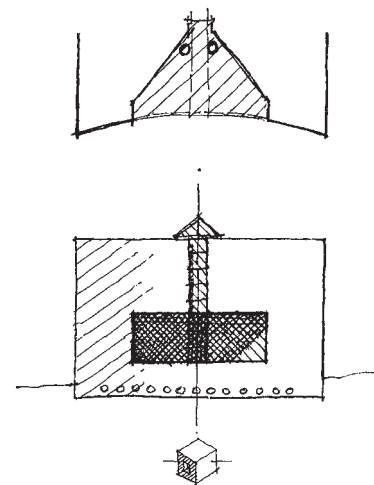
elaborately configured elevational extrusion, and due to the extended length of the building as well as a lack of clues as to the shape of any initiating volume, a “die-cut” reading again predominates (4.34). Although criticized for a lack of scale-making detail in its low-rise context, the building is an effective demonstration that no one conformational device must dominate. It should be clear that the one great limitation of the approach—the unvarying continuity of the extrusion in depth—brings with it a partially compensating freedom in the conformation of the die-cutter, limited only by the old antagonists of imagination and discernment.

Elevation-Oriented: Three Dimensions

When the modes of elevation-oriented subtractive form vary in three dimensions, the resulting interventions are inherently fitting to the nature of architecture as experienced in space and time: the extruded or sheared modes characteristic of the two dimension cases no longer apply, and all faces of the initiating volume which are affected by the intervention undergo increases in shape complexity.

Volume Centered

A special case at the outset precedes all issues of external configuration, for the *volume*-centered removal has no visible impact on exterior elevations. Having no adjacencies to faces, edges or vertices, it possesses something of the paradox of the ground plane face-centered situation in that its presence is normally undetectable from the exterior. Such cases are reminiscent of singular regression—although that approach more typically involves miniature “solid” figures entrained within the internal void of a parent volume. Something of the inverse applies here, recalling the variegated internal voids of the OMA Library of France proposal, but the scale of such an interior removal must clearly dominate that of other interior spaces in order to be legible as a primary formative gesture. Perhaps the old-fashioned



4.35 Mario Botta: Posteria Residence, Morbio Superiore, Switzerland, 1986.

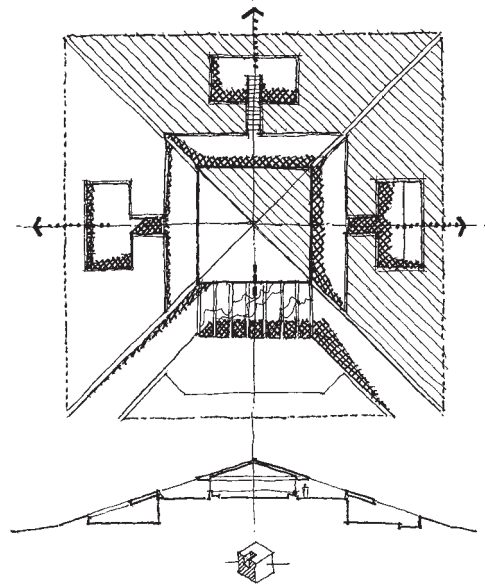
urban movie palace comes close to epitomizing the case: isolated from all peripheries and with no need to seek natural light, the audience hall is entirely encapsulated by the poché of the building and its urban surroundings.

Face Centered

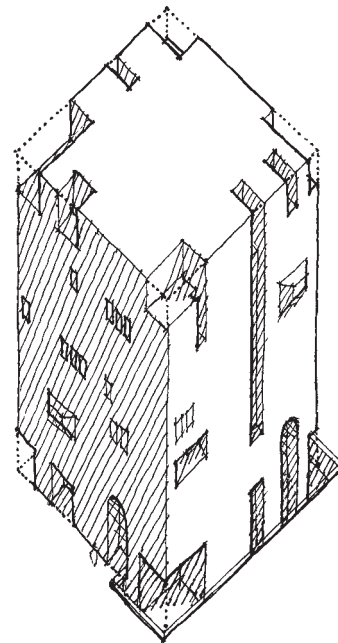
The most elemental of the visible cases, the face-centered mode is detached from all elevational edges and extends into, but not through, the body of the building. As the central feature of another of Botta's villas, this gesture takes on a measure of deliberate ambiguity: with the centered excision linked to the parapet by the architect's signature slot device, the removal is not a truly isolated element on the elevation, but the slot is too narrow for the facade to acquire some sort of U-shaped reading (4.35). The villa illustrates an obsessive motif seen repeatedly in Botta's work which involves teasing the limits to which "pure" initial subtractions can be distorted or their boundaries interrupted before they either fission apart or breach into a continuity with the surround.

Edge Centered

Lower-edge-centered removals can be as familiar as a commonplace entry recess, while a removal from a vertical edge is uncommon, if for no other reason than the structural complications it entails. Upper-edge-centered removals sometimes come into play as penthouse terraces, given a sense of place by sidewall entrainment in the volume. The gesture is first cousin to a subtractive operation when the surface of the initiating volume is inclined, resulting in a nick- or notch-like removal that is highly evocative of a cutting-away subtractive process. Sometimes employed for energy conservation, the use of earth embankments as an architectonic medium can also simply embody a primal fascination with the imagery of bluffs and caverns. Morgan's pyramidal partially earthform house realizes this atavistic urge to burrow into the hillside while simultaneously claiming and



4.36 William Morgan: Thomas house, Brooksville, FL, 1975.



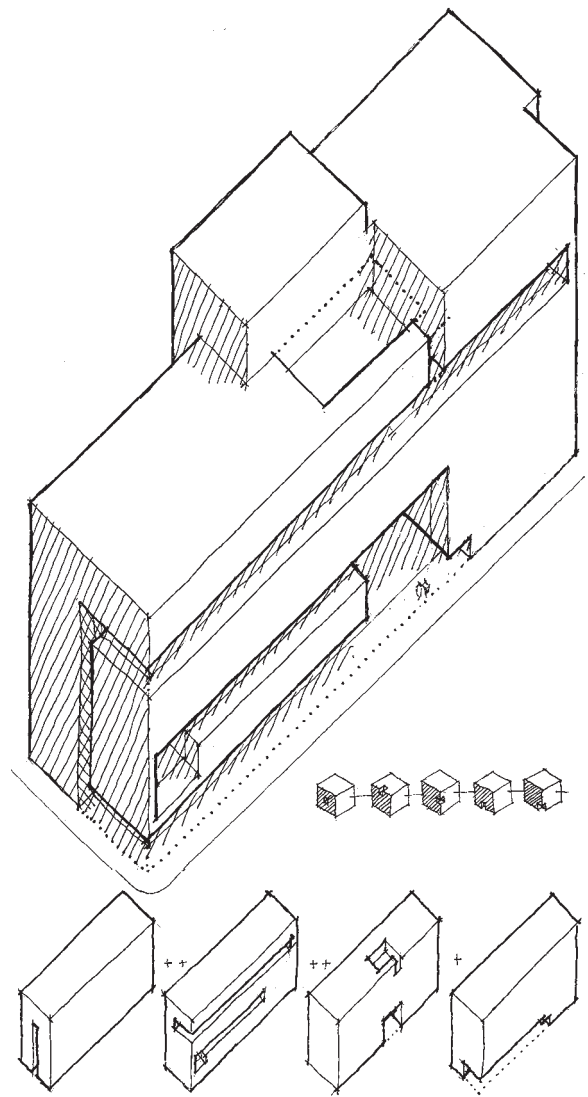
4.37 CRS: Larsen Hall, Harvard University, Cambridge, MA, 1965.

occupying its summit. Excisions of this type provide light and access to the lower level, while at the upper level a “full circuit” removal trims open the crow’s-nest studio (4.36).

Vertex Centered & Combined Cases

Harvard’s Larsen Hall covers the field of vertex centered removals by incorporating a variety of both upper and lower versions; each corner is altered, converting the initiating rectangular solid into a more complex “three-dimensional cross” of sorts (4.37). The building is in fact a catalog of several three-dimensional elevation-oriented excisions: upper and lower edge-centered removals are featured in the form of toothed slots and entry recesses, and some deeply embrasured windows are face-centered. The latter are echoed by occasional deeply projecting window surrounds, a perhaps unnecessary addition to an already hyperactive form vocabulary.⁴

Although Larsen Hall assembles a variety of 3d removal types, each case is an isolated exterior gesture and the building’s identity as a square-based rectangular solid preserved. But if such gestures are allowed to connect, a greater range of expressive and complex formative treatments can result, as at Chicago’s William Jones High School (4.38). Providing its nominally flush glazing treatments are subsumed in a diagram of the basic volumes, a *contiguous* network of subtractive gestures is revealed, in contrast to the discontinuous removals of Larsen Hall. Assembled from a series of constituent gestures, this treatment serves to break up the compact slab



4. The building does demonstrate an important point regarding the various case studies of subtractive form, for while they were chosen to showcase the specific version under discussion, clearly it is often the case that multiple types are employed in the same project—not to mention multiple formative modes, those ramifications to be addressed in later chapter.

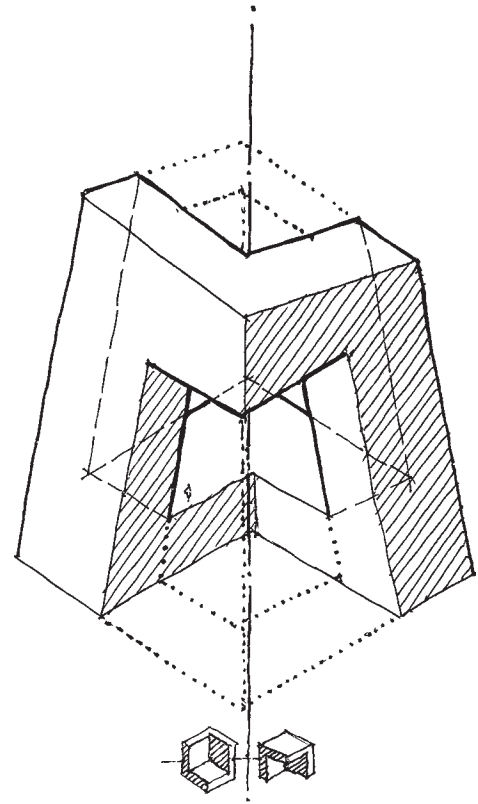
4.38 Perkins+Will: William Jones College Preparatory High School, Chicago, IL, 2013.

of the eight story building into a composition of interrelated sub-volumes and intervening recesses.⁵

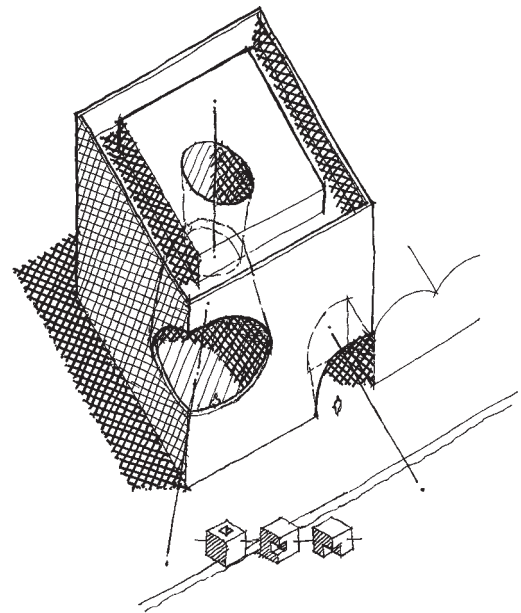
Some of Eisenman's theoretical projects conflate two subtractive gestures, an upper corner removal blending into a lower corner removal diagonally opposite. This conceit recurs as the formative basis for OMA's massive CCTV Headquarters (4.39). If its continuously looped beam-volume were skinnier, the plausibility of this formative basis would probably have been lost: as it is, the brash gesture seems intent upon defying such analysis, the sloping sides and tops further eroding the perception of a theoretical originating volume. If the excisions were elbows that match the widths of the uprights—one standing atop the base L and one fit beneath the cantilever—restoring them would result in something like a 2d plan-face-oriented removal: a very large light well building (not that this is being advocated). We need bold buildings, for if everything were carefully and elegantly circumspect the built world would be a dull place, but this bold building has an edge to it, all jutting jaw or jutting beak, maw wide open, heading our way.

Just as William Morgan's house reminds us that an initiating form need not be some variation on a box, subtractive removals can likewise vary in shape, and Jakob + MacFarlane's "Orange Cube" offers a quirky demonstration (4.40). Setting aside its cladding and color innovations, the project's significance here are its three large-scale conoid-shaped 3d removals: upper-plan oriented, lower vertex-centered, and a vertical-edge-centered void that connects with the roof opening. As has been noted, such a "bite out of the corner" doesn't show up often, but its potential effectiveness is demonstrated here with focused energy directed diagonally up the adjoining river.

5. While subtraction defines the building's basic morphology, a secondary treatment is also brought to bear to develop the main exposures with a different formative mode in mind, discussed when this project reappears in the following chapter.



4.39 OMA: CCTV headquarters, Beijing, China, 2012.

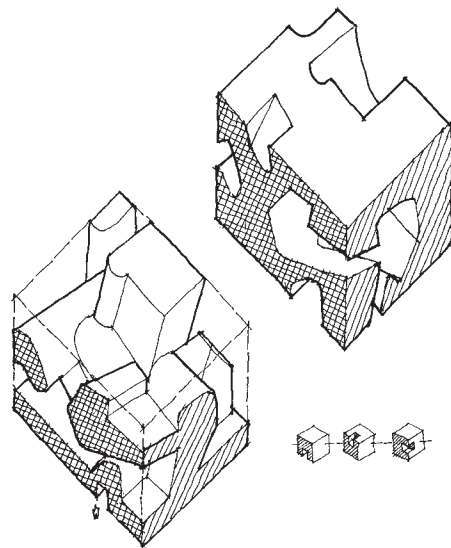


4.40 Jakob + Macfarlane: Orange Cube, Lyon, France, 2011.

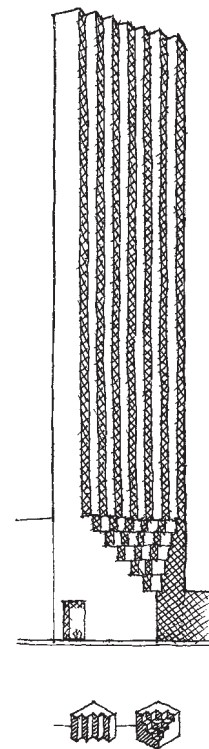
As if taking a leaf from this approach, Holl's massive Tianjin EcoCity Ecology and Planning Museums go a step further yet, in two respects (4.41). Subtractive gestures from an initiating volume, representing several of the types noted, are expressively irregular in form and extend within to link up a cavernous array of curvilinear spaces. But the project's ultimate hat trick as represented in conceptual form is for the remnant volume to house one museum, while the volumetric removals, reconstituted to comprise an adjacent interconnected volume of their own, house the other. As such it is one of few projects with subtraction as the dominant formative gesture wherein the takeaway sticks around to help constitute the completed work.

* * *

The several three dimensional vertex-centered modes combine the characteristics of the corresponding two-dimensional plan- and elevation-oriented modes in one figure. Thus the "three-dimensional L" is a combination of the simple L shape in plan (once) and in elevation (twice, for the two elevational axes). If a "mediating" corner mode—the echeloned or stepped extrusion—is developed in the same manner, the outcome of the collidive process which intersects the three initiating forms is a synthesis resulting in a dramatically revised geometry. The essential nature of the mode—that of step-wise incrementation approximating a sloping surface—is retained, but the surface approximated is now normal to the *vertex*, and the increments are unitary or atomic rather than linear and indefinite. These increments are commonly manifest as cubes or rectangular solids with architectural treatment often favoring the subtractively biased imagery of an overall volume undergoing an erosive removal, as if its coarse crystalline structure were exposed and abraded, as opposed to the additive model of many enfaced and stacked increments comprising an aggregate volume. Manhattan's Trump Tower demonstrates the treatment's role as a transition device, serving to join the initiating outer



4.41 Steven Holl: Tianjin Eco City Ecology and Planning Museums, China, design 2012. Interpretation of watercolor study by architect, found at www.stevenholl.com.



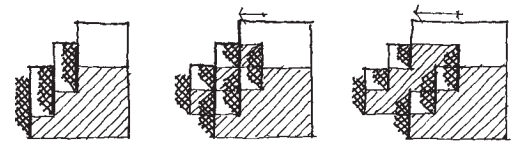
4.42 Der Scutt: Trump Tower, Manhattan, 1983.

corner of lower floors to the plan-oriented extrusion of the main shaft above, recalling that aspect of the Cincinnati Federated building (4.42). In the process, the incrementally expanding volume below the shaft acquires a somewhat unflattering bustle-like quality. Relatively fine in scale in contrast to the building as a whole, the cubes and pleats begin to visually suggest the limiting diagonal chamfers they approximate.

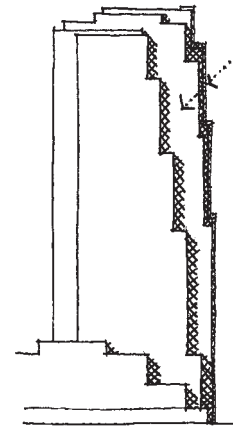
Variants On The Mediating Cases

The mediating cases, so called due to their intermediate place in a continuum of corner-related excisions, have ranged between extremes of concave and convex form, but there are variants lying slightly outside this main sequence that have had notable design roles. The first of these arises from an alternate means of visualizing the relationship between the two-dimensional echelon and the above three-dimensional configuration. If either the plan- or elevation-related echelon form is sliced perpendicular to its steps into several segments and each slice transitioned the depth of one step, the lateral continuity of the steps is completely interrupted, resulting in the above “sugar-cubed” morphology. But when the slippages extend *beyond* these points of geometric coincidence, the echelon slices are now parallel echoes in sequence, separated by intervening zig-zag surfaces (4.43).

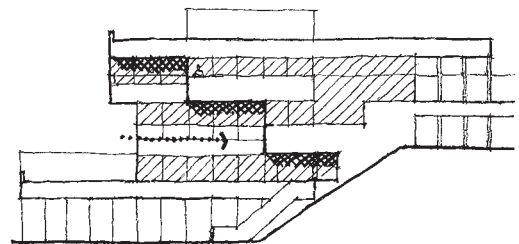
Rockefeller Center’s RCA Building (now the GE Building) is arguably the most celebrated modern example of this approach. The two narrow exposures of the tower stand in striking contrast, the west a sheer face while the east displays stepped, layered massing, its volumes sheared laterally with diagonal displacements. Erosion is also an appropriate metaphor, the vertical strata worn back increasingly with height and flanking a more resistant spine. Some of its strength is attributable to a synergistic presence of both additive and subtractive interpretations, the building fabric simultaneously enlarged by regressive replication and reduced by echeloned erosion, the



4.43 Evolution of “slipped” variant.



4.44 Raymond Hood: RCA Building, Manhattan, 1933.



4.45 Richard Neutra: Lovell House, Los Angeles, 1929.

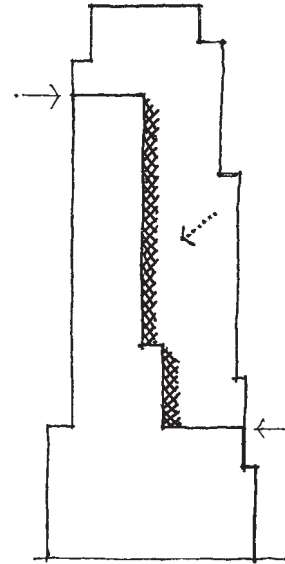
complementary processes acting in a sort of tectonic equilibrium. 4.44

While the originating form of the RCA Building is an up-oriented elevational echelon, a down-oriented version is clearly the basis of Neutra's Lovell House (4.45). The importance of surface articulation is made clear by a comparison of the two designs: while the RCA Building's vertical ribs of glazing tend to suggest erosive reduction as readily as lateral shear—the diagonal displacement of the echelons blunting a reading of vertical shear along these ribs—the horizontal glazing bands of the Lovell house make a reading of lateral shear all but undeniable.

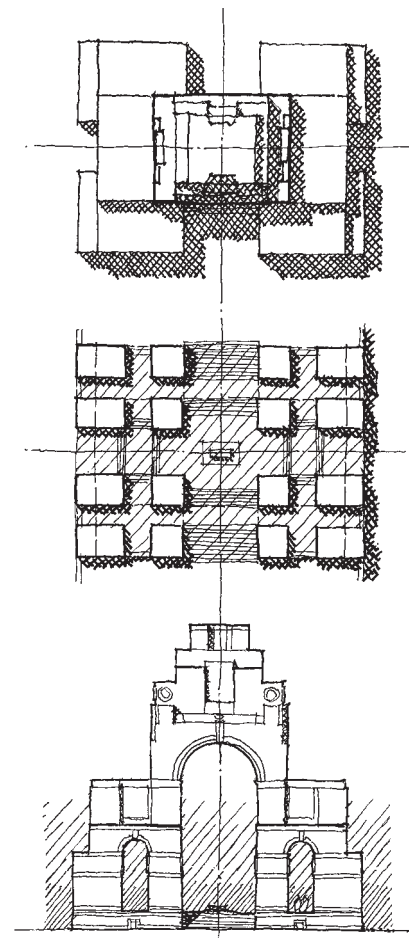
* * *

Hood's design for the New York Daily News Building, while it preceded his work on the RCA, serves as a bridge between the above approach and the second of these special cases, in that it embodies attributes of both (4.46). On the surface there are striking similarities between the two towers, specifically in the vertically ribbed glazing, the contrast of sheer with stepped endwalls, and the iteration of the stepped profile on the long elevations. But the ordering of stepwise elements at the endwalls of the Daily News invokes another approach. Below the top step on the more sheered endwall and above the bottom step on the other, a re-entrant step in the plane of the sidewalls is interposed, resulting in an *alternation* of extrusional steps between front and side elevational orientations.⁶ An interesting comparison can be made between this project and Pelli's World Financial Center towers: the echeloned profiles of both have a superficial similarity, but the subtractive alternate-echelon treatment of the Daily News tower integrates the entire building form into a single complex event,

6. Variants that have been noted, such as plan versus elevation, monodirectional versus reflected, up- versus down-oriented, etc., represent a wide variety of further potential applications of this approach.



4.46 Hood & Howells: New York Daily News Building, Manhattan, 1930. d: RCA Building, Manhattan, 1933.

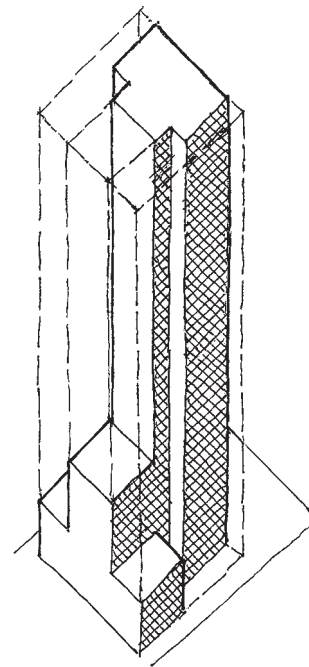


4.47 Edwin Lutyens: Thiepval Memorial, near Thiepval, France, 1932: roof plan, floor plan, east elevation.

whereas the unelided additive hierarchy of Pelli's jackets is a rather obvious gesture in comparison.

With this device, the "wedding cake's" potentially simplistic repetitions and the "sugar-cube's" prissy busyness are inherently avoided. Lutyens favored it, putting it dramatically to use in the greatest of his war memorials, the Thiepval Memorial Arch overlooking the Somme battlefields (4.47). The ground level features three edge-centered removals in the form of vaults that intersect three others at right angles, and the resulting figure-ground conundrum of sixteen massive piers, roughly equal in area to the six vaulted passages, offers no clue in plan of the three-dimensional development above. Excepting the elaborated treatment of the topmost portion, the memorial represents a clear exposition of elevational stepwise alternation. It also comprises another manifestation of the fractal regress, for the central tower with its vault is replicated at half-scale by the four corner pavilions.

Mies' and Johnson's Seagram Building, which can seem a minimal rectangular block at first glance, actually employs an ingenious application of this device on the exposure opposite the entrance plaza, with sequential excisions in all three of the dimensional orientations (4.48). These serve to transition the scale of the highrise mass down to that of midrise buildings adjoining, while also achieving a painterly manipulation of mass and exterior space. Ultimately there is no clear and simple sequence of subtractions that would result in the Seagram massing, and this is actually one of its strengths, lending a measure of desirable ambiguity. Specifically, while paired plan-oriented corner removals clearly neck in the massing behind the main shaft, and a large upper corner removal in elevation causes the major step down to midrise level, the paired bottommost elevational steps provide the puzzle: how does their extra depth, protruding beyond the base of the main shaft, fit into the typical model of an iconic initiating volume? The answer is that it doesn't,



4.48 Ludwig Mies van der Rohe and Philip Johnson: Seagram Building, Manhattan, 1958.

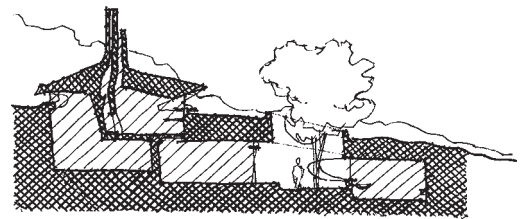
and that a subtractive parti need not necessarily be legible as the remnant of a single undifferentiated element. In this case each step in sequence reads plausibly and appropriately as a subtraction, the lack of a circumscribing volume being something of a red herring. In massing terms, these sub-volumes serve to lower the scale, anchor the tower, add desirable volumetric interest, and partially compensate for the austerity of its forecourt.

“Ultimate” Subtraction

The ultimate case of subtraction in architecture would be a building made invisible. Making a building hard to see—burying it, screening it, dematerializing it—these would be the practical limits of subtraction as a mode of forming. Such deliberate constructs go well beyond the use of formative strategies to achieve functioning architectonic ends, and variously pursue this extreme as their foremost presentational goal:

- Troglodytism, the original subtractive resort of living in caves, has existed since the Paleolithic era and continues today in a wide variety of locations and conditions around the world, in naturally formed caverns and dwellings hollowed into bluff faces. And at conditions such as those of Mesa Verde, the naturally subtractive hollows of stone overhangs shelter additive villages of the same stone. But caverns and cliff walls aren't the sole origins of “ultimate vernacular subtractive housing:” The Chinese loess belt of wind-deposited silt facilitated manmade pits excised from a flat ground plane, square holes in the ground functioning as sunken courtyards surrounded by vaulted apartments invisible from the ground plane.⁷
- Such “building burial” in modern times has not been that uncommon, when incorporated with structures that afford access, natural light

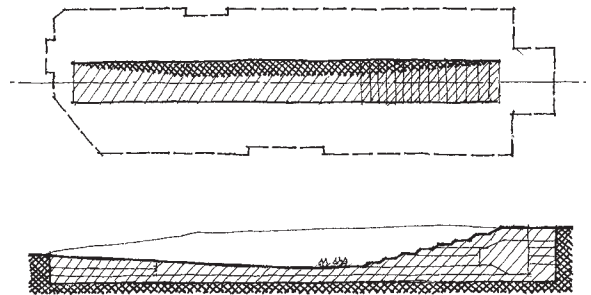
7. Bernard Rudofsky, *Architecture Without Architects* (New York: Doubleday, 1964), pp. 14-16.



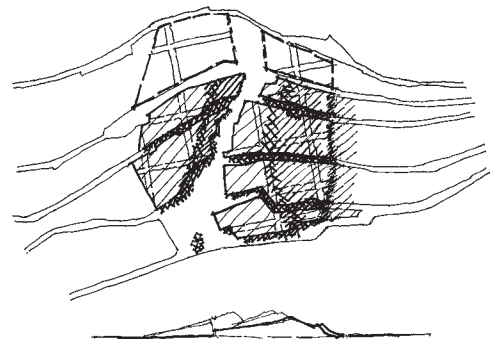
4.49 Malcolm Wells: Hypothetical underground house design, 1960's.

and views; but such cases—which may involve berms, recesses into rising grade, and green roofs—typically involve the emergence of conventionally developed building elements from the “cavern” aspects of the scheme. Malcolm Wells was a pioneer of such partially earth-sheltered architecture achieved in an artful way, and with wider acceptance of the merits of sustainability its applications have proliferated to varying degrees (4.49).

- In a sort of modern-day version of the Chinese pits, Seoul’s Ewha Woman’s University Campus Center configures a gently sloping and landscaped “plane of grade” and then makes an 800 foot long cut, descending from each end to reveal flanking “canyon walls” of glazing for four levels of the subgrade building, invisible from many on-grade viewpoints (4.50).
- To consider an *inverse* approach to burial, the plane of grade could be added to as opposed to subtracted from, building up a new topography that houses habitable space. So is it then additive rather than subtractive? Eisenman’s City of Culture of Galicia is both, unless one regards its dramatically rolling manmade hills as conceptually “pre-existent” to the subsequent operations of subtraction that, as with the Ewha cut, slice through to define pedestrianway canyons flanked by glazed sidewalls (4.51). Hardly another attempt to disappear into the terrain, the project is an assertive analogy of terrain itself, subtraction-by-burial inhering solely as a theoretical construct. The “new” terrain represents a *deformation* of the existing—foreshadowing the discussion to follow of deformation as a formative mode—in addition to its subtractive excisions; thus it is more accurately considered a hybrid of formative modes, appearing here to best make the point of its overarching idea of hiding the project under the rug.

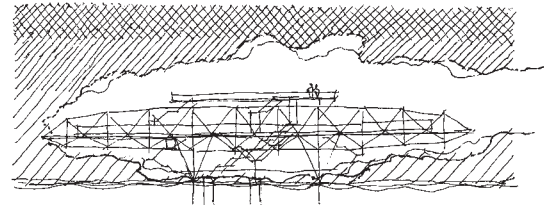


4.50 Dominique Perrault: Ewha Womans University, Seoul, South Korea, 2008.

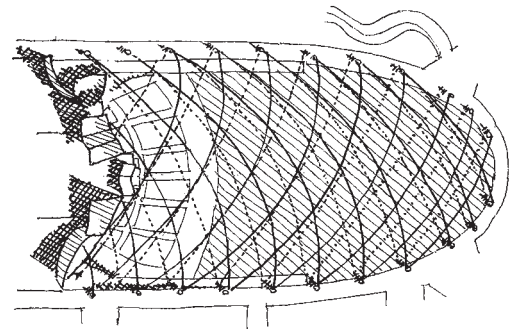


4.51 Peter Eisenman: City of Culture of Galicia, Santiago de Compostela, Spain, construction terminated 2013.

- Screening and dematerializing remain the exotic strategies available to make a structure invisible or at least hard to get a grip on. The glass houses—the Farnsworth, Philip Johnson’s and their emulators—are famously expressive of this motive, but they are content to have achieved an elegant minimalism. With advances in glass technology, the entry vitrine of the Fifth Avenue Apple Store is strikingly close to invisible, the functioning architecture again buried below grade.
- As opposed to such extremes of glazing transparency, dematerialization can also be attempted by rendering a project’s elements into a fog of increments, which was the theme of Fujimoto’s 2013 Serpentine Gallery Pavilion. Its complex grid of thin steel bars, meant to emulate the surrounding woods, achieved a labor-intensive mist of sorts from a distance. (Both the Apple Store and the Gallery Pavilion are nearly impossible to satisfactorily represent in line drawings!)
- An *actual* fog was the theme and *raison d’être* of Diller+Scofidio’s “Blur Building” on Lake Neuchatel, a temporary exhibit structure like the Pavilion, and similar as well in its attempted ultimate subtraction by making its nature hard to perceive (4.52).
- Just as much of the Blur Building was simply a dramatically framed open structure to support a misting system and some ramped walkways, Gehry’s Millennium Park Amphitheater employs a minimalized vaulted crossing grid of tubular beams overhead (4.53). Ostensibly for the purpose of supporting loudspeakers, their architectonic function is to define a space without actually enclosing it. In a way the project gets even closer to the unspoken goal of a building that isn’t there: the grid defines the grass amphitheater to aesthetic and acoustic effect, but makes no efforts of actual enclosure or environmental protection: those were not among the goals.



4.52 Diller & Scofidio: Blur Building, Lake Neuchatel, Switzerland, 2002.



4.53 Frank Gehry: Millennium Park Amphitheater, Chicago, 2004.

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Chapter Five

DEFORMATION

Notwithstanding their many variants, the formative modes of addition, replication and subtraction are immediately graspable on an intuitive level; on the evidence of built form extending from modern times back through history they are the mental models most commonly employed in the manipulation of form. These models predominate due to their logical and practical qualities in equal measure with their expressive potential. But there is another fully distinct approach to forming which deserves a more systematic understanding, involving cases in which form is neither added nor removed: the architectonic material remains, but with its form altered by intervening manipulative processes. These involve the imposition of forces—analogically suggestive in many cases of the behavior of structural materials under stress—which give rise to the deformation or fracture of an “initiating” form. Although some of these processes indeed result in a breakup of form, the resultant segments and their shapes and relationships remain, affording evidence that defines the gesture involved. By contrast, subtractive gestures normally leave as evidence only the shape of the resulting void, the subtracted portions typically having been removed from the stage. In the present cases, all material is preserved, helping to tell its own formative history.

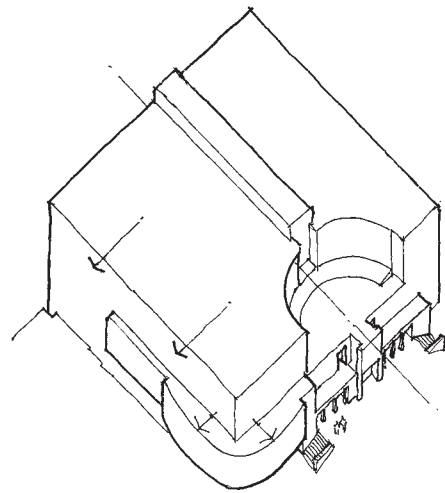
Tensile

“Tensile” forces have a basic role in the overarching processes of orthogonal transformation, as noted in the discussion of unitary design. Pulling a point into a line or stretching a line into a plane—or a plane into a volume—call up the image of tensile forces in the service of generating this range of generic form options. But secondary clues are required for tensile “stress” to be manifest as an analogical aspect of a project’s design. Violation of symmetry is one such clue. Heery & Heery’s Tallahassee City Hall is a colloquy of several formative gestures, but the largest is the distortion of an otherwise rigidly axial symmetry in the overall massing, wherein the building’s left flank extends twice as far to one side as the other. There is a sense that internal or external forces have stretched this half of the building laterally, an impression reinforced by the inflated form of the commission chamber (5.1).

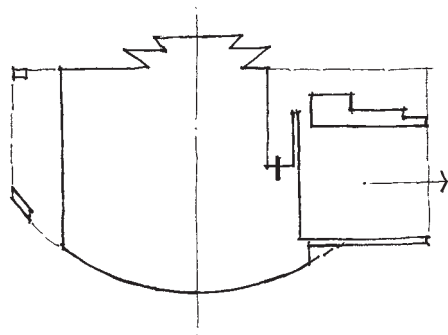
Similarly, at VRSB’s Brant house the garage wing not only extends significantly further from the axis of symmetry than its opposite extent, but the otherwise uninterrupted arc of the facade is snapped into a straightened alignment which parallels this axis of elongation, enhancing the impression of lateral tensile force (5.2). The device is often employed in this general way when a strong central axis and a markedly lopsided functional layout must both be accommodated, requiring finesse to avoid the impression of an unresolved imbalance.

Plastic Tension

Such a violation of symmetry is but one means to communicate the presence of “tensile” forces and their impact on built form. Aalto’s Finlandia Hall and Congress Wing are free of localized symmetries—even the main auditorium is given a characteristic off-center seating plan—but the overall volume strongly evokes longitudinal tension or stretching (5.3). This impression is fostered by the taut linearity of the



5.1 Heery & Heery: Tallahassee City Hall, 1984. Adapted from “A Positive Presence,” *Architectural Record* 172 (Nov ’84): p.145.



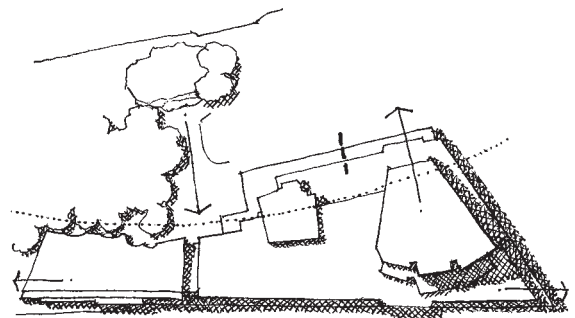
5.2 VRSB: Brant House, Greenwich, CT, 1972.

esplanade facade, by the acute corners terminating this exposure, and by the effacement or thinning of the building mass toward the center in plan and elevation: the building appears about to pull apart, an image reinforced by the recessed neck at the juncture of the later addition. The general concavity of the facade facing the park may also be read as a response to the *compressive* impact of the parkscape and massive rock outcrop beyond. The series of smaller concave excisions or bites which define that facade of the Congress Wing, in conjunction with the echeloned recesses of the original building adjoining, lend a specifically erosive character to this impression, as if the parkscape were nibbling away at the building mass. Ultimately the dominantly tensile and supplementary compressive/ erosive processes hold sway simultaneously, interacting seamlessly in defining the overall composition.

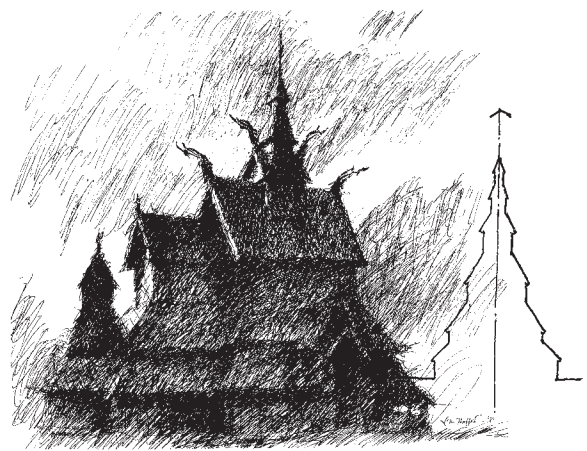
The manifestation of axial tension through stretching and thinning is not limited to the horizontal plane: additive regress cases can evoke such forces on a vertical axis, as at the Borgund stave church, its nested elements seeming to become progressively steeper and more attenuated toward the center (5.4). Something of an ultimate case of vertically “stretched” attenuation would be one or another of the supertall unitary designs that dwindle to a point.

Tensile Failure

There is a clear progression from such tensile deformations to tensile “failures,” when an initiating volume becomes two or more sub-volumes as a perceived result of oppositional forces implied in the design. Properties of formability—elasticity, plasticity, ductility—may be directly expressed in the morphology of such failed or fissioned volumes. Pietilä and Paatelainen’s Dipoli student center, now a congress center, is expressive in plan of a highly plastic and deformed breaching-apart along its irregular circulation spine: while the expressionistically shaped assembly spaces are made to appear rooted



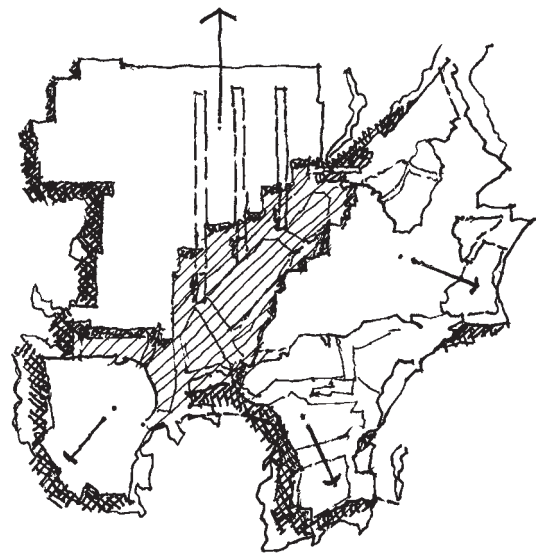
5.3 Alvar Aalto: Finlandia Hall, Helsinki, Finland, 1971 (Congress Wing, 1975).



5.4 Stave Church, Borgund, Norway, 1250. Sketch by author.

in the rock of the site, the more orthogonal building element flanking the breach is pulled away from these immobilized objects, its several open stairs tautly extended in the perceived direction of movement (5.5). Irregular bridges at the upper level span the breach, transitioning from the seemingly rockbound anchorages to the tensioned element seeming about to snap these remaining tendons. Massively faceted and angular fascias echo the rocky site, but float above it as if breached away vertically, endowing the building with further tensile expressiveness. The rectangular element houses support facilities, the angular forms assembly spaces, and the breach between is circulation, in an extreme and expressively geomorphological case of form evoking function.

Intentions in architecture can be just as difficult an issue as they are in art: although the critic is entitled to note the failure of an intended gesture on the stage of reality, it is less clear whether or when it is “proper” to posit the seeming presence of gestures which may well have been unintended by the designer. Tensile forces, as the term is used in this context, were not described by Kahn as having had a consciously applied part in his design of the Salk Institute, yet one can perceive forces shaping the labs complex which are analogous to those at Dipoli (5.6). The massive bodies of the labs proper seem in the process of being pulled in opposite directions by the engines of the service towers—as if in the service of achieving their status of singular duplication—while the study buildings appended to the inner faces are stretched away from the labs on necks to form a lineup of linear links. The serried array of canted outer walls opening each study transversely to the view of the Pacific is evocative of a broached bi-parting down the center of the complex. While these diagonals point to the ocean, they also point across the court to their opposite numbers, a politely regularized pair of ragged edges arguably suggesting that the studies were “originally” joined as one series of vertebrae down the centerline. Like the mid-Atlantic rift, that imagined juncture is marked by a centerline breach in the form of the watercourse,



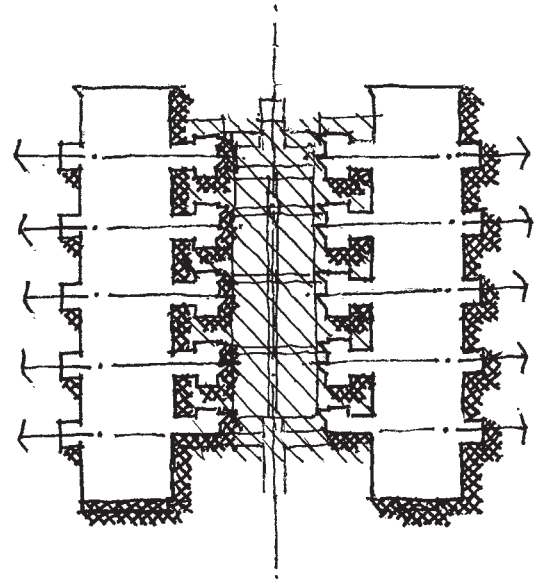
5.5 Pietilä and Paatelainen: Dipoli conference center, Aalto University, Espoo, Finland, 1966.

with transverse walks marking the traces of separation.

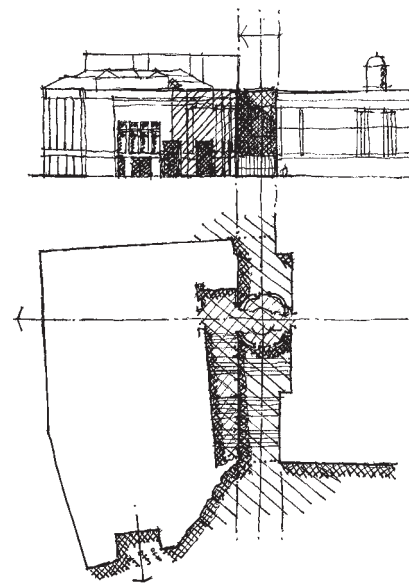
While their morphologies exhibit varying degrees of ductility, these cases of tensile failure all involve longitudinally extensive and highly indented boundaries of separation, and the paired volumes or assemblages making up each ensemble tend to a rough equality of visual weight, a tug-of-war image seeming central to the parti. In contrast, some works involve short, clean breaks with a clear order of major (initiating) and minor (broken-off) volumes. The Sainsbury Wing of London's National Gallery is a case in point, its inflected and articulated facade segueing back from the street such that plan and elevation conditions alike make a close match across the intervening pedestrian defile (5.7). The full height flush-glazed surface with which the addition faces the original building across this gap tends to reinforce the impression that the two have popped apart, as it were, the glass wall a sort of vitreous interior fracture plane. None of this imagery is made at all obvious or central to the appreciation of the architectural merits of the wing, but serves as a subtext, among other characteristic gestures, which adds some spice to the solemnity. The impact of significance to the architectural ensemble is that the addition—despite its deliberate quirks—seems rather comfortably and appropriately of a piece with the main building, without having resorted to the unbalancing factor of a more contiguous and stylistically imitative treatment.

Compressive

Compression and tension both play integral supporting roles in many of the additive schemes that have been discussed. Tension is generally legible to one degree or another in schemes involving linear links, such as the Aalto sanatorium, while compression is implicit as a subtext in many superposed partis. Matrix designs vary in this regard as a function of the morphology of the connective material: the Houston and New York YWCAs both



5.6 Louis I. Kahn: Salk Institute for Biological Studies, La Jolla, CA, 1965.

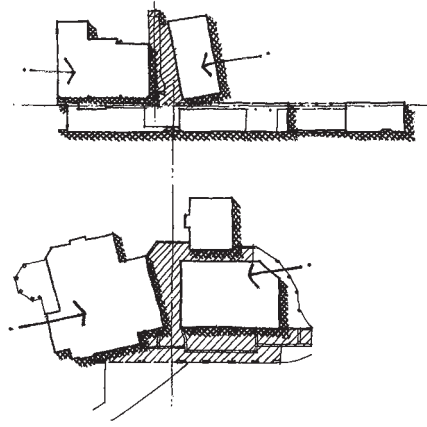


5.7 VRSB & Sheppard Robson: Sainsbury Wing, National Gallery, London, 1991.

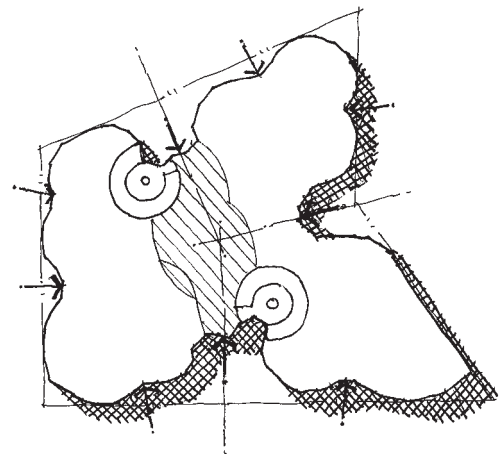
evoke compressive deformation, as if from mutual pressure of the adjoining volumes (5.8), while the main juncture space of the Moore/ Bloomer house seems stretched by divergent movements. Only the typical subtractive case with its lack of volumetric interaction, or the additive case of touching surfaces, fail to evoke these forces to some degree. When present in such cases, compression or tension are entailed by but secondary to the central procedure: they may be necessary to the initiation of the additive act or a consequence of its outcome, but it is the idea of putting parts together, rather than the means, which dominates. In contrast, deformation arises not from addition or subtraction but through the influence of stresses such as tension and compression in *primary* roles of form alteration.

As opposed to compressive forces apparently imposed by convergent elements, such forces can be evidenced only in the resultant form. Convex profiles alternate with concavities to configure virtually the entire periphery of one of Mies' hypothetical glass skyscrapers (5.9). Erosive imagery is made somewhat implausible by the onmidirectional nature of the design, and its biomorphic form augurs against the machine-like image of die-cut extrusion. Ultimately the analogy of sculpture in clay comes to dominate, its concave recesses evocative of compressive dents made by fingers drawn down the moldable trunk.

Built form of the past has often defined itself at odds with compression: to deny it, to the extent that the art of building of the times permitted, the Gothic cathedrals being an obvious example. But other world cultures appear to evoke compression through manipulation of subsidiary elements to enhance the gravitas of the composition (5.10). Greek columns incorporate entasis, arguably to embody the reality of weight. Onion domes of Russia and Eastern Europe are simultaneously expressive of the weight of compression and the aspiration of vertical attenuation. Hindu temples with their distinctive convex profiles are said to create "a symbolic holy mountain over the



5.8 Taft Architects: YWCA Masterson Branch, Houston, 1979 (demolished 2011); Kliment & Halsband: YWCA, Kingston, NY, 1978.



5.9 Ludwig Mies van der Rohe: Glass skyscraper (project), Berlin, 1922.

sacred cave.”¹ While a smooth convex surface can give the impression of inflation (literally so in the case of pressurized dome enclosures), the palpable weight of such articulated stonework rejects such a reading.

Gravity has often been treated as an antagonist in the architecture of modern times—to be defied heroically or its power mocked by sleight-of-hand—which may account for a paucity of designs based primarily on compressive imagery. Compression as a conceptual design force, when applied uniformly and axially, is evoked by plastic deformation. Among historicist approaches the building base may express the compression cumulatively imposed by the building mass itself through a thickened profile, reduced fenestration, and heavier, more monolithic construction. The exaggerated base of Graves’ Portland Building makes something of a cartoon of the issue, stepping outward beneath the apparent weight of the main mass, although this imagery of mass and compression is denied in reality by its thin appliqué of curtainwall and tile (5.11). This once hailed icon of its times, compromised by budget cuts, has barely avoided demolition as of this writing.

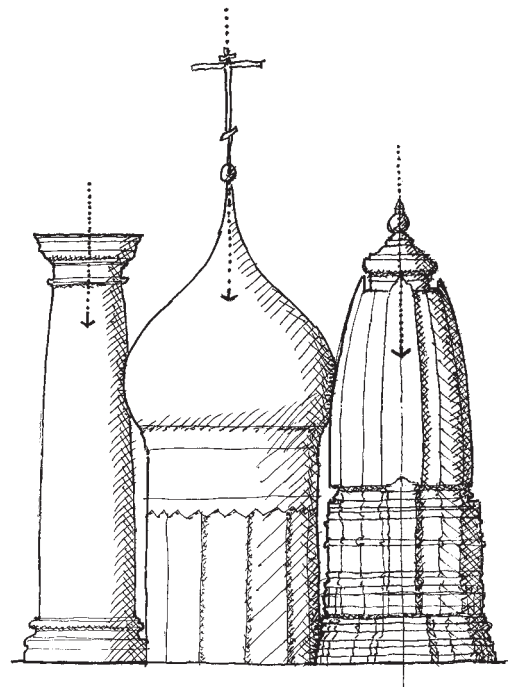
Shear

“Shear” involves the deformative effect of eccentrically opposed forces, which may be manifest in plan or elevation, and differ markedly in effect as a function of the implied stiffness of the structure and the implied strength of the forces involved.

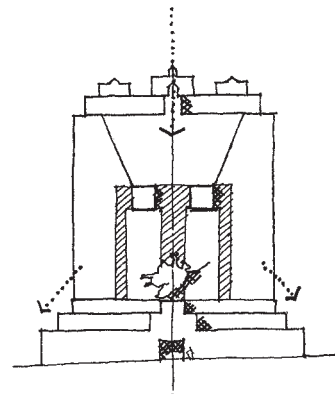
Plastic Shear

Buildings that embody aspects of a visually unstable parallelogram evoke *racking*, as if by lateral forces acting on an anchored but unbraced structure:

- Hadid’s Broad Museum is willfully slanting, seemingly not so much due so some sort of



5.10 Doric column; Onion dome, Spaso-Yakovlesky Monastery, Russia, 1686; Temple Khajuraho, India, 10th c.



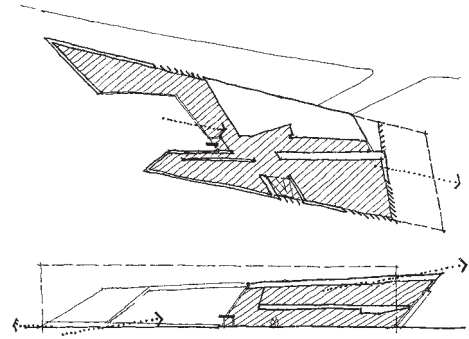
5.11 Michael Graves: Portland Building, Portland, OR, 1982.

1. Marian Moffett, Michael Fazio and Lawrence Wodehouse, *Buildings Across Time* (New York: McGraw Hill, 2004), p.78.

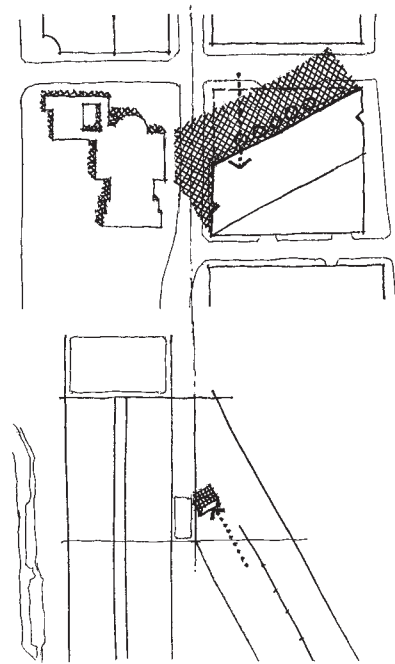
windstorm effect image as a palpable yank to the high end, that has left the low end all but wrenched out of the ground (5.12). The Broad's façade treatments of juxtaposed pleated cladding seem a peculiar counterpoint to this image, itself willfully at odds with the project's straight-laced immediate context, the aggressive thrust seeming to deliberately threaten adjoining buildings.

- Applied in plan orientation at Pei's Hancock tower, the parallelogram deformation seems at first glance an arbitrary distortion of a conventional rectangle (an impression somewhat blunted by the notches in the short sides) (5.13). But seen in its immediate context, the distortion of the footprint can seem the result of urbanistic "pressurization" at this entrance to Copley Square adjoining Trinity Church, pushing the volume back into its skewed form and opening up the empty triangular forecourt in the process. Only when the broader context of the tower is taken into account does its further role as a mediator between the grid alignments of Back Bay and the South End become clear, such that the tower seems now to be deflected more from the opposite side, as if by the inrush of the skewed neighborhood's geometry toward the tower's position astride the confluence of the grids.

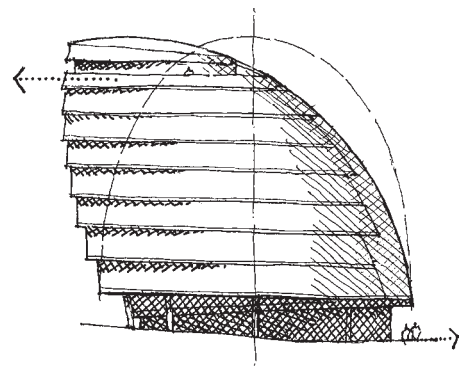
Such an opposed ensemble of acute and obtuse corners is not the only means for expression of deformation in shear, as demonstrated by Foster's London City Hall (5.14). Immediately preceding his St. Mary Axe, both are based on prolate spheroids, but the stubbier city hall is markedly leaning. Lateral forces are again evoked, the sequentially overhanging levels at the south serving ostensibly as integral shading, but they seem more an excuse for an elaborate expression of dynamic lateral deformation, and the volume appears rather more to be in the process of deflating.



5.12 Zaha Hadid: Eli & Edythe Broad Art Museum, Michigan State University, East Lansing, MI, 2012.



5.13 Henry Cobb (Pei office): John Hancock Tower, Boston, 1976: immediate site and urban area plans.



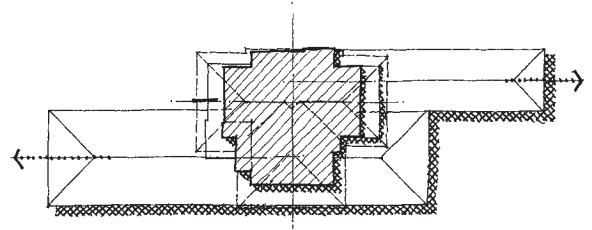
5.14 Norman Foster: London City Hall, England, 2002.

Failure in Shear

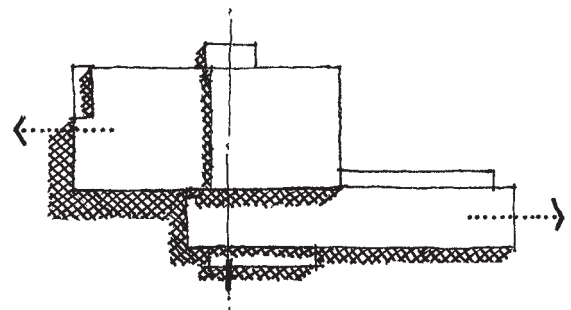
Wright's Robie house has been discussed in the context of additively superposed or layered volumes. The longitudinal energy of the design owes a great deal to the horizontal stratification of the exterior, as well as to the extraordinary cantilever and thinness of the roof profiles, but the disposition of the lower elements gives the house a special sense of movement. This has to do in part with "failure in shear," the two adjoining volumes comprising the lower levels appearing to have slipped longitudinally relative to each other (5.15). Several functional factors work in concert to encourage this result: the front element housing family spaces is drawn to the corner to overlook the streets and take maximum advantage of daylight, while the rear service element retreats behind the dominant mass to afford an entry walk, and its corresponding extension into the service court gives sheltered garage access. Here one can indeed summon up the reading that these two volumes arose from a single initiating form, fractured and displaced along a longitudinal slippage plane.²

Aalto's Viipuri Library, although of an entirely different architectural character and program, is based on a similar implication of sheared masses (5.16). A narrower, lower volume transitions across the blank facade of the main reading room element, evoking an almost uncomfortable sense of slippage between the two. (The slippage planes of these projects recall their appearance in the replicative case of the Hibiscus house.) In this instance it falls to a perpendicular circulation axis, ambiguously expressed on the exterior by further subsidiary slipped volumes, to take on something of the pinning-together function that was served at the Robie house by the upper level and chimney mass.

2. Though discussed here by virtue of this aspect of deformation in shear, the house is another case that is more properly considered a formative hybrid, equally and synergistically expressive of both additive and deformative modes: it is a foretaste of a discussion to come on hybrid forming.



5.15 Frank Lloyd Wright: Robie house, Chicago, 1910.

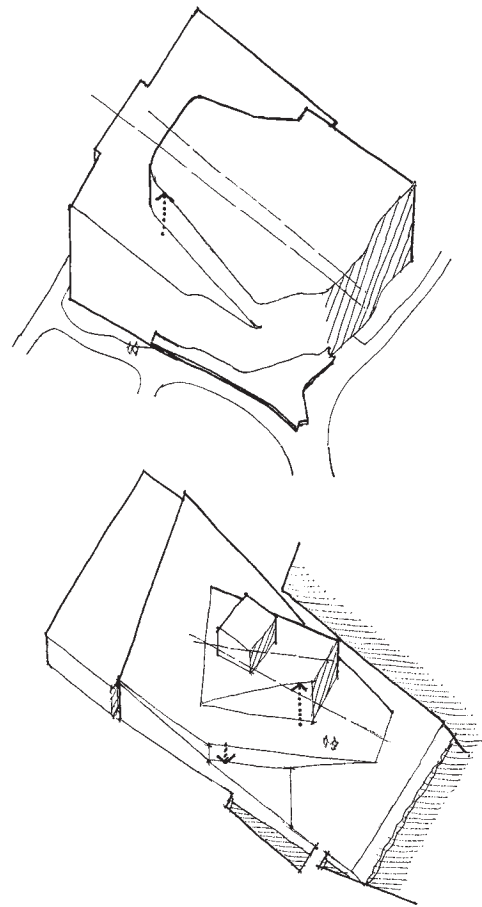


5.16 Alvar Aalto: Viipuri Library, Viipuri, Finland (now Vyborg, Russia), 1935.

* * *

Aalto employed the image of shear failure in a more integrated and ambiguous manner at his Essen Opera House, all but unique in an oeuvre characterized by differentiation and complexity of form, for the building is a single irregular volume, its form derived in part from the spatial requirements of interior functions (5.17). A lower roof surrounds the main roof on three sides, inclined at a slightly lower pitch, and the upper and lower sidewalls below these two roofs gradually blend together in a seamless juncture above the building entry. These gestures evoke shear, as if the higher volume had risen in response to tectonic uplift forces while its outer lamina were held more in check by “adhesion” at its subgrades. But the reading is neither obvious nor exclusive; the surrounding lower volume can also appear to have shifted downward from a fixed centerpiece. The uplift reading is enhanced by the divergence of the two roof planes, as if the mass were a solid fault block with two partially concentric sub-masses rotating about a large vertical curve as they emerge upward. In either case the sheared surfaces transition back into a monolithic continuity, expressive of plasticity and incompleteness as opposed to the fully resolved discontinuities of other shear cases. Ultimately both images remain in the subconscious and alternate in dominance, like the two mutually exclusive readings of a figure-ground puzzle.

Homage or not, Snøhetta’s National Opera House of Norway significantly recalls the Essen design with respect to its similar expressions of shear. The outer reaches of the plinth first “subside” along shear planes, while the audience hall/upper lobby volume hinges up out of the plinth. The curvilinear ambiguities of Essen are replaced by crisply defined volumes, the Oslo project’s variously angled surfaces and subtle asymmetries affording their own ambiguities. While Essen fully encapsulated its fly loft, at Oslo the inspired decision to make the roof an accessible terrace ruled out such heights and its loft emerges as



5.17 Alvar Aalto: *Aalto-Musiktheater Essen*, Germany, 1959; Snøhetta: *Oslo Opera House*, Norway, 2008.

a rather clumsy boxed volume, so often the case with theater and opera houses. While the Essen building is somewhat isolated in a pleasant park setting, the Oslo work makes a dramatic focal presentation at the terminus of a harbor inlet, oriented to showcase its composition of intersecting slopes.

Bending

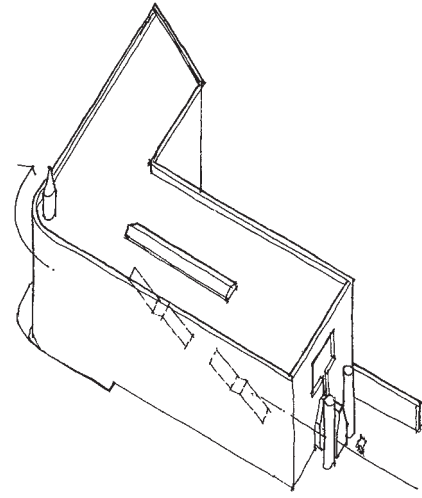
Yet another class of formative modification departs from these generally longitudinal alignments to embody the bending effects of *transverse* forces. But as with shear, the evoked nature of the architectonic material itself—its degree of stiffness or plasticity—is a major factor in these cases.

Plastic Bending

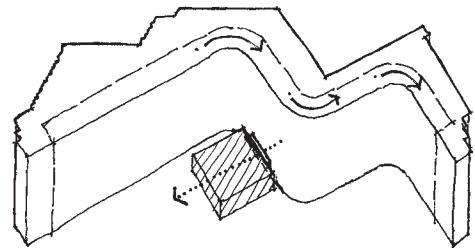
Volumetric deformation in bending takes place when the building skin and its contents act in concert and exhibit a high degree of plasticity:

- Stirling’s Sackler Museum at Harvard is essentially an L-shaped volume—and, characteristically, the interior does whatever it wants, dominated here by an axial skylit stair—but the continuity of its elevational banding as well as the radius of its outer corner encourage the reading of an initiating bar subjected to an abrupt bend (5.18).
- Aalto’s Baker house at M.I.T. displays a more relaxed expression of transverse forces, taking on the graceful wave of a shaken rope, while the diagonal cross-axis of a low-rise element assumes some significance by appearing to pull the central concavity into its final position. Forms of this nature appear malleable, like plasticine, capable of assuming and retaining sometimes complex reconfigurations (5.19).

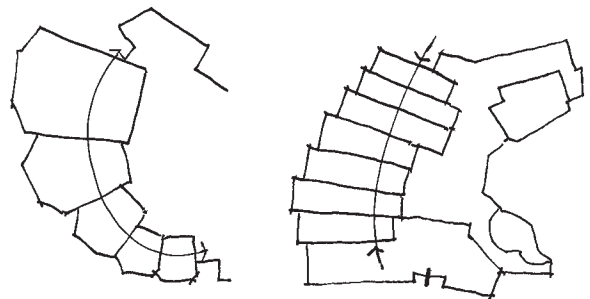
Some of Aalto’s characteristic fan shapes exhibit more of a “warping” stress deformation, notably the Wolfsburg center and the unbuilt museum for Shiraz,



5.18 James Stirling: Sackler Museum, Harvard University, 1985.



5.19 Alvar Aalto: Baker House, MIT, Cambridge, MA, 1948.



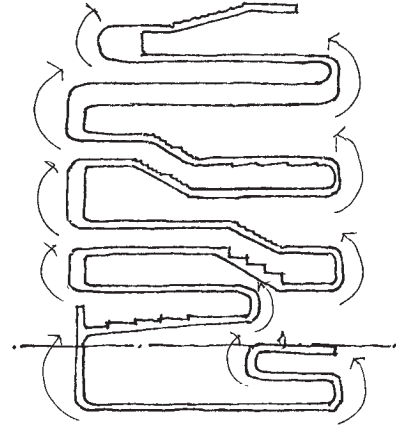
5.20 Alvar Aalto: Plan diagrams, Wolfsburg Cultural Center, 1962; Shiraz Art Museum (unbuilt), Iran, 1969.

Iran (5.20). In the former the exterior exposure of the regressed row of meeting rooms appears to have swelled in response to its macro-scale surroundings, resulting in the convex bend that turns the corner. While the museum can be interpreted similarly, an alternate reading invokes *compression* of the exhibit volume toward its entrance end as if clamped within the constrictive sub-volume housing circulation and support.

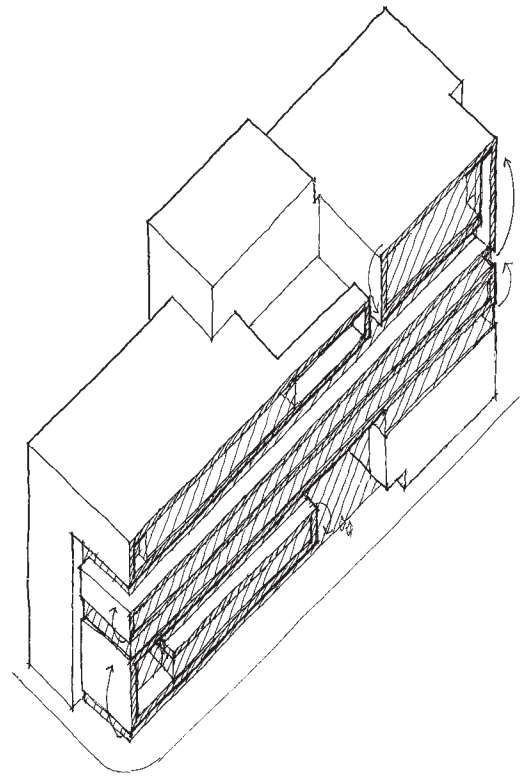
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The theme of plastic bending can go beyond such singular applications to embody cases of repetitive iteration:

- The unbuilt Eyebeam Museum of Art and Technology demonstrates an approach to form that one cannot resist calling a ribbon candy aesthetic, its floors and sidewalls morphed into a rather forced exercise in continuity (5.21).
- William Jones Prep School reappears in this context, for once planes of glazing are taken back into account, a linear band that bends back on itself again and again appears as an organizing theme for the frontal exposure (5.22). Here the treatment is limited to the façade, floorline bands returning via endwalls from top to bottom in an ingenious if obsessive attempt to further organize and animate the building's face.
- The plan of Berlin's Jewish Museum also involves a scheme of repetitive bends, but with less predictable regularity, and with harsh, acute bends as opposed to fluid transitions or right-angular returns (5.23). While the jagged series of contiguous line segments is striking and bold in plan, it is lost to confusion at eye level. A series of linear voids appears to represent a superimposed order in plan, but are separate experiences in reality that do not evoke a gesture of order, not that this was necessarily the intention. The



5.21 Diller & Scofidio: Eyebeam Museum of Art & Technology (unbuilt), Manhattan, 2002: diagrammatic cross section.



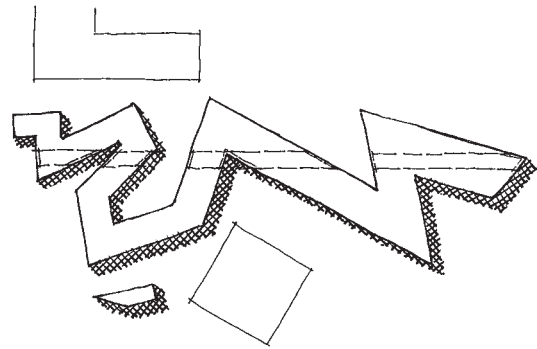
5.22 Perkins+Will: William Jones College Preparatory High School, Chicago, IL, 2013.vv

projects demonstrate that bending is a useful formative tool but one which runs the risk of becoming banal when the bends recur again and again, becoming more a motif than a parti.

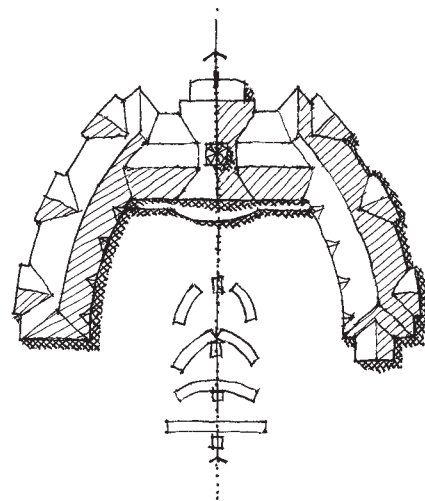
Plastic Failure

As the implied degrees of a volume's stiffness and of transverse forces increase, eventually failure in bending occurs, just as with fissions and fractures due to tension or shear forces. At a Massachusetts congregate residence, the rift between the two residential wings can be alternately read as a failure due to the "impact" of the dominant axial volume, or to a transverse force of attraction to the south which bends and ultimately breaks the linear element across the fulcrum of the axis: the effects and results are the same (5.24). The gentle curvature of the wings is particularly expressive of these scenarios, evoking as it does the potential energy of a drawn bow. These flanking elements serve several expressive functions, including setting a protective tone by the "circled wagons" convexity seen on approach, forming an expansive receptor for the entrance at the central breach, and defining an apsidal shape on the private exposure, which both signals intimate enclosure and gestures out to the lake beyond.

Buildings which must turn corners often give rise to the imagery of bending forces. Some, such as the Sackler, remain orthogonal and in one piece, while the congregate residence exemplifies both shape deformation in bending and a resulting breach. The two-phase building which houses Harvard's J.F.K. School of Government presents something of a middle ground between these two cases, its accretive linear scheme turning two corners with breaches in the outer fabric while an inner layer remains contiguous—a sort of greenstick fracture imagery evoking a brittle shell with a more elastic interior fabric (5.25). Here there is no overt impacting element incorporated in the architecture; rather the hypothetical initiating volume appears deformed by



5.23 Daniel Libeskind: Jewish Museum, Berlin, 2001.



5.24 KJA: Annie Maxim House, Rochester, MA, 1985.

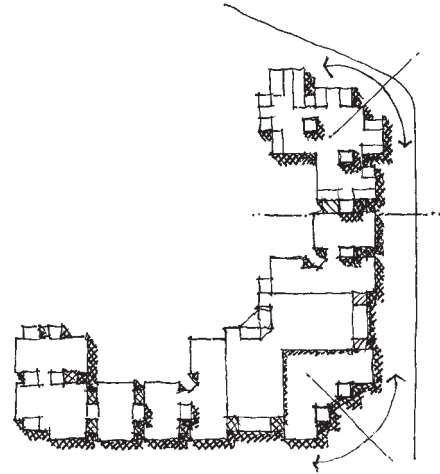
virtue of having been “vacuum-formed” to the well-defined edges of the site perimeter.

Rigid Failure

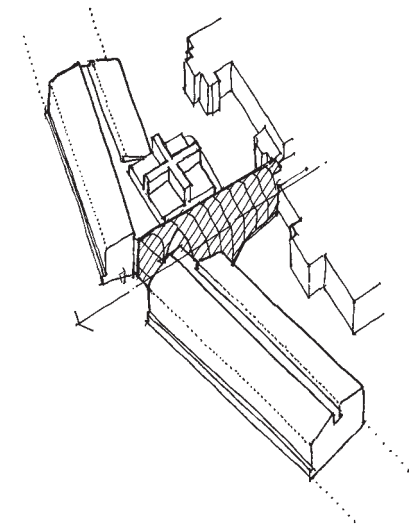
At an opposite extreme from the expression of contiguous deformation, some designs exhibit no remnant of elasticity but appear fully rigid or brittle, with bending failures expressed by sharply defined fractures and displacements:

- Stirling’s Olivetti training school begins with a glossy vocabulary of GRP cladding and greenhouse glazing, and the machine-made fragility of these elements is played up further when the initiating volume is rudely broken across the knee of the assembly room volume (5.26). (Or was the damage done by the glazed connector thrust forth from the pre-existing building? Stirling offers ambiguous choices as usual.) Flat end panels at the outer ends as well as at the breach contrast with the sinuous curvatures of the longitudinal cladding, emphasizing the imagery both of fracture and of indeterminate extensibility.
- Similarly, HHPA’s Pingry School, while incorporating the novelty of the fractal regress, is first and foremost another case of transverse impact and dislocation (5.27). The prominent engine of the circulation hall has snapped the primary volume at its center and carried it forth, the flanks dragged back and partly buried in the process.³ The echeloned metallic profiles of the rear exposure, their continuity and elongation emphasized by emphatic horizontals, seem to ripple with the implied energy of impact and movement.

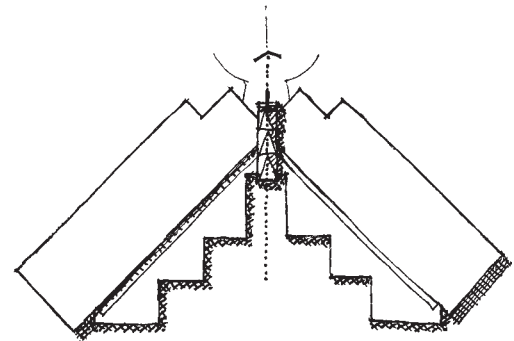
3. The imagery of collision and breakage which characterizes some of these cases has potentially troubling connotations. Clearly such gestures are open to a variety of interpretations, but there is a pattern of violent and destructive expressionism which is hard to dispute. Whether architects in this vein are the bold interpreters or the unwitting prisoners of their age is something to ponder.



5.25 Architectural Resources Cambridge: KFK School of Government, Harvard, 1978 and 1984 phases.



5.26 James Stirling: Olivetti Training School, Haslemere, England, 1969 (existing building not shown).



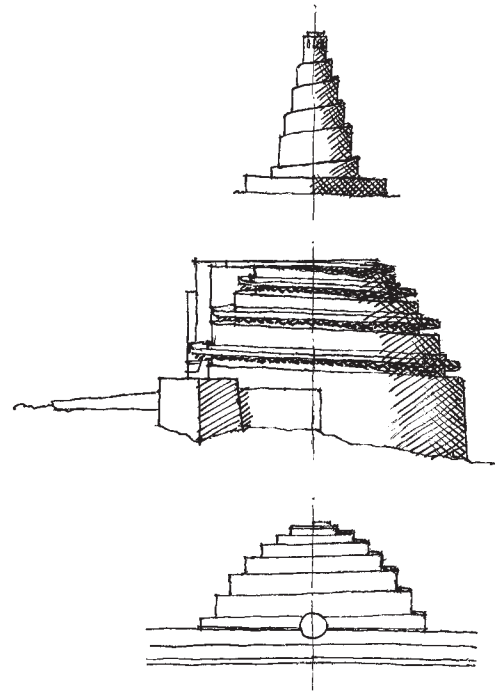
5.27 HHPA: Pingry School, Basking Ridge, NJ, 1984.

Torque

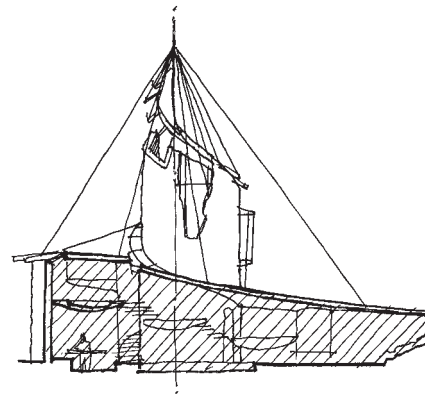
Torque is the tendency of a force to rotate an object about a pivot: in short, a twist. The term means something different to structural engineers than bending, and likewise provides an apt category for a distinctive formative sidebar. The literal meaning is given some leeway here to include cases involving concentric deformation—linear spirals. The type, though often impractical and non-site-specific, seems to have been irresistible for its potential expressiveness of dynamic, centrally focused motion (5.28; 5.29):

- Precedents from history include the mythical Tower of Babel—best known in Bruegel the Elder's painting—and the Great Minaret at Samarra, both configured as rising and reducing corkscrews.
- Wright's Gordon Strong Automobile Objective scheme, a wrapping up of spiraling roads intended to have clad a hidden planetarium, is generally considered to be the precursor for the *expanding* corkscrew of the Guggenheim Museum.
- Le Corbusier's Mundaneum project, despite its squared plan configuration, exemplifies the type, as does the later flattened squared spiral of his Museum of Contemporary Arts proposal.
- Goff's Bavinger house was a flamboyant and imaginative realization of the type, succeeding where others did not in spiraling in and up to a thin central pinnacle.

Wright's brilliantly romantic house for his son David's family did not reduce in diameter as it rose, but turned a full circle in the course of the rising entry ramp leading to the continuing arc of the house itself, floating a level above and encompassing a round grassy court (5.30). This 11th-hour-preserved landmark embodies its formative gesture with a convincing grace that avoids the potential banality of a corkscrew or a wound-up spring in its imagery.



5.28 Great Minaret, Samarra, Iraq, 851 C.E.; Frank Lloyd Wright: Gordon Strong Automobile Objective (unbuilt), 1925; Le Corbusier: Mundaneum (unbuilt), Geneva, Switzerland, 1929.



5.29 Bruce Goff: Bavinger house, Norman, Oklahoma, 1955 (demolished 2011).

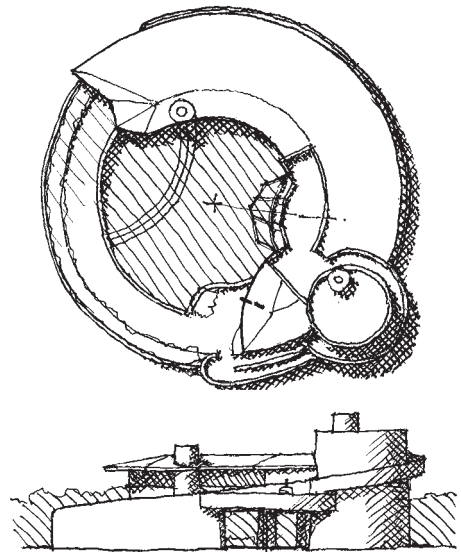
Computer modeling and engineering have enabled the design and construction of high-rise versions of this helical geometry, such as Calatrava's Turning Torso and unbuilt Chicago Spire. SOM's Cayan tower in the chaotic playhouse of Dubai is a realization of the approach with a relatively chaste 90 degree torque from bottom to top, and arguments can be made in its favor regarding a grace implicit in the long vertical curves as opposed to the corkscrew geometry of more extreme high rise versions of torque (5.31). London's "Gherkin," while an altered unitary form, features a spiraling order of glazed cladding and corresponding atria that step up in spiral fashion on the interior. Such high-rises are eye-catching, as intended, and the race continues for the next thing that hasn't or couldn't have been done yet, despite skepticism one may have that the test of time will be passed by these efforts.⁴

Biomorphic

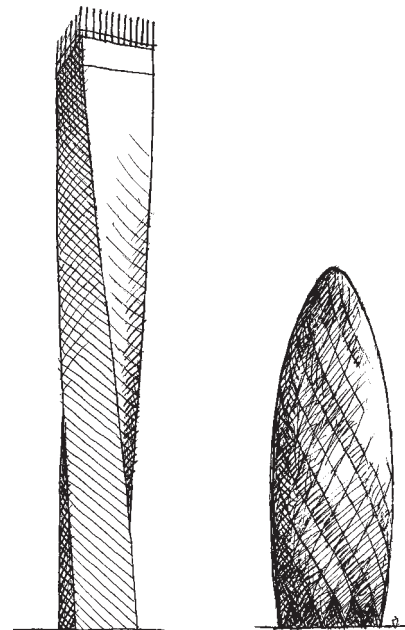
Departing of necessity from the "structural engineering" analogy, there is a general category of deformation that often centers on singular elements, but which has left the geometric purities of the "unitary" mode behind. The catch-all aspect of the title reflects the multifaceted nature of these cases.

Mendelsohn's Einstein Tower, an astrophysical observatory, is a landmark of architectural expressionism that was truly before its time, its stucco-clad streamlined curvatures setting the stage for trends decades in its future (5.32). Like some sort of upright diesel engine, the building seems on the move, its physical fabric deformed as if windblown and stretched out in its wake. There is less a sense

4. By way of a postscript, the application of a twist suggests the figure of the Möbius strip, which has found several alleged applications in proposed and built projects. As above, some have the look of a stunt, carried out just because they can be and not necessarily because they should. In any case, a true Möbius strip requires a 180 degree flip at some point, which may be achieved in some symbolic manner but not in a literal embodiment where gravity holds sway, assuming some actual utility of the full ensemble.



5.30 Frank Lloyd Wright: David & Gladys Wright House, Phoenix, AZ, 1952.

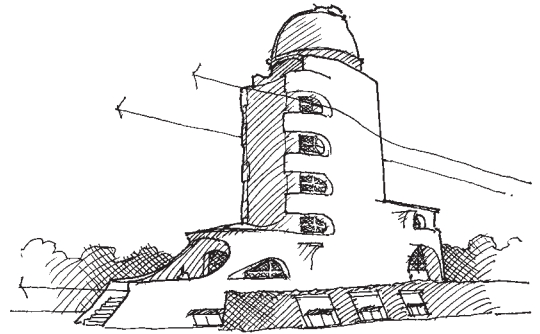


5.31 SOM: Cayan Tower, Dubai, UAE, 2013; Foster + Partners: 30 St. Mary Axe ("The Gherkin"), London, 2003.

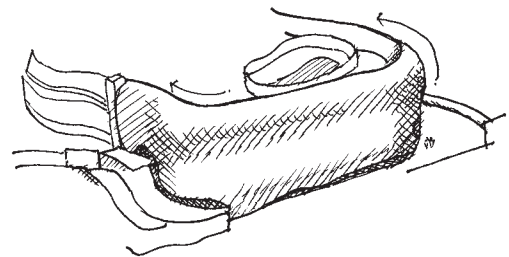
of subtractive removal by a scouring away than of a lateral distortion, oddly recalling the faces of astronauts distorted by high-g forces.

More recently, “blobitecture” has been one unrefined term for a range of work seizing on the potential of the computer to quantify continuously deforming closed-curved surfaces that may have few or no edges or symmetries. The *Kunsthaus* in Graz and Selfridge’s in Birmingham are among the more highly visible examples of an approach that varies in its applications from the ingenious to the faddish (5.33; 5.34). While Selfridge’s department store addition is basically an ambitious multicurveded cladding—sort of a rug of innumerable spun aluminum discs thrown against the building—the *Kunsthaus* is a more fully formed volume. Unnervingly suggestive of a huge stomach, it features another pixilated cladding, self-illuminated in this case. Such projects are characterized less by imagery of windward distortion as by a sense of tension and compression working together on the volume as if it were a lump of clay, in conjunction with the impression of inflationary forces from within. The geodesic dome as well as inflated membrane structures are forbears of these projects, both formally and structurally. Selfridge’s foreshadows later projects that feature irregularly “draped” surfaces, either as the spatial enclosure itself or acting as a configured quasi-planar surface in conjunction with other enclosures.

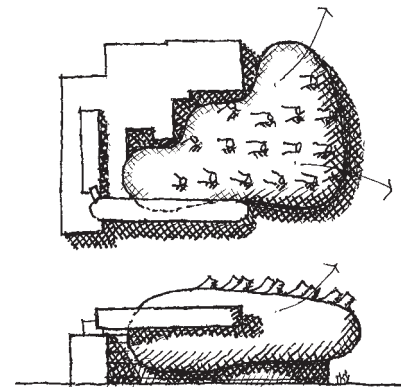
A subset of this type sees the expansion of the small increments of triangulated surface that are sometimes used to aggregate and define such biomorphic projects—and that make up the regularized precedent of the geodesic dome—into larger ones, resulting in assemblages of irregular polygons defining indents and projections. There may be little or no evidence of an “originating” orthogonal element having been involved. The paired volumes of Hadid’s Guangzhou Opera House appear to lean into the wind, which seems in turn to have eased the edges of their polygonal junctions (5.35). The architect’s image is said to have involved river-smoothed stones and



5.32 Erich Mendelsohn: Einstein Tower, Potsdam, Germany, 1921.



5.33 Future Systems: Selfridges Building, Birmingham, England, 2003.



5.34 Cook & Fournier: *Kunsthaus* Graz, Austria, 2003.

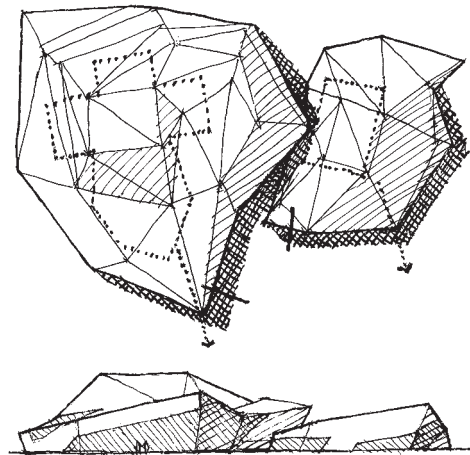
eroded river valleys, though from some vantage points the oddly configured glazed areas tend to give an impression of lunging sharks baring their teeth.

Dealing with an even larger singular volume, Coop Himmelb(l)au's Dalian Conference Center applies parametric iterations to interweave serried openings into the exterior skin, the whole an assemblage of linear panels (5.36). The enormous flattened volume, its deeply returned soffits giving a floating appearance from some vantage points, intermixes a confused array of biomorphically curved and faceted surfaces, leaving an impression of conflict between the variegated and complex interior program and an unachieved goal of UFO-like sleekness. Such cases can seem to strain at their leashes, striving to be both unitary and diversified, resolved and complex—disdaining the unitary, planar or orthogonal but often failing to find another way that is convincing.

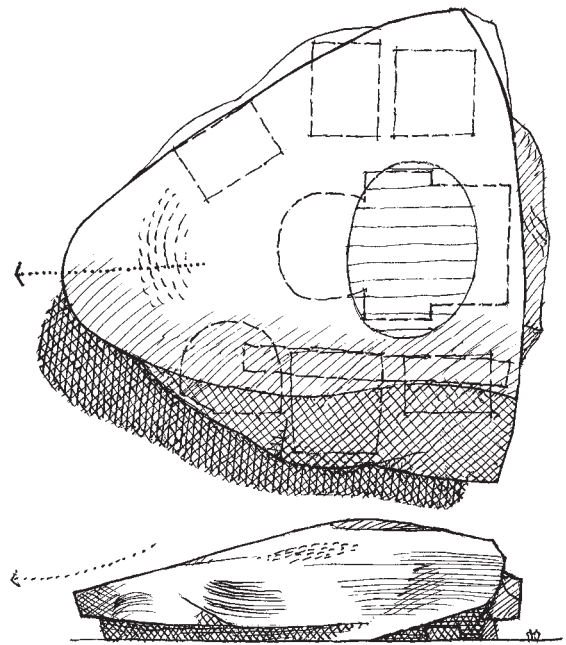
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Experiments with non-orthogonal geometries and approaches to complex curvature are benefiting from ever-expanding computing capabilities. But the computer doesn't correspondingly convey the discernment needed to achieve convincing results. (Indeed we have entered an era when positive descriptors such as "beneficial," "pleasing," "convincing," etc., seem oddly quaint.) Arguable cases of questionable judgment could include:

- awkward faceting in attempts to approximate complex curvatures;
- uncomfortably abrupt junctures of straight and curved geometries;
- stretched "bubble-gum" networks entraining deformed ovoid surfaces or openings;



5.35 Zaha Hadid: Guangzhou Opera House, China, 2010.



5.36 Coop Himmelb(l)au: Dalian International Conference Center, China, 2012.

- seemingly deliberate efforts to obfuscate the horizontal as if to induce vertigo in the observer and user.

Desirable goals arising from these newfound tools and freedoms, such as the acumen and capability of achieving sensitive design, are clearly works in progress.

Explosive

While most of these approaches to deformation have involved the effects of external forces—pushing or pulling as the case may be—a remaining type involves forces emerging from *within* the building. The “inflated” aspect of some biomorphic works hints at this ultimate manifestation of deformation as a mode of forming.

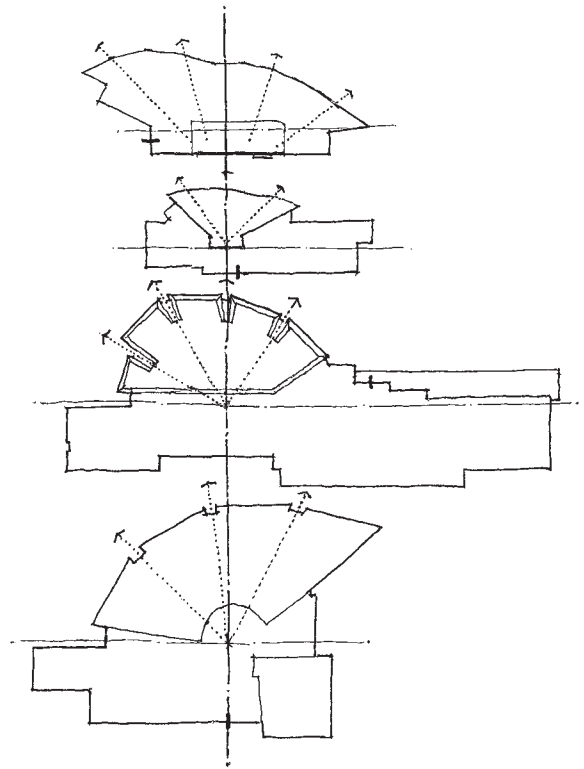
Directional

The expression of directional outward pressure is Aalto’s signature motif, and his series of libraries—for Seinäjoki and Rovaniemi in Finland and Mount Angel Benedictine College in Oregon—is a well-known sequence of variations on this same theme, involving an unassuming spine which sprouts an eruption or herniation at the main reading/stack area (5.37). Aalto had famously exploited the characteristic fan shape of assembly spaces in his many theater and auditorium projects, making the motif his own in the process, and seized upon the desirability of lines-of-sight to a central surveillance desk in his library projects as a justification for the fan’s reappearance in this different guise. The asymmetrical, billowing volumes have sufficient articulation in plan and elevation that, despite a continuity of cladding treatments, their formative origin is ambiguous: one may perceive either a localized but contiguous perturbation of the initiating spine, or a collusive addition of separate spine and fan elements.

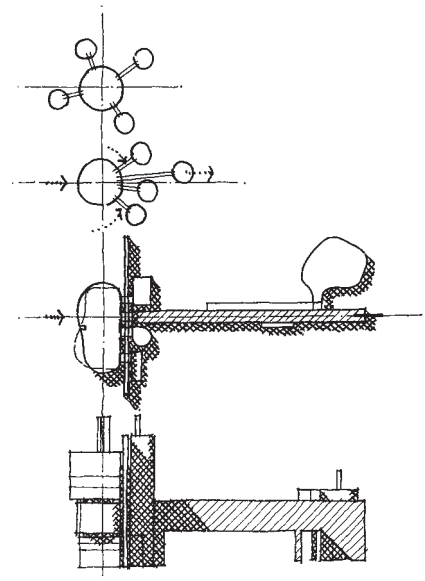
At Bremen's Neue Vahr apartments, the streamlined asymmetry of the fan resembles that of the slightly later Seinajoki design, but the functional rationale differs: here the radial geometry is justified on the grounds of the wider exterior exposure it affords each unit. The spine has dwindled to a compact orthogonal armature from which the radiating apartments spring directly. Owing to this tighter-knit junction of the two parts, as well as the similarity of their exterior treatment, the reading of an explosive outward distension is especially strong.

The explosive analogy is not the whole story, for the particular shape of the fan element at Neue Vahr and the libraries reveals the presence of a secondary countervailing force. An opposing deformation flattens the overall form, sometimes to the extent of breaking the continuity of the perimeter curve, while it simultaneously attenuates and sharpens the outer extremities. There is the sense of a "headwind" or a quasi-inertial effect acting at cross-purposes to the forces of expansion, with an irregular resultant shape as the characteristic outcome. Alternatively the headwind effect could be read as an erosive force producing the flattened asymmetries by subtraction, or the differential restraint of outward expansion could be read as an *internal* phenomenon having to do with grain or striation, but the general image of a frontal external resistance seems to predominate, constituting a secondary factor of *compressive* deformation. The image of windward distortion recalls aspects of the Einstein Tower.

- As a pertinent sidebar, Hedjuk's Wall House II reveals an arguably central role played by such "headwind pressure" in its idiosyncratic configuration (5.38). A case can be made that the design's initiating concept is a central node with radially linked subsidiary elements, but altered by metaphors of deformative headwind and/or subtractive erosion. These displace the subsidiary elements to one side and scour the stacked



5.37 Alvar Aalto: Neue Vahr apartments, Bremen Germany, 1958; Library, Seinäjoki, Finland, 1965; Library, Rovaniemi, Finland, 1968; Library, Mount Angel Abbey, Oregon, 1970.



5.38 John Hedjuk: Wall House II/Bye house (unbuilt), Ridgefield, CT, 1973. Built, Groningen, Netherlands, 2001.

“windward” elements, and one link is stretched longitudinally to become an elongated buttress for the anomalous intervention of the freestanding wall.

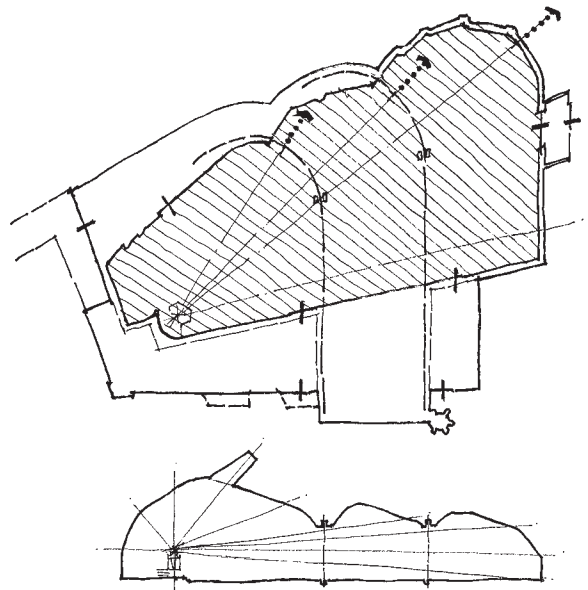
While its design precedes that of the above projects by Aalto, his Church of the Three Crosses at Vuoksenniska extends their image of outward distension still further (5.39). The spine has dwindled to become a more suppressed and secondary wrapping comprised of lower elements, and the contrast between the orthogonal and the explosive is embodied within the main volume itself. To an extent not found in the libraries, the volumetric distension is strongly expressed both in plan and section. An intuitive approach to acoustic issues as well as a need for subdivision of the auditorium suggested the elaborately forced but inspired formative rationale, the two cinched-back conditions resulting in not one but three inflated volumes in succession. The lectern acts not only as the point of origin for the radiating force—now the force of speech—but as an anchor for the entire combined volume.

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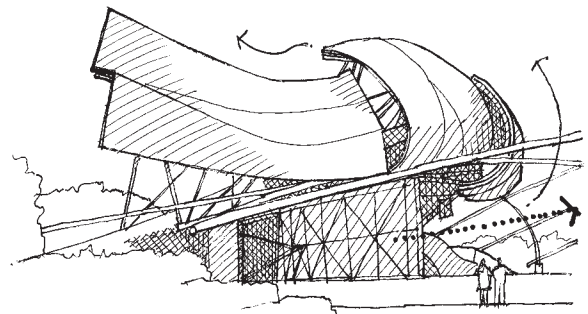
The imagery in these Aalto works is abstract, comprising variations on his recurring fan theme and certainly lacking significant violent expressiveness that the explosive terminology may imply. A more directly evocative use of such imagery appears at Gehry’s Millennium Park bandshell and its “headdress” (5.40). Perhaps an ideal application, for once, of the architect’s signature compositional use of curved stainless steel-clad sails, these structures splay to the sides and fly up in convex curves overhead as if blown open by acoustic forces emerging from the stage.

Omnidirectional

The scope of explosive deformation may expand to an omnidirectional expression, a device used by Kahn in a number of projects. In his Goldenberg house design,



5.39 Alvar Aalto: Church of the Three Crosses, Vuoksenniska (Imatra), Finland, 1958.



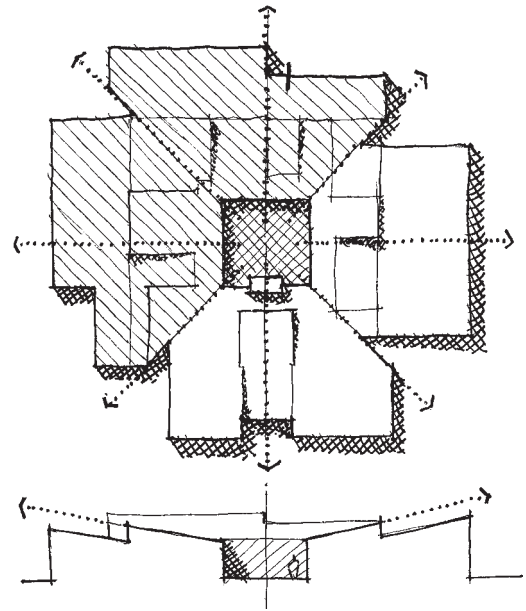
5.40 Frank Gehry: Millennium Park Amphitheater, Chicago, 2004.

a central plan is articulated into a number of radiating elements which extend outward in all directions to varying degrees as a function of programmatic requirements, and the result is unusually evocative of an uneven—and therefore dynamic and energized—explosive pressure radiating from the calm center to the jagged periphery (5.41). The section expands as well, upward from the center, to substantially reinforce the image; a more conventionally hipped roof, dropping to a low eave at the periphery, would have had a damping effect.

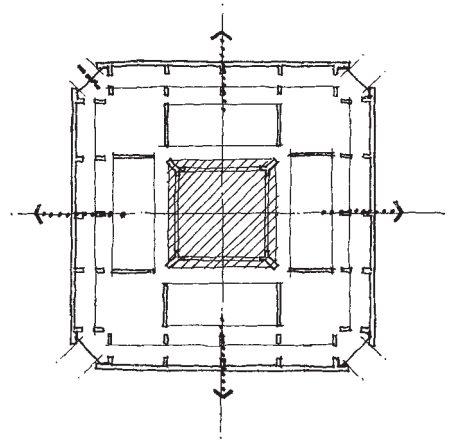
His Exeter library—superficially at rest, its Janus-faces presenting the same visage from four approaches—also exhibits a pressurized energy that counteracts the grave weightiness of its gradated brick exteriors (5.42). This is manifest at the open corners, where gaps between these adjoining walls are bridged by taut spandrels. Each of the four walls is, in fact, the outer portion of a cage of brick beam, pier and wall members, which forms in turn the outermost of the several concentric replicative shells. While the architect himself refers to the brick structure as a doughnut,⁵ each of the four portions is separated from those adjoining by slight gaps at the diagonals: the four “cages” are pushed apart in a gesture palpably expressive of omnidirectional outward forces, visually held in check by the diagonal spandrels. As opposed to the chamfered corner subtractions they may superficially resemble, the open corners are neither additive nor subtractive, but artifacts of internal form “stresses” seeking to push the components apart.

Taken more literally yet, “explosive” implies a flying apart into pieces in all directions. Gehry again provides a pertinent scheme: LA’s Disney Hall appears as an aggregation of volumes floating above the datum of the street and departing from each other in space, their warped, gapped and outwardly tilted surfaces indeed expressive of a measure of omnidirectional outward force and movement (5.43). This sense of

5. William Marlin, “Within the Folds of Construction,” *Architectural Forum* 140 (October 1973): 33.



5.41 Louis I. Kahn Goldenberg house (unbuilt), Montgomery County, PA, 1959.



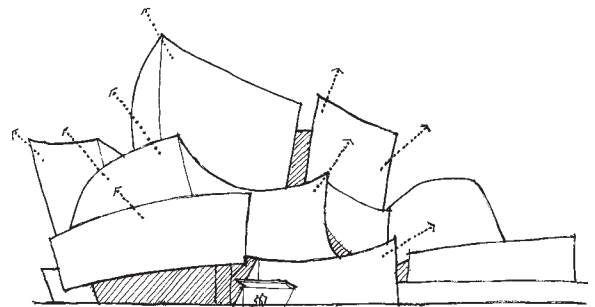
5.42 Louis I. Kahn: Phillips Exeter Academy Library. Exeter, NH, 1971.

floating apart recalls the initial additive mode of elements adjoining, but here in a scenographic rather than literally separated ensemble, and dominated by the conformational implications of explosive deformation. The architect has stated “the shapes of the exterior are based on sailing—wing on wing—.”⁶

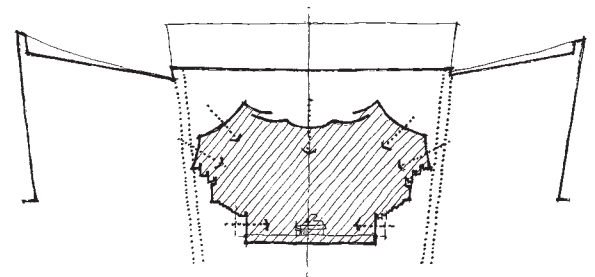
Implosive

A move to the interior at Disney Hall reverses the thrust of expression to one of implosion: the catenaries overhead and the convex faces of audience containers are palpably drawn inward and downward, toward the focal point of conductor or soloist (5.44). It has been stated that this centerpiece of the building’s interior was designed to represent the hull of a boat.⁷ Both sets of devices—the “implosive” and the “explosive”—serve to partially obscure the straight-sided oblong box that is the true structural container for the music hall as well as its primary acoustic definer, derived from the time-honored “shoebox” proportions of 19th century halls.

Le Corbusier also turned the explosive image on its head at Notre Dame du Haut (5.45). The chapel’s rear exposures present gently convex faces, working with the re-entrant depths at the entrances and the depth dimensions of the contiguous towers to suggest implacable thickness and solidity. But the more public outlooks tell a different story, where the two concave wall faces appear drawn inward from an initiating position at the rim of the roof element, as if the exterior were once conventionally monolithic on all sides but deformed under stress on these exposures. The monolithic exterior presented on the convex sides is breached here at the deeply revealed vertical separations, as well as at the thin gaps at the roof soffit signaling a discontinuity between the wall and roof elements. While it is possible to interpret the recessed concavity of these walls as an evocation of compressive



5.43 Frank Gehry: Walt Disney Concert Hall, Los Angeles, 2003.

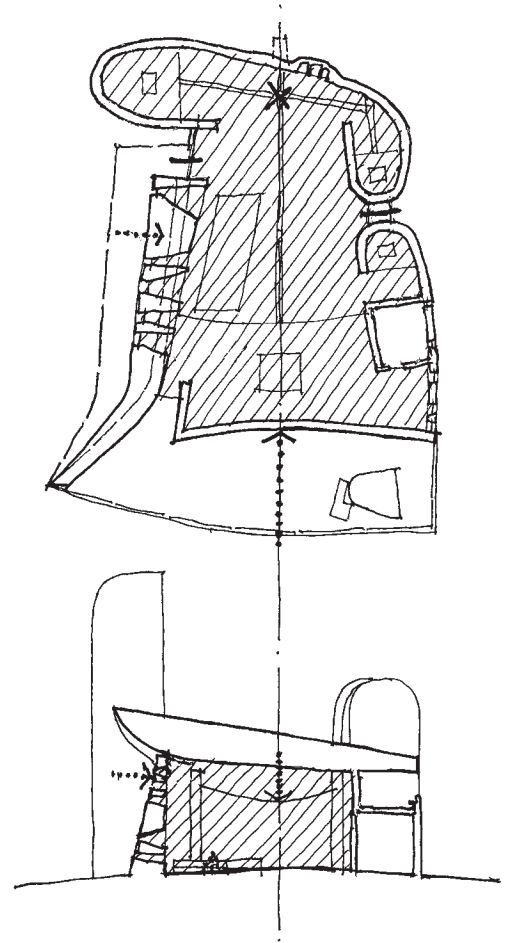


5.44 Walt Disney Concert Hall: transverse section.

6. YouTube: 2009 talk by Frank Gehry.

7. en.wikiarquitectura.com.

external forces—as of the “pressure” of arrivals at the entry or of crowds facing the exterior chancel—the roof element itself tips the balance in favor of an implosive interpretation. The complex roof form, while maintaining a sturdy profile above the altar, deforms inward and downward along its longitudinal axis; toward the rear it has been pulled down into a dramatically depressed pendant form as seen from the church interior. The thick embrasured wall reinforces the image, in ways which differ on its two exposures: from the exterior it seems to have been sucked in at the top while held fast at its foundation, tilting in to reveal a swath of curved soffit, while on the inside the now exposed depths of the embrasures are expressive of an ironic massiveness. The roof is being sucked down overhead, and the wall, despite its muscular thickness, does not restrain it; the thin glazed reveals removes any plausible reading that the walls are buttressing or restraining the roof. The imagery of implosion culminates midway between the entrances as the rear of the interior is approached, where the paving pattern marks a cross axis between two of the chapels. While this area appears compressed by the deeply bowed ceiling when seen from the chancel area—a sensation reinforced by the false perspective of the converging sidewalls—the effect is reversed in a dramatic transmutation when one looks back from this point: the inward rush of implied forces seems to resolve itself at this calm focus, from which the impression is now one of quiet, radiating expansiveness.



5.45 Le Corbusier: *Notre Dame du Haut*, Ronchamp, France, 1954.

Chapter Six

DIMENSIONALITIES

In the same way that one particular *formative* mode generally dominates in a given design, a single mode of *dimensionality* usually retains dominance as well. Architecture having largely to do with shelter as encapsulation, the most prevalent mode of dimensionality is the *volumetric*, and the preceding chapters have largely centered on cases where this is the dominant mode. But *planar* and *linear* morphologies also have their place.

This would be an oxymoron if architectural form were always characterized by space and mass, neither of which is the case with true planar or linear figures! But some less literal-minded distinctions that will be ascribed among these three dimensionalities are central to an understanding of the varied ways and means that forming is achieved, on the evidence of built work through history and the present. Although planar and linear form commonly participate in supporting roles to the volumetric, they may also *predominate* in a given scheme, and in fact some cases are characterized by two or even three modes of dimensionality participating coequally.

“Planar form” may refer to thin membranes of construction, possessing some necessary physical

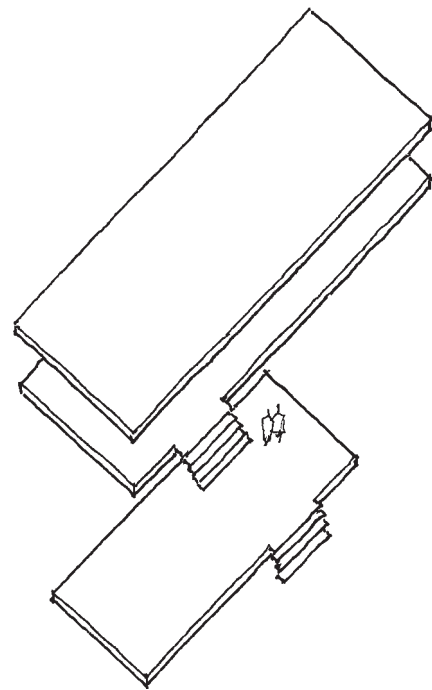
thickness yet clearly intended to be perceived as “planar” in the conventional architectonic sense. But it may also refer to constructs that, while habitable in scale, have an overall proportion that seems more deserving of the planar identifier than the volumetric. “Linear form” is limited to the latter case: constructs that are habitable, but characterized by unusual elongation, such that it doesn’t seem fitting to characterize them as either volumetric or planar in dimensionality.

As opposed to addressing them in piecemeal asides throughout the preceding discussions, cases of these special modes of dimensionality have been gathered together to be dealt with here in an integrated way. The focus of this chapter will be on applications of *one or another* of the formative modes—addition, replication, subtraction, or deformation—in order to keep the playing field simple and allow the issues of dimensionality to dominate with clarity. When *two or more* of these formative modes are employed, a “hybrid” scheme results, and permutations of both dimensional *and* formative modes arise. Implications and examples of this more complex set of possible conditions are addressed separately in the next chapter.

Again, while the whole of the preceding narrative has centered on issues and cases where volumetric forming largely predominates, this discussion will serve to continue on from that first and most prevalent type to address the other dimensionalities, each case being under the impact of a single dominating formative mode. And dimensionalities occurring in *coequal combinations* will also be addressed—including combinations that feature the volumetric among them.

Planar

Although any given initiating volume with corners and edges could be interpreted as an assemblage of boundary planes, such a reading is often a forced one,



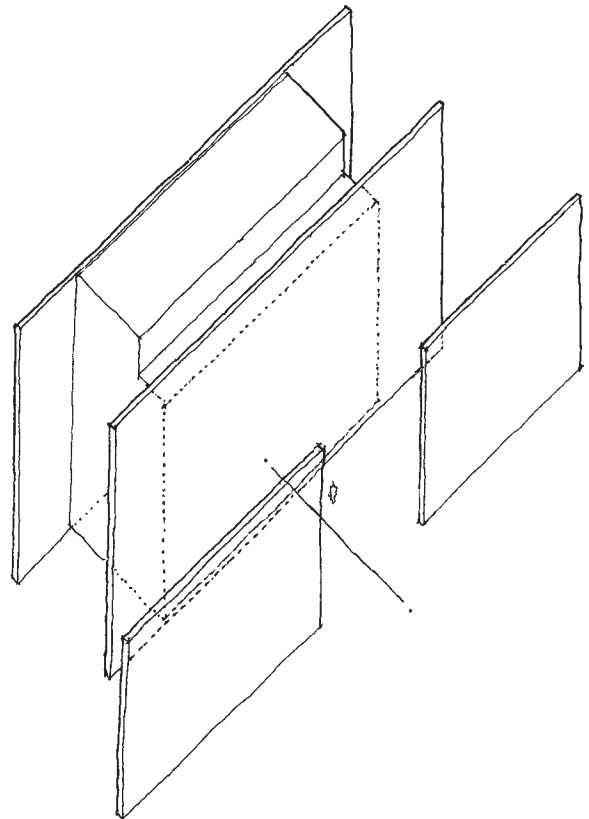
6.1 Ludwig Mies van der Rohe: Farnsworth house, Plano, Il, 1951.

the intrinsically volumetric nature of architecture tending naturally to dominate. Notwithstanding, the plane as a separately expressed element in the composition can be central to the distinctive nature of modernism in architecture, and indeed many of the cases that have been discussed above incorporate independent planar elements, though generally cast in supporting or enhancing roles. But there are designs, among them landmarks of the modern era, which are comprised *predominantly* of planar elements, configured by the influence of formative modes.

Within the additive mode of *adjoining*, there are cases where planar elements serving as walls, roofs, floors, or something in between are brought together as assemblages that preserve their separate entities:

- The conceptual basics of Mies' Farnsworth House come close to reading through if time and light conditions are right: three horizontal planes spaced apart from each other and the ground plane, the roof and floor planes congruent on the Z axis (6.1).
- Nouvel's Cartier Foundation is also based on three spaced planes, but oriented vertically, the seemingly freestanding walls—themselves of glass on steel frameworks—arrayed in a rudimentary case of linear duplication (6.2). The first is a streetwall gateway and windscreen, gapped as if slid apart at the entry axis, while the others receive the building enclosure itself, deeply recessed at the sides and top to foster the impression of weightless planar transparency. As such the volumetric reality of the functioning building is secondary to the planar realities of its concept. When truly planar elements are the dominant forms yet full enclosure is a requisite, such designs inevitably represent an exercise in artful illusion.

When such planar elements are arrayed in perpendicular and *enfaced* relationships, a house of cards can be the outcome. Rietveld's Schroeder House



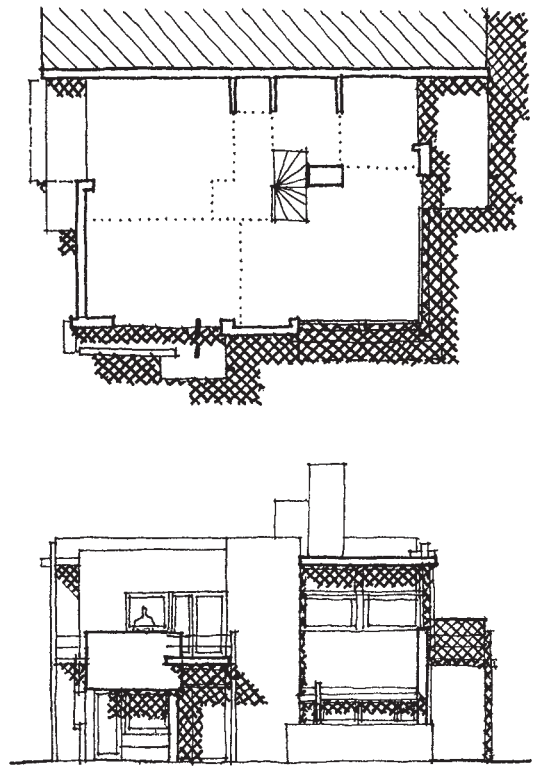
6.2 Jean Nouvel: *Fondation Cartier*, Paris, 1994.

is a clear realization of the elementarist concerns of *Die Stijl* in this regard, and shows the related influence of Wright's efforts toward the "destruction of the box" (6.3). The cubical volume of this small attached townhouse is dematerialized into a juxtaposition of projected and overlapped planes, touching at end junctures or crossing points. Its design vocabulary also includes important secondary contributions by thin linear elements—columns, beams, rails—likewise in an equilibrium of point junctures. The image and parti become a counterpoise of planes and lines, again seeking almost by slight-of-hand to de-emphasize volumetric solidity or enclosure.

If an assemblage of planes is taken to the level of *superposition*, the perpendicular intersecting elements of The Palace Condominiums come to mind (6.4). Although previously noted in a volumetric context, their thin proportions also make them candidates for quasi-planar status. Further additive techniques such as embedding or encapsulation, however, are not applicable in plausible ways to planar architectonic assemblages.

The same lack of utility applies to the other formative modes, when applied individually to "non-habitable" planar constructs: a plane altered by a subtractive gesture remains a plane, and while "bending stresses" may alter planes into L- or U-configurations or other variants which are quasi-space defining, they require the incorporation of further gestures to be habitable.¹ Only by increasing the scale—by admitting thin volumes to quasi-planar status, as

1. Inevitably, the elemental differences of plan and elevational orientation have their effect in such perceptions; Ls or Us in plan define space open to the sky as do fences or walls, whereas these configurations in elevation, featuring a "roof" plane, are more conventionally architectonic. The compromise of glazed infill, as between the superimposed planes of the Farnsworth house, can render the latter habitable, and it is obviously possible, if more problematic, to encapsulate the former as well by extending glazing overhead. The result in both cases partakes of the modernist game of minimizing the dividing line between inside and out. It will be noted that the L or U must be thin to sustain the reading of deformation; as the element increases in thickness, while it may become habitable in and of itself, a zone of formative ambiguity eventually arises, leading in turn to a point where



6.3 Gerrit Rietveld: Schröder House, Utrecht, Netherlands, 1924.

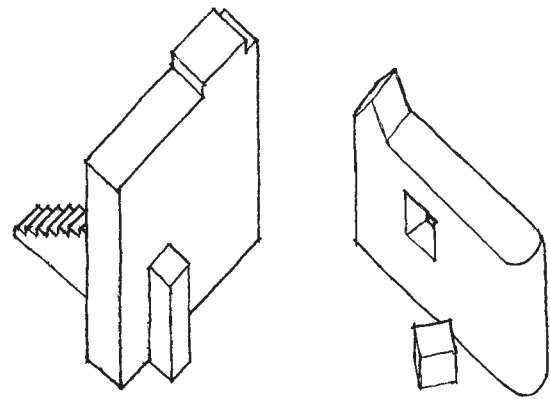
at the Palace Condos—are such formative means again rendered more productive. Thus the slab of the Atlantis, recalling many wall-like buildings that are thin in depth relative to their height and width, may be considered both planar in character and capable of being altered; in this case, by its face-centered *subtractive* gesture. Aalto’s Baker house, wall-like as seen from its riverside exposures, responds with graceful flexibility to the bending *deformations* that subtly imply thinness, as does Erskine’s Byker Wall (6.5; 6.6). One of the most ambitious of modern era wall-buildings, the single-loaded midrise housing structure extends protectively for a remarkable distance alongside an extensive complex of low-rise housing, with deformative bends and breaks occurring in plan and elevation as occasion demands or suggests.

The admission of such habitable elements to planar status raises a matter-of-degree question. While it presents no problem to refer to the floor and roof structures of the Farnsworth as planes despite their actual nature as thin volumes, there is an essentially undefinable dividing line as scale increases, beyond which a plane seems more properly considered a volume regardless of its intrinsic proportions. There is no clear division or rationale short of a pragmatic one to the effect that volumes are normally inhabitable and planes are not. Ultimately the only important distinction—crucial to such arguments concerning perceived formative natures and relationships—is whether an element, regardless of scale, seems wall- or plane-like in shape and architectonic behavior.

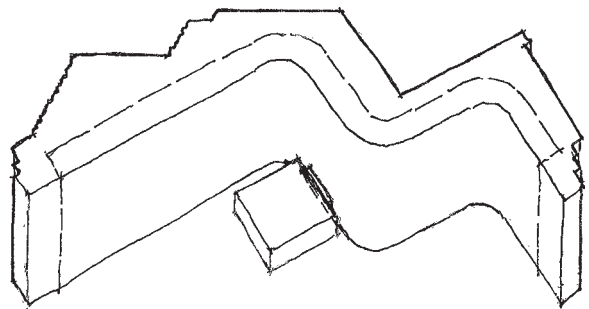
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While a bent plane largely remains just that, a particular means of deformation can nudge a plane further into the ambiguous zone between surface and volume. Tensile membranes or thin-shell surfaces involve the application of *actual* stresses on planar membranes to impose double curvatures, resulting

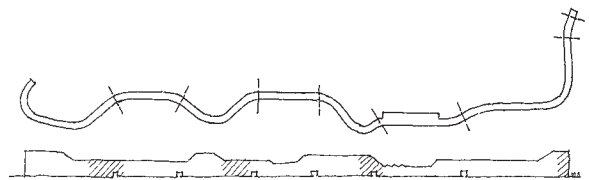
a subtractive reading is more plausible. This sequence was illustrated in the arrays of types presented in the chapter on subtraction.



6.4 Arquitectonica: Palace Condominium, Miami, 1981; Atlantis Condominium, Miami, 1982.



6.5 Alvar Aalto: Baker House, MIT, Cambridge, MA, 1948.



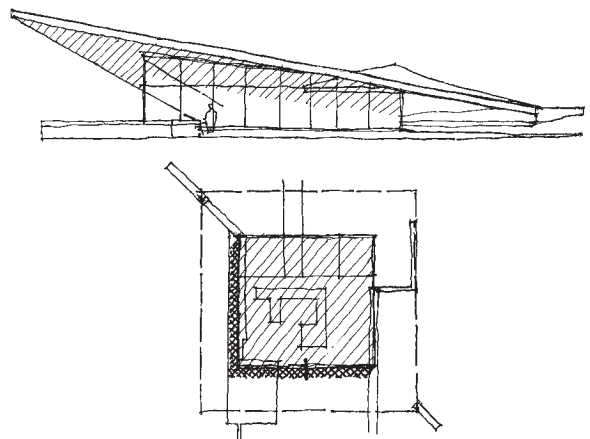
6.6 Ralph Erskine: Byker Wall, Newcastle upon Tyne, England, 1982.

in quasi-planar figures that are two-dimensional yet which can almost appear to occupy three-dimensional space. While such structures may shelter secondary volumetric enclosures, or may themselves be subsidiary features incorporated into larger elements, the simplest case of a freestanding tensile surface embodies a polarity of contrast between the visually weightless membrane and the monolithic solidity of the developed ground plane beneath. Catalano's Raleigh house offered an accomplished version, the inherent oddity of the hyperbolic paraboloid shape ameliorated by the streamlined elongation and minimized curvatures along its axes (6.7). Deformation is the mode involved, via an oppositional synthesis of its tensile and compressive aspects.²

As opposed to such thin-shell structural means, the complex curvatures of Hadid's Heydar Aliyev Cultural Center are defined by a "thick membrane" entailing a sandwich filled with a complex space-framed network (6.8). Clad in elaborately configured white surfaces, its glazed openings are confined to recessed planes of vertical infill thereby avoiding the difficulties of glazed curvatures. Despite the extremes of its morphology, in formative and dimensionality terms it can be interpreted as originating as a planar surface—a "tab" cut and lifted from the ground plane to be altered by several means of deformation. Tension and compression work in tandem to stretch the initiating plane into saddles and arches, bending turns it around and under, and "cuts"—a sort of shear—enable both the major sectoring of the surface as well as two sets of sequential iterations of wavy slots.³ Its flamboyant

2. While such doubly-curved surfaces typically retain a sense of their planar nature, assuming that their boundaries aren't entrained with enclosing surfaces, *singly*-curved surfaces such as domes or vaults—plus some of the unitary cases that have been cited—read as volume definers.

3. The shifts at the cuts recall the treatments at Aalto's Essen project, though the latter is expressive of volumetric shear, while this project is consistently expressive of cuts that are analogous to shear in a planar surface. Though the repetitive motif of the cuts is a significant design feature that could be considered replicative in nature, it is secondary as a formative mode to the noted aspects of deformation.



6.7 Eduardo Catalano: Catalano house, Raleigh, NC, 1954 (Demolished 2001).

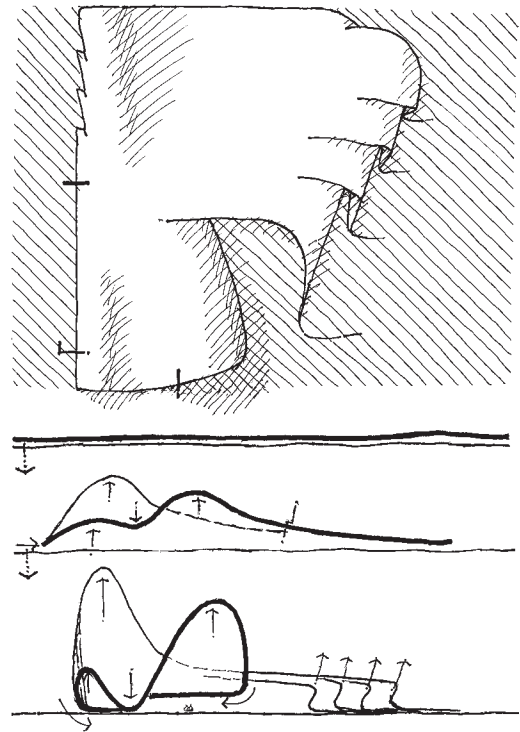
shape comprising large, undifferentiated surfaces of glass and fiberglass-polyester are consequences of a planar surface altered to an extreme degree for experiential effect. The relentlessly white interior plus the ever-shifting curvatures risk disorientation and, ironically, a seeming sense of placelessness. When cost is no object in works aggressively pushing the envelope, these are among the risks.

Volumetric/Planar

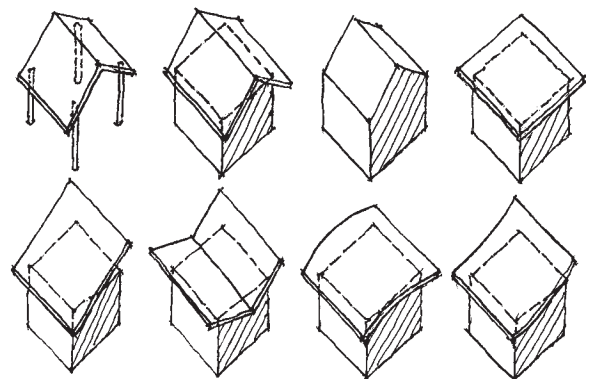
The limitations of such an all-planar vocabulary are clear, but when planes or plane-like elements are employed as equal partners in conjunction with volumes, a far broader architectonic palette is availed for the application of formative modes.⁴ This pairing is embodied by one of the most elemental manifestations of architectonic form, wherein walls define a volume containing warmth and providing security while the roof, a broad surface casting shade and shedding rain, is planar in a diagrammatic sense (6.9). Clearly there is no one “best” model of this type—indigenous structures of the tropics may have no walls, while vernacular buildings of arid or cold regions may be solidly volumetric: that version of the iconic model would see the house form as not two elements but one. It’s fair to say that a common modernist parti comprises a planar roof, flat or slanted, overhanging a sheltered volume below on some or all exposures. Further variants summon up the familiar tropes of butterfly, vaulted, and otherwise reconfigured planar roofs, the ubiquity of such variants coming and going with the trends of the times, as with all modes of forming and dimensionality.

A formative model based on the interaction of planar and volumetric elements has come to play an iconic role in Western architecture. Looking back at cases

4. For a discussion of the development of the wall in modernism leading to its quasi-independence as a primary element in the composition, see the author’s article, “The Wall in Recent Architectural Form: A Pattern of Evolution Toward Autonomy,” *Journal of Architectural Education* 47 (May 1994), pp. 242-257.



6.8 Zaha Hadid: Heydar Aliyev Center, Baku, Azerbaijan, 2012.



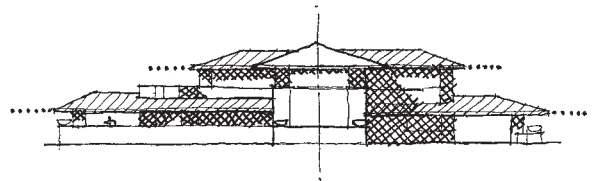
6.9 Vernacular houseform plane/volume types.

employing horizontal planar elements with varied additive modes, Wright's Prairie houses can often be read as volumetric/planar additive schemes involving both collision and separation (6.10). Their lower roofs behave compositionally as planes and engage the volumetric elements collidively—impressions fostered by their elongated proportions, knife-edged profiles and through-passing geometries—while their main roofs are also quasi-planar, their low-slope hipped configurations thinning out to narrow sight-lines at the eaves with deep, flat-soffited overhangs. These aspects, along with ubiquitous sill courses and pier truncations separated from these soffits by bands of glazing, foster a sense of hovering separation between these main roofs and the articulated base volumes below.

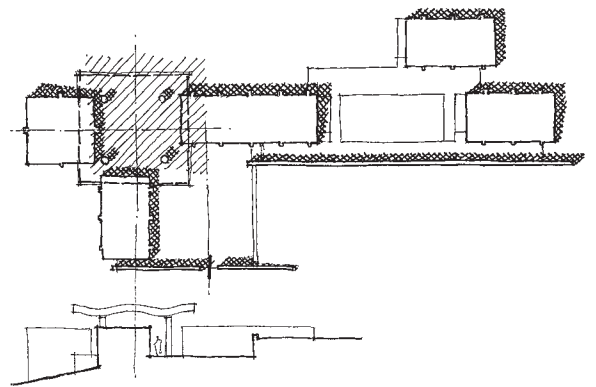
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The vertical analog to such a floating roof plane is the autonomous freestanding wall. Johnson's second Boissonnas House makes effective use of juxtaposed yet physically separated elements, including parallel wall planes that help mark the boundary between public and private realms of the site (6.11). Planar and volumetric elements again work together as equals to establish the overall composition, freestanding volumes working in concert with the walls to subtly and partially define outdoor spaces—one of which is also sheltered by a horizontal planar element, an undulating freestanding canopy defining a phantom room between volumes. The volumes range in proportion from elongated elements that echo the form and alignment of the walls to a square glazed pavilion that terminates this movement, an austere shape vocabulary that leavens the richness of mixed dimensionalities and dispersed composition.

If such vertical planes and volumes are moved together into *enfacing* relationships, the wall plane must extend beyond the appended volume in some way in order to be readily perceived as a separate entity, and this was the case with the elongated frontal wall plane of



6.10 Frank Lloyd Wright: Ward Willits House, Glencoe, IL, 1902.



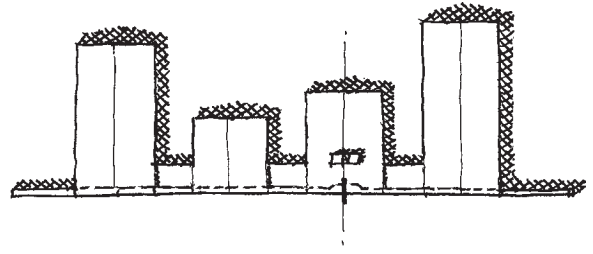
6.11 Philip Johnson: Erik Boissonnas house II, Cap Benat, France, 1964.

Jacobsen’s Putterman house (6.12). A collidive design by Arquitectonica presents a superficially similar order of dominant wall plane with subsidiary volumes, but the scheme is more surreal on two counts: the largely blank armature wall of this bank is actually a twelve-foot wide mid-rise building, something of a stunt attempt to achieve a minimum habitable thickness of profile (6.13). Further, attendant glazed volumes are not appended or enfaced but collided with the wall on both sides, yet each fails to re-emerge on the other side in the expected manner, sinking and disappearing instead into this slightly unnerving architectural black hole.

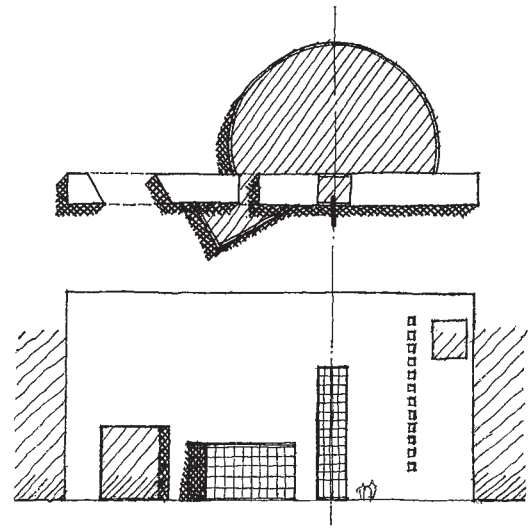
Le Corbusier’s *Cité de Refuge* offers another quasi-planar case, its main housing slab prefiguring his *unités* as well as his Swiss pavilion (6.14). A suave sequential array of frontal elements seems the more fully-formed and the slab the more planar by mutual contrast: in front, a low-rise reception hall volume enfacing the slab is serially linked in turn to a cylindrical lobby, a canopied bridge, and an entrance pavilion adjoining the street. The contrast of scale is as significant as the volumetric/planar contrast, the wall-building serving as a broad backcloth for this forestage “furniture.” An armature wall exhibiting such clear scale predominance represents the closest approach such a quasi-planar element can attain to the condition of encapsulation: while its planarity prevents the actual encapsulation of related volumes, the wall does establish a perceived sphere of influence that extends an indeterminate distance from its faces, subsuming the related smaller-scale elements to a notable degree.

Linear

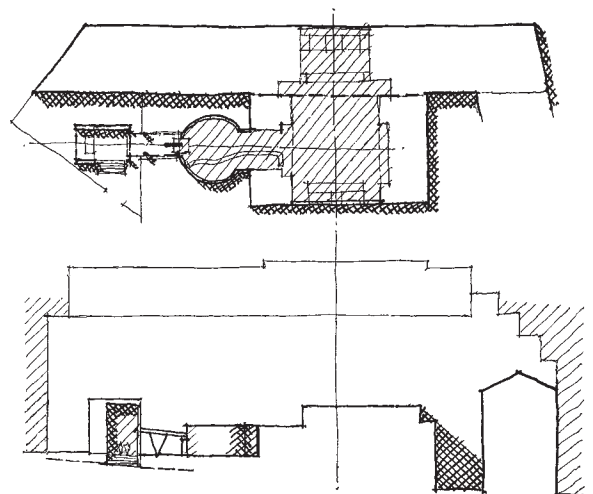
Implicit in this sequence of volumetric to planar, a progression of dimensionalities leads next to the “one-dimensional” world of the linear. While the phrase “linear form” may seem oddly contradictory, it legitimately describes a diverse and useful world of elements in architecture. Beyond the shift in dimensional scope, linear form differs from the planar



6.12 Hugh Newell Jacobsen: Putterman house, Central Pennsylvania, 1980.



6.13 Arquitectonica: Overseas Tower, Miami, 1982.



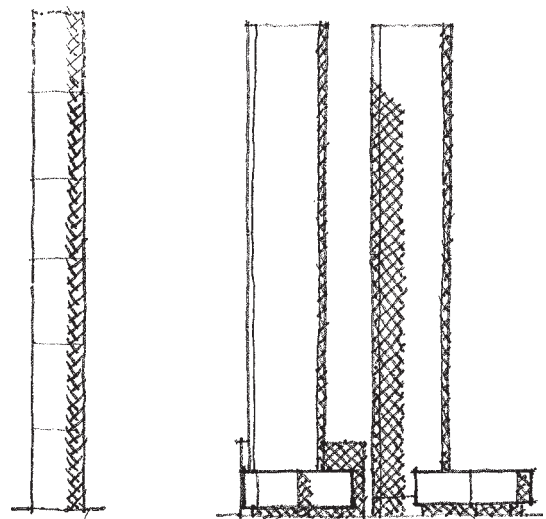
6.14 Le Corbusier & Pierre Jeanneret: *Cité de Refuge*, Paris, 1933.

in another way: while true thin planes can be and are dealt with as elements involved in forming, true thin linear elements devolve to the familiar panoply of linear building components—columns and beams, railings and trims, gutters and downspouts—which are not central to the present arguments.⁵ At habitable scale, conventional hallways are typically linear, but these circulatory systems are also not normally what one would consider elements of linear form. Cases where the built form itself is markedly extended and attenuated—but not flattened into a figure more suitably identified as planar—this is form that is linear in its conceptual nature.

As with the planar case, there is the business of a matter-of-degree: at what point does an extended volume become linear rather than volumetric? When does an attenuated slab-element become more linear than planar? In the latter case it would seem that a wall is a wall, no matter how extended—as well exemplified by the Byker Wall. But the former issue seems best resolved by discerning whether an impression of open-ended continuity resides in the form, along with substantial elongation and a compact cross-section. A manifestation of indefinite extension or continuation would seem the essence of linearity. Clearly there are zones midway among the dimensionalities which are inescapably ambiguous, and such cases are legitimate, often desirable options among the panoply of form choices. But the present arguments deal with the special character of these dimensionalities when relatively clear and indisputable, in so many works that require attention to these distinctions to be best understood.

While elements of linear form appeared in significant secondary roles throughout the cases of the formative modes, and as such were treated integrally in

5. In the present reductive approach to form analysis, columns or piers can be perceived as wall-plane definers as in a colonnade, or a “ghost” volume as a “four-poster”—or may be abstracted away from the reductive form concept altogether as in the floating planes of Mies or Wright. More generally, component elements such as columns and beams, while highly significant to the built and perceived reality of a building, join the rest of the “palimpsest” that must be boiled down in order to uncover a given design’s irreducible formative nature.



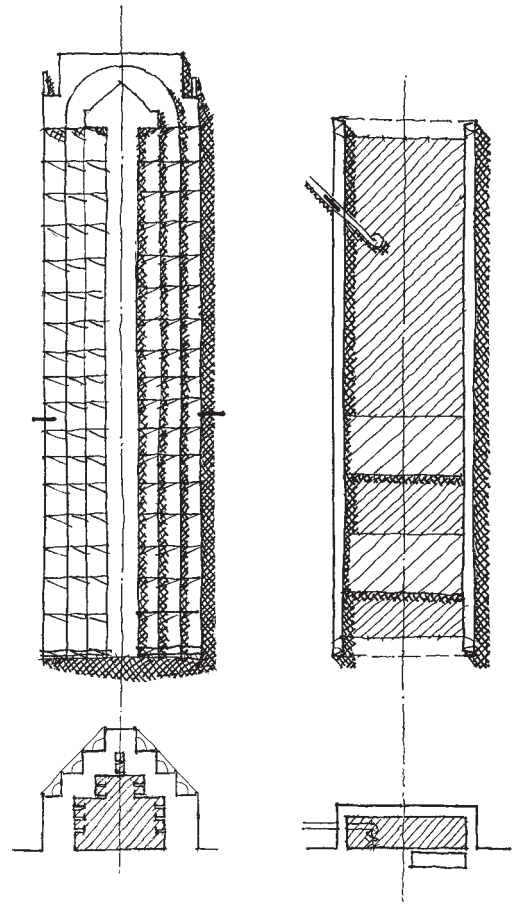
6.15 Jean Nouvel: *Tour Sans Fins* project, 1989; Minoru Yamasaki: World Trade Center, Manhattan, 1977 (destroyed 2001).

those discussions, the present concern is *primary* manifestations of linear form:

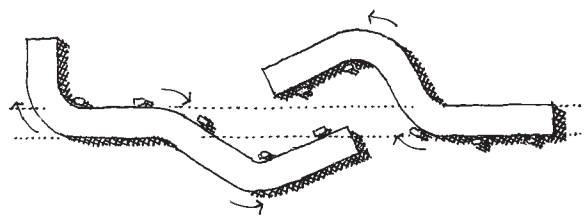
- Attenuated towers such as Nouvel’s *Tour Sans Fins* could be said to exemplify “unitary linear” form, in that they display no overt evidence of formative measures: they are initiating forms of a linear dimensionality.
- With the application of one or another of the formative modes, cases depart from “iconic” linearity while retaining a strongly expressed linear character, as in the replicative twinning of the World Trade Center towers (6.15).
- Both Boston’s Long Wharf and Foster’s Sainsbury Center in England employ subtractive “extrusion” to configure tunnel-like forms, the Sainsbury an especially direct expression with open-ended clarity (6.16).
- Meier’s scheme for Cornell University Housing, while it features secondary additive and subtractive gestures, presents a clear manifestation of deformation in bending imposed on the attenuated segments of its square cross-section (6.17).

Volumetric/Linear

As with volumes and planes in concert, the collaboration of volumetric and linear form is rich and productive. Since the present discussion is limited to one formative mode, and addition or replication are necessary to achieve volumetric/linear interaction, subtraction and deformation essentially fall out. The ubiquitous church and tower, whether superposed, en faced or freestanding, exemplify these paired dimensionalities back through history as noted with respect to the Hawksmoor churches: the naves volumetric, the towers “linear.” And the civic tower—freestanding at the Procuratie Nuove in Venice, partially embedded at the Allegheny County Courthouse, fully integrated at Siena’s Palazzo Pubblico—is an equally familiar application.



6.16 Araldo Cossuta: Long Wharf Marriott Hotel, Boston, 1982; Norman Foster: Sainsbury Center for Visual Arts, Norwich, England, 1978.

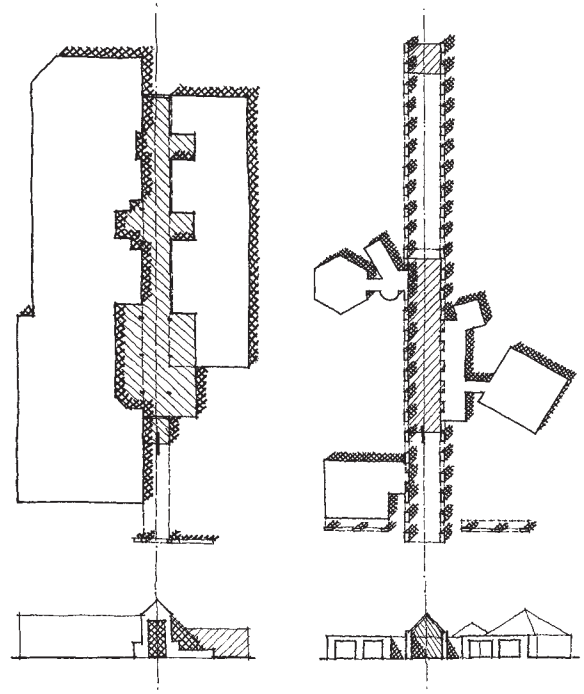


6.17 Richard Meier: Cornell University Undergraduate Housing (unbuilt), Ithaca, NY, 1974.

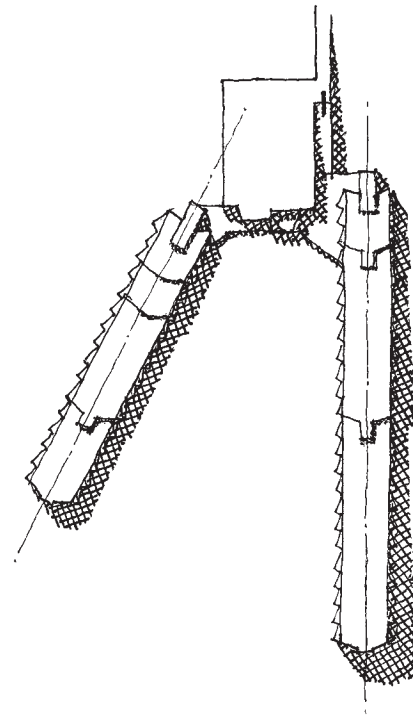
Cases from modern times also ring the changes of one or another additive mode in conjunction with this pairing of dimensionalities, with the linear element either vertically or horizontally featured, as in the following (6.18):

- Stirling's Leicester Engineering Building and Venturi's Columbus Fire Station, while noted as tower/volume pairs demonstrating nominal cases of replication, are also versions of this pairing of dimensionalities.
- Volumes often enface the flanks of a linear spine element. A conference center by Bohlin Cywinski Jackson presents something of a minimized case, its gabled circulation spine flanked by single elongated volumes, while some expressive treatment at the main entrance helps compensate for the simple order of the building.
- At Pelli's conceptual Long Gallery House, the appended flanks are disengaged to become a whimsical variety of scattered room volumes enfacing an elongated and colonnaded circulation spine, plus linking or colliding with each other.
- Stirling's dormitory at St. Andrews reverse the order, with a volumetric element as the focus of splayed linear wings that are hinged at their connecting linkages (6.19). The repetitive aspect of the wings begs the question that this could signal a case of replication, but the asymmetric splay and differing lengths tip the balance to an interpretation as a skewed grouping of linear elements that are not clearly duplicates.

The interaction of volumetric and linear dimensionalities clearly has to do with either programmatic differences that demand both types of elements, or with organizational issues that result in linear spine elements linking with co-equally important volumes.



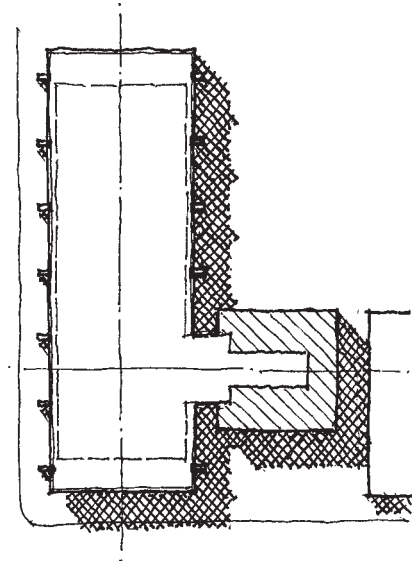
6.18 Bohlin Cywinski Jackson: Luzerne County Community College Conference Center, Nanticoke, PA, 1981; César Pelli: Long Gallery House (project), 1980. A house based in part on this design was built in Maryland in 1989.



6.19 James Stirling: Andrew Melville Hall, University of St. Andrews, Scotland, 1967.

Planar/Linear

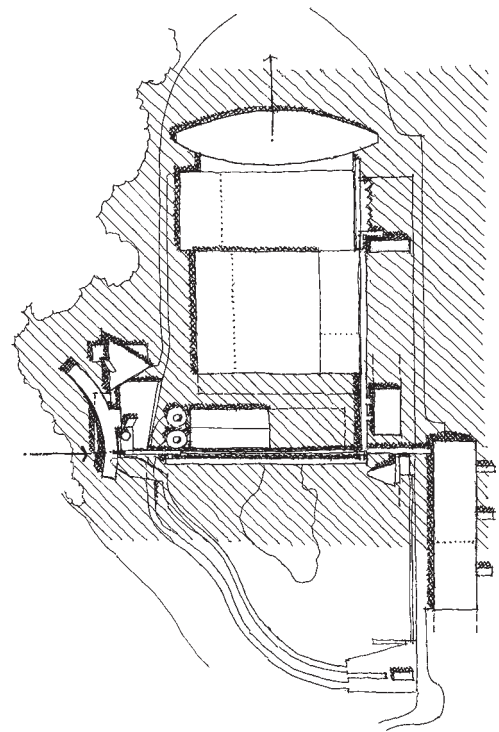
The planar/linear ensemble comes of age with the proliferation of the thin slab as an approach to high-density commercial and residential design, wherein services are pulled outboard to form linked or en faced “vertically linear” towers. SOM’s Inland Steel Building is an elegant example (6.20). Some of Stirling’s early works, not to mention Le Corbusier’s Swiss Pavilion, may appear at a glance to epitomize this type with their thin room buildings and stair tower anchorages—the latter particularly so given the clarity of the room slab and stair tower ensemble—but this disregards crucial aspects of its ground level commons building. These seminal projects are more complex both in forming modes and dimensionalities, properly appearing in discussions to come.



6.20 SOM: Inland Steel Building, Chicago, 1957.

Volumetric/Planar/Linear

Stirling & Wilford’s factory and distribution center for Braun is arguably a comprehensive and suitable cap for Stirling’s career, and accomplishes this with an inimitable additive composition that employs the full range of dimensionalities (6.21). Extended linear links comprise the predominant formative mode, connecting up an ensemble of elements that ranges from a broad quasi-planar pancake of distribution buildings to inventive and variegated volumes serving the several functions of a self-contained production community. The firm’s signature interplay of confidence and ambiguity prevails. The elongated elbow of enclosed linking bridges serves an important space-defining function, helping to delineate pastoral open spaces that also vary ambiguously, in conjunction with adjoining woodlands, from contained to expansive. Formative modes are ambiguous as well: the administration building—elongated to an extent that it is “linear” in plan but less so in its rather husky reality—has a curved profile that may or may not evoke the deformative mode of bending, since its place in its own ensemble of elements—including later additions



6.21 Stirling & Wilford: Braun Headquarters, Melsungen, Germany, 1992.

by Wilford—is so firmly and solidly expressed. That said, the Braun complex as a whole evokes an overall dynamic of kinetic forces: the administration building bows in as if in response to longitudinal forces along the signature bridge, the distribution complex is expressive of axial forces pressing out on the convex “heat shield” of the loading docks, and a knuckle of disparate elements at the junction between them anchors these axial forces. While these curved elements loom large in the composition, they don’t notably signify a major application of deformation: the overall project remains a tour de force expression of additive techniques: adjoining, linking, enfacing, embedding.

Chapter Seven

FORMATIVE HYBRIDS

One of the basic observations thus far holds that many designs are characterized by a single dominant formative mode (with the likelihood that one or more secondary modes are often present in varying degrees). Thus a predominantly additive scheme such as the Moore/Bloomer house can also exhibit some subtractive gestures in its component volumes, and its connective matrix can have a stretched footprint evoking longitudinal deformation. In the case of some designs, however, no one mode clearly takes precedence over others: two or more formative aspects are so basic to the nature of the scheme that their relationship is symbiotic and coequal, constituting *hybrids*. With the various implications of dimensionality now in mind, the task becomes one of investigating how such hybrids may contribute to the realization of formative design, in each of those dimensionalities and their *combined* applications.

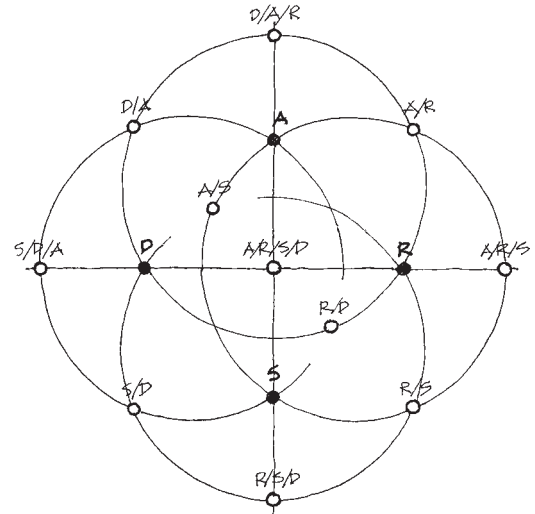
To recap, volumetric modes of forming were addressed in earlier chapters regarding works where one or another mode dominated—just as in the case of the other dimensionalities and their combinations that were then addressed in the preceding chapter. The headings to follow here are the same, *except* for

the addition of an initial heading for “volumetric,” a narrative on volumetric hybrids in order to start again at the outset, so to speak, with this most prevalent of the dimensionalities. While the preceding chapter was focused for clarity on one mode of forming in each case—as was the format of the earlier chapters—the mission here is to deal with the more wide-ranging and complex application of two or more formative modes, acting together to achieve *hybrid* formative designs throughout the *full range* of dimensionalities. Addition, replication, subtraction, and deformation afford combinations of two, three or four formative modes, and these—not to mention the arrays of versions *internal* to each—represent the broad spectrum of such hybrids. A combination diagram illustrates the eleven possible hybrid combinations among those modes (7.1).¹ No attempt has been made to seek out examples for each and every such combination—which would accumulate a very lengthy sidebar somewhat populated with far-fetched or one-of-a-kind schemes—but rather to address the subject with pertinent, plausible cases.

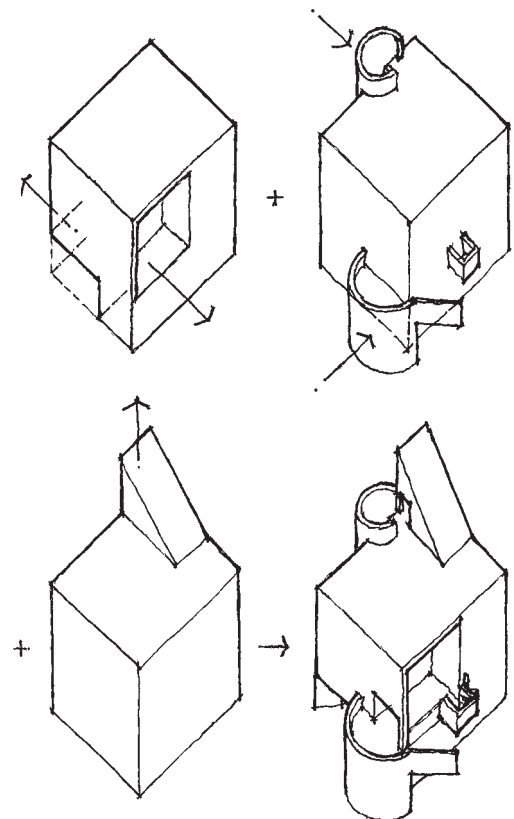
Volumetric

So the narrative returns to the diverse world of volumetric form—not to rehearse again the various modes and means, but to concentrate on cases where *hybrids* of those modes are central:

The Gwathmey Residence and Studio presents a clear give-and-take between gestures of additive volume and subtractive void, acting on the iconic initiating volume of a cube (7.2). These take the form of corner-centered subtractions at adjacent front and rear exposures, each paired interactively with collidive



7.1 Formative mode hybrid combinations.

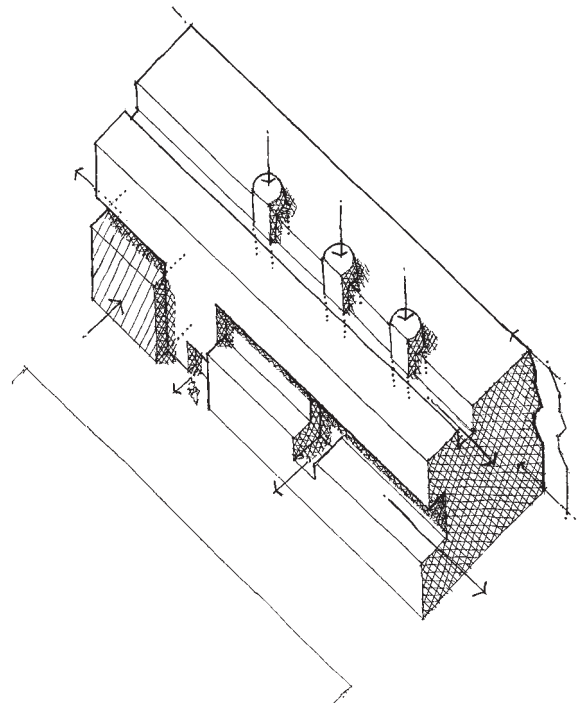


7.2 Charles Gwathmey: Parents' house. Amagansett, NY, 1966.

1. By way of clarification, if two or more sub-types of forming internal to each mode—for example, addition via linear links and addition via embedding—are employed on a particular project, the result remains a case of forming via the single mode of additive means. Only once one or more sub-types from two or more formative modes are employed—such as addition via embedding and deformation via bending—is the result a *formative hybrid*.

additions in the form of the stair tower and the raised deck volumes. But an anomaly remains, as the shed-roofed monitor is not clearly legible as either a subtractive remainder or volumetric addition. This is provisionally resolved if that element is seen instead as a result of *deformation*, the corner isolated by the stair volume stretched or bent upward to form the assertive shed form. If any one of these gestures were missing, the scheme would be markedly diminished: three formative modes are intimately related to effect this exercise in abstract solid/void volumetric manipulation, resulting in what remains one of the most admired and convincing works of the architect.

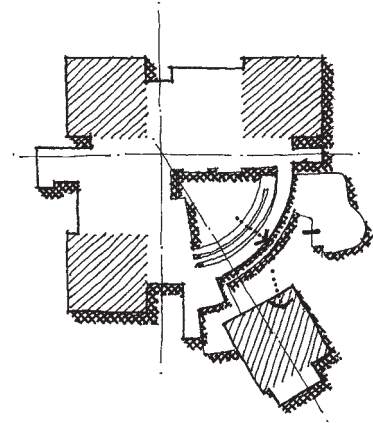
In a very different context that deals with urban as well as historicist issues, Holl's Reid Building of the Glasgow School of Art directly confronts Mackintosh's famed School of Art Building across the street, badly damaged by fire in 2014—so close in footprint and volume as to suggest a case of replication were the exterior treatments not so different. It succeeds in not challenging or overwhelming its predecessor, by virtue of its understated opaque glass cladding and minimized façade treatments, in contrast to the elaborate and inventive stone- and ironwork of Mackintosh's masterwork (7.3). An "extruded" subtractive profile extending across its north face in response to studio exposures contrasts with multiple subtractive excisions at the south. These configure an articulated base that accommodates the entrance, and the "additive" element of a pre-existing building at the end, as well as the integrative factor of full-length continuity at the upper levels. Hollow cylinders (with their linear proportions, an exception to the volumetric theme) pierce the longitudinal centerline as additive elements to bring down natural light and anchor the somewhat amorphous program of studios within. Slippery forward bypassings that flank the entrance seem the only slightly false compositional move. The cladding, its uniform pale gray-blue-green midway between Glasgow's overcast and blue skies, effectively defuses the building's massiveness.



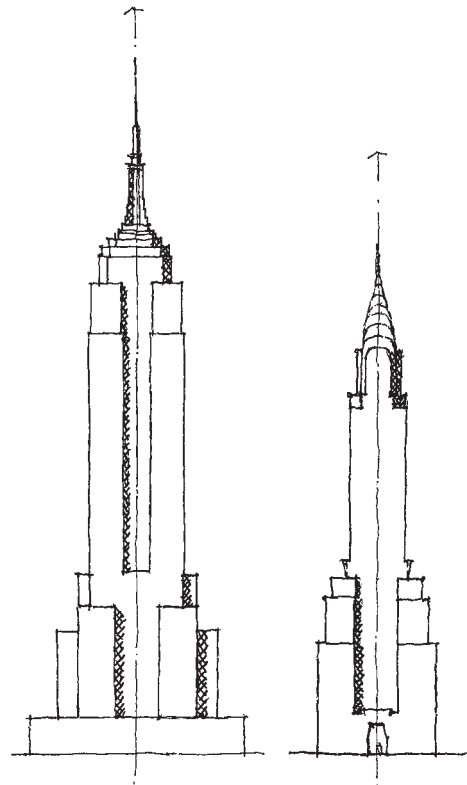
7.3 Steven Holl & JM Architects: Glasgow School of Art: Reid Building, Glasgow, Scotland, 2013.

Replication begins the formative sequence of Meier's High Museum, wherein the influence of his Frankfurt museum design is evident in the four corner pavilions (7.4). A complex "matrix" expands from the center to engage the four pavilions, accommodating a miscellany of smaller display, service, and circulation functions, while also demarcating the hollow top-lit center. In the crucial final step, a sort of tensile exfoliation occurs, superficially reminiscent of explosive deformation but having a different basis: one radial quadrant of the assemblage undergoes contextually induced stresses, and the pavilion housing the auditorium is transitioned radially outward toward the primary pedestrian approach orientation. As if flaked away, the thick shell of subspaces is largely absent on these orientations, revealing the bowed glass wall of the ramps and atrium. This signature form could be said to represent a mediating surface between inner and outer conditions: with the fourth pavilion pulled loose, the matrix boundary is disengaged and appears to spring back through a sort of surface tension, but this motion is in turn resisted by the space-filling energy of the atrium itself as signaled by the convexity of the final volume.

Such high-profile modernist works are hardly the sole protagonists of hybrid volumetric forming. The Empire State Building embodies an urbane integration of formative modes based on an initiating gesture of $2d/\text{inverse regression}$ (7.5). Its nest of tubes is stretched to form the main body of the shaft, while vertical excisions on opposite sides reveal the continuity of the internal shafts, and a deft subtractive composition of lower step-wise elements affords visual weight without becoming too discontinuous or bottom-heavy. Although its block-deep podium is not volumetrically integrated with the shafts above, this disappointment is apparent only from grade level approaches. Atop, successive terminations of the concentric tubes shorten as they approach the transition to the pinnacle at the observation deck level, where the sequence elegantly reverses itself, in



7.4 Richard Meier: High Museum, Atlanta, GA, 1983 (subsequent additions not shown).



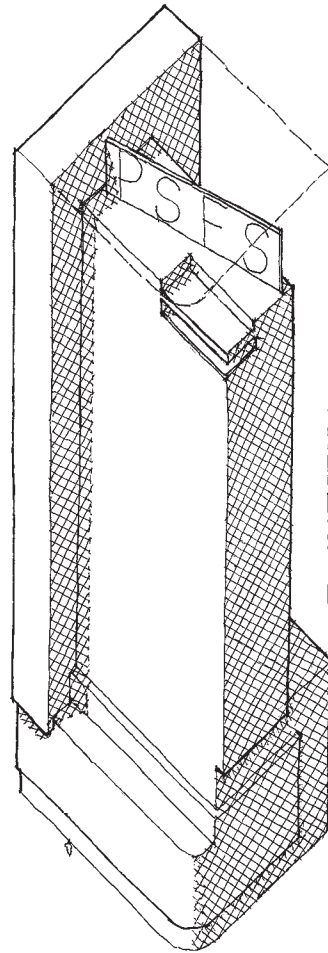
7.5 Shreve, Lamb & Harmon: Empires State Building, Manhattan, 1931; William Van Alen: Chrysler Building, Manhattan, 1930.

another exercise in 2d/inverse regression that stretches out to the media antenna's ultimate extension.

Its sister project, the Chrysler Building, shares many of the same characteristics, but the lower stories are less artfully integrated, being a simple wedding cake on three exposures. A nearly full-height excision at the entrance exposure affords some tenuous integration. The composition of its summit, more fully incorporated into the building's overall massing than the Empire State's, is itself yet another 2d/inverse variant. Celebrated for taking off into a flamboyant tensilely deformed nest of halos in a race to be the world's tallest, it shortly had that honor taken by the Empire State. These iconic towers compare favorably with the stretched-pyramidal and conical unitary designs, not to mention with ubiquitous flat-topped rectangular towers: their closely considered pinnacle developments, encompassing integrated compositions of expressively configured terminations and aspirational spires, exemplify something of a lost art in comparison to schemes based more literally on an invariant tapering to a point.

* * *

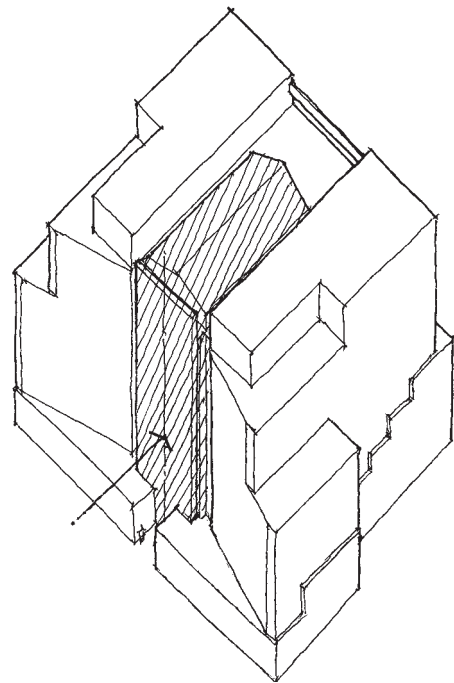
Regardless of their varied approaches, these hybrid cases present relatively clear and unambiguous applications of the several formative modes. But sometimes an uncertainty can prevail. Howe and Lescaze's PSFS Building is a case in point, for depending on where one's attention is initially focused, the overall design presents conflicting additive and subtractive interpretations (7.6). At a cursory glance, the site-filling base with its eased corner appears to define an initiating volume with subtractive cutouts at differing heights on flanking exposures. But several nonconforming gestures add a shadow of a doubt: two street-facing end exposures cantilever forward from the defining profile of the base, and at the top the upright of the tower's remnant "T" stops well shy of its crossbar. Yet despite these clues suggesting an additive interpretation of multiple



7.6 Howe & Lescaze: PSFS Building, Philadelphia, PA, 1982 (Now the Loews Philadelphia Hotel).

notched and en faced volumes, the overall impression arguably favors the reading of a monolithic overall volume with subtractive removals, the additive aspects contributing as secondary enhancements. This mix of clues reflects, in part, the building's important role in 1929 as a bridge to the fuller development of the modern movement, a role embodied in its remnants of symmetry, the conservatism of its gestures, and their ambiguities, seeming a fulsome attempt to bring all the tricks to the table for the project's benefit. Ultimately these aspects enhance rather than detract from the building's substantial appeal with both dignity and flair.

In contrast to the consistent aesthetic emerging at PSFS, KPF's Hercules building is a complex artifact of a period when modernism and a tweaked historicism were sometimes conflated in a single project (7.7). Its cuboid glass volume rises from the shell of a lowrise stone-clad quasi-historicist base, ironically recalling numerous insensitive actual demolition/additions to buildings of the past that outlived the property value of their sites. In formative terms, various anomalies signify the imposition of a lateral incident force, with resulting deformations primarily affecting the "soft interior" rather than reshaping the overall volume. The atrium void, defined by ghosted sidewalls and the en faced endwall element, seems to have been inserted into the initially monolithic building mass. This is not a case of additive superposition, for there is none of the mutual overlap that typically characterizes that approach; here the impacting element has done the taking, with the chunky main mass a passive receiver. A prominent clue for this reading is the inward cant of the frontal surfaces flanking the axial junction, acting in conjunction with the tautness of the curtainwall to reinforce the impression of a wall surface deformed and ultimately breached. As a result the atrium is unusually expressive of what such elements often are: a cyst of encapsulated exterior space, but emplaced by pushing into the building and compressively deforming the hypothetical initiating square footprint into a U. Emphatic centerline markers—interior

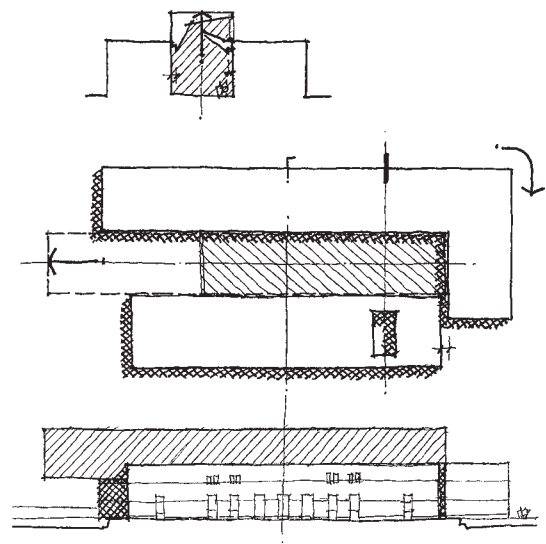


7.7 KPF: Hercules Headquarters, Wilmington, DE, 1983.

and exterior, in plan and elevation—underscore the directional axuality of such a reading. The exterior receives its share of the “damage” as well, for in addition to the inward cants, glazed sidewalls have rippled in massively scaled stair-steps, and the stone base steps up and down in an evocative if clumsy subtractive gesture.

Aspects of kinetic imagery also join the fray at Philadelphia’s Barnes Foundation, based on an ensemble of three beam-like forms arrayed side-by-side in close parallel order, arguably a case of linear duplication (7.8). But the middle form has been repurposed as a massively scaled light box that rises to float partway up between the others and cap the central hall below. Or has it descended from above, as visualized in some Z axis additive cases? Regardless, its deeply cantilevered extension evokes a palpable sense of horizontal shift as well, suggestive of shear. This is enhanced by the bent profile of one of the of the flanking elements, both appearing to give the light box a “push” and serving to terminate the hall below in contrast to its open end. Yet a third mode of forming is implicit in the reveals and slight gaps among the elements, expressive of addition by adjoining though by very small degrees: they are carefully not-quite enfaced, and an uneasy and probably deliberate sense of somewhat unresolved attraction/repulsion results, enhanced by the variegated spacings of the panels cladding the volumes. Perhaps this is an homage of sorts to the uneasy puzzles of the cramped gallery reproductions within.

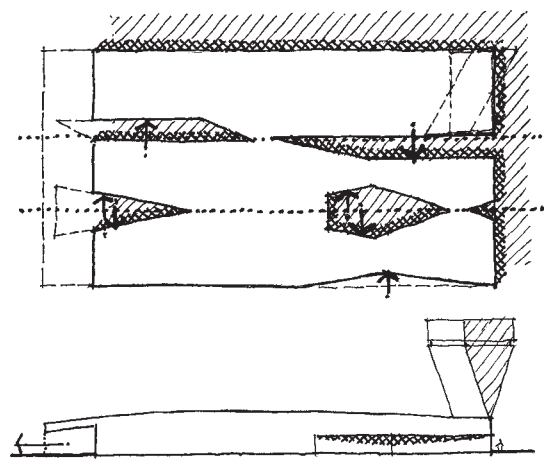
Another museum, San Francisco’s de Young, is a stealth hybrid: its flattish, rather monolithic expanse exhibits one or another formative mode depending on point of view, but ultimately reveals all of them at work within the context of volumetric dimensionality. (7.9) The anomalous tower is a clear case of addition, with deformation imposed for its peculiarly torqued profile. As for the main body of the project, the plan reveals evidence of another set



7.8 Tod Williams & Billie Tsien: The Barnes Foundation, Philadelphia, 2012.

of three en faced initiating bars, again suggesting replication as a factor. But various voids come and go, widening and narrowing and connecting to define the intriguing ensemble of interiors, courts and breaches. Subtraction may seem a reasonable mode to account for these, but does not exhibit any particular relationship to the dominant factor of replication. Deformation is the more logical causation, the longitudinal boundaries of the bands having been pushed and pulled into the final form. Subtraction does also play a part: the overhang at the end is so massive and also so integral with the main volume that it reads as the result of a removal rather than an appendation.

Architecture can seem analogous to sculpture at a large scale, particularly with regard to biomorphic designs. An iconic case of habitable sculpture, Kiesler's Endless House project was never built at full scale. The ensemble of constantly curving interiors morphing one into another presents itself, elevated on a series of dissimilar "stands" that house functional spaces, as a composition of biomorphic volumes (7.10). Each spatial element is legible as an individual form, but all are connected, three elements variously appending the larger centerpiece. The scheme seems a case of addition via mutual embedding, with deformation brought to bear in the service of sculptural expression. The continuously morphed linkages of the elements are in some cases more evocative of compression—of being pushed together—and in others of a tensile pulling apart, seeming a study in plasticine. These expressive and intuitive aspects far preceded efforts employing computer resources to achieve a measure of freedom from orthogonal and invariant form, but its muscular and sculptural composition continues to offer a more convincing approach to constantly varying sculptural form than do many 21st century parametric exercises.



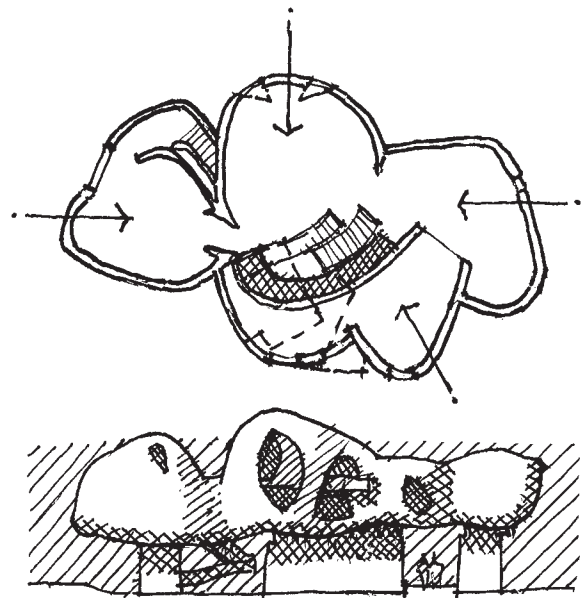
7.9 Herzog & de Meuron: de Young Museum, San Francisco, 2005.

Planar

While individual formative approaches are productive with an initiating vocabulary limited to planar elements, what of formative approaches in combination—hybrids—still acting in a strictly planar vocabulary? Addition in conjunction with subtraction doesn't have the symbiotic outcome that can arise with volumetric schemes; instead the result is essentially additive but with secondary removals from the assembled planes, such as window or colonnade openings, clipped or eroded corners and the like. Within the planar vocabulary, it is addition in conjunction with deformation that affords a richer and more ambiguous world of form.

Mies' Barcelona Pavilion, even more so than for its fine materials and details, owes its status as a modernist icon to an exploitation of this combined approach—with the disclaimer that aside from the tiny service rooms it is truly a pavilion, open to the weather and thus freed from many of the more customary attributes of architecture as shelter (7.11).² While the central area of the pavilion can recall the Schroeder house in some of its precise, orthogonally touching relationships of pristine planes, the two end elements employ deformation to effect an influential motif of modernism. The deceptively simple device of the U-shaped wall comes into its own in this additive context: partially engaged by the bypassing roof plane, it is most plausibly read as an artifact of bending, the end pieces seemingly bent from the same initially straight material as the other walls. The fact that the fancy wrapping papers of marble and onyx vary from wall to wall does not significantly alter this impression. Such a conclusion arises partially from a process of elimination: there isn't enough correspondence among the pavilion's dispersed pieces

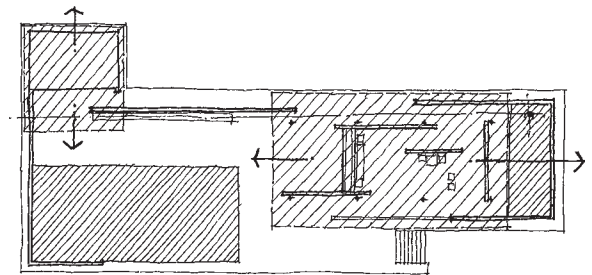
2. At least this was the impression Mies wished to convey, to the extent of having the two pairs of glass doors facing the pool exposure removed during the period that the well-known original photographs were taken. While one assumes they remained ajar during exposition visiting hours for the sake of that image, they were locked each night.



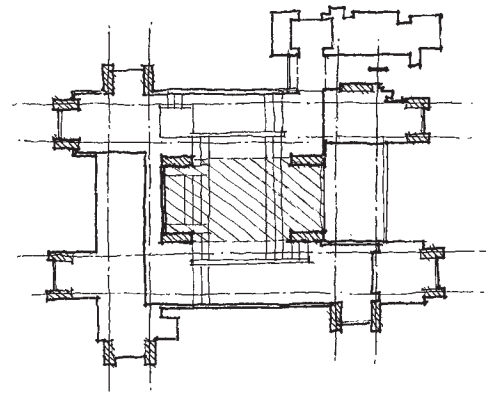
7.10 Frederick Kiesler: Endless House (project), 1950.

for it to read as some sort of partially disassembled volume, and neither is a subtractive reading plausible, the very thinness of the U-walls making them unlikely as remnants of an initiating solid. They impart far more visual stability to the design than their flat counterparts, being intuitively stable and self-supporting. Most importantly, they are receptors; these walls terminate the flashing movements of the intervening flat plane walls, calming and finishing the movement experience. A final step in the composition sequence leaves a last way out, the walls slipping out like drawers from below the roof planes such that one is simultaneously contained in the deepest recess and yet almost back outside, the sky beckoning both overhead and below in the water's reflection. The apparent deconstruction of the conventional order of walls and roofs, with planes pulled or slid apart longitudinally, enhances the innate tendency for the wings to seem outward bound. At the same time, the tensions implicit in these lateral displacements harbor the unnerving suggestion of an inverse potential: the pieces can also seem about to snap back into place, filling in the open corner in a collidive involution.

If the parti of the Schroeder house were altered to express further “implosion,” a collidive structure would result, its defining planes passing partially through each other like a house of *slotted* cards. The doubled piers of Rudolph's Yale Art & Architecture Building are based in some respects on this model (7.12). The twinning of each vertical plane, a gesture of replication, renders the project a formative hybrid. The architect's conception of overlapping trays of space, while highly significant to the development and experience of the building interior, is subsidiary from exterior viewpoints to this formative order of collided twinned wall planes. The paired planes do define a circumferential zone of secondary functions that surround a central stack of special spaces, rendering the overall plan organization legible as a case of singular regression. Gwathmey Siegel's eventual addition betrays the difficulty of successfully doubling



7.11 Ludwig Mies van der Rohe: Barcelona Pavilion, Spain, 1929 (demolished 1930; reconstructed 1986).



7.12 Paul Rudolph: Yale Art & Architecture Building (now known as Rudolph Hall), New Haven, CT, 1963 (subsequent additions not shown).

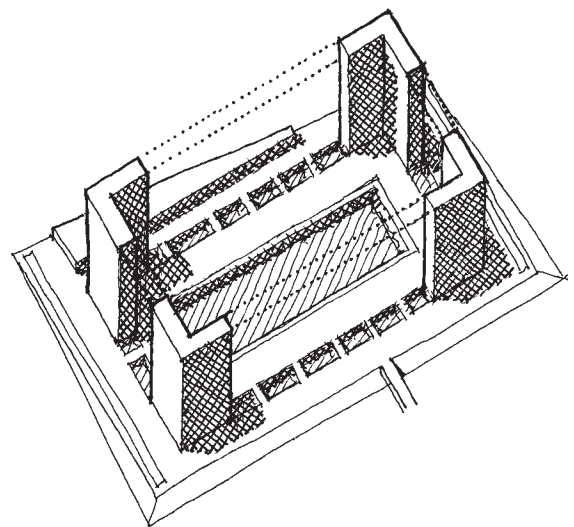
the footprint and volume of this very personal and self-contained work.

A thickening of the planar vocabulary such that elements are again habitable avails a different variety of applications. The modern era’s ubiquitous vertical slab is subjected to two formative modes at Perrault’s National Library of France, where an exercise of flagrantly indulgent elegance bounds the rectangular site with four “open books” in an exercise of both replication and bending (7.13). A great deal of the program is buried in the plinth, but it is these enigmatic stacks buildings, so impractically clad in glass and oriented to four directions in equal measure, that express those modes with utmost clarity.³

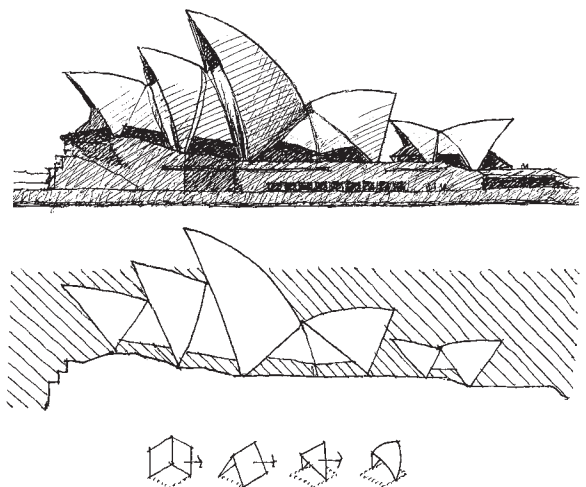
The planar origins of the Sydney Opera House bear little resemblance to the above cases, seeming at a glance to have at least a bit more in common with the Catalano house (7.14).⁴ The scheme is said to have won its competition on the basis of drawings evocative of light, thin structures suggestive of wind-inflated sails, but reality and the technology of the day intervened when its single curvatures required a heavy assembly of precast components to achieve something like the billowing convexity that Utzon had originally envisaged. That said, the iconic aspect of the project is one of contrast: between the sequentially replicated and nested shell-pairs of the upper structure with their kinetic, crustacean qualities—denying their weight by virtue of gaps between and below—and the podium structure, massively expressed like a rock outcrop integral with the ground plane. The opposed duality of the sky building and the ground building alluded to at the Boston City Hall is realized more

3. A corollary interpretation, that an originating rectangular “wall” left these corners as subtractive remnants, is ultimately rendered implausible by their wide separation.

4. The place of its elements in a taxonomy of planar variants can be roughly pictured by tipping one of the Paris library elbows on its side, revisualizing it as the bent plane of a gabled roof, trimming the sides to point junctures at the ground plane, and finally inflating the figure such that the planes become sections of spherical geometry.



7.13 Dominique Perrault: National Library of France, Paris, 1995.



7.14 Jorn Utzon: Sydney Opera House, Australia, 1973.

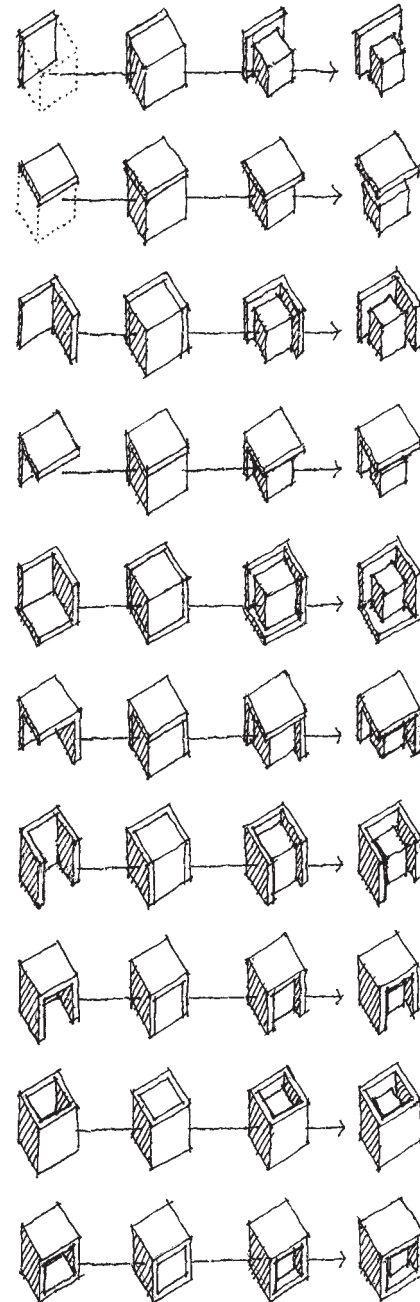
convincingly here, one reason for its status as one of the most famous of modern era structures.

Volumetric/Planar

In Chapter 4, the diagrammed arrays of subtractive variants illustrated not only the various related possibilities in plan and elevation, but also dimensionality in terms of the *range* between beginning and ending limits of subtractive degree. At the ending limits, many of the remnant shapes diminished to minimized thicknesses, and volumes became planar shapes that evoked deformation more than subtraction. A selection of these limiting cases returns here as a sort of diagrammatic library of planar configurations (7.15). Associated volumes now join these figures in an array of *combined* relationships, the planar elements first comprising partial “wrappers” of their volumes (cubes in these diagrams, analogous to the cube-based simplifications of the subtractive arrays). A further benchmark on a continuum of adjustments demonstrates a selective pulling-in of the volumes from the planar boundaries, leading finally to a *disconnect* between the planar and volumetric figures. In a very simplified way these arrays represent the range of relationships available for hybrid volumetric/planar designs. Some representative projects follow:⁵

- One of the simplest of this diagrammatic library is a single vertical remnant plane. We saw versions of this figure engaged in additive volumetric/planar combinations in the previous chapter. But a special hybrid case involves the simultaneous removal and regeneration of a volume’s boundary surface—subtraction and addition operating as coincident related processes—to form an intimately related pairing of plane and volume. The intent of this gesture varies: At Le Corbusier’s

5. The initial cases in this selective taxonomy represent undeformed planar figures, thus involving addition only as a formative mode and constituting a sort of link back to the volumetric/planar examples of the previous chapter. But exceptions in the present discussion render those cases formative hybrids.

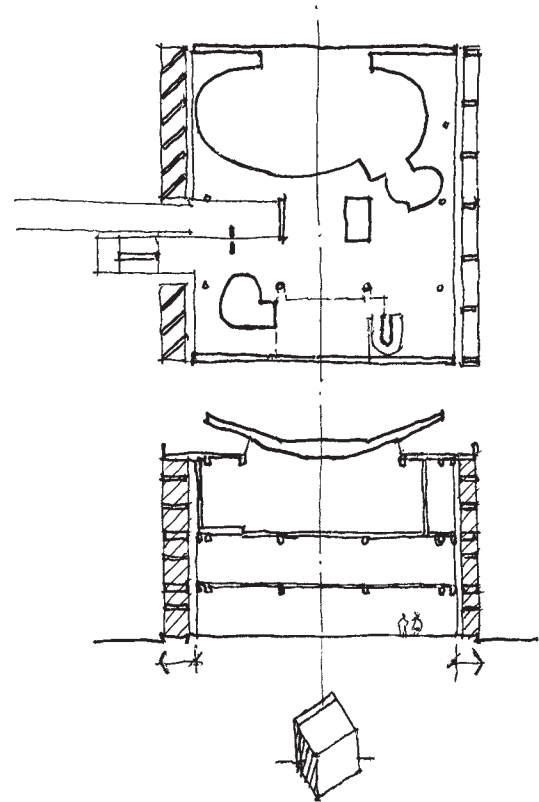


7.15 Sequence of diagrammatic planar/volumetric variants.

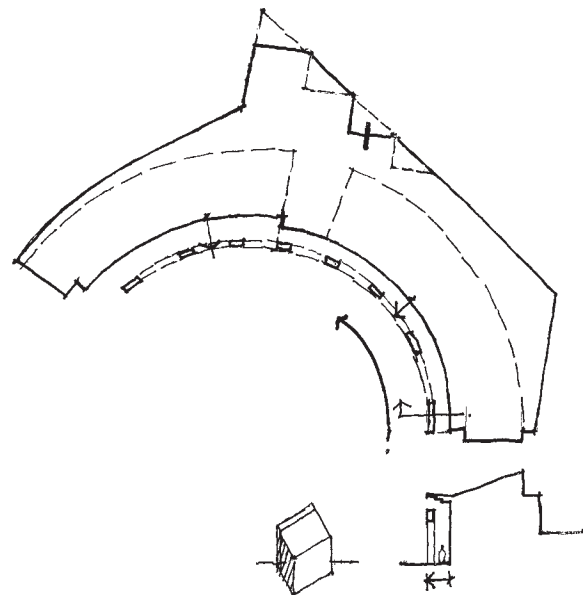
Ahmedabad Millowners' Association Building, the espoused purpose is sun control in the form of *brise-soliel*, although more abstract architectural goals were probably as strong a motive (7.16). The characteristic deep grids of concrete form thick quasi-planes corresponding to facade dimensions, yet floated outboard of the nominal surface, the separation emphasized by open slots in the side elevations.

- Giurgola's Tredyffrin Public Library, seemingly torqued into its concave rear profile, applies the device in a manner that both increases the wall-like materiality of the separated plane and emphasizes the fact of its separation (7.17). While the Ahmedabad facade grids maintain continuity with the building at floor and roof planes, the library's planar element is completely independent. On a superficial level this curved, punched wall reads as the original back wall of the library simply pulled away from the facade, leaving its glass behind, but the inner facade has its own reality of punched openings and echeloned recesses. The "original" rear wall, solid, white and punched like the rest of the periphery, is detached, but the newly exposed rear wall has "healed" and adapted itself into a new and specialized rear surface, the two forming a contrasting but symbiotic pair.

- The corresponding case of a *horizontal* remnant plane is commonplace in its role as a modernist flat roof, but if multiple such planes are composed with multiple volumetric elements, their hybrid compositional potential becomes more complex and diverse. This is manifest by Gehry's Panama City *Biomuseo*: though an apt example of addition via linear links, the museum goes well beyond that feature of central connectivity (7.18). The ensemble of planar roof elements—pleated, clipped, tilted, warped—float above or engage a variety of volumetric elements that are themselves also composed in adjoining, linked and embedded



7.16 Le Corbusier: Mill Owners' Association Building, Ahmedabad, India, 1954.

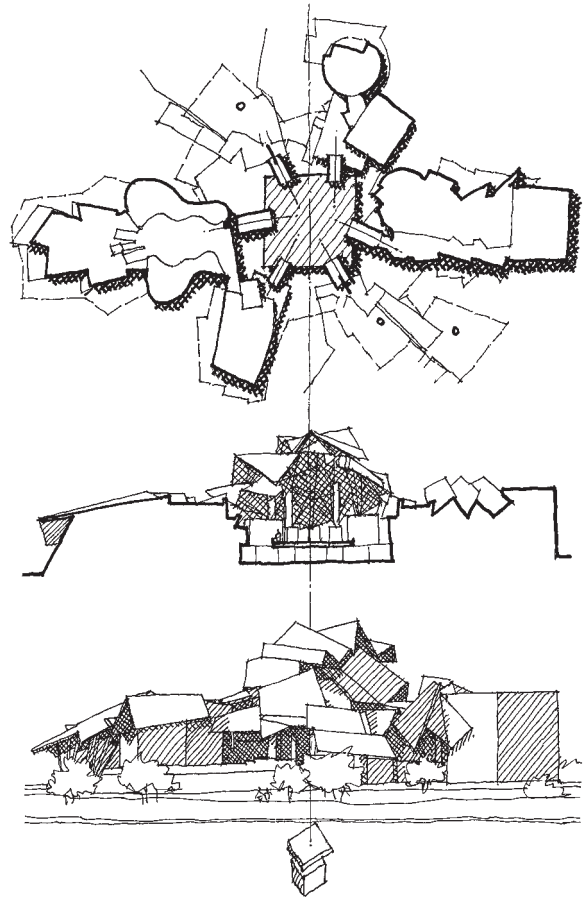


7.17 Mitchell/Giurgola: Tredyffrin Public Library, Strafford, PA, 1976 (subsequent addition not shown).

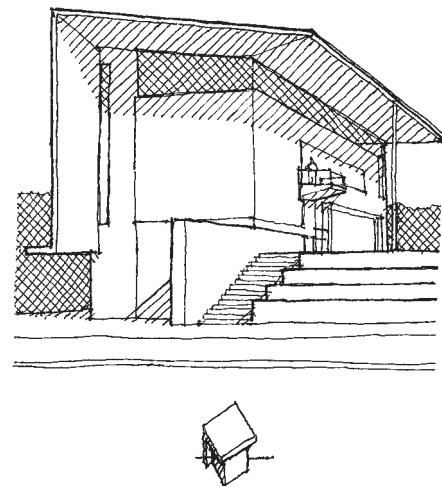
relationships. Here is a case where the one-to-one correspondence of plane to volume that the present taxonomy implies has gone to a different level, with planes and volumes serving separate and autonomous roles in the composition.⁶

- A planar roof-wall elbow may well be the most ubiquitous variant of this series. The version at Harmon's AIA NC Center features enhancements such as a subtle thickening of the roof plane and a horizontal kick at the base of the downstand. (7.19) Given the distinctive extensions of the planar element, the project exemplifies a rather typical case wherein its formative dynamic may be visualized as subsequent and additive: a conformal but independent planar element is introduced to shelter and orient the volume.
- Clark & Menefee's Inn at Middleton Place turns the elbow on its side, thickened to accommodate circulation and services, and it engages several identical room elements—themselves singular duplicates—via enfaced addition, sheltered within the partially enclosing wall (7.20). The surfaces of juncture between the massive wall and the delicate volumes are carefully articulated, suggesting a mythology of difference in time: one can visualize a pre-existing ruin, as if the fragmentary L was once a more completed figure in the imagined past to which the more recent volumes have been ingeniously added. An anomalous gap in the stuccoed wall mass separates the terminating lodge element: this is suggestive of failure in tension, as if the "attraction" of the adjoining wooded riverbank was both the initiator of the elbow deformation and the pulling apart of this breach.
- Enfaced volumes and L-walls also appear in Eisenman's House VI, but with superposition rather than bending effecting the wall

6. While the project is notorious for its variegated riot of saturated color, credit is due for the boldness and discernment of that palette, in contrast to the frequent timidity of color choices by architects.



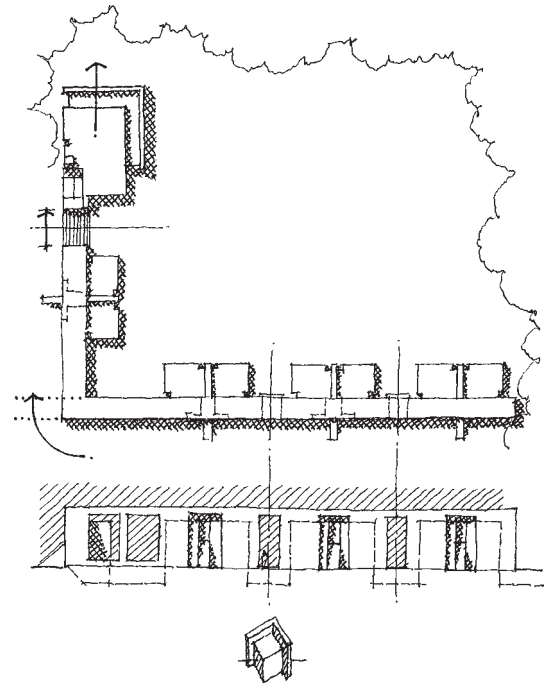
7.18 Frank Gehry: *Biomuseo*, Panama City, 2014.



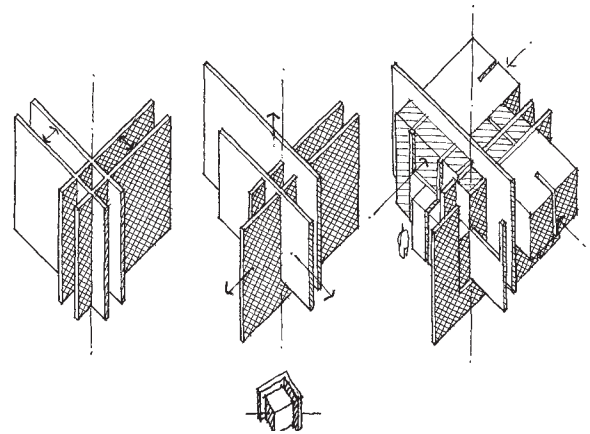
7.19 Frank Harmon: AIA NC Center for Architecture and Design, Raleigh, NC, 2011.

configurations (7.21). In a recall of singular planar duplication, crosshair axes are themselves twinned, the wall-pairs colliding at right angles. Voids subtracted from the wall planes begin a theme of paired inversion, one pair featuring a large down-oriented cutout in one wall and a row of three cutouts leaving up-oriented columnar remnants in the other. The second pair reverses this orientation. Rectilinear volumes are en faced at the walls, notably featuring elevation-oriented two-dimensional removals. The theme of inversion is made even more explicit by notorious paired stairways within, one for second floor access and the other a faux shape descending from the ceiling. These also give emphasis to a diagonal axis of symmetry, first apparent in the collided wall array, that is the axis of “flip” should there be a judgment day when the floor becomes the ceiling.⁷

- The same architect’s House X offers variations based on an initiating cube replicated about a so-called “voided center” to become four cubes, subjected to corner-related removals to become vertex-centered quasi-planar elements among those represented in the above “library” (7.22). These enter into varied relationships with volumetric forms, and are manipulated—thicker or thinner, translated along one or another axis, proportions stretched or condensed—in a series of tertiary operations which are neither additive nor subtractive but deformations that further alter the initiating array. Further subtleties of mutual adjustment and elaboration add to the complexity of this obsessive rumination, but the sequence of operations involving all four formative modes remains their morphological basis.
- Asplund’s Stockholm library, a clear manifestation of addition, also involves deformation in an understated but notable role with its orthogonal



7.20 Clark & Menefee: Inn at Middleton Place, Charleston, SC, 1987.



7.21 Peter Eisenman: House VI (Frank house), Cornwall, CT, 1975. Sequential diagrams adapted from Peter Eisenman, *House of Cards* (New York, Oxford University Press, 1987), pp. 82-85.

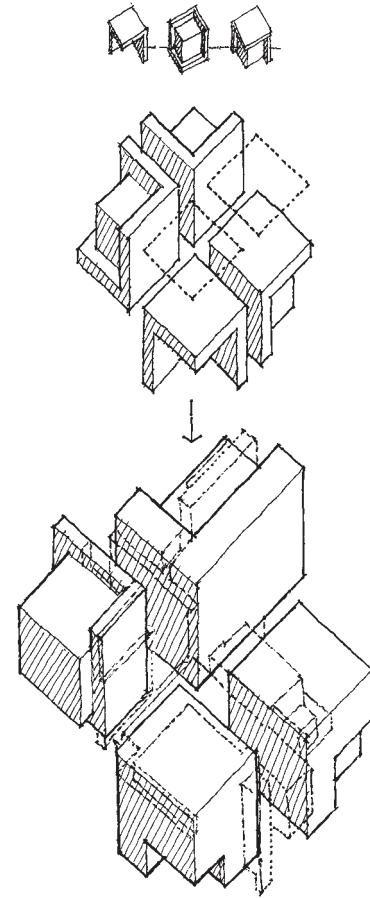
7. The author brashly submitted a letter analyzing and criticizing House IV to *Progressive Architecture* which was published in its 8/77 issue.

element bent into an upright U, a habitable version of the planar deformation seen in Barcelona (7.23). Whether the wall wrapped the pre-existing volume of the cylinder or the cylinder socketed into the pre-existing court seems unanswerable, a fact which suits this elegant and enigmatic design.⁸

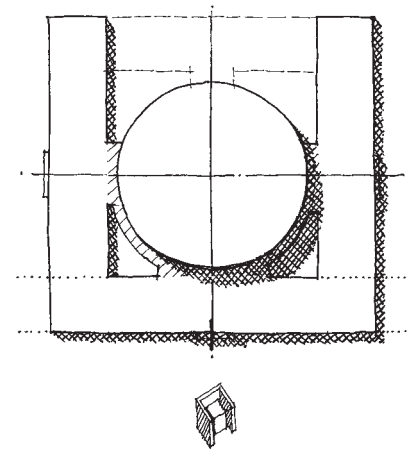
- Morphosis' Emerson College in L.A. is a bit of a riff on this basic order, as if it were tipped on its side, and also recalls the quasi-unitary *Grande Arche de la Défense*. But these impressions are only partially indicative of the building's formative sequence, an unusually complex evolution that merits a brief interpretive sidebar (7.24). In a speculative return to first principles, its initiating elements could be visualized as a cube and a cylinder, again recalling the Stockholm library in a rudimentary way. The cube undergoes a series of subtractive excisions that define the final armature figure, with "planar" sidewalls embodying the mode of singular duplication as one outcome of these removals. The cylinder likewise undergoes several formative changes, being sheared, split and shifted. Set within the isolating confines of the rectilinear armature, the now paired elements sprout attenuated connections, and the initiating figures have become a complex volumetric composition.

- A plane's capability to be bent into these quasi-space-defining shapes of L's and U's leads ultimately to a closed "tubular" figure. Tucson's Eller Dance Theater wraps a floating frontal volume in a doubly tweaked version, expressed as two distinct elbows: an overhead

8. In the building's eventual form a fourth segment infilled the open end of the U, turning it into a closed tubular configuration and resulting in a marked lessening of the initial project's power due to the more predictable two-fold symmetry. A competition for a major addition to the west was abandoned in 2009, partly out of concerns that the original building would be compromised. The work was referenced above as a case of "touching" additive elements, being an especially apt example, though the perimeter element falls more into the "planar" than the volumetric category.



7.22 Peter Eisenman: House X (unbuilt), Bloomfield Hills, MI, 1982. Architect's formative array developed as pertinent planar/volumetric elements from Figure 7.15; speculative "intermediate adjustment" of composition leading to final scheme (dashed). Adapted from Peter Eisenman, *House X* (New York, Rizzoli International Publications, 1982), Fig. 21, p.55 and Fig. 10(d), p. 27 respectively.



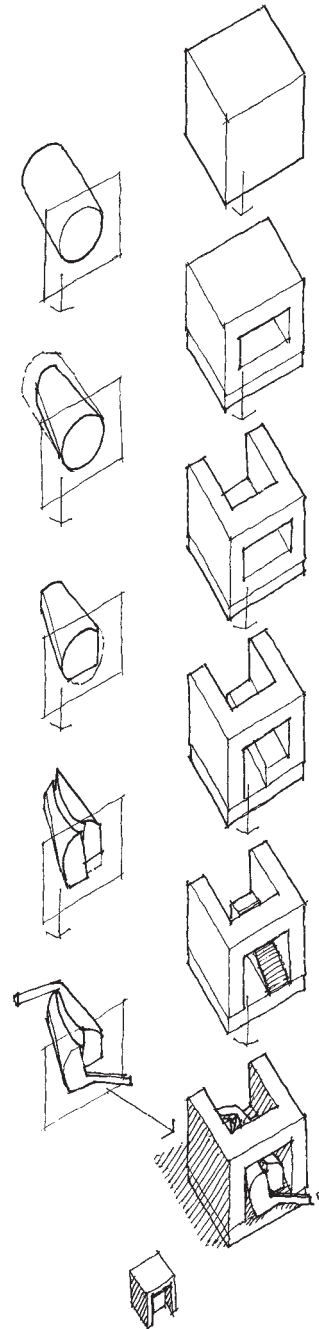
7.23 Erik Gunnar Asplund; Public Library, Stockholm, 1928.

L is conventionally engaged, as at the Raleigh project, but the figure is completed by an inverted L of perforated screenwall, irregularly bent and julienned (a case of replication?) into slightly nested segments along its length in a nod to parametric iteration. So instead of the “extruded picture frame” that is often typical for such a case, the project attempts a more ambiguous coming together/coming apart assemblage (7.25).

- The upright ground-based version of this figure is a planar analog of a courtyard building: a thinned torus. Volumetric elements can be brought additively into play with such a figure by the conventional approaches—set apart within the space defined by the wall, or attached to it as at the Asplund library—but a more idiosyncratic analogy leads to some interesting variants. Since the sector of open space within the boundary now has sides, as opposed to issues of indefinite extent faced by the replication modes, volume can be additively “poured in” like batter in a cake pan. The solidified space-filling volume then permits plan-oriented excisions of the volumetric material. Johnson’s Cambridge house presents the simplest possible version of the case, with facing rectangles of solid and void within its boundary wall, an “indoor/outdoor universe” fully isolated from its context (7.26).⁹

Clearly, variants often serve to play up the drama of planar constructs in hybrid conjunction with volumetric form. While the most ubiquitous case of all—the rancher, with its slightly bent overhanging planar roof—is generally prosaic, the above series demonstrates that the approach is also a rich vein of invention that interfaces the planar nature of construction with the necessity of volumetric enclosure, for the architectonic enhancement of both dimensionalities.

9. Mies, the connoisseur of the parti, used such strategic removals to define multiple courtyard voids in his well-known series of walled house schemes.



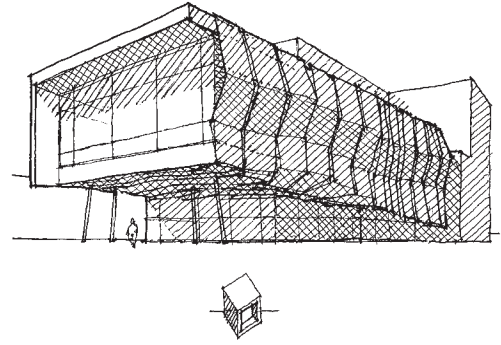
7.24 Morphosis: Emerson Los Angeles, 2014.

Linear

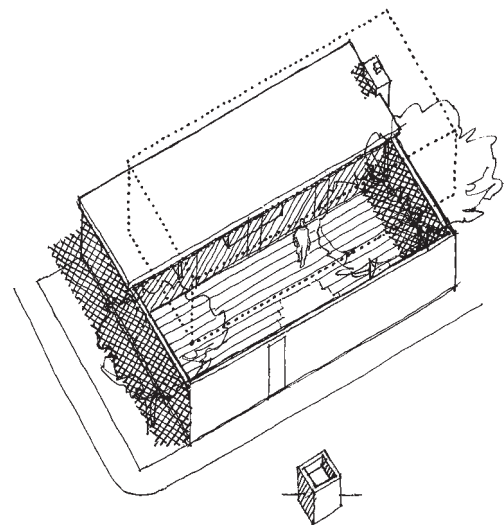
When elements of linear dimensionality are impacted coequally by two or more formative modes, extensive reconfiguration can result. Harvey Court's linear-proportioned room volume defines its courtyard by virtue of subtractive extrusion into its stepped profile—an understated version of Gund Hall's—and by deformation as well with its corner-turnings (7.27). The compact section steps down to the central space, affording chilly terraces overlooking the court, while the outboard orientations shelter an ingenious series of stairs. The detachment and about-face of the fourth side exposes several endwalls revealing the extruded nature of the scheme. The overall cross-section can evoke a reversal of Long Wharf, the up-oriented steps now facing the axis of reflection, but the organization is now central rather than longitudinal: the building and its courtyard are generated in a continuous process of quasi-rotational extrusion, analogous in a squared-up way to applying a stepped or ribbed shape to a bowl rotating on the potter's wheel.

Deformation in tandem with replication are central to the formative development of Barnes' offices at Crown Center, for once the bent elbow is initiated, replication iterates the L into the zig-zag result (7.28). And Hartsfield-Jackson Airport's transverse concourses, elementally linear and growing in number over the years via replication, are linked additively via their en faced junctions with the rail connector's underground linear spine. Like most large airports, Atlanta's is constantly expanding, this neat diagram being amalgamated with an assortment of attachments and remote facilities (7.29).

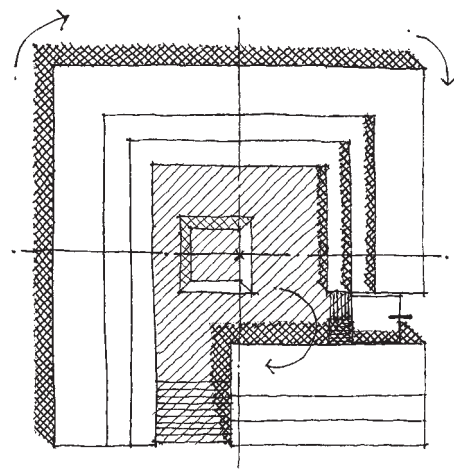
In contrast to the relative clarity of these cases, ambiguities characterize the formative nature of Gropius' Bauhaus building (7.30). While appearing from several vantage points to be an additive composition of rectangular volumes, an argument can be made that its overarching dimensionality is linear. Two elongated sections of architectonic "bar



7.25 Donna Barry: Stevie Ellis Dance Theater, University of Arizona, Tucson, AZ, 2003.



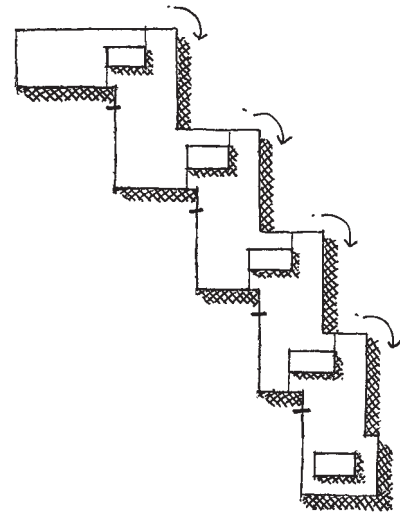
7.26 Philip Johnson: Johnson house, Cambridge, MA, 1942.



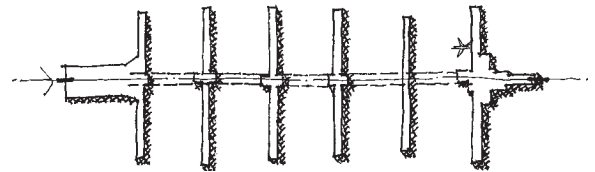
7.27 Leslie Martin & Colin St. John Wilson: Harvey Court, Cambridge University, England, 1962.

stock” are collidively joined at right angles, and the resulting wings each subjected to a 90° bend, establishing the basics of the scheme’s partial-swastika footprint. Lower- and upper-edge-centered removals then define the porte-cochere and the upper gap that further isolates the studio volume, and a series of further smaller-scale removals fosters the ingenious indeterminacy of the completed design. The frontal workshop building, for example, is set apart by a slight recess at the return of the L as well as an inset ground floor, suggesting but not insisting that it is a separate rectilinear pavilion. Revealed treatments at the juncture with the studio/ housing wing, plus its dissimilar facade development involving punched openings and balconies, hint strongly at an additive interpretation for that element. Such debates are not resolvable and need not be, for this very non-obviousness of interpretive possibilities help lend liveliness to the modernist rectitude of these machines in the pasture.

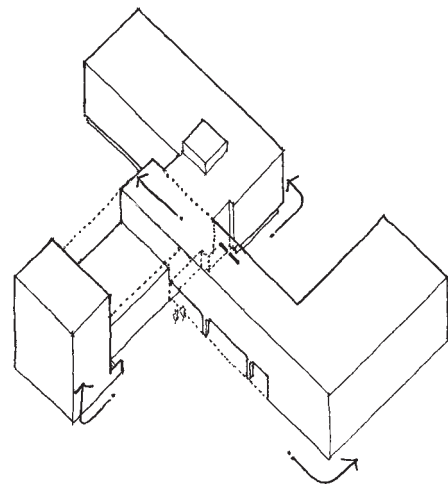
“Linearity” can be evoked as much by a sense of directed movement as by a literal elongation of proportion (7.31). The bold undercut removal at Ten Arquitectos’ Rutgers Business School reminds us a bit in that one regard of OMA’s CCTV Headquarters, but the result, despite its raffishly skewed toothpick columns, is more deft and convincing in its gestures and proportions. Here the cutout serves purposefully—to frame a through-passing street, shelter and define a generous entrance experience, and manifest an important element in the overall master plan—as opposed to serving a self-important object building in an amorphous urban context. Confident efforts of spatial ingenuity continue on the interior, where an elongated, floating volume is legible as a case of singular regression. As for an “originating volume,” the deformative gesture of a linear bar building bent into an L predominates, followed by the large removal, its void echoing the shape of the overall building. While the building’s ground-based portions are clearly volumetric and the L-in-the-sky more planar in proportion, the overall connected path



7.28 Edward Larrabee Barnes: Crown Center Office Complex, Kansas City, MO, 1971.



7.29 Stevens & Wilkinson, Smith Hinchman & Grylls, & Minority Airport Architects: Hartsfield-Jackson Airport, Atlanta, GA, 1980 (Initial phase).



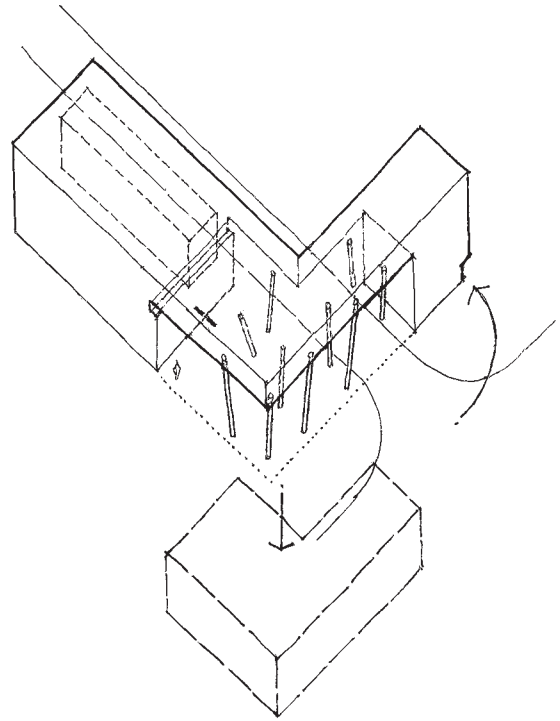
7.30 Walter Gropius: Bauhaus Building, Dessau, Germany, 1926.

taken by these contiguous segments nonetheless seems expressive of linearity. And ironically so, being a path that keeps bending rather than continuing straight ahead along a linear axis.

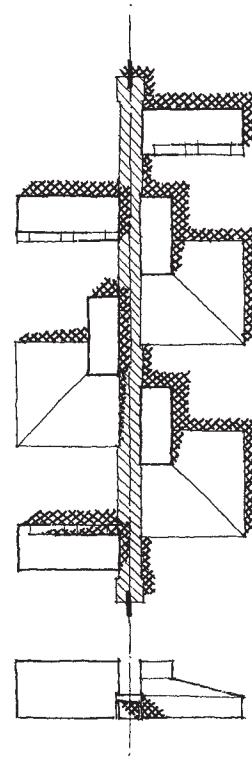
Volumetric/Linear

The hybrid case of two or more formative modes achieves great “flexibility” with designs combining volumetric and linear dimensionalities:

- At a private school dormitory by Barnes, an unrelentingly linear spine recalls the extended footprint of the Bohlin firm’s conference center, but here the spine is low, understated, and flanked by a family of separated elements that dominate the composition (7.32). These turn out to be three each of three dissimilar elements, a formative application of replication. While rigid in its hierarchy of trunk and alternating branches, it is rendered informally villagelike by the varied spacing, shape and order of the en faced volumes.
- In Kahn’s unbuilt project for a Dominican Motherhouse, a linear element is deformed into a U-shaped receptor which gently receives the carefully composed randomness of additively touching volumes that form ineffable negative-courtyard spaces in the process. The nuanced ensemble accommodates needs of the institution’s private, semi-private, semi-public and public spaces (7.33).
- Aalto’s Säynätsalo town hall, noted and illustrated in the discussion of “matrix” facilitated addition, is also defined by a U element which could be considered linear as well and serves a similar compositional purpose. With the dominating volumetric council chamber embedded at one end, the element bounding the courtyard’s fourth side seems a bent leg broken loose from the other, possible influences on Harvey Court being evident.



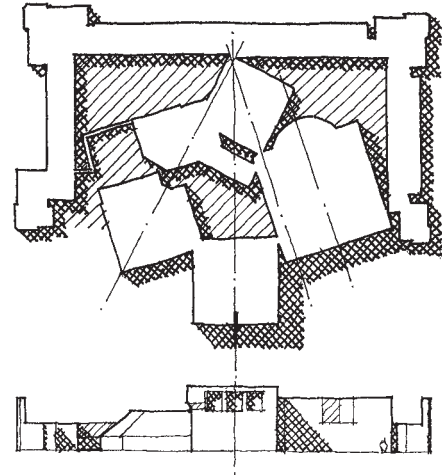
7.31 TEN Arquitectos: Rutgers Business School, Piscataway Township, NJ, 2013.



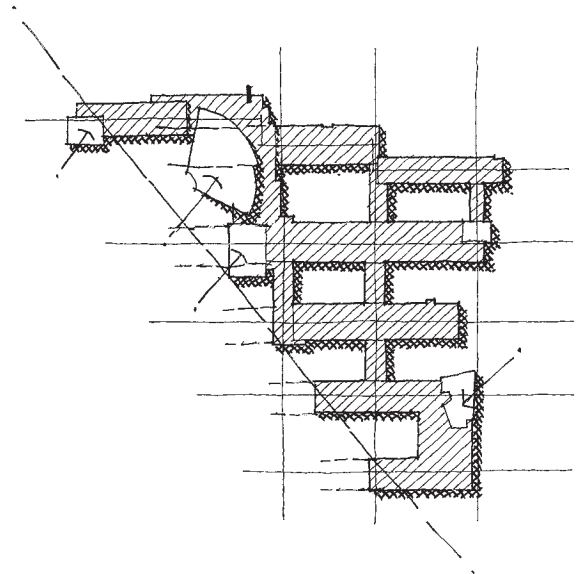
7.32 Edward Larrabee Barnes: Kittredge Dormitories, St. Paul’s School, Concord, NH, 1970.

- Aalto's Institute of Technology at Otaniemi employs the dimensionalities in a sequence of formative gestures (7.34). Initially an overall warp and weft of linear bays is established, defining light courts and extending in planar replication. A large frontal park is formed by essentially ripping this indefinite grid diagonally, a bold subtractive move which is tailored into an echeloned series of terminations, each extending beyond the last. Next a series of lecture hall volumes joins the composition as objects collidively embedded in the pre-existing linear grid. The impact of the largest of these, the signature radial wedge, fractures the adjoining element into consecutively displaced segments. Thus three formative modes are brought to bear on a sequenced definition of linear and volumetric material in this mature work.

- Le Corbusier's Carpenter Center illustrates how all the formative modes can be simultaneously employed in such a way that careful study is required to decode the design process (7.35). While the preceding cases present their natures fairly directly, here ambiguity again appears as an important partner in enhancing intrigue and character. Carpenter Center is a grab-bag of components—a central box, a service tower, the two wings, the linear ramp, a penthouse—joined in a complex additive composition employing collision, en faced juncture and linkage. Selective removals occur at the lower levels, and the boundaries of the colliding elements themselves define the tunnel that allows the ramp to pass through the central box. Deformation comes into play in the form of the ramp's twisting of the composition out of square with the rest of the campus, and by the distortion of the wings, sheared apart from a paired relationship and stretched in opposite directions. As has been noted, the wings themselves exemplify singular duplication. While exhibiting Le Corbusier's mature mastery in many ways, Carpenter Center



7.33 Louis I. Kahn: Dominican Motherhouse (unbuilt), Media, PA, 1967.



7.34 Alvar Aalto: Otaniemi Technical University (Now Aalto University), Finland, 1964 (Subsequent addition not shown).

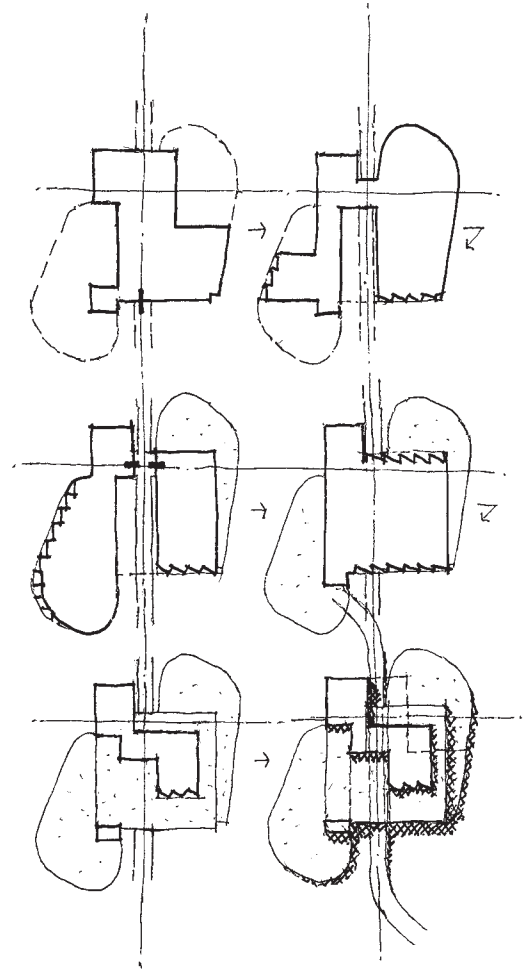
has been criticized for insufficient attention to context issues, and its lavishly diverse use of formative modes surely has something to do with that perception.¹⁰

Planar/Linear

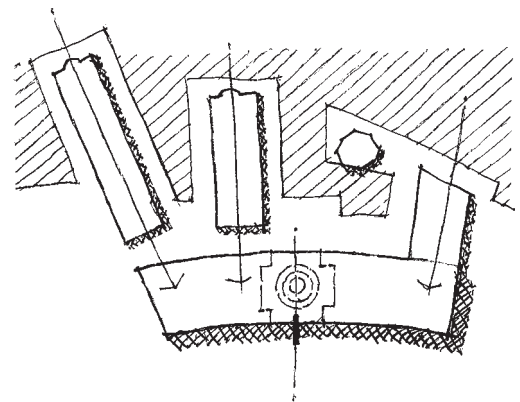
With this dimensional pairing, both must normally be habitable in scale to achieve constructs that would be considered architecture. While these terms readily evoke the extremities of modernism, hybrid forming in this context can also come into play with quasi-revivalist works such as Rowe's Wharf, where linear elements in the image of waterfront piers engage the perpendicular "planar" slab, the slab itself particularized by its subtractive gestures as well as subtle evidence of longitudinal bending (7.36). The somewhat forced feature of the internalized domed feature at the slab's midpoint seems indicative of a drawback intrinsic to this dimensional duality, given the mode's exclusion of the forthrightly volumetric: planar slabs and linear forms seek a thinness, an attenuation and extension that seduce with their movement and drama, but we can miss a sense of place: the internal dome could be considered something of a response to that sometimes problematic aspect of planar/linear form.

The slab of Oxford's Florey Building, its irregular cross section palpably expressive of extrusion, bends in informal segments around its courtyard, with Stirling's characteristic "linear" service towers clipped to the outer face (7.37). In a manner more pronounced than at Harvey Court, the bent slab's concavity in both plan and section again evokes the potter's wheel. In light of this image, not only is the outer half of the bowl sheared away but its lower sides as well, the remnant left up in the air on its splayed

10. A major central facility for the Harvard museums by Piano—sensibly treated as a separated building as opposed to the problematic mating of the new and old art and architecture buildings at Yale—now gives more rationale for the east extent of the bridge as a connector.



7.35 Le Corbusier: Carpenter Center for the Visual Arts, Harvard University, 1962.



7.36 SOM: Rows Wharf, Boston, 1987

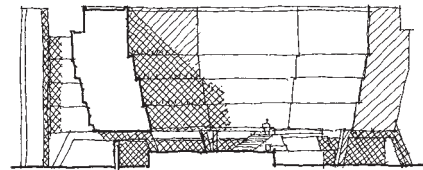
pilotis surrounding the elevated terrace that is its disconnected base.

The elongated structures of the Florey Building and Harvey Court are considered planar and linear respectively by virtue of a judgment call regarding the aspect ratios of their cross sections, locales on a continuum having no clear dividing line between the two dimensionalities. The same can be said for any pair of dimensionalities: to reiterate, when does a volume achieve sufficient thinness to be considered “planar” or sufficient elongation to be “linear?” As another example of “I’ll know it when I see it,” the planar aspect of the Stockholm library contrasts persuasively with the linearities of the Stuttgart museum, despite their otherwise notable similarities. Clearly some designs will fall in a gap of ambiguity wherein the distinction becomes arguable and less central to the interpretation of their formative nature.

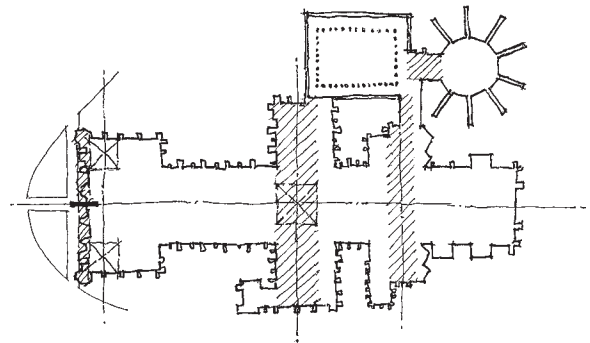
Volumetric/Planar/Linear

The Gothic Cathedrals can be perfect exemplars of multiple formative modes applied in conjunction with multiple dimensionalities. At Lincoln, not only do towers with their linear proportions embed at the west front and the main crossing, but an unusual planar screen enfaces the west as well (7.38). As at Salisbury, two transepts are superposed, and linear links lead to the cloister—itsself a nearly freestanding “tubular planar figure”—and chapter house. A further assortment of porches and chapels enfaces the main volumes. Contemplation of this virtuoso ensemble can tend to set a lot of more recent work in a rather inconsequential light.

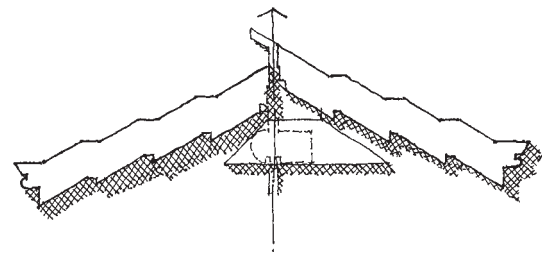
In the unruly modern age, just as throwing all of the formative modes at a design runs a risk of unwarranted complexity, the same could be said if significant gestures of all three dimensionalities are employed. Mitchell/Giurgola’s Mission Park Houses project at Williams College does this, while also embodying two formative modes and a third in



7.37 James Stirling: Florey Building, Oxford University, England, 1966. Adapted in part from images at www.quondam.com/dt13/cad/1305a.htm.



7.38 Lincoln Cathedral, England, 1311.

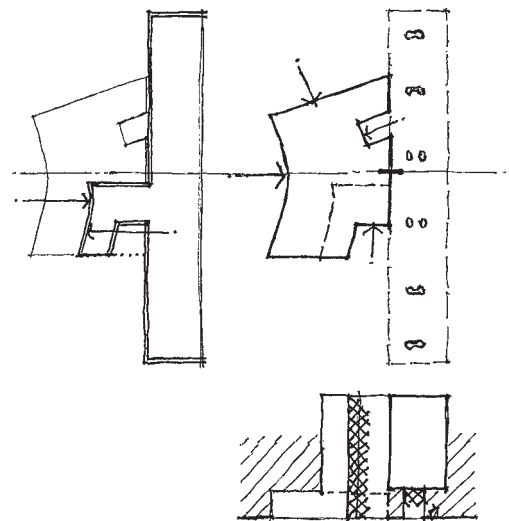


7.39 Mitchell/Giurgola: Mission Park Houses, Williams College, Williamstown, MA, 1971. Adapted from “Complimenting the Past,” *Progressive Architecture* XIV (Nov. 1973), p. 56.

a secondary role, yet all with apparent confidence (7.39). From the uphill or entrance exposure the two flanks of the quasi-planar room building are splayed back as well as sheared apart at the center, as if due to the impact of the wedge-shaped frontal volume.¹¹ These shifts are given emphasis by the linear element of the entrance circulation bridge, which both penetrates the frontal piece and continues through to breach the two halves of the main element. A secondary visual clue reinforces this reading of considerable disruption in the formative parti: the uphill flanks exhibit a series of sharply defined fractures or faults, like a sequential ripple effect outward from the center—a series of sheared transverse displacements. But while the downhill exposure retains the emphatic reading of displacement and shear at the central breach, the flanks have lost their secondary shears and become almost sinuous, recalling the elastic, wavy give of Baker House as well as the contrasting exposures of Pingry School. This outer exposure embodies a more domestic and less assertive imagery than the entrance side, where a supposed intention of welcoming focus and enclosure seems somewhat contradicted by its aggressive implications. A diagram of deferential closure at the toe of a park has evolved into one of a more kinetic, collidive nature, the arms seeming as much pushed back at the center as spread forward in an embracing gesture.

Le Corbusier's Swiss Pavilion makes a deceptive first impression: from the main street exposure it seems an example of a single thin "levitated" element, the ground plane below devoid of enclosure, its pilotis deeply recessed from all faces (7.40). But other exposures reveal the other elements of the ensemble, the service tower and low-rise commons being equal partners in its architectonic nature. An attempt

11. The distinction among the dimensionalities can be as much one of perception as reality. Here the room buildings average about as wide as they are tall, but their extended profiles plus their thinned terminations offer the reading of a wall-like element, or more accurately a stepped series of wall elements.

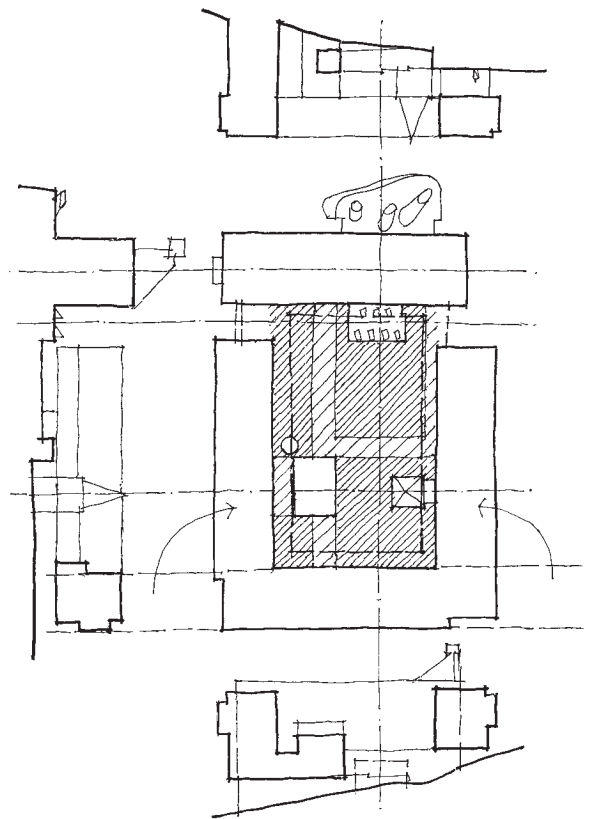


7.40 Le Corbusier: Swiss Pavilion, Paris, 1932.

to visualize the formative sequence confirms the project's status as a hybrid of several formative modes. Beginning with the slab block, the continuity of cladding at the rear cues a potential reading that the service tower "emerged" from the slab as an unusually focused case of explosive deformation. The ground level commons element echoes its configuration, as if defined by an extension of these energies outward from the tower. The expressively concave rear faces of both tower and commons, plus the commons' angled sidewall, seem deformative responses to the limitations of the site. Their profiles contradict the expected convex explosive image: here the impact of the site has prevailed. Plan-oriented excisions articulate the tower and enliven the inner façade of the base building, which is in precise plan alignment with the opposite-facing facade of the room slab above, and with a slight elevational gap between the two.¹² The thinness of the room slab affords one of the very few non-dark and dingy soffit spaces among piloti buildings, as well as permitting the curious experience of walking beneath the full depth of the building one is entering in order to enter it. This thinness permits a reading of the elongated slab block as a "planar" element, while the base building is clearly volumetric, and the service tower of linear dimensionality. Such interpretations are beset by ambiguities and subject to alternative readings—is the service tower an addition to or an outward herniation of the room block?—contributing to the fascination of this seminal work.

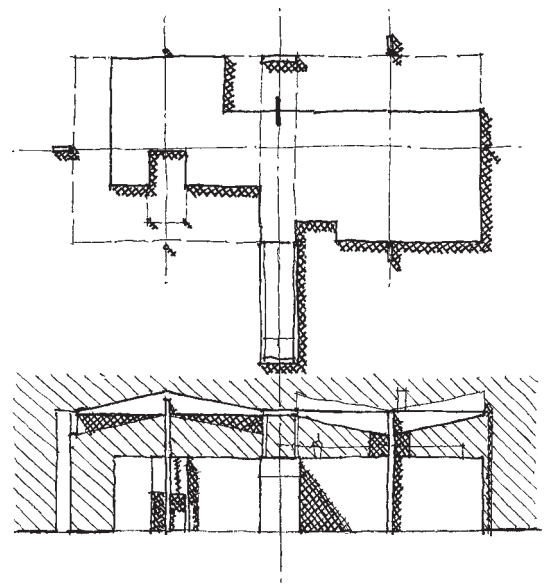
A study of Le Corbusier's mature work at the *Couvent Sainte Marie de La Tourette* reveals ever-increasing levels of complexity (7.41). At a cursory glance its parti is a "doughnut," but the disconnection and dissimilarity of the main chapel volume immediately disabuse this impression. The dormitory building

12. Le Corbusier amuses himself here by skirting the edges of two potential conditions without having to embrace either, in that an extension beneath the slab soffit would enter the realm of vertical layering, while closing the gap vertically would result in an awkward z axis case of touching corners.



7.41 Le Corbusier: *Couvent Sainte Marie de La Tourette*, Éveux, France, 1960. Adapted in part from images at <https://s-media-cache-ak0.pinimg.com/originals/b7/f8/15/b7f8151ee97d6f268be69bf0ea0605cd.jpg>.

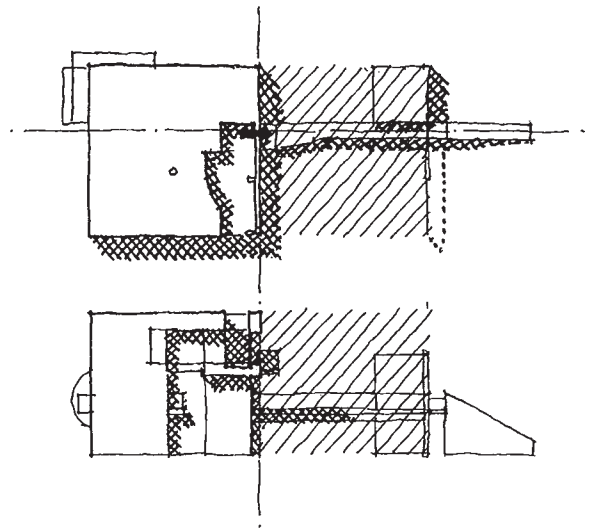
is diagrammatically linear and continuous, raised above a varied aggregation of subsidiary elements and gaps beneath and formed into a U to partially enclose the courtyard. There is no Williams College-style aggressor volume present to have “caused” this reshaping, nor is it conformed against a pre-existent perimeter as at the JFK School. And the inverse case of a strongly defined central focus is absent, the courtyard deferentially preserving the hillside landform below, and otherwise containing an artfully unfocused and austere composition of small pavilions and circulation links. Formative issues that do appear are the historic precedent of the monastic cloister as an organizing form, and the ritualistic dominance of the main chapel. The proportions of that severely unfeatured concrete volume are so elongated that it reads as a wall, a bastion resisting the outer-directed forces of its several appended elements. Ultimately the chapel might be said to have effected the deformation of the U-building around the “ghost form” of the precedent cloister owing to the force of its physical and symbolic dominance, everyday functions and sacred ritual thereby drawn close yet still held apart in isolation, the only links between the two being the indirect connectors in the courtyard. Aside from these visually insubstantial connections, the principal additive parti at La Tourette is that of the two primary elements held apart in space, the chapel wall-like and the linear dormitory U-building with deformative bending evident at the articulated corners. Significantly, a pair of smaller but more assertive volumes are clipped to each of these elements: a pointy-roofed oratory and a shed-roofed atrium element opposite each other in the courtyard, while the side chapel and a sacristy—the most artfully curious elements of the project—append opposite flanks of the main chapel. Thus assertive volumetric elements enfront the larger linear and planar components, in a multifaceted composition involving formative modes of adjacency, bending, linkage and more.



7.42 Le Corbusier: *Centre Le Corbusier/Heide Weber* Museum, Zurich, Switzerland, 1967.

Near the end of his career Le Corbusier achieved his clearest realization of volumetric, planar and linear elements acting together with multiple formative modes in synergistic composition (7.42). Dedicated to his own work, Zurich's Centre Le Corbusier is a replicative pair of pairs, set apart in space horizontally and vertically: its two crisp volumes (actually one but perceived from most vantage points as paired due to the articulated footprint), linked by the anchorage of a linear ramp, are surmounted by parasol-like roof forms whose warped planar elements are structurally independent and physically lifted above the volumes' top surfaces. It would be hard to imagine a design that promotes a greater contrast between the taut closure of volume and the expansive, floating generosity of roof, yet which still manages to contain them as two complementary aspects of one complete scheme. Despite their physical and structural separation, the volumes and roofs read as closely related due to their one-to-one correspondence, as well as the volumes' containment below the perimeters of the roofs.

At Graves' Hanselmann house, the unbuilt studio and pipe-frame structure that was to have defined a first gateway plane at the parking area is a diagrammatic replication of the actual facade of the house, translated forward a distance equal to the house's depth (7.43). An alternate reading would view the entry plane as marking the originating facade alignment, with the forceful energy of the linear stair and bridge element having "translated" the near-unitary cube of the house proper to the rear, an interpretation somewhat reinforced by the concave recess of the back wall of the upper level terrace as if a result of such frontal pressure. Regardless of the perceived kinetic order, the separated plane functions in this case as a gateway element which, due to the correspondences of width, height and depth, establishes an especially heightened sense that the intervening zone has been appropriated from the outdoors—a foregrounded ghost of the actual house volume. Employing elements of all three dimensionalities, the house's status as a formative hybrid arises from replication (three wall planes

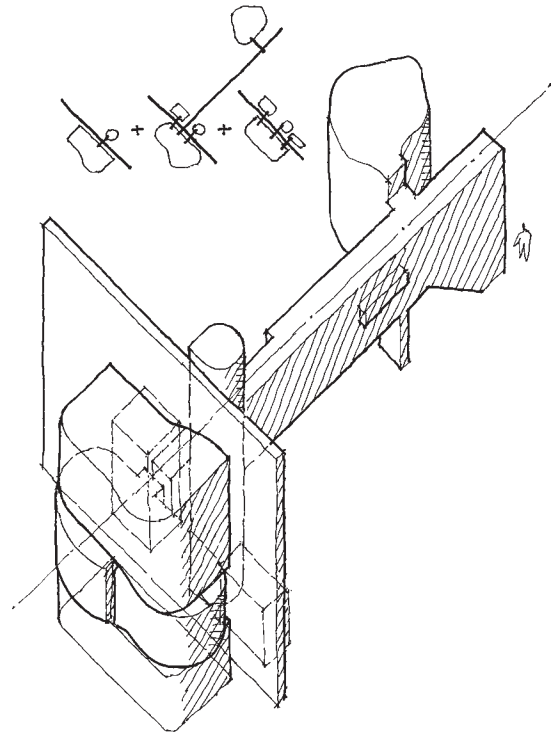


7.43 Michael Graves: Hanselmann House, Fort Wayne, IN, 1967.

in sequence) in conjunction with subtractive and deformative alterations to the house volume itself.

A return to Hejduk's Wall House II reveals three dimensionalities and three formative modes employed in a tour de force of hybrid forming—perhaps demonstrating in the process that restraint in the use of these tools can be as important as virtuosity (7.44). Its upright freestanding plane has expanded beyond an equal partnership with the volumetric elements to dominate and order the composition: target, picture plane, picture frame, cliff face, tipped-up ground plane—the indulgent scale of that device affords a richness of analogical content. Although the volumes are connected by linear links, the wall cuts through all these links collidively to align and anchor them in space. A perhaps truer image would involve the simultaneous mutual collision of wall and links, each indulgent gesture attempting to help justify the existence of the other. The volumes are spaced apart, vertically to one side of the wall but also laterally on the other side. The wall plane has succeeded in removing itself from any functionally determined role of providing privacy, shade, or the like, lavishly becoming instead the organizational core of the composition. However, just as the hearth mass at the core of a prairie house sometimes sets the indweller into a peripheral, supporting role, the two out-facing sides of the wall cast the anchored volumes into external contexts, all standing on the doorstep of an impossible entry.

Meier's Atheneum Visitor Center is a complex assemblage requiring close examination to fully reveal its status as a formative hybrid (7.45). An irregular serpentine-faced volume bursts forth from the main rectangular body of the building, and lacking the radial geometry that provides the main explosive clue in the Aalto designs, the large splayed-out wall serves that purpose here in concert with this billowing form recalling the signature profiles of Le Corbusier. It seems to be in the process of inflating so abruptly that it has pushed out this large segment of the initiating



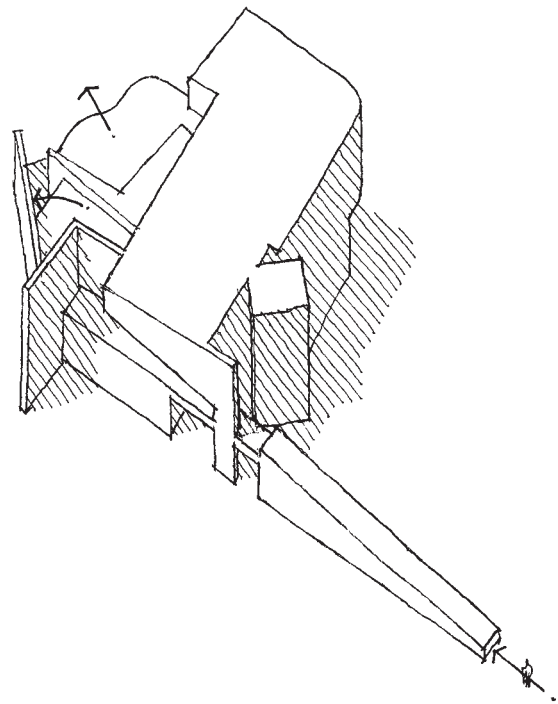
7.44 John Hejduk: Wall House II/Bye house (unbuilt), Ridgefield, CT, 1973. Built, Groningen, Netherlands, 2001. Adapted in part from images at www.quondam.com/dt13/cad/1305a.htm.

volume's wall, like a door swung open—or did the wall open first, releasing the inflation? The Atheneum embodies two modes of deformation in this process, for in contrast to the Aalto designs, the “initiator” of this explosive effect is manifest as an important formative element in the composition. The elongated wedge of the approach ramp is analogous in some respects to the collidive elements which cause the “bending failures” at Pingry School and Williams College, although here there is no explicit imagery of volumetric fracture as a result of impact; instead, the thin finger of the ramp seems to do increasing amounts of “damage” the further it extends through the initiating volume. Although the ramp dwindles to an openwork of stairs and rails—the outer wall of the initiating volume sacrifices itself, negating the volumetric solidity of the wedge once collision is imminent—it still seems able to have displaced the angled wall out of alignment as if by force of impact.

In formative terms, the cuboid initiating volume additively receives the collidively imposed ramp as well as an anomalous ghosted stairwell volume, while a number of subtractive removals occur, plus the above deformative gestures. The composition is not without some awkward moments, but restated in terms of dimensionality the angled wall plane, expressive volumes, and dramatically extended line/wedge of ramp are skillfully integrated into a formative hybrid. The Atheneum has little to do formally with the historic context of New Harmony's twice-over attempt at a utopian community, but the bold, white enigma, out at the edge of town with a bit of characteristic nautical character as if towing it toward the adjacent Wabash, seems oddly fitting.

* * *

Part I has demonstrated that these several formative modes and dimensionalities are productive of wide varieties of persuasive design, whether in the simple interaction of a single means from each, or via more complex combinations. But such variants



7.45 Richard Meier: Atheneum Visitor Center, New Harmony, IN, 1979.

are dependent on sound discernment to achieve satisfactory results: these are elemental approaches and their relationships, affording no guarantee of well-formed architecture or urbanism arising from their application. Some concluding thoughts on forming will follow at the very end of this narrative, but suffice it to say for now that it is hoped a heightened awareness of these “unsung fundamentals” will have a positive benefit.

Part II, concerning issues of “centering,” presents a typology for working in tandem with these formative tools to achieve a sense of focus—one important factor in raising their application to the level of convincing and admirable architecture and urbanism.

PART II: CENTERING

It is your work to clear away the mass of encumbering material of thoughts, so that you may bring into plain view the precious thing at the center of the mass.

– Robert Collier

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Chapter Eight

LIMITING CASES

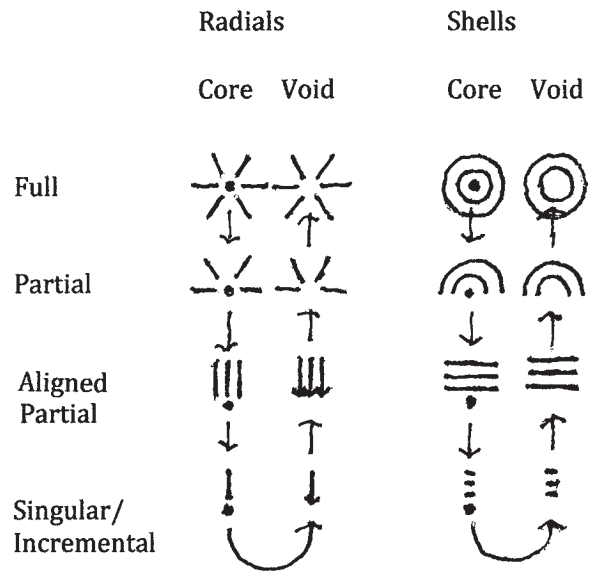
A recurring aspect appears among the preceding cases of form making, cutting across the boundaries of those differing types. In some instances it is obvious, as in the Aalto libraries, while in others it is so indirectly applied as to be seemingly absent. This could be called a seeking of center. Some designs celebrate their center of focus and make it the clear hub of the building, while others cast themselves (or are cast by circumstances of context) as fragments of a larger whole, the center of which is external to that fragment which is the building. This seeking of center may even play no immediately apparent part whatever in the geometry of the building form, and in fact such a goal may have had no conscious role in the designer's thinking. Nonetheless, the thesis here is that most designs, intentionally or not, have an identifiable relationship to a center of focus, and that the specific nature of this relationship in each case plays a significant part in the organizational part of a scheme. A corollary to that thesis would hold that the more insubstantial the sense of focus, the less satisfactory and fulfilling a design is likely to be, assuming it is to be a place for people.¹

This issue of a relationship to a center exists on an equal footing with the formative strategies of Part I.

1. This not to assert that a clear center of focus will suffice to save a scheme otherwise fraught with mediocrities.

These symbiotic aspects, forming and centering, are two sides of a coin; both must be examined to fully define a parti in its irreducible basics. As with forming, centering is manifest in a number of distinct normative approaches, some remarkably common, some obscure, yet all ultimately interrelated in specific, definable and sometimes surprising ways.

A “map” of this chapter may help with an understanding of its reiterative format and the relationships of its sections (8.1). The chapter examines designs exemplifying each of these partis in the order indicated, constituting two evolutionary sequences of scope. The title “limiting” refers to the fact that the beginning and end points of each sequence are completed parti figures: they have reached a limit. Each section in the discussions of cases to follow begins with a pertinent segment of the map (8.2), and each illustration is accompanied by a corresponding small ideogram. These are abstractions, that subsume any number of quirky and hard-to-discern variations, but which nonetheless generally find their place among the constructs to be examined in this chapter and the next.



8.1 Map of chapter organization.

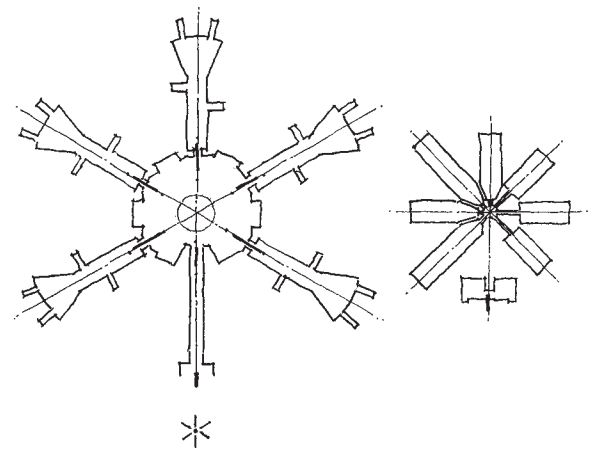


8.2 Core centered radials: sequence.

Radials: Core Centered

Full Radial Arrays

Arguably the clearest and most direct graphic expression of centrally focused form is, in essence, an asterisk: lines radiating from a center of focus—the cartoon of an explosion or a shining light. Another analogy would be the palmate compound leaf with its radial convergence of elements. But in terms of built form this image is a rarefied domain: programmatic separations and adjacencies must foster linear structures that diverge from their one shared point of linkage at the center. A few early hospitals used radial plans, as did a number of nineteenth century prisons such as Philadelphia’s Eastern State Penitentiary. The singular requirements of airports often result in

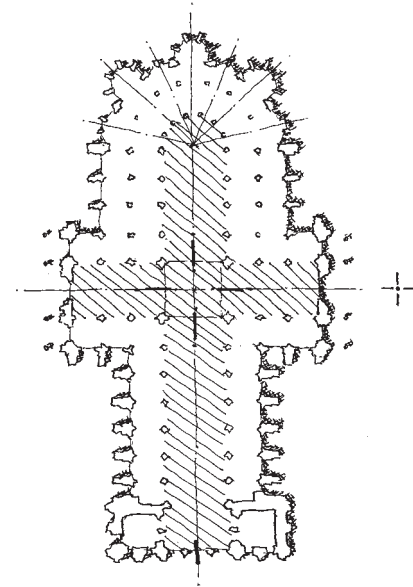


8.3 Moshe Safdie: Ben Gurion Airport Tel Aviv, Israel, 2004 (partially implemented); John Haviland: Eastern State Penitentiary, Philadelphia, PA, 1829 (subsequent additions not shown).

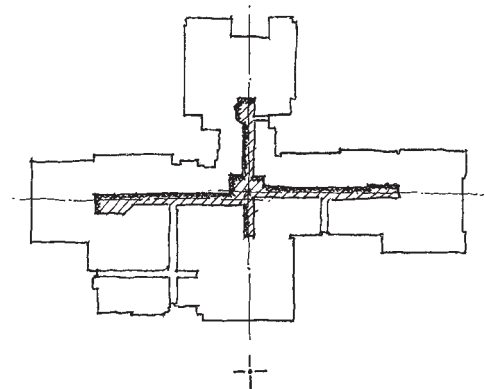
radiating concourses, occasionally extending in all directions as at Tel Aviv's Ben Gurion Terminal (8.3).

A far more common version of the case arises if the radial array is simplified to axial elements converging at ninety degrees. Many Romanesque and Gothic cathedrals characteristically demonstrate convergence to a central crossing, and modern-day shopping centers often locate an enclosed central court at the junction of orthogonally converging malls (8.4; 8.5). The urban crossroads is one of the most ubiquitous of orthogonal crossings, but is not normally legible as convergence to a core, typically being a subset of a repeating grid: the issue of a core or center devolves to another order of magnitude, as with state capital buildings, county courthouses or other built or defined foci at a civic scale. Numerous small county seats in America were planned with courthouses or obelisks serving this role of marking the town center, either by interrupting the crossroads or placing the town square at a central block defined by pairs of street crossings (8.6).² More generally, neighborhoods and garden suburbs have often featured central squares serving as cores, the converging streets that make them pertinent to this case exhibiting a wide variety of patterns, even including diagonal and "pinwheel" variants.

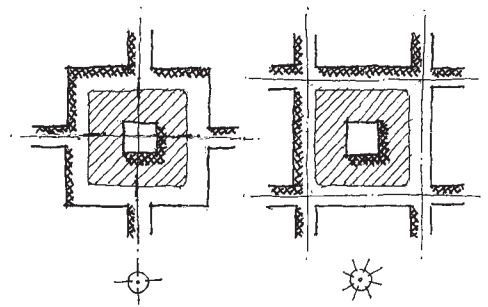
A more complete embodiment of radial geometry at the urban scale exists in the form of connector roads leading to the central area of cities, though typically these patterns evolve by virtue of incremental growth more than by deliberate planning. But the compelling idea of the radial parti has left its mark on the urban scene. Paris' *Arc de Triomphe* at the *Place de l'Étoile* is surrounded by twelve converging avenues (8.7), and L'Enfant's street network for Washington,



8.4 Chartres Cathedral, France, 1250. Chartres and other cathedrals with round apses also typically feature a secondary set of radial elements defined by apsidal chapels, the geometry thereby actually an amalgamation of radial and circumferential orders.



8.5 Klontz & Wrede: Bellevue Square, Bellevue, Washington, 1980's.



8.6 USA county seat town squares: plan types "Shelbyville" and "Lancaster."

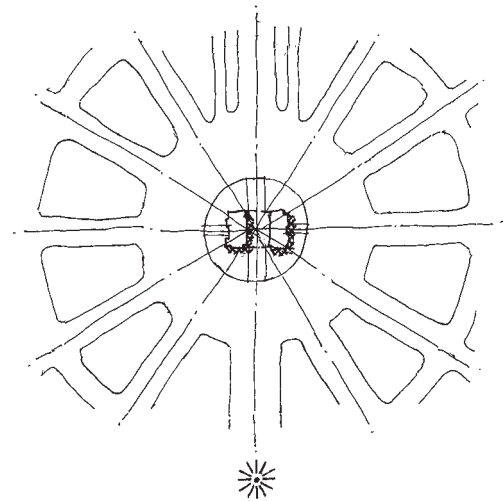
2. These came to be known as the Shelbyville and Lancaster types respectively. Dr. Marian Moffett's unfinished study of the county seats of Tennessee documented numerous variations and combinations of these approaches, as well as a bewildering variety of schemes for plot subdivision patterns.

D.C. features “étoiles” of its own, problematically superposed on its overall grid.

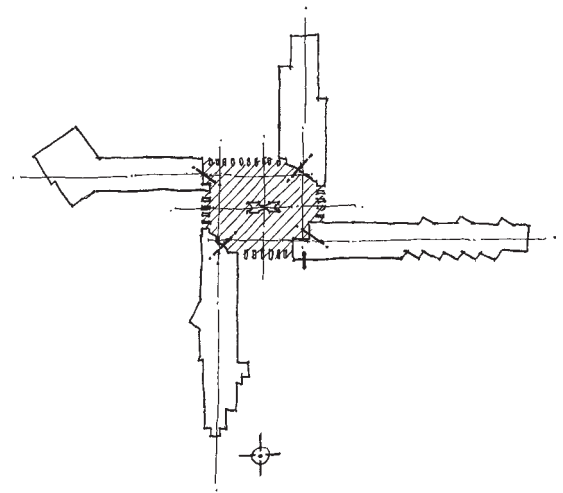
Among further approaches at the scale of architecture that defuse a crossroads effect—seeking to define the focus as a hub rather than simply a crossing—Wright’s “Wingspread” features one means in the form of four orthogonally arrayed radials but with the familiar device of a pinwheeled sequential offset, permitting each arm to terminate at the living space hub without continuing through (8.8). The core to which the plan’s energies converge is actually the central fireplace/chimney mass—featuring no less than four fireplaces—which characteristically sets the living environment slightly apart from being a true center of focus. This sequence of massive core, surrounding ring of space and embedded radials actually constitutes a *hybrid* centering type, many of which are the subject for a later chapter.³

The adoption of an odd number of radials is another strategy that obviates a cross-hairs misreading, as at Predock’s Tang Teaching Museum (8.9). That design also employs the architect’s signature sloping wings rising from grade to the center to emphasize its radial aspect, plus an ambiguously configured central junction that ameliorates the inherent predictability—not always desirable or appropriate—of the central-focus approach. In contrast, Graves’ Vassar College Art and Museum project brooks no such ambiguities, its central drum mediating three converging radials (8.10). The drum, an omnidirectional axle from which spokes may radiate equally in any direction, is clearly the most concise architectonic realization of a core for radial elements.

3. It’s been said that Herbert Johnson had his own ideas for the house as clients often do and that his scheme involved a rather simplistic convergence of four radials crossing at the central living space. Obligated to take this under advisement from his important client Wright came up with the offset scheme: perhaps less innovative than he might have done otherwise, the house remains convincing in its morphology, and surprisingly “livable” in the scale of its interiors. It is has been sensitively repurposed as a conference center with the requisite offices located in what was once the extended carport.



8.7 Place de l'Étoile (now Place Charles de Gaulle), Paris, 1670.



8.8 Frank Lloyd Wright: Wingspread (Herbert F. Johnson House), Racine, WI, 1939.

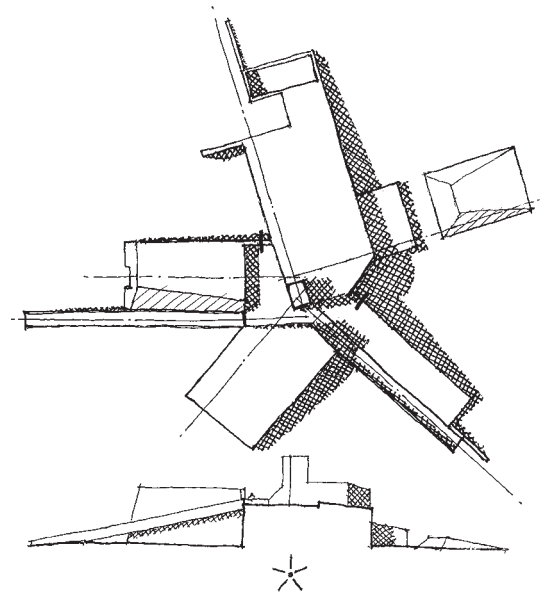
Partial Radial Arrays

But warranted occasions for such a fully encompassing array are not all that common: they constitute a “limiting case.” A more commonly seen and generally more interesting situation obtains when two or more radials converge eccentrically to a core from one side. A sense of incompleteness, directional orientation and movement is often the result, though frequently tamed and rationalized by 90° and 45° alignments. KPF’s Procter & Gamble Headquarters demonstrates an orthogonal approach with elongated bars or circulation axes forming an L in plan in conjunction with the hub at the corner, while a 45° axis of circulation establishes a third radial defined by a sequence of elements (8.11). On the evidence of numerous built examples, it bears noting that applications of the “ 45° aligned radial” often present a difficult challenge in terms of achieving a convincing, non-awkward juncture at the inside corner of the ensemble.⁴

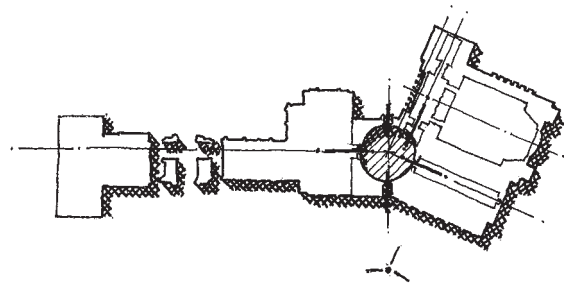
The L form recalls Wright’s Jacobs and Rosenbaum houses (8.12). They incorporate no overt or implied marking of a 45° axis, but instead comprise three radials converging at 90° to the characteristic workplace/ fireplace hub, the outboard carport supplementing the dominant L of the house proper in each case. While the irregular stepping of the footprints blunts the reading to a degree, the mutual anchorage of the several differing roof planes at the corner masonry mass serves to re-emphasize it. The core in these cases, as is typical of the Usonian houses, gathers bathroom, kitchen and furnace room behind a fireplace to form a massive anchorage for the radiating wings: the life-giving hearth supplemented by more modern life-support.

Stirling achieved freedom from such orthogonal geometry at his St. Andrews dormitory, noted

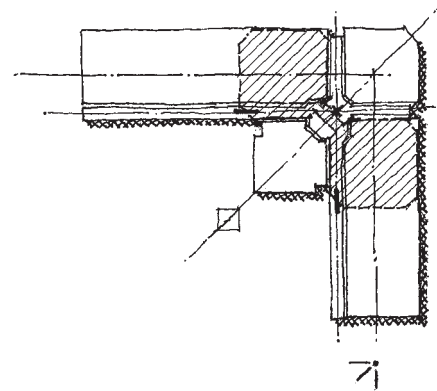
4. The paired towers of the project, flanking the core area and located on axis with a prominent vehicular entrance to the city, also comprise a notable example of singular duplication.



8.9 Antoine Predock: Tang Teaching Museum & Art Gallery, Skidmore College, Saratoga Springs, NY, 2000.



8.10 Michael Graves: Art Department and Museum (project), Vassar College, 1981.



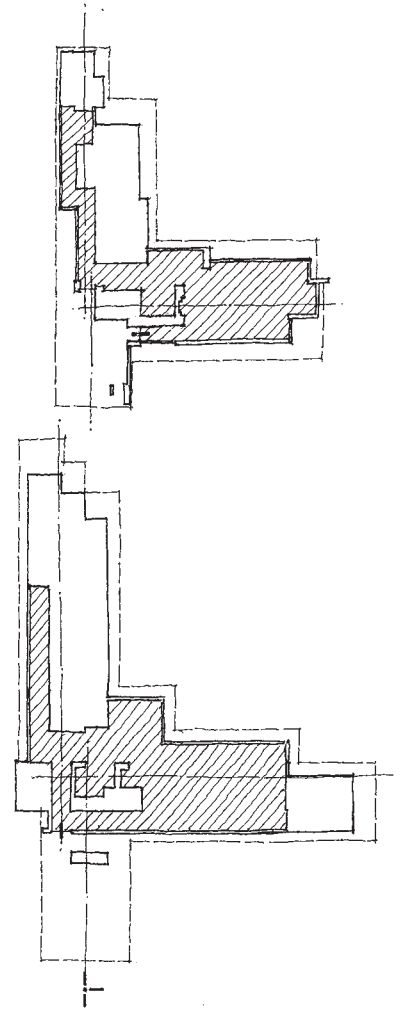
8.11 KPF: Procter & Gamble Headquarters, Cincinnati, OH, 1985.

previously for its pair of single-loaded room wings diverging on their way downhill from entrance and commons facilities (8.13). The unrealized master plan calls for two pairs of these subassemblies, each splay of four fingers inflecting toward a common unexpressed focus in the depths of the escarpment to which they appear anchored by the commons blocks. But it is likely that the present pair of wings will remain the full extent of the development, with the commons as their true core of focus.

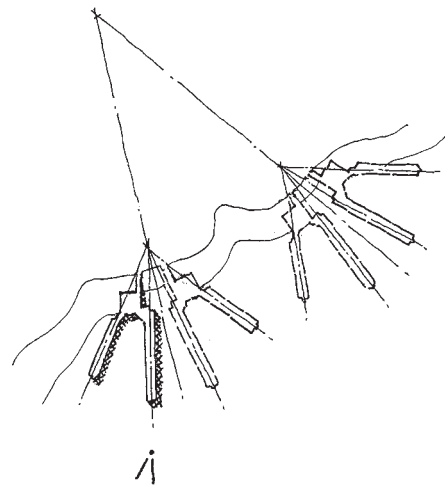
Aligned Partial Radial Arrays

A variant on this case bends the rules a bit but deserves mention as a significant piece of the centering puzzle. This arises from “straightening up” the two or more radial elements of a partial array into parallel formation, and as a result the core element is no longer the geometric focus of all elements, yet it still terminates and dominates the composition. The rationale for this less common and less diagrammatically logical variant arises from a simultaneous desirability of systematically parallel ranks of building and of a terminating center of focus. MIT’s extensive Maclaurin Buildings complex roughly encompasses four aligned radials, linked to the core of the “great dome” by a famously long corridor. This transverse link plays an important part, to the extent that the ensemble could also be considered a hybrid of two centering modes (8.14).

Another iconic academic complex, Jefferson’s great lawn building group at the University of Virginia presents a clearer version of the type with its four parallel rows of colonnaded student rooms, terminated on center by the Rotunda (8.15). (The variegated two-story “pavilions and hotels” spaced along the radials introduce another centering factor which will be revisited.) The overall effect of the ensemble has been described as “paradoxical... regimentation and individual expression... hierarchical order and relaxed improvising... But it is the



8.12 Frank Lloyd Wright: Jacobs house, Madison, WI, 1936; Rosenbaum house, Florence, AL, 1940 (subsequent addition not shown).



8.13 James Stirling: Master plan for dormitories, University of St. Andrews, Scotland, 1967.

reconciliation of the apparent irreconcilables that is the genius of the system.”⁵

Looking further back in history and casting a wider geographic net, the Great Mosque of Córdoba is arguably another case, the elaborately developed mihrab that marks the direction of Makkah being the core (8.16).⁶ At an intermediate stage in the development of this mosque, preceding its lateral expansions and the insensitive imposition of a large Christian church, the mihrab was centered at the end of the many parallel rows of horseshoe arches, affording something of an interior version of the type. The approach is particularly well suited to mosque architecture with regard to the conjunction of a large undifferentiated prayer hall with the single peripheral focus of the mihrab.

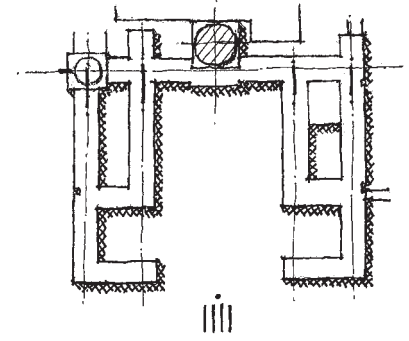
Single Radials

This dwindling sequence—from full to partial radial arrays, to “parallel” partial radial arrays—leads in turn to an ultimate case that completes the progression. While most prevalent of all by virtue of its direct and logical order, it is less immediately legible as a member of this series of radial partis. A single axis, leading at one end to a clear terminus point of heightened importance, is the asterisk pared down to a single radial. Two dissimilar parts—the axial bar and the terminating core element—are the irreducible recipe of this type.

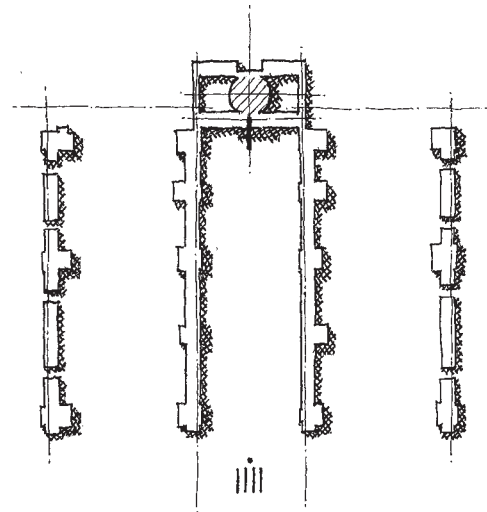
A wide range of secondary orders is found within the simplicity of this diagram. At one extreme, Boston’s Long Wharf hotel is again of note for its extruded profile: the case is demonstrated with clarity despite the building’s size and complexity, its elongated arch of rooms terminating in the “head” facing the harbor

5. Wills, Gary, 2002. *Mr. Jefferson’s University*. Washington, DC: National Geographic Directions.

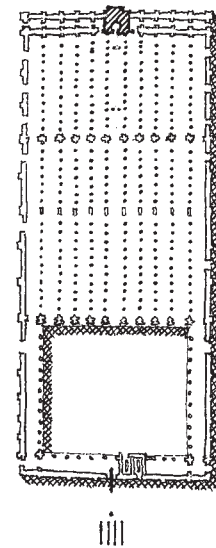
6. While this is physically the case, Muslims would rightly regard the mihrab as a step along the way, the Kaaba at Makkah being the core to which it is pointing.



8.14 William Welles Bosworth: Maclaurin Buildings, MIT, Cambridge, MA. 1913.



8.15 Thomas Jefferson: Great lawn building complex, University of Virginia, Charlottesville, VA, 1826.

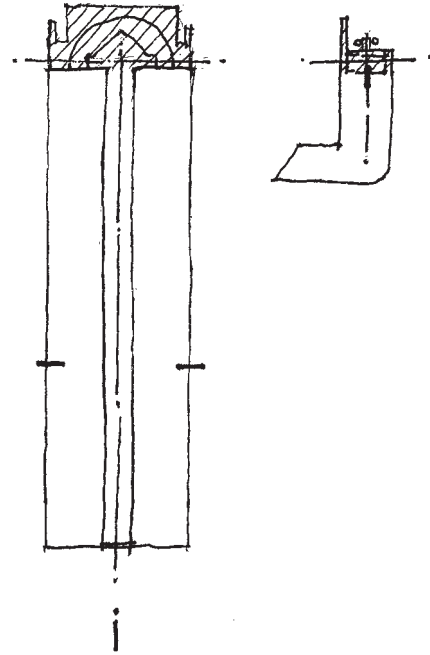


8.16 Great Mosque, Córdoba, Spain, 10th Century.

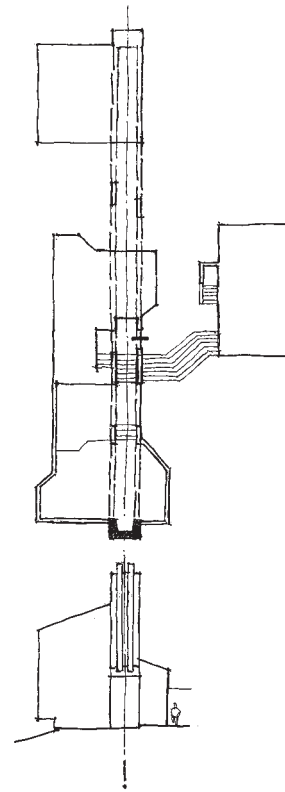
(8.17). Harvard's Sackler Museum also involves an axial spine lined by peripheral spaces, the whole sheathed in a building which itself embodies an axis, albeit one with a twisted tail. This deformation, however, is secondary to its reading as a radial, terminated by the unmistakably anthropomorphic head of the lobby.

The additive strategy of a spine with lateral appendations, "saddlebags" in Moore's argot, is a frequent application of the single radial. Turnbull & Moore's Hines House at Sea Ranch issues from the terminating fireplace as its core, the tall circulation spine flanked by large and small saddlebags, the guest house element having detached itself and drifted away as a sort of tensile failure (in a good way) (8.18).

Barnes' Haystack Mountain School demonstrates something of the limit to which a project's organization can be elaborated in this way and still remain, at its most basic, a single radial (8.19). The romantic gesture of a grand stair to the sea comprises the radial spine, and the overlook at its base is its core. Paradoxically, although one has distant views out from this terminus point, it is as far "in" to the scheme as one can go—one can't keep descending and re-emerge in the outer world which one left at the top of the stairs. It is a poetic diagram, the core a place of contemplation at the periphery of the complex as opposed to a hub of activity at the center or the entrance. The spine and core encompass no functional or sheltering aspects of the design, save a linking role, all buildings of the school being actually located on the transverse extensions. While structurally founded in its trunk, the bulk of this tree is in its branches, which follow contours of the slope laterally for considerable distances. This "alternate pinnate" order is hierarchical; the transverse axes do not cross the spine to challenge its dominance but terminate there, arrayed in informal alternation. There is even a suggestion of "fractal regression" in the alternation



8.17 Araldo Cossuta: Long Wharf Marriott Hotel, Boston, 1982; James Stirling: Sackler Museum, Harvard University, 1985.



8.18 Charles Moore & William Turnbull: Hines House, Sea Ranch, CA, 1967.

of the small huts at the extremities, mimicking the similar first-order pattern along the spine.⁷

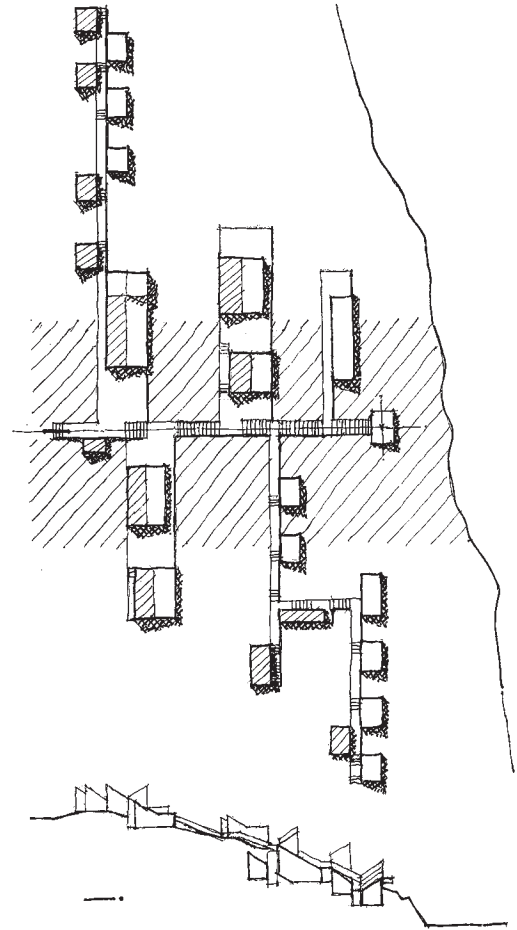
Radials: Void Centered

A crucial single step in the sequential analysis of these types arrives when the pairing of radial and core is examined with a goal of further simplification. The case can be made convincingly that a core alone, shorn of all radials or other appendages, is something of a logical impossibility or contradiction. A core by definition is linked to or encompassed by subsidiary material of which it is the core; in the context of architecture, regardless of the degree of Zen-like simplification that may be achieved, an identifiable hierarchy remains. The core element of a given design, shorn of its dependencies, would tend to manifest at least some small degree of internal order, itself focused on a sub-core. If this onion-peeling is carried to its logical extreme, the arguable outcome seems not a “naked” core but nothing at all.

Single Radials

But the other option—removing the core from the composition—is not only possible but commonplace. The result is a single radial “open” at both ends—the ultimate simplification of the sequence beginning with the asterisk (8.20). But given the asserted primacy of a seeking of center, how may the core be readily shorn? Answers consist of hedges of sorts that permit having it both ways, albeit rather unsatisfactorily in some cases. The open-ended radial can be conceived of as focused on a core that is indefinitely distant. Although out of the composition, the core as a generative force remains an issue; the radial remains so-named because its focused and axial linearity is not self-referential, but an architectonic response to a greater order of organization—the distant and understood core. Conundrums emerge from this interpretation that are

7. A true opposed system of crossbars transverse to a spine, as at Hartsfield-Jackson Airport, is morphologically different and constitutes a hybrid centering case.



8.19 Edward Larrabee Barnes: Haystack Mountain School of Crafts, Deer Isle, ME, 1961 (Initial plan and section drawing information courtesy of Haystack School. Subsequent additions not shown).

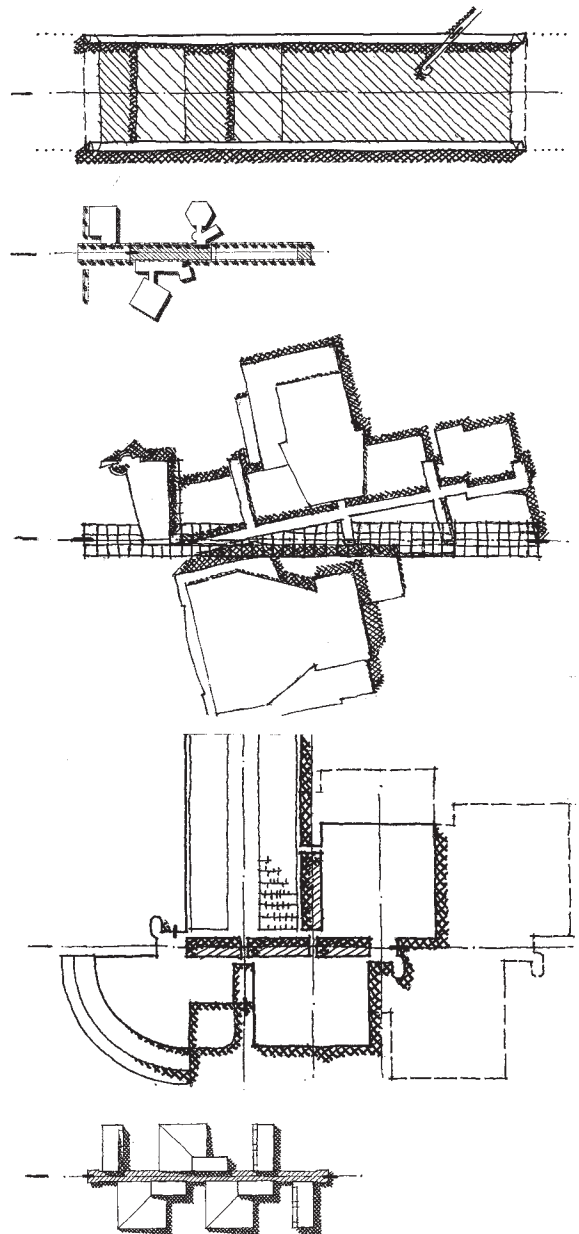


8.20 Void centered radial: sequence.

poetic, disturbing or disappointing depending on the nature of the design and context involved.

Given the utter conciseness of the parti, it is the domain of a surprisingly wide range of interpretations. As with the Long Wharf hotel, the singular radial at its most elemental may be manifest via extrusion, analogous in linearity to Foster's Sainsbury Centre in the above discussion of dimensionality. But the two projects part ways in the present context due to the Sainsbury's lack of a "head" (8.21):

- Reduced to a thick-walled, permeable, inverted channel with no dominating core along the axis, its radial experience is truly open-ended, and while sub-structures occur within, the linear focus of the extruded surround prevails. While the open ends are logical locations for entrances, this is a banal choice that could blunt the goal of continuity: Foster employs understated side entrances instead, including a punched-through diagonal bridge to the pre-existing campus.
- Not uncommonly the contiguous space of the radial axis is reserved primarily for circulation, as at Haystack Mountain, with actual use areas as appendations: a fundamental distinction in experiential terms, but a matter of degree with regard to the radial as a centering mode. Pelli's Long Gallery House project goes to extremes to preserve the dominance of such a circulatory spine in that the subordinated volumes of the house itself are attached in an irregular order to its sides via linked, en faced and collided junctions, while the spine itself extends well beyond in the service of unequivocally asserting its primacy.
- Eisenman's Wexner Center adopts a similar diagram, the axial ramped corridor and scaffolding structure clearly dominating the composition, and although the re-interpreted armory building fragments compete for attention at the entrance, these elements and the lobby



8.21 Foster: Sainsbury Center; Pelli: Long gallery house; Eisenman: Wexner Center, Columbus, OH, 2005; KPF: Long Lines; Barnes: Kittredge Dormitories.

they house do not suffice to constitute a core for the design. The outdoor walk below the scaffold framing which divides the project from end to end, in conjunction with the adjoining interior ramp, is its defining feature. On a diagrammatic level, the relationship of the spine and its adjoining volumes is collidive: the spine is treated as a skewed intervention which respects an adjoining urban grid in preference to that of the campus, appearing to cut across the corners of the pre-existing flanking auditorium buildings. The origins of this gesture being apparent only from above, it is debatable whether the result is contextually ingenious and expressive of bold dissociation from the cultural and aesthetic context of the campus, or more in the nature of fashionably skewed geometry that has been polemically spun for a fare-thee-well.

- Other cases flesh out variations on the open-ended spine. KPF's AT&T Long Lines and Barnes' New Hampshire dorm recall the alternating branches of Haystack Mountain. Long Lines' assertive cafeteria volume brings to mind Wexner's off-center gatehouse in that its dissimilarity is welcome, but it is not a core; the spines of both projects are open-ended in both directions with diagrammatic clarity.

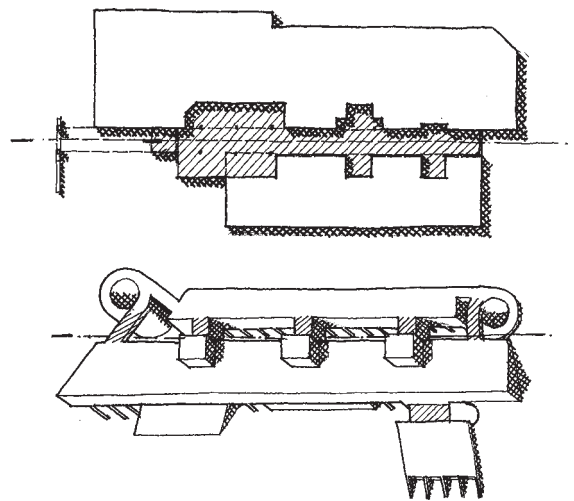
Such significant appendations are, more often than not, part and parcel of the radial cases. The extended wings of Haystack Mountain, Long Lines or Olivetti have the proportions of full radials, while the more truncated attachments of the Hines house, Long Gallery house or Wexner are radial increments.

The crucial issue lies in their status as *subsidiary* appendations to elements that are themselves radials. The "fractal regress" interpretation of Long Lines is again pertinent, for the situation of the above cases is provisionally resolved as one of a "hierarchical self-hybrid," the primary radial giving rise to secondary radials or radial increments, attached along its flanks

by one or another additive means. For each secondary element, the primary radial spine functions as its terminating core, being the immediate goal of that element, while the question of a true core for the ensemble as a whole remains a separate issue.

When such flanking appendations grow together to become contiguous volumes the singular radial takes on the nature of a sandwich, as at the Bohlin firm's conference center (8.22). While the singular radial of the spine remains the dominant form, it is more obscured by the side volumes. A view down the spine's axis evokes a dilemma inherent in the open-ended radial: the unobstructed vista from the front entrance centers on the rear entrance, the way out immediately beckoning from the way in, and if nothing else this consequence can seem a bit of a let-down, the main event of the scheme being immediately visible: at the point of entry the experience becomes a journey to the exit. Barring interesting and unexpected experiences which may await in the subsidiary appendations, with the main sequence thus revealed all else can become a *denouement*. The term "sequence" is, in fact, something of a misnomer for it is the *lack* of sequence that can be the Achilles' heel of the open-ended radial.

At TAC's Johns-Manville Headquarters there is no predominating axial pedestrian spine, for in keeping with the influential role of the automobile in shaping its design the dominant axial passage is the entry drive. The drive itself has become the spine, flanked by longitudinal building elements with links forming a sequence overhead. With this in mind the scheme is not a spine *parti* in quite the typical sense, nor is it totally consistent as an open-ended radial. A primary influence on its unusual character is the sloping site whereby the building gradually emerges as if from underground, to end at the other extremity cut off in midair. While an open-ended scheme can foster an anticlimactic aspect in a more mundane context, it seems entirely suitable in this dramatic mountain setting: nothing less than the opposite poles of earth



8.22 Bohlin Cywinski Jackson: Luzerne County Community College Conference Center, Nanticoke, PA, 1981; The Architects Collaborative: Johns-Manville headquarters, Denver, 1977.

and sky are *dual* “remote cores” of the design, linked by the building’s longitudinal sweep.

* * *

The Z axis comes in to play in this context, in that many if not most high rise buildings lack what would be considered a core: a lobby may be grand, but it is still ultimately just an entrance. Variants on the theme of sky atria are changing the long-standing nature of the skyscraper, but the typical condition through the years of the tall building’s evolution as a type involves a “solid” trunk of functional elements at the hub of the footprint, with variegated workplaces infilling the outer reaches to the perimeter. Tall buildings, including the special efforts of the supertall and extended unitary cases, are single radials on the Z axis, aspiring to an indefinitely distant core above. As such they sometimes make for dramatic architectural theater, but often lack a sense of focus within—despite vertiginous interior voids in some cases—ultimately constituting ambitious leasing opportunities as opposed to centered places.

Aligned Partial Radial Arrays

Retracing the previous sequence in the direction of multiple radials, but continuing without a core in the immediate composition, a case arises that is a morphological counterpart to the University of Virginia great lawn ensemble, but without the rotunda—the core. Again adhering to the convention of a focus or core located at an indefinite distance, multiple radials whose axes converge there would be aligned. Two or more parallel bars, architecturally related, physically separate, and conceptually axial (approached and traversed longitudinally rather than transversely)—these are the basic characteristics to be met by such a scheme. Some anonymous factory and warehouse complexes meet these criteria, and large shipping and recreation piers such as those fringing Manhattan along the Hudson afford a somewhat more colorful if no more consciously wrought

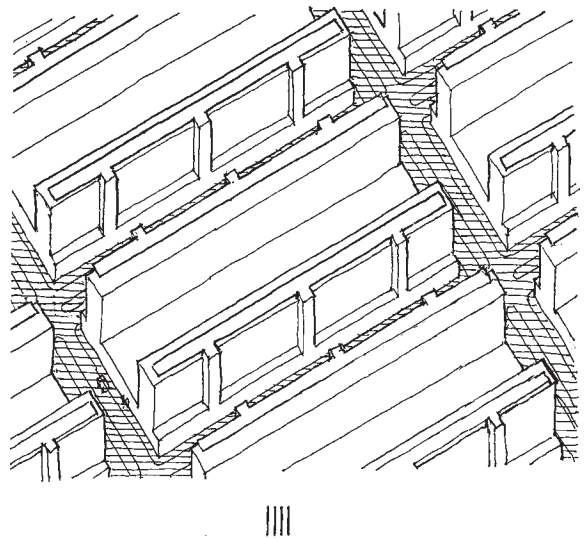
realization (though they inevitably connect at the landside end, becoming in theory a different sort of order).

The parti also recalls districts of linear apartment blocks in repeated ranks, as developed by Gropius, Hilbersheimer and others in the late '20's and '30's (8.23).⁸ While these elongated bars are spines in form only, being aggregations of flats side by side, the type offers a useful lesson about the nature of multiple radials in parallel. It is a cautionary one, in that such repeats of three, four or more elongated profiles, separated by equally elongated voids, can have an undesirably synergistic effect: to perhaps state the obvious, extreme elongation and undifferentiated repetition have the potential for evoking a sense of placeless alienation, and both are present here. Surely one key to this sense is the loss of focus: not only is there no compositional center, but the multiplicity of elements eliminates the axial energy present in the single radial as pointer, and an anonymous directionality is the only remnant.

Excepting the quite important issues of human scale and the materiality of historic urban fabric, something similar could be stated regarding London's ubiquitous "terrace" housing and similar arrays throughout the old world. There are endless expanses of parallel housing rows, the relative benefits or failures of this planning approach devolving more to cultural and economic issues than to its inherent architectonic nature.

By boiling the type down to two parallel bars, the axial focus is restored. The case could be said to be cousin to the contiguous entity of the spine with continuous flanks such as the PA conference center, with the enclosures of the spine removed and the

8. The hypothetical example by Hilbersheimer could be perceived either as a series of such parallel radials or as a series of parallel walls, depending on one's vantage point, given the totally abstract context. The design is also of interest as a hypothetical case of multiple dimensionalities, given the wall-like slabs, linear verticals of the service towers, and planar platforms beneath.



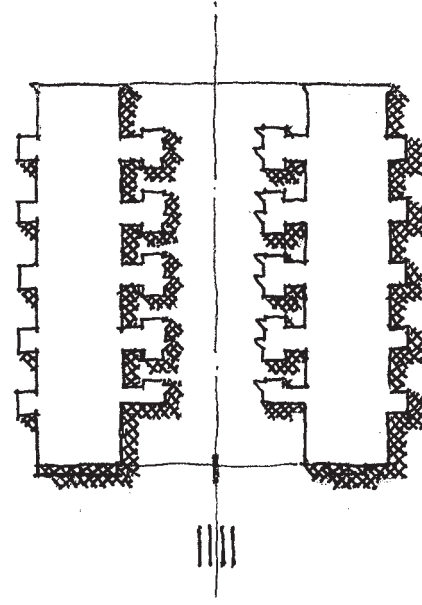
8.23 Ludwig Hilbersheimer: Hypothetical commercial blocks design (undated), adapted from Ludwig Hilbersheimer, *Contemporary Architecture: Its Roots and Trends* (Chicago, Paul Theobald and Company, 1964). Fig. 173.

flanks imbued in compensation with added axial energy. The somewhat rarefied nature of the parti may play a part in the iconic aura of the Salk Institute labs (8.24). The mirror-image pair of buildings flanking the open-ended court is approached axially from the east, while the focus is no less than the Pacific horizon to the west. Although it is possible for a scheme of one or several parallel radials to have an ambiguous directionality, the setting of the Salk labs leaves no question, and the angled bladewalls of the study wings which flank the court give further emphasis. The reticent endpieces housing offices and mechanical spaces aren't sufficiently dominant to be legible as core elements: as with other aspects of the flanking buildings they are subordinate to the open axis of the court as the defining aspect of the composition. The buildings are a great deal more than longitudinal extrusions, but in their basic linear form, enhanced by the angled blades, they are focusing devices for the coherent linear space of the court, pointing out to sea.

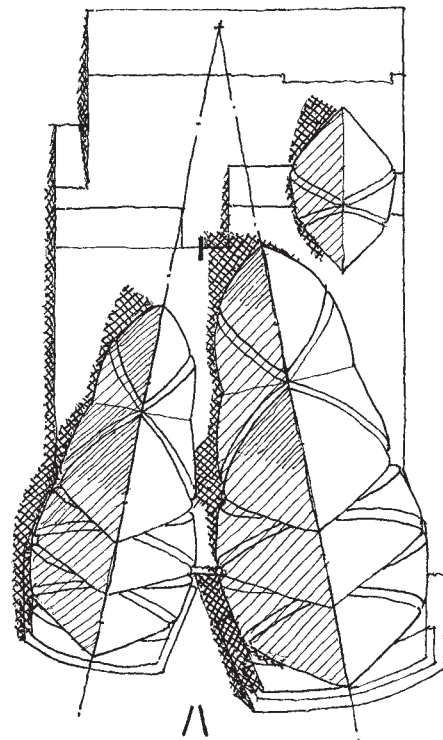
Partial Radial Arrays

When the focus returns from the indefinite distance but still remains outside the domain of the composition, the result is a partial array of radials inflected toward a common but otherwise unexpressed center:

- The simplest case of two radial elements is seen at the Sydney Opera House, where the structures of the main and small halls inflecting toward an unmarked common focus at the foot of the great steps mounting the public concourse (8.25). The splay emphasizes the contrasted separation between the hall volumes and the massive base, while the lack of a core fosters a sense that the shells are cut loose and heading out to sea. In any case, any sort of common core physically linking the two halls would have clearly been alien to the architect's intent.



8.24 Louis I. Kahn: Salk Institute for Biological Studies, La Jolla, CA, 1965.



8.25 Jorn Utzon: Sydney Opera House, Australia, 1973.

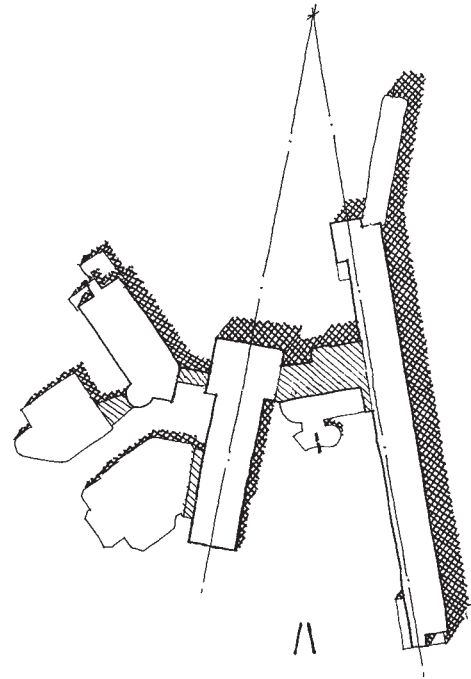
- Aalto's Paimio Sanatorium also features a slight splay between its two dominating longitudinal building forms (8.26). The driving force of the splay is, as at Sydney and St. Andrews, outward rather than inward, here configuring a welcoming profile at the entrance drive. The St. Andrews splay recalls a similar rationale sometimes seen at highrise beachfront condominiums, their wings diverging to give each unit some semblance of access to the view.

Full Radial Arrays

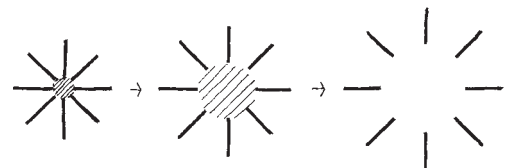
To complete the sequence, one returns full circle to the parti of the asterisk, but now without a central core. While the preceding cases demonstrate that partial arrays of radials can be both expressive and useful while lacking a core at their point of focus, a different situation obtains when radials converge from all sides to a voided center (8.27). The case is somewhat paradoxical in that a closely converged radial array is necessary for cohesion of the ensemble as a single architectonic entity, but such proximity tends to invest the common focus with some sense of defined center despite its lack of enclosure and contiguity. If radials are backed off sufficiently to eliminate any such special centered quality, the composition essentially falls apart into its separate component pieces. Ultimately it becomes clear that a full radial array lacking a core is a limiting case which, while anchoring the continuum, is approached but seldom realized: it is truly an ensemble working at cross-purposes, the convergent energies of the radials fated to unconsummation.

Shells: Core Centered

The term "radial" rightly recalls its use and meaning in city planning, as has been noted with respect to major collector roads diverging from a shared central urban area. The analogy extends usefully to the ubiquitous partner of the radial in metropolitan traffic planning, the circumferential. While its role



8.26 Alvar Aalto: Paimio Sanatorium, Finland, 1932.



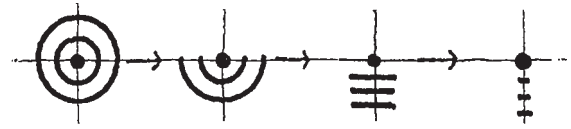
8.27 Unfeasibility of the full radial array without a core.

at the urban scale is that of movement around its course, the circumferential route also inevitably acts as a physical barrier to some degree, entraining and separating inner and outer urban districts. Several concentric circumferentials, aggregated over time, typify many cities—each a wall as well as a path. Moscow is an unusually clear example, its several traffic circumferentials, some once city walls, forming a nest of concentric rings around the hub of Red Square (8.29). Though a vast open space, its signature definition in Moscow's urban scheme of things tenders it the status of core at this urban scale. Radials and circumferentials are both present here, as in the typical city, forming a combined if generally incomplete network. But versions of one or the other normally dominate in architecture, as in the above sequence of cases based on the radial. Each step in that sequence has a counterpart in a progression based in turn on the circumferential, of which the fullest, most elaborated diagram, much as in the city, involves several concentric layers centered on a core.

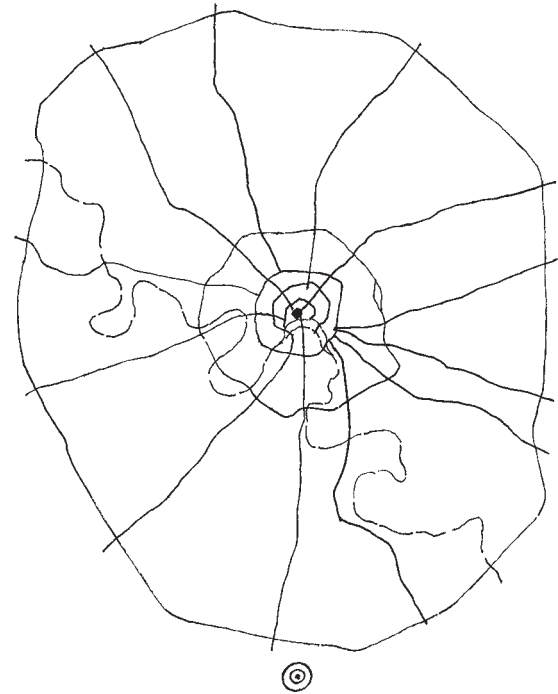
Full Shell Arrays

In the realm of architecture, these layers—here more likely to represent edges, barriers, or walls than paths of transverse movement—may be more simply referred to as *shells* (8.28). And just as an asterisk effectively represents a full array of radials, a corresponding array of concentric elements or layers resembles nothing so much as a “bullseye.” Foster's rework of the British Museum exemplifies the case, the removal of stacks from around the central domes reading room permitting a circumferential light well to become an intervening skylit space, a pseudo-exterior shell linking between the perimeter shell of galleries and the core of the central element. A penumbral deck of public functions adds another concentric shell around the core (8.30).

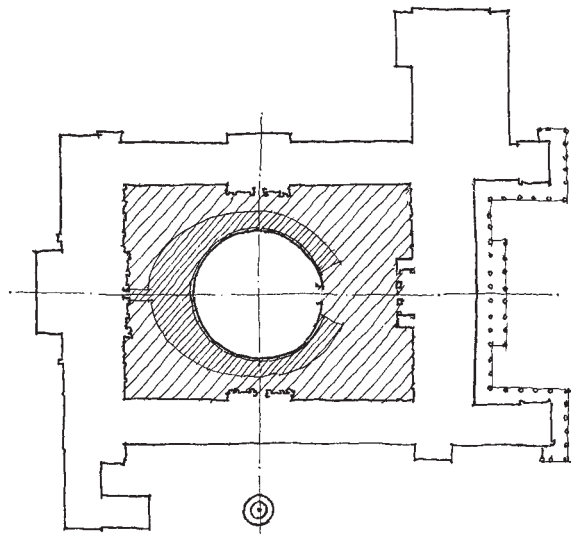
This parti of nested shells has already been well represented by buildings based on a centrally focused version of the linear regress: Kahn's Exeter library,



8.28 Core centered shells: sequence.



8.29 Road connector network of Moscow showing principal circumferentials and radials. The dashed line is the Moscow River.



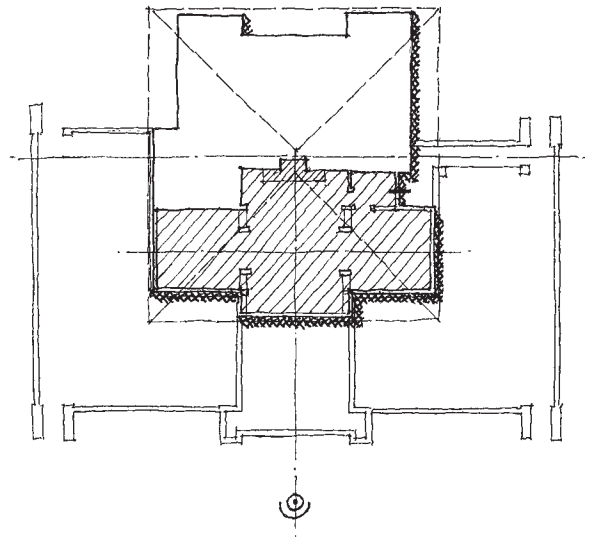
8.30 Norman Foster: Great Court, British Museum (showing original footprint of the museum, based on designs by Robert Smirke, 1823), London, 2000.

Turnbull's lattice-wrapped house, the stave church at Borgund, Pelli's World Financial towers—these and others demonstrate the close affinity between indefinite linear regression in this form and the approach to centering involving multiple concentric shells. The office towers employ the parti as a volumetric modifier, brought to bear to express the idea of concentric shells from external viewpoints, their interiors reflecting a more conventional nonhierarchical reality. The other designs bring the parti to more literally realized form, with layers of wall or colonnade heightening by degrees the ultimate impact of the innermost nested element: the core or center.

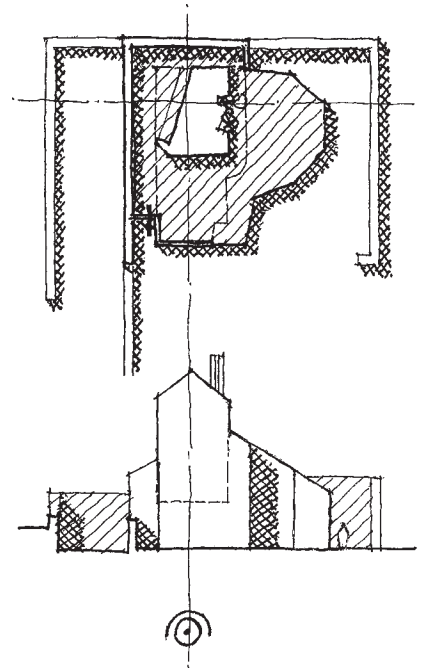
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Space-centered versus form-centered: these parallel themes on the nature of the core follow each other through the history of architecture. While most of the above cases incorporate a habitable space at the center, a more organic approach places a solid anchorage for the building at its heart:

- As in his Usonian houses, Wright's fireplace mass epitomizes this theme, but he seldom employs it in conjunction with concentric shells. His Cheney residence comes close, however, with an outermost trace defined by the peripheral site wall, the house perimeter itself below the square pyramidal roof coming next, and a central inglenook space finally showcasing the fireplace mass at the hub of the composition (8.31).
- An homage from more recent years is seen in the Bohlin firm's Gaffney house, which employs a similar progression (8.32). A rough stone wall remaining from a barn is the outer boundary, partly of a courtyard and partly of the house itself. An island volume in the interior focuses on a chimney mass for the woodstove as the heart of the house, given emphasis by an uppermost step above in the form of the partial second floor.



8.31 Frank Lloyd Wright; Edwin Cheney house, Oak Park, IL, 1903.



8.32 Bohlin Cywinski Jackson; Gaffney house, Romansville, PA, 1980.

With concentric shells thus rising sequentially toward its core in an approximate sort of way, the parti is also reminiscent of $2d/\text{inverse regression}$.⁹

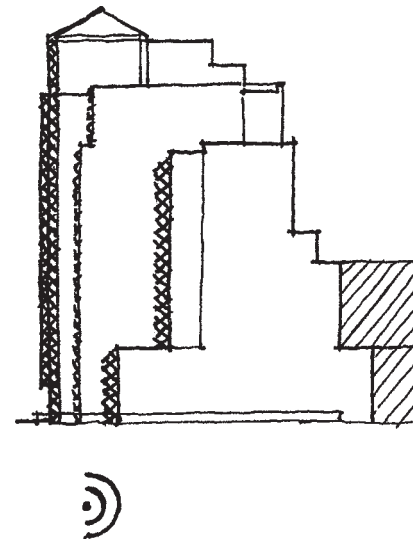
Partial Shell Arrays

A core only partially wrapped with multiple layers seems less common. In the Cooper-Ekstut hotel design whose lateral shifts of the several layers partially reveal the core, centering and regression are both served with equal clarity (8.33). Similarly KPF's Hercules building could be seen simultaneously as two iterations of a direct/ inverse regress and as a partial shell array, its atrium core emerging from the partially surrounding stone clad volume (8.34). As a secondary manifestation of forming, both exhibit irregular "eroded" top profiles in the fashion of face-related subtraction.

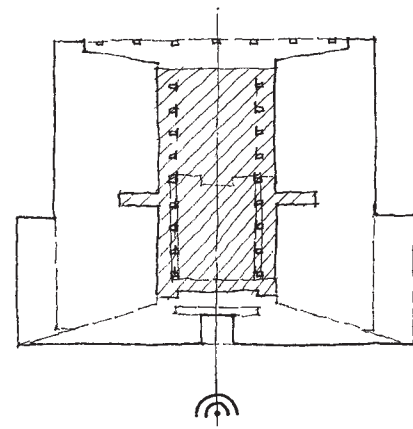
Aligned Partial Shell Arrays

The intermediate case that follows bears mentioning due to its place in the overall scheme of things, but more for theoretical reasons than its utility of application. It is analogous to the aligned radials with a core, but now in the form of aligned shells: concentric partial shells "ironed flat" to the point of having mutually infinite radii. It would seem a clear case of inconsistency for a core to remain within the immediate scope of the composition, but that is the reality of this transitional version of centering components. Neither is the result born of logic, as functional circulation would normally require the core to be sequentially linked to such parallel bars by some

9. Stadiums and arenas comprise a self-evident example of full core-centered shell arrays. While physically planar, the playfield occupies a three-dimensional volume defined by the thrown, kicked or hit missiles involved, with peripheral shells comprising the tiers of patrons and variously circumferential provisions of services, concourses and exits. At one extreme, theaters and music halls evince much the same, as at the Mummies or Arena Stages of the world, until the sequence begins to close upon itself into the asymmetrical surrounds of the Berlin or Disney halls, then to the European shoeboxes lined with tiers, and ultimately devolving (to jump ahead in the narrative) to aligned shell increments—lobby, balcony, orchestra, pit—of a conventional theater or cinema, focused on the core of the stage or screen.



8.33 Cooper, Eckstut: Margaret Hotel (unbuilt), Manhattan, 1986.



8.34 KPF: Hercules Headquarters, Wilmington, DE, 1983.

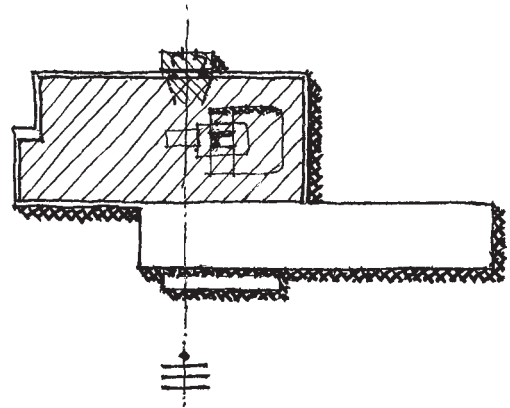
sort of spine, the result becoming something different: a hybrid of two centering types.

But if the aligned shells were to *enface* each other, a somewhat more plausible diagram results. Aalto's library at Viipuri, renamed Vyborg when it became Russian territory, offers some aspects of this parti, foremost its series of parallel laminae that slide past each other—cited previously as exemplifying deformation via “failure in shear” (8.35). Suggestions of a linking cross axis are more apparent in plan than in reality. While the circulation desk takes a central supervisory post in the dominating volume, the lower “apsidal” children's library entrance with its boldly articulated interior poses as an outboard core of sorts for this engaged series of parallel shells. But ultimately this seems something of a red herring, the circulation desk clearly being the more logical core for the scheme. The general case of “aligned shell arrays with a core” comes to seem another theoretical puzzle piece more than a useful construct manifest by built form.

Incremental Shell Arrays

As concentric arcs or their straightened analogues pull in to become smaller and smaller segments of the initiating shells, the parti approaches a limit wherein the arc of circumference becomes arbitrarily small; the shell segments devolve ultimately to narrow “increments” in an aligned radial sequence, retaining no aspect of partially surrounding or entraining the core or each other. This corresponds directly to the reductively limiting case of the *radial* sequence: the solitary spine or radial. The two diagrams are closely related structurally, the incremental shells being equivalent to an interrupted or dotted-line version of a radial. The axial route of passage, when present, is a sequential one that passes from segment to segment in a progression, *en suite*, as opposed to the dominating continuity of the radial spine.

The Isozaki museum may seem a perfect example with its axial sequence of galleries and the dominating core



8.35 Alvar Aalto: Viipuri Library, Viipuri, Finland (now Vyborg, Russia), 1935.

feature of the entrance porch, but closer examination reveals that it embodies a further level of centering issues, the subject for a later discussion. For an ensemble which does represent the case, a highly extended version at the urban scale exists in the form of the Parisian sequence beginning with the Louvre's entrance pyramid as its core, the axis of the Champs-Élysées and its extensions aligning an enfilade of widely separated shell increments (8.36). Before the advent of Pei's entrance, the pristine and foursquare *Cour Carrée du Louvre* was clearly the terminus of this sequence, but it now seems to have taken on something of a backstage role, the glass pyramid now clearly the focus of the U-shaped receptor formed by the later, grander wings. From this core extends the attenuated but clear and visible sequence of the *Arc de Triomphe du Carrousel*, the *Obélisque*, the *Arc de Triomphe de l'Étoile*, and (maybe not so visible) the *Grande Arche de La Défense*. While the La Défense arch is slightly rotated on that axis—perhaps in a bit of protest to the rigid axiality of this Haussmannesque sequence—it remains an open arch rather than a terminus, in keeping with the parti.

Shells: Void Centered (8.37)

Incremental Shell Arrays

The sequence is again reversed, now of limiting shell configurations with a core *absent*. Jacobsen's Zamoiski House returns to represent the incremental case (8.38). Setting aside the focal point aspect of the pool, the four linked pavilions themselves are a diagram of shells in linear sequence that have been truncated into increments, the system of swing-up louvers seemingly expressive of the increments' transverse aspect as shells. The lineup of gable roof forms presents a challenge to the conceit in that they are readily visualized as a single longitudinal volume—a radial—that has been cut into segments. But it is this cutting that affords a measure of justification for the "shells" interpretation: by definition, the interruptions transform the formative experience into



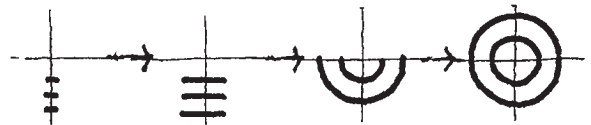
8.36 Incremental shell array of axial sequence to scale, Louvre to *Grande Arche*, Paris.

one of penetration, bit by bit via linear links, through the longitudinal sequence: a dwindled version of full shell arrays but one which preserves this step-by-step sequence as opposed to the linear continuity of the radial.

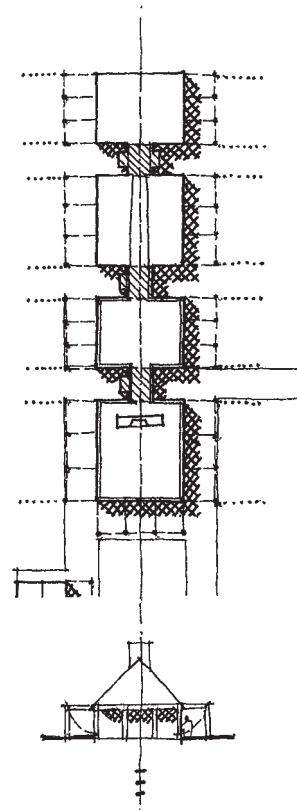
Aligned Partial Shell Arrays

Returning as before through the sequence but with no immediately involved core in the composition, one again encounters the special case wherein a longitudinal sequence of incremental elements such as the above regains lateral extent—now as shells rather than radials. It is a parti of parallel planes or parallel wall-like building volumes, approached and engaged frontally. Their parallel geometry reflects the indefinite remove of the focus entailing an “indefinite radius” for its concentric shells, and a correspondingly unlimited envelope of length for these elements, which finds expression in a variety of transverse extents, modes of expression, and building types (8.39):

- Nouvel’s Cartier Foundation has been noted for its illusionistic development of three parallel wall planes, which not only de-emphasize the volumetric nature of the building itself but seek themselves to fade away into transparent scrims. Seen frontally their thin steel framing networks form a complex pattern that increases the ambiguity of depth and extent. In a sense each wall is also a gate or portal, and here the split personality of walls in general—protecting and excluding, yet inviting where penetrated—is reduced to its most diagrammatic essentials.
- van Eyck’s sculpture pavilion at Arnhem required no volumetric enclosure, only a thin translucent roof plane, so its six parallel block walls, lacking any sort of clear core element, make an especially direct impact. Modified with a variety of semicircular apses and connecting openings, the scheme partakes of both the rigidity and solemnity of its initiating wall array and the complementary



8.37 Void centered shells: sequence.



8.38 Hugh Newell Jacobsen: Zamoiski house, Maryland eastern shore, 1983.

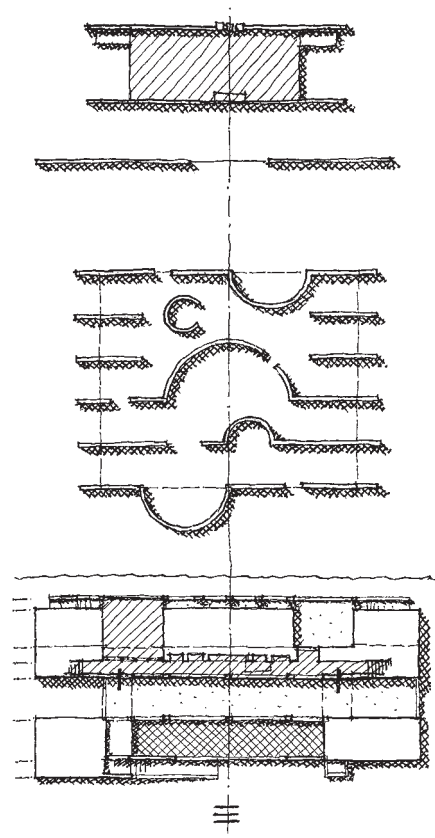
maze-like and space-defining experiences fostered by these interventions. Although the apses and connections may take the project beyond the status of parallel shells to approach a type of hybrid centering, the strength of the wall array renders it the dominant characteristic. The massive solidity seen on axial approach is belied by the utterly contrasting openness of the side exposures, in a manner elemental to the parti.

- Arquitectonica's Spear house employs no less than eight parallel wall planes, some substantial, others dwindling to parapets, colonnades or cheekwalls. The planarity of the scheme is emphasized on the exterior by color, gradating from red at the approach to pale pink at the bayfront, a treatment which visually suppresses the actual volumetric enclosures when they occur. The walls filter the transverse experience: from approach, to courtyard, to the layered interior, to a variously colonnaded exterior, to the water beckoning beyond in the service of the absent core. The house is an indulgent exercise in carefully slipping rooms into this abstract array of walls so that the latter dominates without compromising the former.

Partial Shell Arrays

As the point of focus returns to the vicinity of the ensemble, multiple laminae of concentric shells again inflect from parallel clarity to partially surround the realm of a center:

- The layered elements of Giurgola's Tredyffrin library are defined by true concentric curves (8.40). Entered through the largely solid upper floor level, a service layer leads to the main library layer, and a brise-soleil layer on its concave exposure permits both floors to overlook a park—the focus of the ensemble's curvature, but not a core as such.

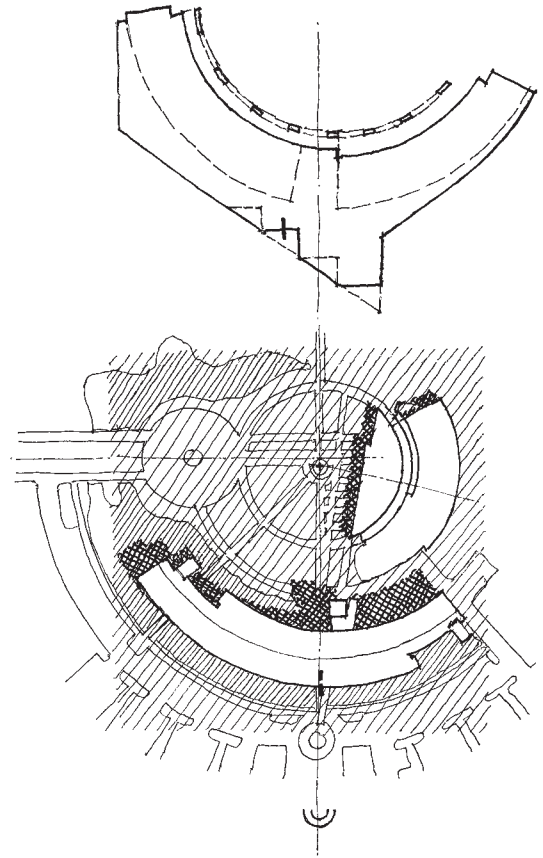


8.39 Jean Nouvel: *Fondation Cartier*, Paris, 1994; Aldo Van Eyck: *Sonsbeek Pavilion*, Arnhem, Netherlands, 1966 (rebuilt, Hoenderloo, Netherlands, 2006); Arquitectonica: *Spear House*, Miami, 1979.

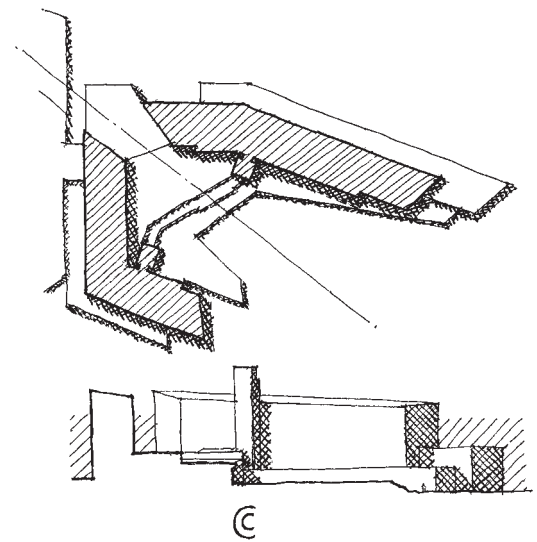
- Partial shell arrays also define the organization of Heifer International's Headquarters, in the laminae of its initial quadrant building and a linked lower rise element, again featuring true concentric curves. Both, as well as perimeter vehicular circulation, share a center of focus in a park and plaza area. But this overscaled circle is quite open on half its periphery, resulting in a lack of definition and focus despite insistent paving geometries. The naturalistic surroundings are more in keeping with the mission of the company, also manifest in the sustainability aspects of the buildings and site.
- KPF's Gannett/USA Today headquarters finds the parti again in a suburban context, its layers stretched and skewed in a sequence of deformative alterations such that they inflect dramatically toward a distant void core, as opposed to the more central expression of the Heifer project (8.41). Despite the elegance of the architecture and its bold departure from orthogonal composition, the voided hub and unengaged context—a suburban office park and interstate setting—impart an element of isolation, the partial wrap being more an abstract gesture than a programmatic or contextual response.

Full Shell Arrays

The final stage in the progression again represents a return full circle to the complete encapsulation of a center by several concentric shells, but now with an empty center lacking the focus of structure or function. As in the corresponding ultimate case of the radial sequence, this configuration represents a limit toward which the sequence evolves rather than a parti that has significant viability on its own merits. Harvey Court at Cambridge answers the description to some degree, its three tiers of rooms sequentially overlooking an austere central courtyard. The arrangement is a rather monastic and contemplative one, well called-for in the case of a



8.40 Mitchell/Giurgola: Tredyffrin Public Library, Strafford, PA, 1976 (subsequent addition not shown); Polk Stanley: Heifer International Headquarters. Little Rock, AR, 2006.



8.41 KPF: Gannett/USA Today headquarters, McLean, VA, 2001.

single encapsulating shell but rare and anomalous in the present situation of multiple shells.

* * *

These examples of centering arrays—radials and shells, with cores and without—have been titled “limiting” because they all deal with the asterisk, the bullseye, or circumferentially reduced segments thereof. Those two full surround/ extent cases are at the furthest limits they can be from each other in diagrammatic terms. The title is misleading in a way because their outward extent is quite the opposite; any length of radial or any number of concentric shells are possible, though there are obviously practical limits when it comes to the realities of architecture and urbanism. But a complementary set of types and relationships arises when seeking a way to forge *links* between these seeming opposites, and they turn out to be quite varied and ubiquitous, thus the chapter titled “linking” which follows.

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Chapter Nine

LINKING CASES

There is a clear one-to-one correspondence between the various centering aspects of the radial and the shell—as the “map” at the beginning of the previous chapter indicates. But one looks for something more comprehensive: a means to link the respective corresponding cases by compatible means of formative evolution, just as the radial and shell varieties were internally linked in sequence of scope. The sections to follow are ordered differently than the “limiting” cases, in order to bring radials and shells together under categories pertaining to their shared natures. The term “penumbra”—used with reference to radial and shell manifestations alike—pertains to surrounds of varying extents. In contrast to the extended geometries of the limiting modes, the penumbral extents deal with the world of more compact and singular surrounds¹. Within each section, corresponding shell and radial cases are examined, and an effort is then made to discern hybrid means—constructs that partake equally of both—to link the two. The ultimate goal in seeking such linkages is a continuous network of relationships among all approaches to centering.

1. Definitions of “penumbra” as applied here include “a surrounding or adjoining region in which something exists in a lesser degree,” and “something that covers, surrounds, or obscures.” —Merriam-Webster Online.

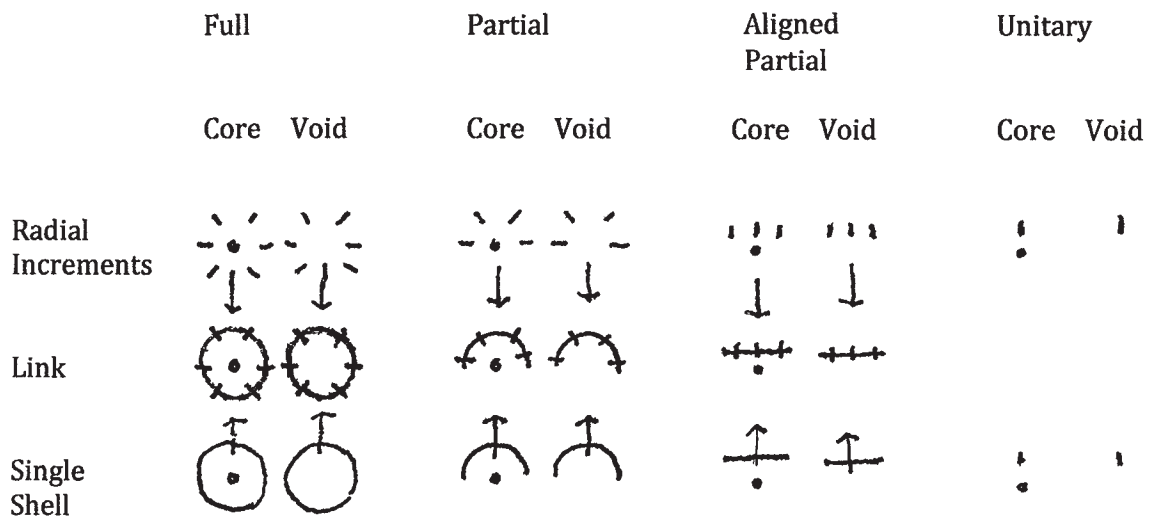
Again, a map of the chapter's organization may help clarify the relationships of its sections (9.1). As shown, this time the overarching order of the narrative descends from partis of complete surrounds—drawing in from the extents of the “limiting” cases—to more and more dwindled versions, with the goal of linking pursued at each step of the way. As before, each section begins with a pertinent segment of the map, and each illustration features a corresponding small ideogram.

Full Penumbras: Core Centered (9.2)

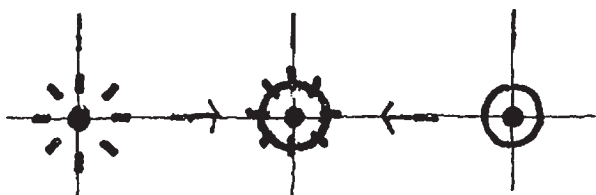
In comparing “asterisk” and “bullseye” partis, there is no direct or obvious means to evolve from the one fully-formed diagram to the other. Aside from the shared feature of a core, the two are remarkably unlike: the one sharp and the other smooth, the one all equal parts and the other a hierarchy, the elements of one perpendicular to those of the other. An intervening step or process is required to make it possible to bridge the gap.

Incremented Radial Arrays

With respect to radial arrays, this is facilitated by “reducing the sharpness of the asterisk.” Just as that parti was pared down by degrees to a single representative radial, it may also be pared down in a way which preserves the full array but in truncated form, such that radials become radial “increments,” analogous to the shell increments discussed among the limiting cases: lacking attenuation, but still embodying deference to a core. As a result, the explosive sense of linear outward movement that often characterizes the radial parti is quieted and replaced in many cases by a palpable sense of inward attraction. Typically the core is now more clearly the dominant feature—the attractor—of the composition, and the surrounding increments may vary, from near-equals to the core that engage it in a subtle bout of centripetal/centrifugal byplay, to subordinate elements offering no challenge to its dominance (9.3):



9.1 Map of chapter organization.



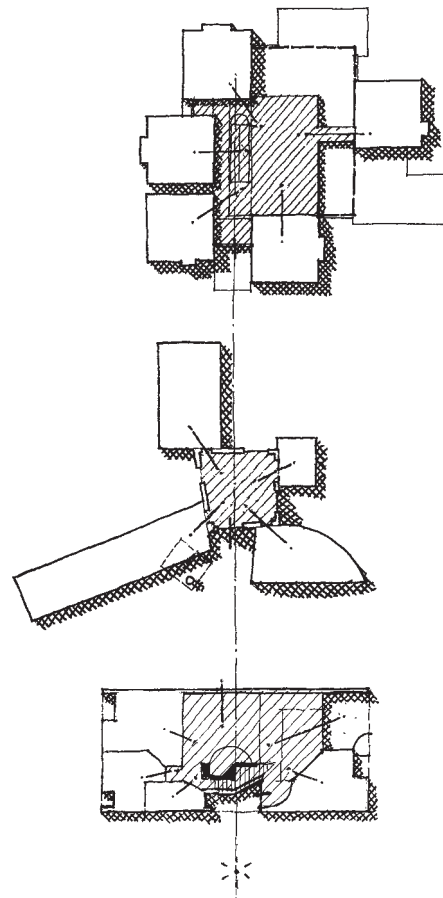
9.2 Full penumbras, core centered: sequence.

- Franzen’s Connecticut house is knit together in matrix fashion, its expansive centerpiece pavilion engaging a penumbra of smaller but taller surrounding elements: the central main living space is the core of the composition, while the outboard elements housing the more cellular functions of the house comprise the radial increments. Although arrayed in right-angular order, they give a clear impression of dispersal in all directions from the center, though they are also self-possessed, rooted volumes without elongated proportions or any sense or linear outward movement.
- Gehry’s Minnesota guest house also constitutes a core surrounded by radial increments, but partially freed of orthogonal geometry: the scheme is expressive of both radial energy and elemental anchorage at the core.²
- And in contrast to that freewheeling footprint, while the influential Vanna Venturi house again presents a strong central element—the dueling ensemble of fireplace and stair acting as the core—engaged increments adjust and diverge to accommodate this centerpiece and become a radiating, space-filling ensemble that bridges from the core to a conventionally limiting rectangular perimeter.

Single Shells

An exercise similar to this simplification or paring down of radial schemes can be applied to the counterpart case of multiple *shells* around a core, by eliminating the “multiple” aspect of the composition. Just as radials were cut back to an inner limit of viability, all but the innermost shell surrounding the core may be eliminated to achieve a correspondingly

2. While the garage wing is elongated in contrast to the other elements and could thus be considered a radial, all the elements are idiosyncratic in one way or another, so it makes more sense to keep them all in the same category.

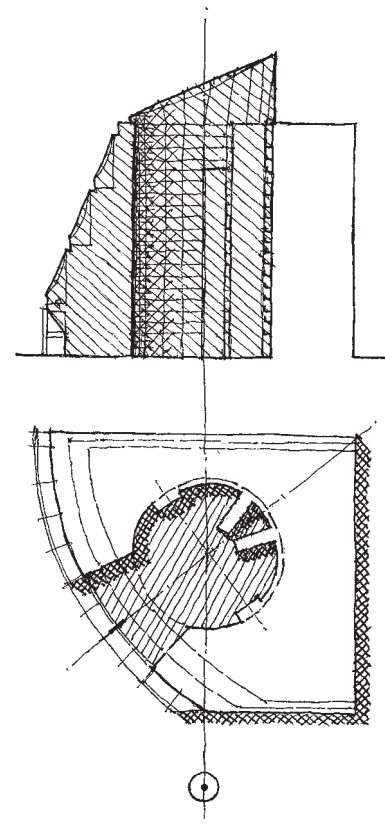


9.3 Ulrich Franzen: Dana House, New Canaan, CT, 1964; Frank Gehry: Winton guest house, Wayzata, MN (since moved to Orono, MN), 1987; Robert Venturi: Vanna Venturi House, Chester Hill, PA, 1964.

elemental reduction. Notwithstanding the apparent simplicity of the diagram, a wide variety of architectural results meets the description of a shell surrounding a core. Jahn's State of Illinois Center (now the James R. Thompson Center) epitomizes a hollow-centered version of the parti with its voided cylinder, active, contained, and focused enough to clearly comprise the heart of the building as opposed to a void within it (9.4). Despite the grand scale of the notch leading to the entry at the periphery, the inner cylinder and outer skin so dominate as to maintain a sense of closure: something close to a full penumbra.

"Singular regression," wherein a single reduced element sits encapsulated within an initiating form, represents another manifestation of this centering parti. Thus a unit of the Sea Ranch Condominium is the shell while the four-poster within is both its miniature and its core. It bears restating that while the terminology of "core" is often used in reference to fixed utilitarian elements as in the core of an office building, the term as used here is generally synonymous with "heart" or focus, referring more often than not to a crucial habitable space that anchors both the morphology and the activity of the building. Multi-story office buildings generally, at least those that don't feature specialized focal elements such as atria, are prey to the Achilles' heel that their most prominent feature is the lobby, failing by virtue of being the initiating spatial experience to function as a focus for the building. The Thompson Center may be grandiose in the scale of its gestures, but its central atrium is surely a welcome and generous core.

Philip Johnson's glass house is another case of singular regression, but the nature of the core is less neatly resolved (9.5). As at Wright's Cheney house, a "solid" element—here accommodating the fireplace and bathroom—visually anchors the house, but it is not the heart in terms of activity; the conversation grouping is clearly that core (with Mr. Johnson himself generally said to have been its core in turn), the fireplace being distinctly peripheral. As has been



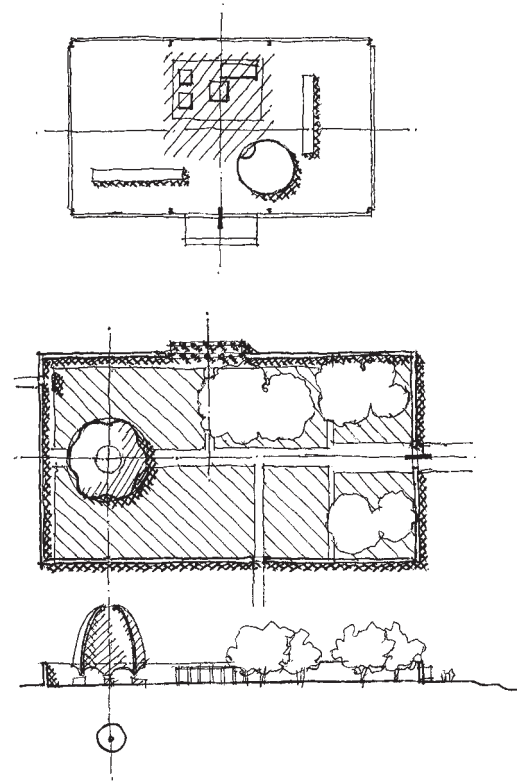
9.4 Murphy/Jahn: State of Illinois Center, Chicago, 1985.

noted, a rather clichéd opposition of humanistic and romantic persuasions is sometimes debated, the former preferring to find people at the building center while the latter reserves that pride of place, as at the Cheney house, for the sacred hearth.

Another Johnson project, the roofless church at New Harmony, affords interesting comparisons to the glass house: a dominant core element sits (or actually sort of floats, seeming to strain upward) at the axial focus, clearly the core in this case and encompassed by a rectangular open space. Here the boundary is solid rather than transparent and is itself the shell. The intervening garden doesn't seem so much a sort of secondary shell as it does a heightened and delimited sector of the outdoors that intervenes between the shell and the core. But is the defining wall indeed the shell, or is it the made-special open space found within? Arguments could be made for either interpretation, contributing to the rather magical character of such "secret gardens," walled off from their surroundings. The floating aspect of the ceremonial shelter—as if about to rise up like a handkerchief covering a helium balloon—contrasts effectively with the dense solidity of the boundary wall. Ultimately the walled garden itself is more affecting than this odd centerpiece, serving as one demonstration that the core in some cases is not necessarily always the most memorable aspect of the experience.

Linking Them

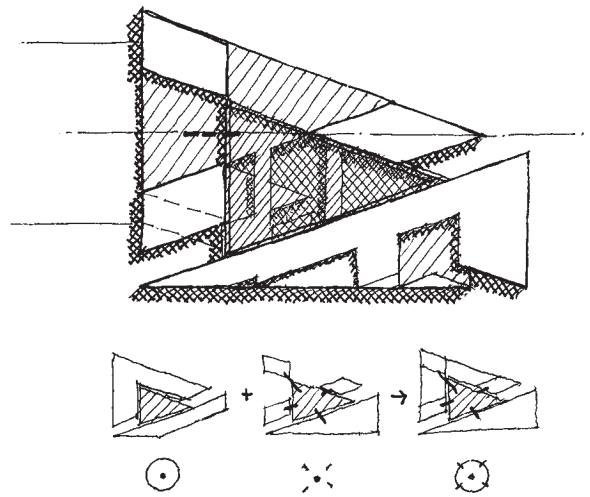
The immediate benefit of these paring-down exercises has been to reveal this inner level of elemental morphological types, differing in basic ways from their "limiting" versions. Widely applied due to their dual virtues of simplicity and versatility, they are arguably the most fundamental among all the related variants of centering. The further goal, however, remains that of seeking final links that will complete a continuum of approaches between the poles of radial and shell, in order to reveal a complete and uninterrupted range



9.5 Philip Johnson: Johnson House, New Canaan, CT, 1949; Roofless Church, New Harmony, IN, 1960.

of centering configurations. The site of those links is the gap remaining between these newly simplified partis. Links to bridge that gap are achieved using several different approaches to the *hybrid* centering of radial increments and single shell. The issue of hybrid centering will be addressed more fully in the next chapter, but selected modes are brought forth to serve this linkage sequence and the several to follow. Here are some of the most versatile:

- *Superposition* simply brings the two partis into the same physical realm, resulting in a hybrid diagram wherein shell and increments occupy the same space, a situation recalling the superposition mode of additive form. Pei's East Building at the National Gallery meets this description, with the notable exception of the full-height defile separating the public areas and the study center (9.6). Three exhibit "houses" plus the incised prism of the study center itself are radial increments, spaced apart from each other but grouped directly around the atrium core. The elbow of exhibit spaces in conjunction with the equally extensive flank of the study center represents the single shell parti as it wraps the atrium. (The gap that prevents their continuity and expresses their differing roles may be the most unequivocal formal gesture in the building.) The superposition of shell and increments is precise, the three houses seamlessly joining the suite of spaces that inhabit this partial shell while fully retaining their outparcel identities above and below. The study center volume might be said to perform a dual formative role: it is both an increment by virtue of its self-containment and overall shape cohesion, and a partial shell as it constitutes a significant portion of the atrium's surround.
- *Embedding* arises from a different order of assembly wherein the shell with its core is acted upon, the increments being the actors: the latter arrive around the periphery to append

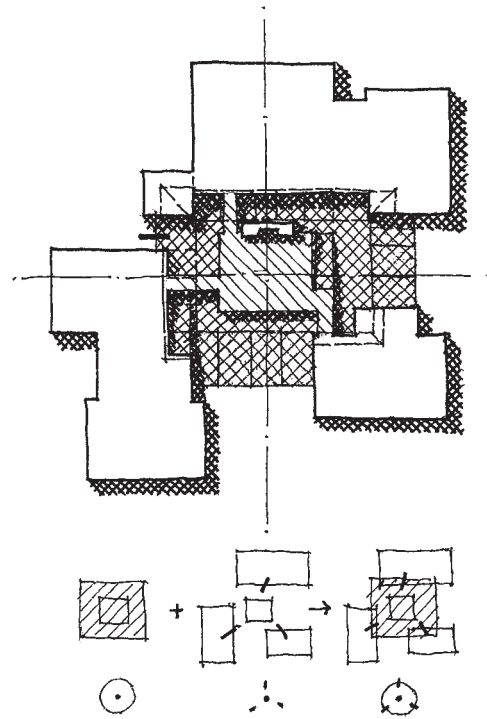


9.6 I. M. Pei: East Wing, National Gallery, Washington, D.C., 1978 (subsequent additions not shown).

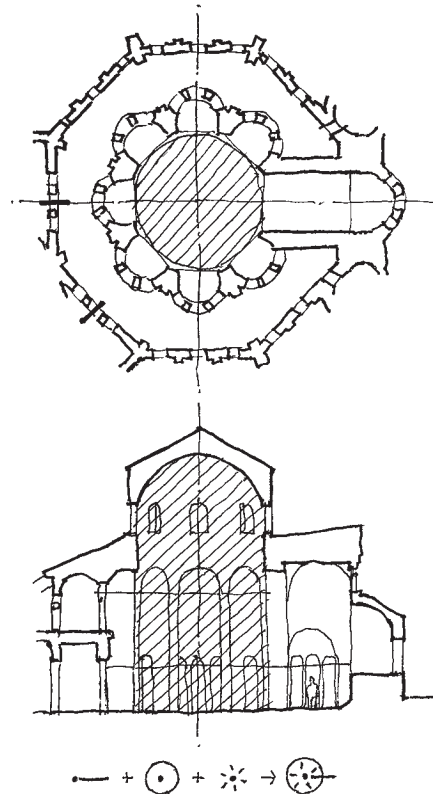
or embed into the fabric of the shell, such that all elements then share the core in common. The main distinction from the preceding case is the preservation of a concentric hierarchy, the increments remaining at least partially outboard of the shell periphery. Johansen's Connecticut house with its greenhouse-as-matrix centerpiece makes the case clear: its innermost living space with loft above (another four-poster) is the core, the surrounding contiguous living and greenhouse space constitutes the shell, and the block-volumes housing bedrooms and kitchen—the radial increments—are embedded by punching through the glazed periphery of the shell on all sides (9.7).

- *Encapsulation* is the dominant hybrid mode at Ravenna's Basilica of San Vitale (9.8). Within its outer periphery, a circumferential ambulatory, surrounding chapels, and presbytery all focus on the core of the tall central space. This centerpiece sockets into the lower volume and the small chapels enface it by invading the space of the ambulatory. The presbytery interrupts the ambulatory, adding a suggestion of axial focus to what is otherwise a remarkable built diagram of concentric central focus. In formative terms, the building also somewhat exemplifies a case of 2d/ inverse linear regression.

- *Morphing* is directly expressive of linking, embodying as it does a more truly seamless transition between two partis. As opposed to treating them as elements retaining their identities when additively combined, the approach consists of gradually joining up the radial increments morphologically, such that they are ultimately transformed into the continuity of the shell. Typically links reach out as the first step in this reshaping, then to broaden and join all the increments in a continuous interface around the core. Notches around the outer periphery may then comprise the only remnants to recall their initially separate identities; once these disappear as



9.7 John Johansen: Private residence, Connecticut, 1976.



9.8 San Vitale, Ravenna, Italy, 547.

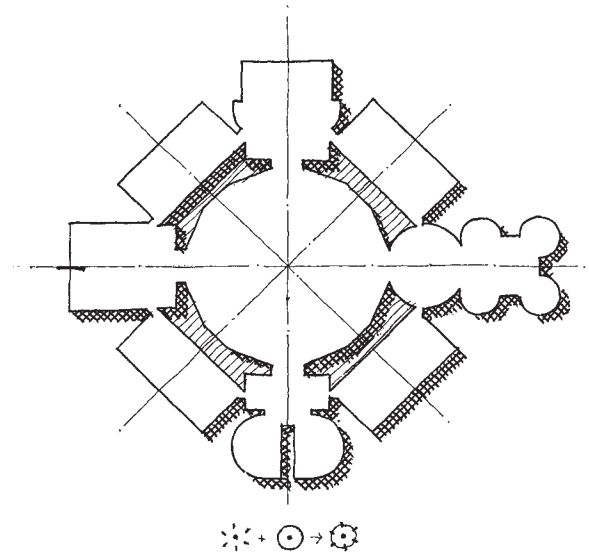
well, the transition to the shell parti is complete. At Kahn's Bangladesh Assembly Building the incremental volumes surrounding the core of the assembly chamber are "touching" elements, but the beginnings of connective tissue are apparent (9.9). While the elemental shapes of these volumes permit no question of their individual identities, a ring road corridor stitches them together like a bracelet of beads on a string, and the relationship of the plan's elements is at the dividing line where touching begins to be legible as morphing.

Full Penumbras: Void Centered (9.10)

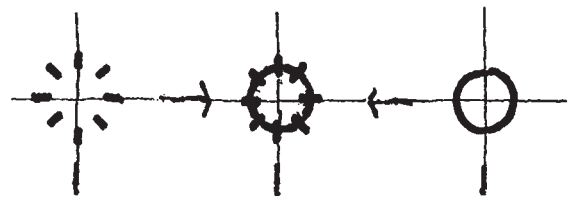
Again, as opposed to the cyclical order of sequence in which the limiting cases were discussed, these linking cases are grouped according to similar *morphology*. The following is a reprise of the preceding full-surround core-centered situations, but now *without* a core:

Incremented Radial Arrays

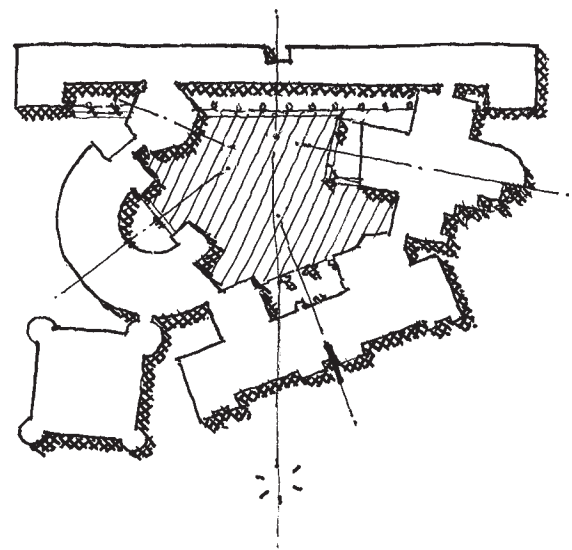
Stirling's & Wilford's *Wissenschaftszentrum* surrounds a small open courtyard with its dissimilar array of half a dozen helter-skeltered elements, their role as radial increments somewhat obscured by their cookie-cutter shapes of little basilicas, stoas, Greek theaters and castles, one of which is an existing building (9.11). The scheme is reminiscent of a prototypical exemplar of the case, the aggregated academic quadrangle, and Old Harvard Yard, defined by its consistent ensemble of similarly scaled buildings, is one among many that could be cited. Nearby Old Radcliffe Yard is a more pertinent example, its central open space a compact oval closely bounded by the skewed faces of the surrounding building group (9.12). The line dividing architecture and urbanism has again been subtly crossed, for while the Berlin project is legible as one work that takes its place in its urban context, these academic quads are buildings severally related to each



9.9 Louis I. Kahn: Citadel of Assembly, Dhaka, Bangladesh, 1974.



9.10 Full penumbras, void centered: sequence.



9.11 Stirling & Wilford: *Wissenschaftszentrum Berlin für Sozialforschung*, 1988.

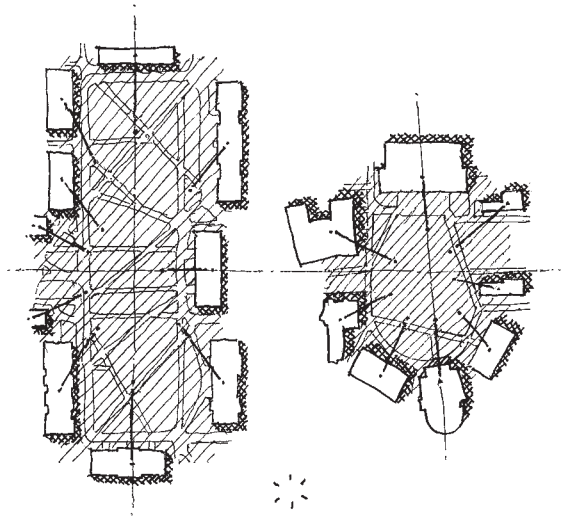
other, to the central space, and to spaces and buildings beyond.³

Single Shells

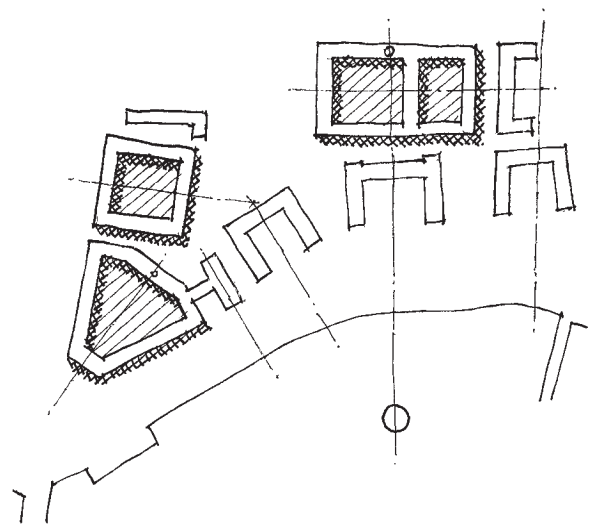
The academic quad reappears when moving on to the corresponding case of a single shell lacking a core. Certain of Harvard's undergraduate houses along the Charles, as with similar designs at other universities, exemplify the case by completely surrounding their central yards (9.13). The type is appropriated from academic quads of Oxford and Cambridge, in turn having further forebears in the cloisters of cathedral church and monastery complexes. A more ubiquitous manifestation of the type appears in European cities and some garden suburb developments, their blocks bounded by continuous streetwall fabric encompassing central courtyards. The densified urban grid typical of US cities could be considered a debased form of this model, the block courtyard typically dwindled to alleys and loading areas.

Boston City Hall provides a high-profile case of a compressed version: a light-well building, more compact than the contiguous quad and characterized by a central court that combines the disadvantages of non-territoriality, lack of placemaking amenity, and a tall proportion that curtails daylight. The cylindrical courtyard of Stirling's unbuilt Northrhine-Westphalia museum might have mitigated some of these problematical aspects—a better defined sense of

3. One could question why these elements are deemed radial increments as opposed to shell increments: after all, in many cases their footprints are more rather than less elongated normal to the direction of the center of focus. The distinction lies in the centering composition of the elements: regardless of their proportions—within the intuitive limits that they appear as increments rather than full radials—they defer centrally and yet retain their separate incremental identity. The one exception one might make regarding the above examples would be the particular elongation of the *Wissenschaftszentrum's* "stoa" element, foreshadowing a case of a single parallel *shell*, but it interacts consistently with the other radial increments in this case and is accorded that status here for that reason.



9.12 Various architects: Old Harvard Yard, Harvard University, 1718; Various architects: Old Radcliffe Yard, Radcliffe University (now part of Harvard University), early 20th C.

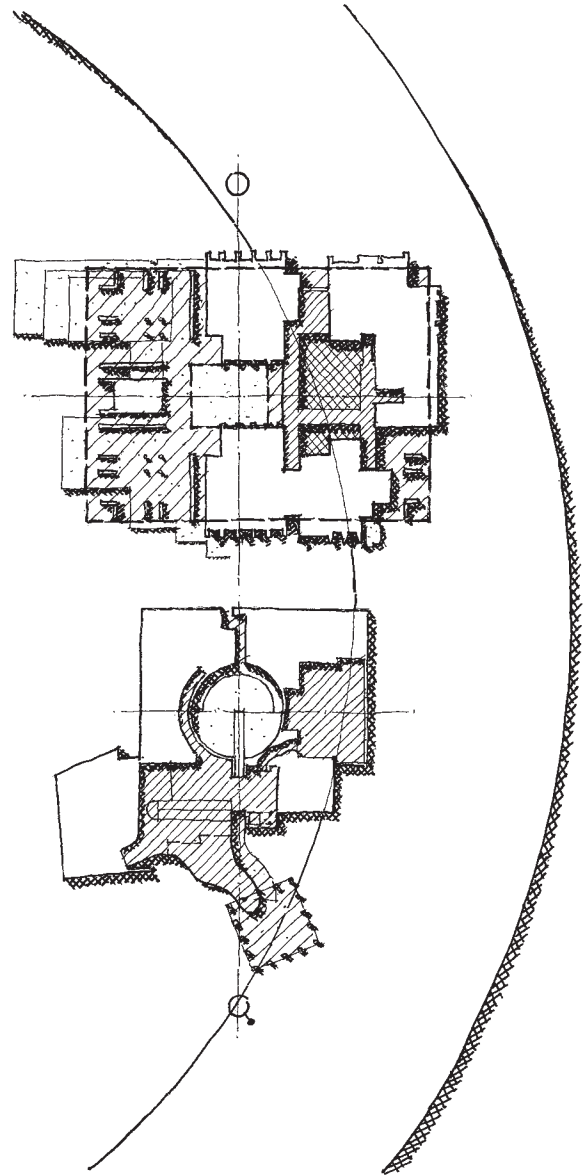


9.13 Various architects: Undergraduate Dormitories, Harvard University, early 20th c.

place would have prevailed as opposed to the open-sided platform of the Boston case—but one can't help visualizing that space as also somehow remote and unsatisfactory; the project's best feature may have been its role as trial run of sorts for Stuttgart's *Neue Staatsgalerie* (9.14).

As something of an ultimate version of the case, both in morphology and scale, the perfect ring of the Apple Headquarters has an outside diameter of roughly 1500 feet with a vast garden court entrained within. Issues of "light-well" character are replaced by the opposite extreme of a minimally differentiated void, so wide that any particular sense of place supported by the architecture would appear to be absent.

In some of these cases where shells encapsulate a central area, there is an uneasy aspect as to the distinction between cores and voids. If the court of the Dusseldorf museum had an enclosing toplight, would that amenity have transformed the space to a core for that ensemble? In northern Europe, given the increased potential of such a space at the heart of the building to function as a hub of its activities, perhaps so, the thought being presumptuous in any case given that an entirely different design would be the outcome. But the point remains well taken that there is an unclear dividing line between the two related parts. It may be best to visualize no dividing line at all but instead a range of variants (9.15). At the one extreme a shell encapsulates interior space focusing on a "solid" core, often distinguished by a *raison d'être* such as a fireplace. As the scale of the core increases, it may either remain unsatisfactorily solid as in a service-core surrounded by outer-directed use areas, or become a room-scale space in its own right such as the Sea Ranch four-poster. With a further increase in scale, the space comes to dominate the composition and may rise to be toplit as at the State of Illinois Center. At this juncture a central space that is open to the sky can seem as either a core or a void, the choice having to do with specifics of scale, proportion, site, program and image. At the next scale increase, a



9.14 Kallmann McKinnell & Knowles: Boston City Hall, 1968; James Stirling: Museum for Northrhine Westphalia (unbuilt), Düsseldorf, Germany, 1975; Norman Foster: Apple Headquarters, Cupertino, CA, under development at this writing (partial footprint shown).

void-centered open court or yard as in the residential quad becomes the more plausible case.⁴

Linking Them

Among attempts to discern a connecting bridge for this sequence, a type closely related to the academic quad forges a morphological link between the discrete penumbral elements of a Harvard Yard and the contiguous surround of the undergraduate houses. The type actually dates back to vernacular courtyard farmsteads, and is ingeniously and elaborately reinterpreted in certain English country houses by R. N. Shaw, Lutyens and others (9.16). The open center, while the largest entity of these ensembles, remains a splendid preliminary, an entry court. Shaw’s Leyswood house demonstrates the mediating character of the case in that while the perimeter construction is contiguous, it is articulated into partially engaged, collided and linked elements—major and minor gabled bays of varying heights which intersect at an assortment of right-angled junctions. While the gable-end projections assert the individuality of the increments, the continuities of the roofscape tend to integrate the ensemble into a lively but harmonious and ultimately unified surround. *Morphing* is the dominant strategy, in that the many distinct elements are blending each into the next: rather than being embedded in a shell, they are *becoming* the shell. The approach manifests the equilibrium of the in-between, convincingly demonstrating its benefits as opposed to the less interesting stability of the well-resolved.

Partial Penumbras: Core Centered (9.17)

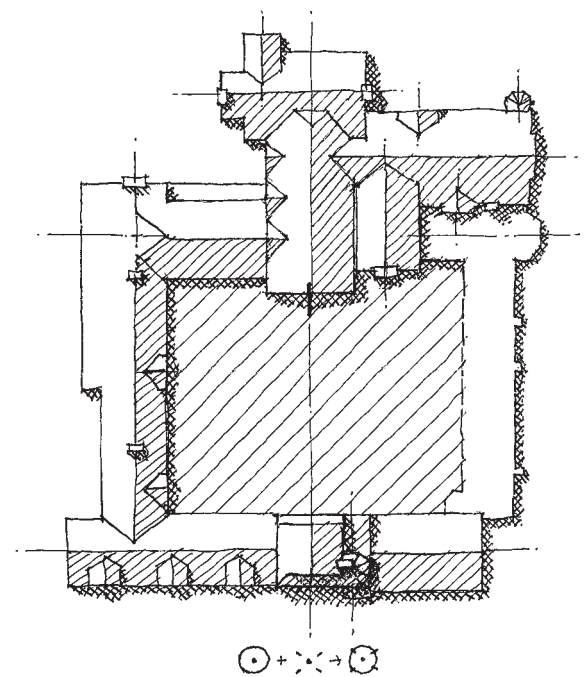
Incremented Radial Arrays

A similar sequence examines corresponding “partial” centering modes, beginning with the core-centered radial increment counterparts of partial radial arrays:

4. The diagrammatic sequence is reminiscent (in reverse) of the continuum of singular regression cases, wherein a replicate begins with the trivial case of identity and shrinks gradually to insignificance.



9.15 Range of variants on the hub or center.



9.16 Richard Norman Shaw: Leyswood, Groomsbridge, England, 1869.



9.17 Partial penumbras, core centered: sequence.

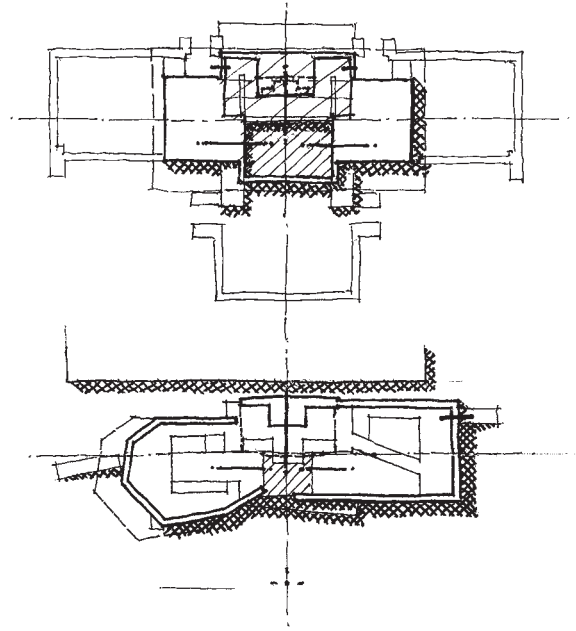
- Again, while a building's core is often a focus of use or indwelling, other collector roles may dominate, as in the often dominating and solid anchorage of the Wrightian hearth. His Hardy house seems to have it both ways with the living room the core of the house but the hearth in turn the core of the living room, the hearth and the outlook directly opposite presenting an unusually clear and symmetrical demonstration of the "prospect and refuge" aspect often noted in Wright's residential work. (9.18)⁵ Three radial increments enface the stack of central living spaces, the partial surround of the scheme a result of the steep site conditions.
- The volumetric organization of Gehry's Aerospace Museum recalls that of the Hardy house in some ways, a tier of central platforms at the shared spatial juncture of its incremental elements constituting the core, which not only affords views of the various exhibit areas but an exterior vista through the open exposure. Issues of restricted site depth and dominating outlook are motives leading to the use of this parti, the depth factor evoked by the compressed profile of the museum ensemble.

Partial Single Shells

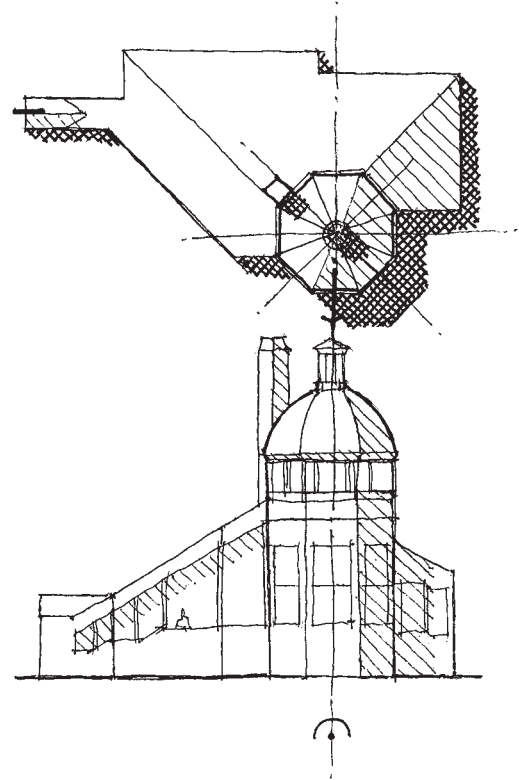
The corresponding shell parti finds the core partially wrapped in a protective or augmenting layer of encapsulation, but with its remainder exposed as a revealed feature of the ensemble. Applications of the approach vary primarily as a function of the relative assertiveness of the core:

- At one extreme, the core element of Centerbrook's Crowell house is expressed as a prominent exposed tower that seems to stretch the fabric of the appended partial shell both upward and outward in a taut elongation (9.19).

5. Grant Hildebrand, *The Wright Space* (Seattle: University of Washington Press, 1991), pp. 16-17.



9.18 Frank Lloyd Wright: Hardy House, Racine, WI, 1905;
Frank Gehry: California Aerospace Museum,
Los Angeles, 1984.

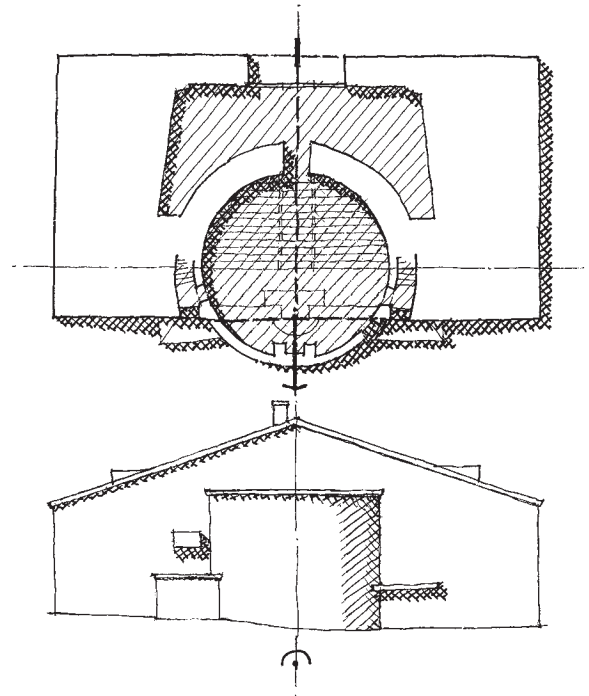


9.19 Centerbrook: Crowell house, Quogue, Long
Island, 1984.

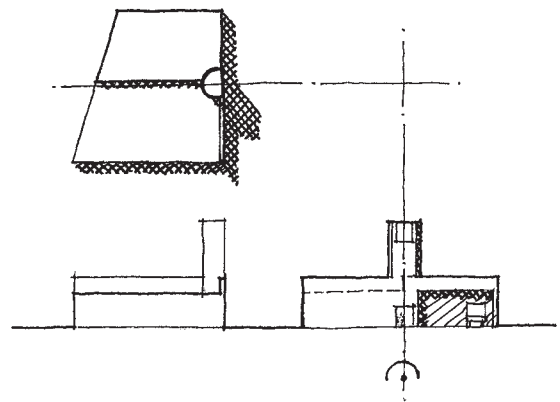
- At Asplund's Lister County Courthouse, the courtroom's core volume does not physically dominate, nor is the form of the support volume distorted, but unresolved forces are apparent: while the two elements are pristine and fully formed, they are collidively related, the cylindrical courtroom volume partially emerging from the building's long-axis facade (9.20).
- Venturi & Rauch's Fire Station 4 employs a similar basic approach: the semi-accommodated intrusion of its hose tower, here sheared off flush with a quasi-symmetrical front exposure, centers the scheme (9.21).
- Roche and Dinkeloo's Ford Foundation Building marks the other extreme of the sequence with its atrium core actually recessed into the fabric of the shell element (9.22). The tensile pulling of the Centerbrook house is reversed, and the initiating volume of the building is invaded in a subtractive gesture, the atrium core re-filling the void with its glass box of space. The concave profile of the section approximates a spatial cylinder which, in its implied completed profile, extends through the glass to involve the space of the sidewalk—a prescient urban gesture for that time in addition to the lavish centerpiece of the atrium itself.

Linking Them

The central exhibit/ circulation space of Hollein's Mönchengladbach museum forms a partial single shell, focused on the core of the entry stair element, but partially surrounded in turn by the diverse assortment of *embedded* radial increments housing galleries, lecture halls, cafes and support functions (9.23). The project's quasi-urbanistic ambiguities and irregularities lead to a different parti for centering than for forming: while the stretched profile of the inner matrix space signals a linear version of that additive mode, the entry element as core of the centering case alters that perception to one of a



9.20 Erik Gunnar Asplund: Lister County Courthouse, Solvesborg, Sweden, 1921.



9.21 Robert Venturi: Fire Station 4, Columbus, IN, 1966.

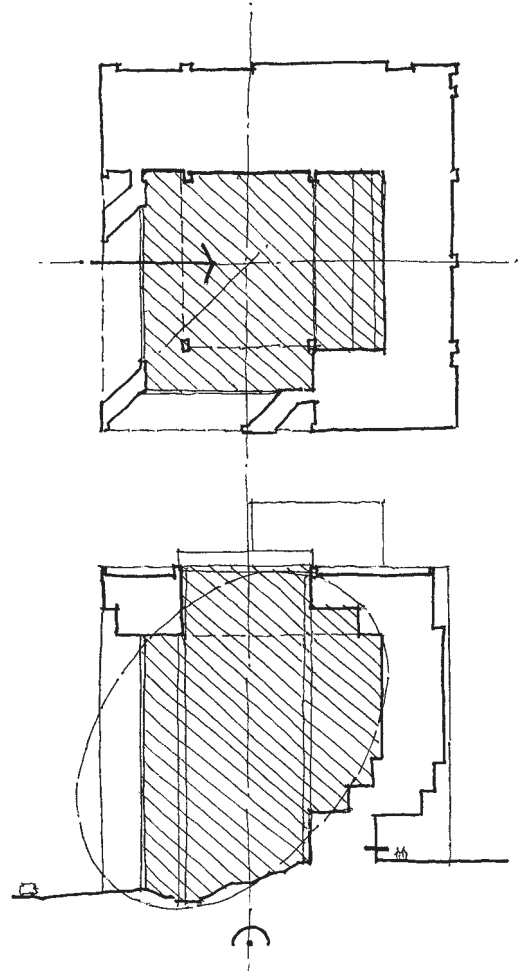
partially-concentric parti, the shell and increment threads finding hybrid linkage here via embedding.

Partial Penumbras: Void Centered (9.24)

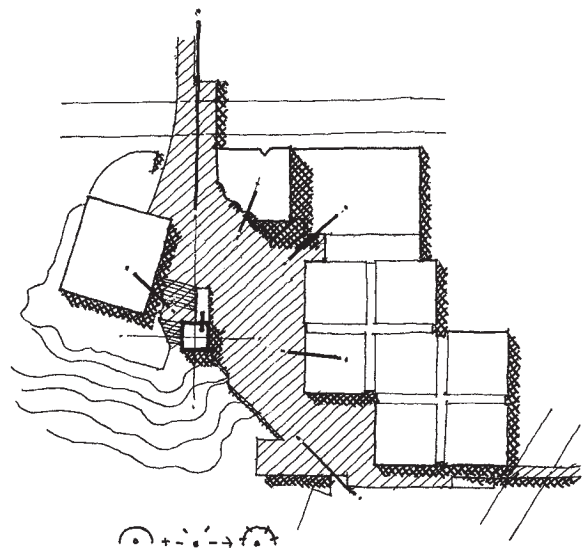
Incremented Radial Arrays

While an array of radial increments fully surrounding a voided core—recall Old Radcliffe Yard—sets the open central area somewhat apart from the outer context and invests it with a sense of separated identity, a *partial* radial array affords the focal area a dual nature: while bounded on one side, it remains open to visual or physical connections on the other. Given the indication of diverse purpose via articulation into separate increments, there is a tendency for the shared center to be rather non-committal; if there are exterior spaces that relate directly to the individual increments, they tend to be outboard where the separation is maintained and enhanced, rather than defused or mixed as at the center. Thus at Jacobsen’s Blumenthal house and Venturi’s house in Bermuda, the partially open centers are entrance courts, wherein the ingratiating aspect of the partial surround attempts to compensate for the rather closed aspect of what are, after all, public exposures (9.25). Their private outboard exposures are just that, looking rather antisocially away from each other in several different directions. The houses are half-unwrapped, midway between Shaw’s fully-encircled courtyard and the wall-like frontality of suburbia.

Another residence, the Bohlin firm’s “Ledge House,” offers some interesting conundrums of interpretation (9.26). This homage to rustic lodge architecture partially wraps its arrival court, collided increments following the demanding contours of the site’s topography. The scheme is suggestive of a partial shell, but the nature of the house’s focus is ambiguous: do the outdoor fireplace and commanding chimney in the entry court indeed work with the configuration of the house beyond to denote a “void” core, despite



9.22 Roche & Dinkeloo: Ford Foundation Building, Manhattan, 1968.



9.23 Hans Hollein: Städtische Museum Abteiberg, Mönchengladbach, Germany, 1982.

the fact that it precedes the actual entrance? A study of the plan shows that despite the insistent concavity of the composition with respect to the entrance approach, numerous interior axes and view corridors converge instead on the living room, rendering it the true and logical core of the incremented ensemble, the house thus being arguably misidentified as void-centered.⁶

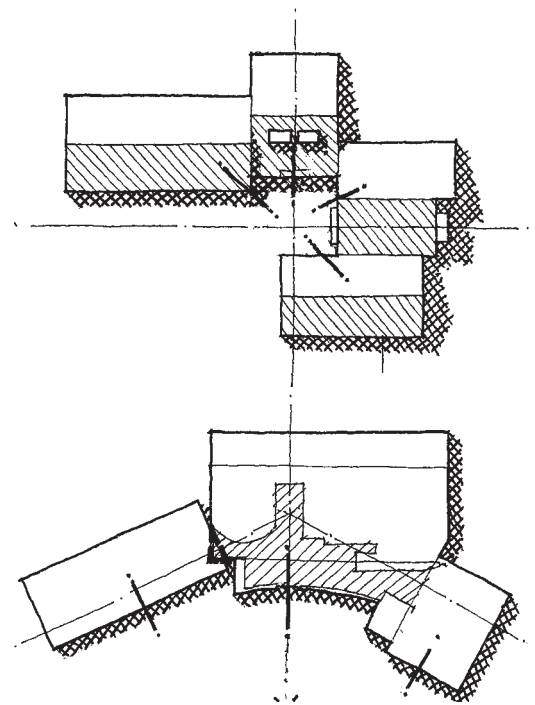
Los Angeles' Getty Center is also pertinent here, and in truth actually deserves some sort of combined category of its own (9.27). A virtual hill town that enters the realm of urbanism, it employs radial increments arrayed in both full and partial penumbras, to define both core- and void-centered ensembles. The museum ensemble itself surrounds an extensive if somewhat amorphous elongated courtyard defined by a full penumbra of radial increments, while the "arrival" and "overlook" *partial* ensembles defer to the entry plaza and terminating garden respectively, open in turn to uphill and downhill outlooks. The complex includes a "meta-core"—the entry rotunda—that attempts an overall focus. A general criticism of the project has been its nature as an array of set-piece buildings, demonstrating an insufficiency of scale differentiation in terms of the building elements themselves and in the definition of the exterior spaces they surround.

Discussion of this project provides a good occasion for a brief further mention of centering modes in ascending sequences of scale, as discussed with

6. Convex perimeters that respond to panoramic outward views, such as that of the Ledge House, can present a challenge to the notion of a center of focus. A few other similar cases include Wright's Fallingwater, Meier's Douglas House, and (something of an ultimate version) Johnson's Glass House. But in each of these cases, despite the competing attention outward, the composition ends up incorporating these semicontiguous vistas among elements of periphery that defer to an internal center of focus. By contrast, high rise buildings often lack such an internal center, and the special situation of an upper level observation deck—or observation tower, such as Seattle's—is truly devised to direct attention outward. While having a physical core, they actually embody a specialized case of the "core at an indefinite distance" wherein the dynamic of the asterisk is reversed, with attention directed outward in all directions.



9.24 Partial penumbras, void centered: sequence.



9.25 Hugh Newell Jacobsen: Blumenthal house, Eastern Shore, Maryland, 1974; Venturi, Scott Brown: House in Bermuda, 1976.

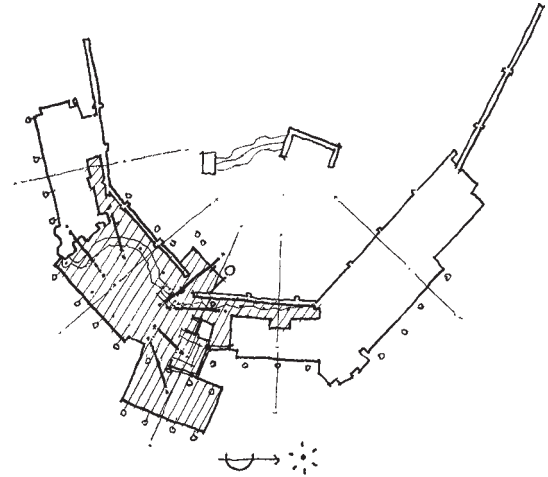
regard to Leverkusen and Sea Ranch as examples among many. Each of the object buildings of the Getty separately focuses on a core of its own, being variously entrance halls, an auditorium stage, or the courtyard of the History Center. The buildings in turn define the three large outdoor spaces noted: the museum's a void core, the overlook's with its focus of the garden pool, and the arrival's appropriately lacking a particular center of its own. This arrival court is actually linked to the others in separate sequences: to the museum court via the rotunda, and to the overlook area via a focal point belvedere. This constituting something of an outdoor counterpart to the rotunda, the overall complex is thus actually ordered by a *pair* of meta-cores.⁷ At this scale the groupings act as meta-radials, each ordered by a linear axis that points to one or the other meta-core. With regard to the "overlook" ensemble one could certainly argue that the thrust of its energy is downhill, either to the core of Robert Irwin's garden or onward to the endless vista of the city below, the link to the belvedere core at best constituting a "central uphill core" opposite to and competing with these compelling aspects.⁸

Partial Single Shells

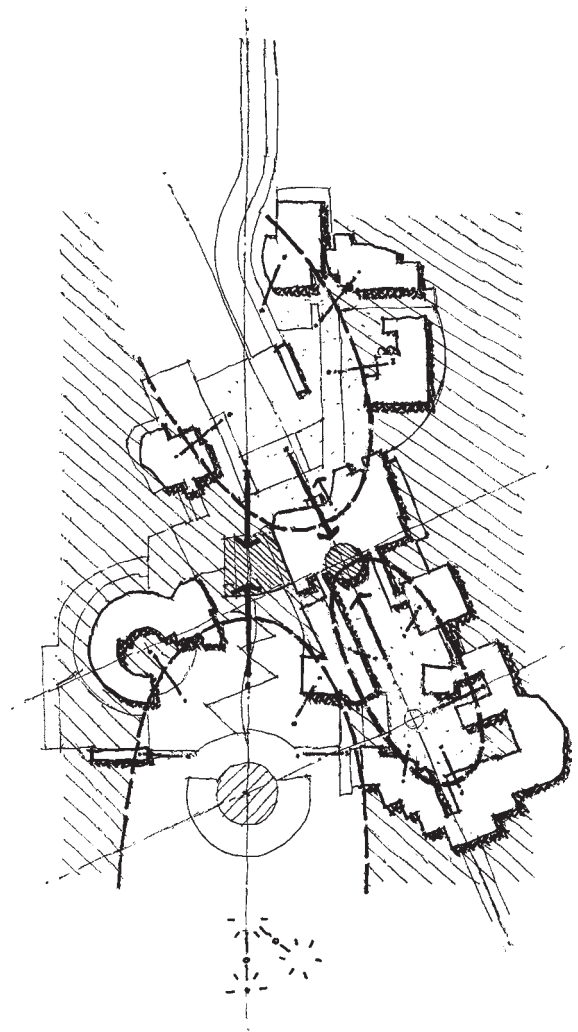
A partial shell with voided center entails a distinction similar to the matter-of-degree discussion in the

7. The ensemble pairs are ordered by two grids, the museum and rotunda aligned with the adjoining freeway and the garden and belvedere with the urban grid of Santa Monica, while the arrival ensemble reflects an overlapping of both grids. ("Recognizing City, Mountain, and Ocean, Siting the Getty," *Architectural Record* 185 (Nov. 1997): 82.)

8. Given the Getty's hilltop isolation, such a nested progression effectively ends at that point, but zones of surrounding context, whether or not focused on a core of their own, proceed inexorably outward from any core of origin: the district, the neighborhood, the city, the region, and so forth, until the Eames' "Powers of Ten" film becomes the model, and we are among the galaxies, looking for their center. Charles and Ray Eames produced this short film in 1977 that moved outward at rates increasing at "powers of ten" from human scale to intergalactic space, and back in to subatomic scale. That effort surely took some of its inspiration from Kees Boeke's book *Cosmic View: The Universe in 40 Jumps* (New York, The John Day Company, 1957).



9.26 Bohlin Cywinski Jackson: Ledge House, Catoclin Mountains, Maryland, 1996.



9.27 Richard Meier: Getty Center, Los Angeles, CA, 1997.

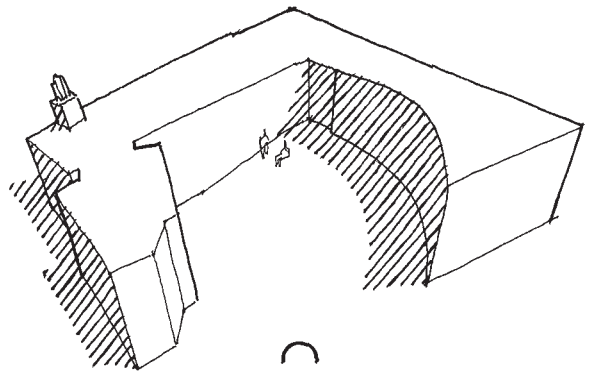
context of subtractive form. If the spatial void is relatively small in proportion to the bounding volume, the tendency to interpret it as an excised removal is strong. Giurgola's Plattsburgh Student Center was a clear case, its notch-like void angled to the main footprint.

At Aalto's Helsinki house and studio the impression becomes more ambiguous with the larger scale of the void, although the concave wall remains a clue of excision (9.28). Two other clues—the acute angle at the excised face and the consistent slope of the roof plane—reinforce the subtractive reading.⁹

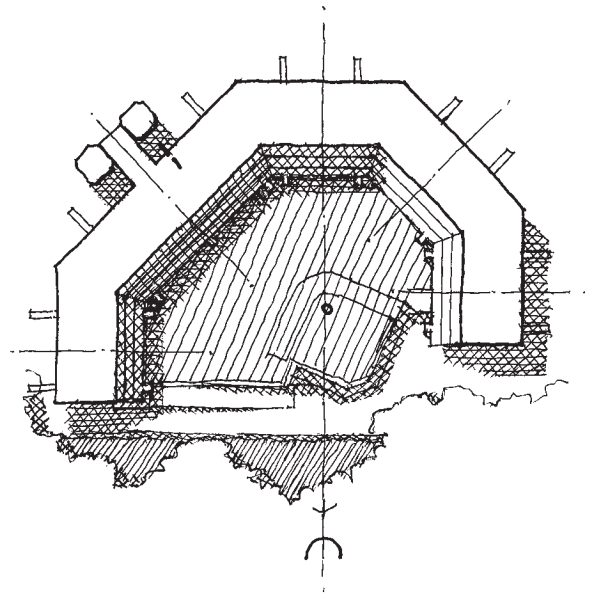
With an even thinner, more regularized profile such as that of Stirling's Florey Building, the impression of excision is supplanted by the sense of a rotational forming that has been segmentally regularized (9.29). The voids they partially define may have accompanying features, such as the Florey's ventilator/stabile and raised plinth, but the expression of a void dominates. The core is "somewhere else"—at the Florey, hiding in the woods across the stream that is the true focus of the ensemble. A shadow of a doubt does remain as to whether the half-buried breakfast room element comprises a sort of co-focus for the scheme, for although treated as a raised platform with no visual or physical connections from the main terrace to the room's sunken interior, its configuration and place in the composition nonetheless impart a heightened center, sitting as it does at the approximate focal point of the segmented shell. But ultimately this plinth seems best regarded as a sort of collimator, focusing the convergent outlooks of the room building to the truer focus of the landscape beyond.

There are as many similarities as differences between such partial single shells and their full-penumbra counterparts, as seen in a further reference to Harvard quads (9.30). The undergraduate houses prove to

9. It should be clear in these cases that, although terms such as "void" and "removal" may be used, the exterior space in question is often highly defined and may be deferred to spatially, as at the Aalto studio.



9.28 Alvar Aalto: Studio, Helsinki, Finland, 1956.



9.29 James Stirling: Florey Building, Oxford University, England, 1966.

include a full array of shell-type enclosures within the same closely defined architectural vocabulary, ranging from complete surrounds to shallow Us, in response to forces of site, composition and program.

Linking Them

Returning once more to address the seam between the two opposite-number partis, hybrids again bridge the gap. In the case of the Inn at Middleton Place, Clark *enfaced* radial increments at the inner face of the thick-wall armature that comprises the partial shell (9.31). Here the focus, though not as a core for the ensemble, is the lawn and river beyond. The dominating lodge volume at one end, departing from the consistent paired geometry of the shell/wall and its enfaced increments, offers some ambiguity: while it may not be the core of the project, it wants to be.

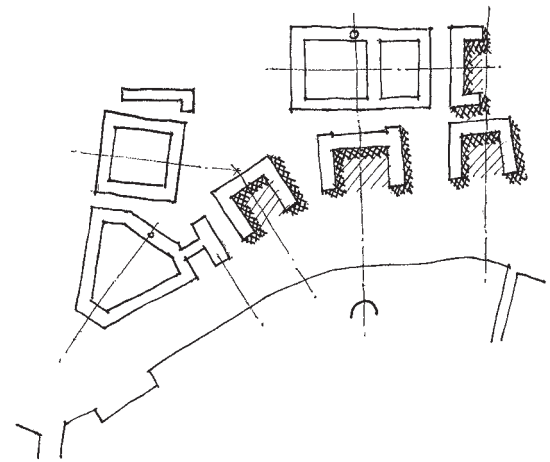
Aligned Partial Penumbras, Core Centered (9.32)

Aligned Incremented Radial Arrays

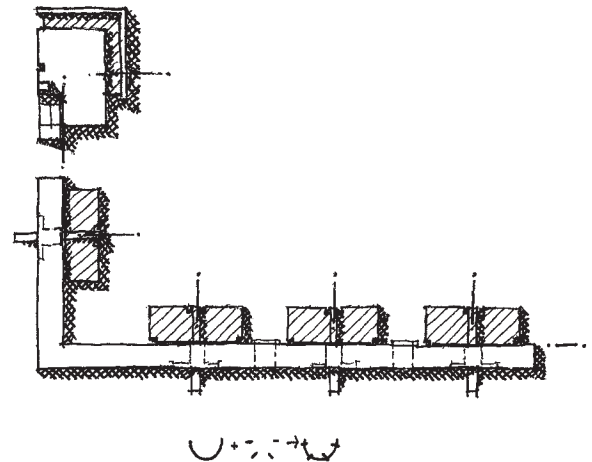
If the parallel radials at the University of Virginia were reduced to parallel radial *increments*, there would be no immediately apparent logic for such a multiple array paired with a singular core element. This is another construct representing a slot in the continuum of formal possibilities that, while theoretically achievable—no doubt manifestations exist—is impractical in reality.

Aligned Single Shells

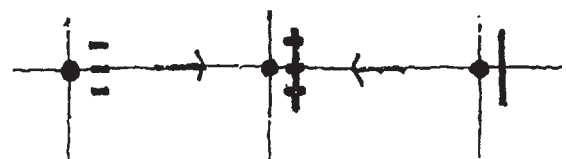
In contrast, the corresponding case of parallel shells dwindled to a single aligned shell element and core embodies a wide-ranging variety of applications. The case represents a partial shell focused on a core but “ironed flat” to serve its particular image, site or functional needs. No rulebook calls for the core to vanish to the infinite distance that the straightened shell would imply. The core and linear shell have



9.30 Various architects: Undergraduate Dormitories, Harvard University, early 20th c.



9.31 Clark & Menefee: Inn at Middleton Place, Charleston, SC, 1987.



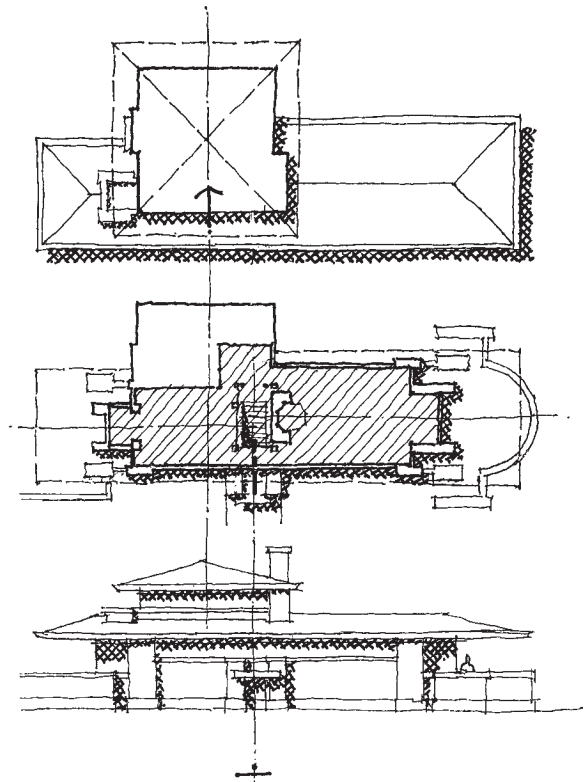
9.32 Aligned partial penumbras, core centered: sequence.

adjusted their diagrammatic relationship to become a collaborative composition of linked, adjoined or collided elements, each retaining its role to play.

The hearth as the core of the house keeps recurring as a favored formgiver of Wright's, and on occasion he incorporated the hearth into eccentric cores engaged with elongated rectangular compositions: aligned single shells. His Tomek house is a clear realization with its frontal approach and abrupt entrance partway along the extended façade (9.33). A precursor to the Robie house, its core is expanded to the scale of a small house in its own right, likewise incorporating the chimney, entry and stair. Rising above the longitudinal main living volume in which it is embedded, its role as core and anchorage has a resolved clarity rather unusual in the oeuvre of the architect. This is core as anchorage as opposed to core as a focus of the life of the house. Ironically, form rather than space dominates in that role, as in so many Wright houses, wherein living rooms tend to be ravishing elongations that don't lend themselves particularly well to conversation.

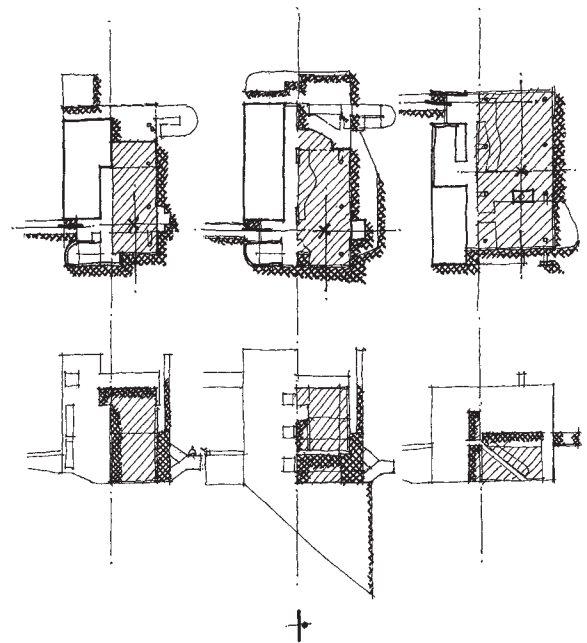
This symbiotic pair of elements went on to come into its own as an elemental type in the form of the ubiquitous mid-rise served/servant slab parti: a parallel shell of use areas dispersed longitudinally for light and view, and vertical services collected at one or more outboard cores. The pairing was touched on in the discussion of planar/linear forming, exemplified by the Inland Steel Building. But while the core as tower is a ubiquitous manifestation of the approach, low-rise elements can and do serve the parti. Aalto's Baker House reappears in this context, its idiosyncratic footprint serving as a reminder that shape is secondary to relationship in discerning the centering nature of a design, with its wavy profile seemingly pulled into place by the lower dining pavilion that is its core.

Those three early Meier houses test the limits of this linking mode (9.34). The image they embody is a



9.33 Frank Lloyd Wright: Tomek house, Riverside, IL, 1906.

rather familiar one of a symbiotic pairing of opposites, a yin/yang interaction. Other versions would include, as has been discussed, the juxtaposition of proportional extremes—a tower paired with a broader, lower element. But the present case seeks to work within the constraints of two discernible elements that lack either overtly planar or linear proportions. The significant remaining variable is transparency, the pairing becoming one of solid and void. The solid protectively faces the entrance approach in each case, and the entryway, off-center and composed abstractly with other small openings, comprises the dominant feature of this exposure. These elements are solid in another respect in that they are filled up with all the smaller rooms and closets of the houses. The centering rationale is somewhat strained in that these elements have a thinness readily perceived as wall-like, but such a reading is not compelling; the fact that the two elements are ganged in tandem with contiguous side boundaries in some cases serves to preserve and reinforce a mutual sense of significant volume in depth. One penetrates directly through this *poché* element of the parallel single shell to emerge into what can seem its fraternal twin, the glazed living volume beyond, the pair having been regarded as a case of singular duplication in formative terms. The glazed openness of the living space, with continuous exposures of glass permitting 180° of outlook, is key to regarding this element as the core in each case. The freestanding fireplace, embedded in the outward glass exposure at the Smith and Douglas houses, is a characteristically contradictory modernist gesture, removing the hearth from “refuge” within the solid element and standing it up like a stage prop opposite the entry axis where it competes with the view for attention. There is a temptation to interpret each of these nearly equal pairings as a sort of hybrid set of parallel shells that looks to the horizon for a “distant core,” especially given the expansive outlooks and descending site that characterize these houses. But ultimately the central living spaces of the glazed elements seem more suitably the core in each case—the focus of the life of the house, surrounded by the



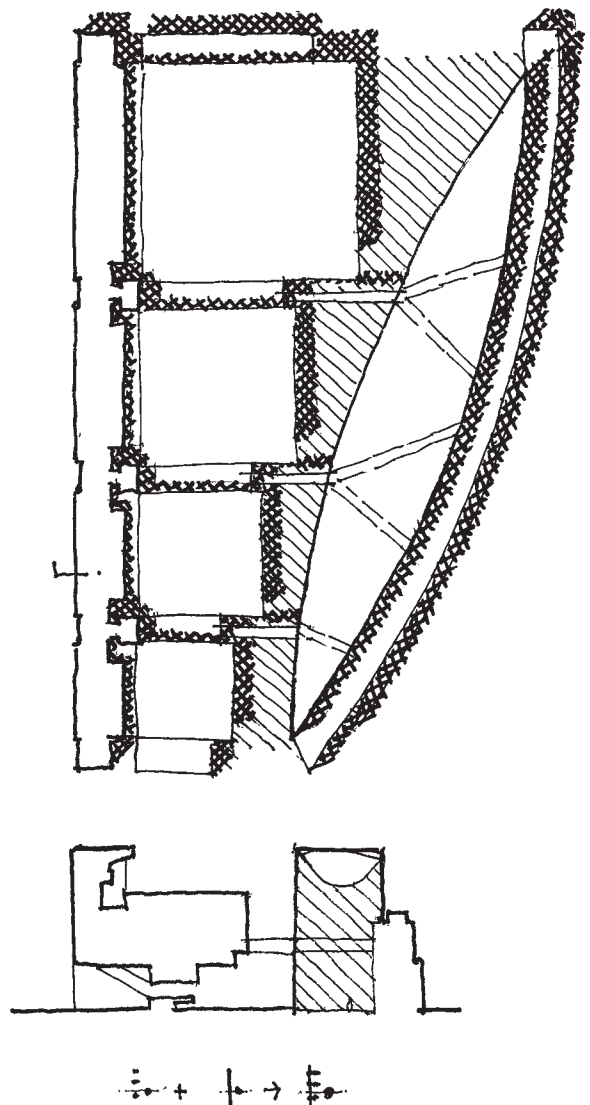
9.34 Richard Meier: Smith house, Darien, CT, 1967; Douglas house, Harbor Springs, MI, 1973; Shamberg House, Chappaqua, NY, 1974.

hearth, the view, the entry, subsidiary living spaces, and the parallel shell of support spaces.

These schemes demonstrate that while frontal approach remains a basic characteristic of this mode of centering, the order and function of the components may vary; thus the core serves as the vessel of entry at the Paris hostel, while the shell is the frontal element of the Tomek house and the Meier houses. A final observation serves both to further distinguish between this aligned-shell case and the true core-centered partial shell, and to demonstrate that ultimately there is no clear dividing line between them. Proportion is the issue, in that while a shell increment is frequently rectangular in footprint, so also is the flattened-out shell of the aligned case. The best one can do is to make an intuitively reasonable division: compact plan proportions of 2:1 or less read more readily as a true partial shell penumbra, as in the case of the Asplund courthouse, while the aligned version dominates when they significantly exceed 2:1.

Linking Them

To again seek out a hybrid, now a bridge to link these straightened-up versions of radial increments and single shells, demonstrates that such combos have the potential to transform impractical schemes into worthy solutions. Viñoly's Tokyo International Forum additively *superposes* a row of parallel radial increments (the several venues, ranging small to large) onto a parallel shell and core: these constitute a tall connective bar of service facilities, linked by connective bridges—linear links over intervening open space—to the elongated lens of the “glass hall” as the core of the project (9.35). The connections serve equally to link the glass hall and the venues. The completed composition is a direct response to the “linear regression” aspect of the row of venues, as well as to the limitations of the trapezoidal site, and also affords a demonstration that an extraordinarily extended core element can serve to render such an unusual hybrid morphologically feasible.



9.35 Rafael Viñoly: Tokyo International Forum, Japan, 1996.

Aligned Partial Penumbras, Void Centered (9.36)

Aligned Incremented Radial Arrays

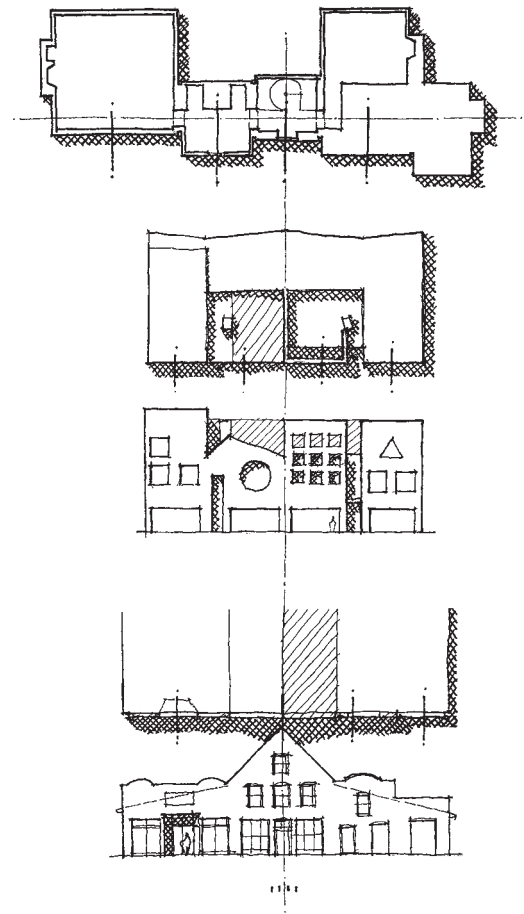
In contrast to the nonintuitive and unproductive version with a core appended, this void-centered case is significantly represented by built projects. Radial increments—aligned side-by-side, either spaced apart or engaged—recall the enfilade of incremental shells employed at Jacobsen’s Zamoiski house, but ordered and approached *frontally* rather than axially. The urban streetwall would seem an obvious manifestation of the parti, except that streetwalls typically face each other as flanking appendations to the street, itself acting as a singular radial. The same could be said of the closely spaced revivalist houses populating early 20th century residential blocks. That said, housing is one of the type’s preeminent applications (9.37):

- The en faced elements of Jacobsen’s Jacobs house are staggered and individualized like separate little houses along a street, focused by the nature of the site into a transverse, enfronted order.
- Arquitectonica’s Mandell apartments differentiate four similar-width bays behind a flush common facade plane, by virtue of variations occurring in openings and skyline profile.
- The Mast Family General Store in North Carolina, which spawned a regional chain, exemplifies the ubiquitous vernacular roadside commercial building, its central bay flanked by characteristically articulated false-front profiles. The building once housed several tenants. Again, a flush façade, now white clapboard, features a variety of fenestration acting in concert with the false fronts to obfuscate the building’s symmetry.

These cases recall the more contiguously extended precedent of the urban streetwall, surely one of the precedents—consciously or not—for this type, with



9.36 Aligned partial penumbras, void centered: sequence.



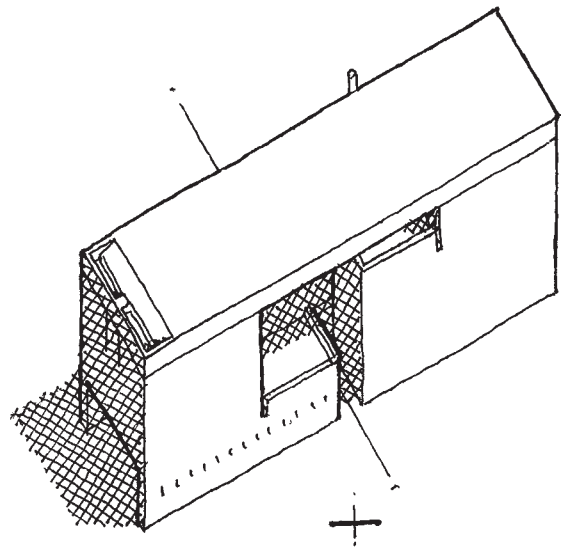
9.37 Hugh Newell Jacobsen: Jacobs house, Meadowbrook, PA, 1988 (garage opposite not shown); Arquitectonica: Mandell Residences, Houston, TX, 1985; Mast General Store, Valle Crucis, NC, 1883.

its sometimes deliberately diversified elements, arrayed like books on a shelf.

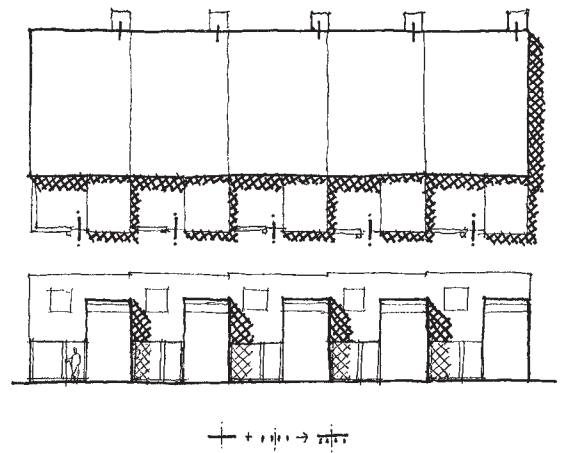
Aligned Single Shells

This mode is productive either with a core, as at the Tomek house, or without, as here. While the morphology of the former was a logical anomaly, it now makes diagrammatic sense that the inflected shell flattens into a straightened wall-mass with the theoretical core again at an indefinite remove. The type has its own ubiquitous place in the world of built form, encompassing designs that are thin in depth but extended in length and lacking appreciable conformation or focus. The modern era has spawned many slab-sided buildings which meet this description in a desultory way, but two characteristics are important for the approach to be well served: appropriate proportion, in that the less wall-like or linear the form the more ambiguous its lineage, and clues of a through-passing cross-axis that aligns the shell in a frame of reference—generally marking its approach alignment and relationship to the “distant core.” Distinctions of planar vs linear dimensionality are less significant here than in discussions of formative issues, either characteristic suitably embodying this centering type if endowed with clues of transverse approach.

Some such designs really are walls, albeit hybridized with habitable appendations, such as Hedjuk’s Wall House II. The Atlantis Condominium is itself a habitable aligned shell, the punched out pool terrace a marker of transverse axial orientation. Botta intended his early house at Ligornetto, thin in section and rather closed and defensive looking, to serve as a symbolic boundary wall for its village, the carved-out recess of its entry and porch signifying that cross-axis (9.38). Considerable ingenuity provided the living spaces with nominal and in some cases generous glazed exposures, but ultimately the concept of a residence as a “solid wall” seems a difficult sub-choice among the possibilities of the aligned single shell.



9.38 Mario Botta: House in Ligornetto, Switzerland, 1976.



9.39 J. J. P. Oud: Weissenhof Row Houses, Stuttgart, Germany, 1927

Linking Them

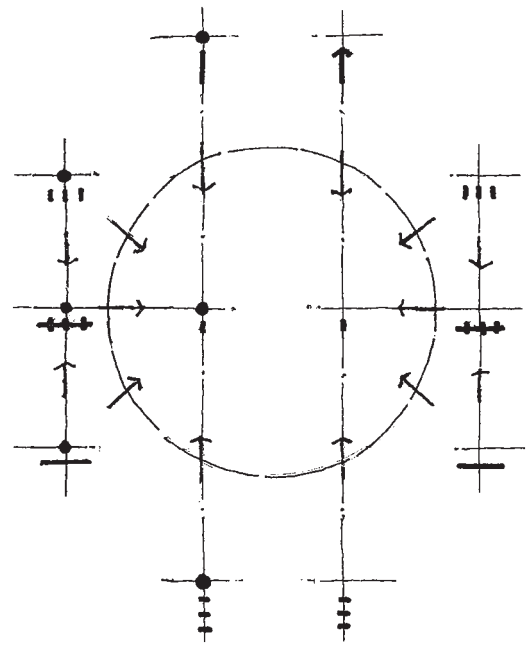
Incremented radials and an aligned single shell come together as a bridging hybrid in J. J. P. Oud's modest terrace housing block at the Weissenhof estate, where short wings projecting to the rear streetwall articulate an elongated bar into its individual units (9.39). Perhaps the simplest and most direct of all modes of connectivity is manifest, the radial increments directly enfacing the spine of the shell. The elegantly proportioned projections are actually prosaic, being laundries at grade with drying rooms rather inconveniently located above. Oud intended the project as a prototype for more extensive development, with greater elongation as well as possible replication.

Unitary Redux (9.40)

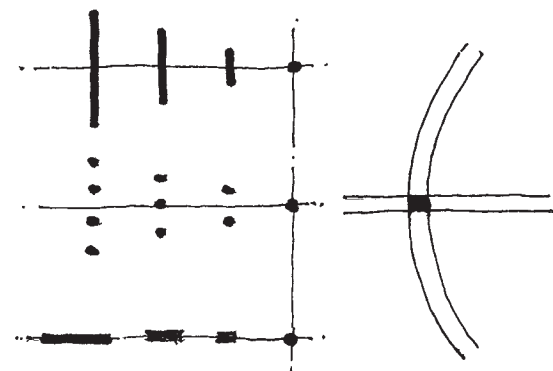
"Unitary form" as discussed in Part I comprises singular iconic forms—Platonic forms and their relatives—that permit of no significant alteration or appendation without becoming something other than unitary. Now, in the context of centering, the term again applies, but it concerns a different realm of possibilities: the array of centering modes now completing its devolution through simpler and simpler cases.

Void Centered

Of the limiting cases, the dwindled extremes of the single radial and the enfilade of incremental shells remain to be honed further toward the goal of linking the two typologies. In the simplest possible version of each—that with no core in the composition—a revealing comparison can be made when each is pared down to a single increment (9.41). As with multiple radials, the lone radial element again shortens until it has no notable axial elongation, the remnant becoming a neutral building block for larger ensembles. The enfilade of shell increments is reduced in turn by simply eliminating all but one.



9.40 Links to unitary modes.

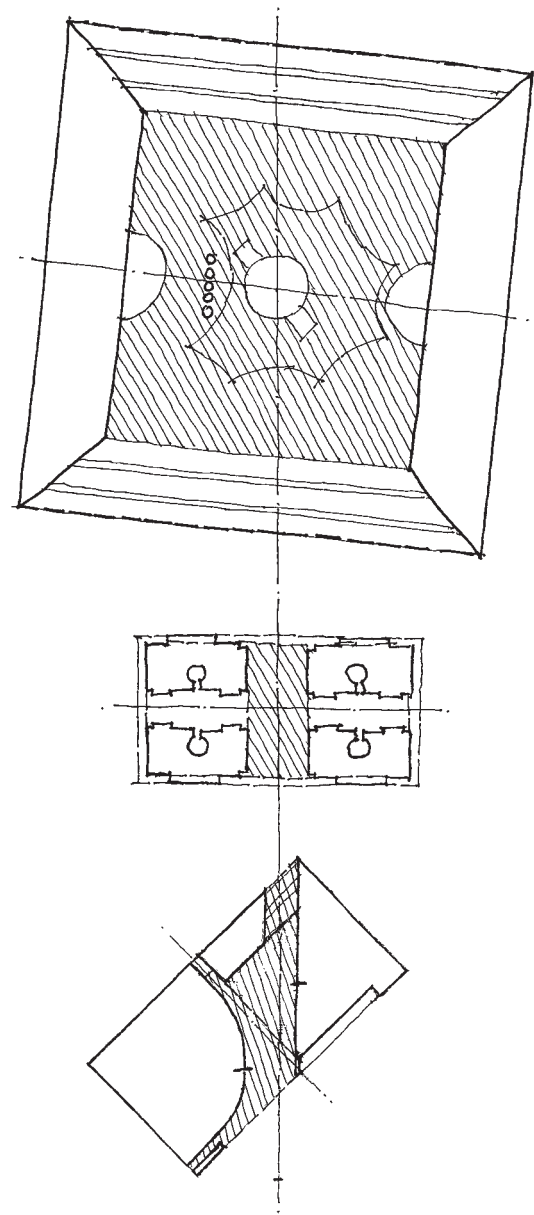


9.41 The diagrammatic commonality of radial and shell increments.

The parallel model of the shell makes for an instructive comparison and point of departure for this paring-down process if, as with the radial, its lateral extent is drawn in until it is no longer wall-like. The ultimate result of paring down these representatives of the two dissimilar approaches to centering is revealing for they become one and the same irreducible figure, the gap between the two approaches bridged because this element is the common building block of both. Another way of putting it is to visualize the radial and the circumferential crossing each other's path; the dot at their crossing is the increment to which they have dwindled.

Although orientation as a function of proportion has been eliminated, clues of the increment's relation to its context must remain for there to be architectural meaning; while increments in larger ensembles have more freedom to be activists or nihilists, the isolated element must somehow be "located" or it is rather more in oblivion than in the world of architecture. While not the only such means, a favored such locator or axis marker is one or another approach to a through-passing portal, similar to the orientational marker noted with respect to the "undwindled" single aligned shell. These manifestations of "aligned increments" recur through history and into the present (9.42):

- Embodying both continuity and unitary simplicity, with neither axial nor wall-like extent, von Spreckelsen's *Grande Arche de la Défense* demonstrates this case of the isolated increment with unusual clarity, regarded here on its own merits rather than in its extended context as part of a sequence.
- The *Arc de Triomphe* can serve as a familiar placeholder for innumerable monumental gateways, drawing attention while signifying entry and passage simultaneously. The proportion of the monument's width to depth approaches the



9.42 Johann Otto von Spreckelsen: *Grande Arche de la Défense*, Paris, 1989; Jean Chalgren: *Arc de Triomphe de l'Étoile*, Paris, 1836; I. M. Pei: Paul Mellon Arts Center, Choate Rosemary Hall School, Wallingford, CT, 1972.

tipping point where it becomes more legible as an aligned shell.

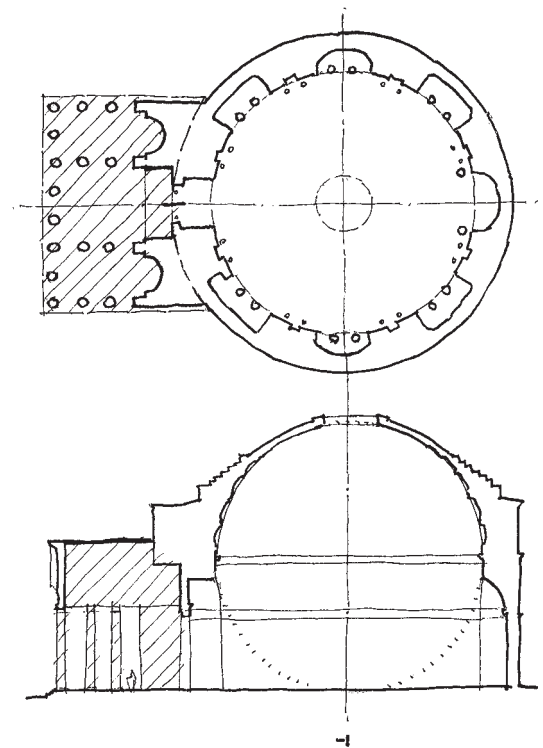
- Few designs that are not so monolithically specific can achieve such simplification of form. Others, while they may constitute several discrete elements, still devote their foremost gesture to this part of an “increment of axis.” While Pei’s Mellon Arts Center is actually two interrelated buildings and has been discussed thereby as a case of singular duplication, the experiential nature of the scheme is, as the architect intended, that of a “gate.” Due in part to the compellingly angled axis of approach and passage the composition is not particularly legible as a wall or a spine, a shell or a radial, but functions contextually as a coherent dot on a path with the understood core at a distant remove.

Core Centered

The companion case wherein such an increment directly engages a core element presents something of a conundrum. With its lack of extent, the increment leaves the core of such a composition exposed to such a degree that one recalls the caveat of a “naked” core’s improbability. The one type which arguably applies is the single centrally organized space entered via an appended increment, such as a porch or narthex, as in the case of the Roman Pantheon (9.43). But although essentially devoid of interior articulations—arguably excepting the perimeter niches—the Pantheon still focuses on a point beneath the oculus at the center of radius, that can’t help being set apart in importance from the space surrounding. Ultimately such a search begins to seem a bit trivial, and the case in question may, in a theoretical sense, be unrealizable.

Linking them

In this chapter, discussions of “linking” concerned the search for means, via centering hybrids, to connect across the divide between the worlds of the radial and



9.43 Pantheon, Rome, 14 AD, rebuilt 126 AD.

shell. But this “unitary” pair represents a different situation, being situated at the divide between counterpart cases that do and don’t feature a core. While the following chapter will reveal that hybrids are eminently possible among a variety of both types, in the present ultimately dwindled pairing there is no hybrid linkage: attempts to link the single void-centered increment with the core-centered increment (assuming that the latter can even exist) result in an isomorphism, the two cases of the increment devolving to one and the same.

Chapter Ten

CENTERING HYBRIDS

Just as with hybrid forming and its collaboration of two or more modes of dimensionality, there are cases where two or more *centering* modes play roughly equal roles in the centering dynamics of a design. But the means whereby they interact brings us full circle to the modes of *forming*: addition, replication, subtraction and deformation have fundamental roles to play in setting the stage for centering hybrids to occur.

Not every centering mode will combine credibly with every other one, but a brief glance at the combinatory possibilities reveals a wealth of potential hybrid centering types. If each of the thirty centering modes discussed among the limiting and linking cases (radials, shells, core centered, void centered) were “hybridized” with each of the others in turn, the result would be the sum of 30, 29, 28, etc. to a limit of 1—*plus* 30 “identity” cases of hybrids with another version of the same mode—for a total of 495. And this hardly represents the sum of possibilities, for only the limits of plausibility prevent the mutual involvement of three or more modes in a centering hybrid.

Additive

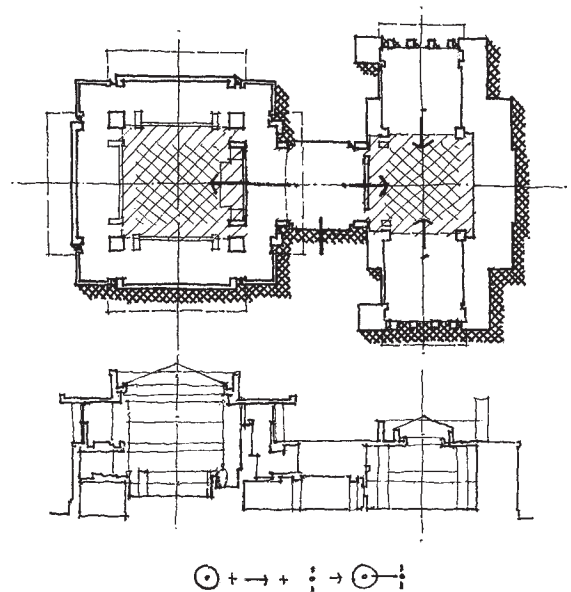
Logic dictates that the various modes of addition are invariably involved to achieve hybrid centering, for by definition, the act will constitute the bringing together of two or more centering modes by one means or another. The other formative modes also employ addition, but as an *initial* step, leading in turn to hybrids arising from their own particular natures. Beginning with the case of addition in a centering role, a review of the evolutionary sequence of additive forming types from Chapter 2 reveals a corresponding wealth of means for combining centering modes into new syntheses:

Adjoining

At the outset, this initial additive mode may seem not to address the issue. It consists of arranging adjoining elements into additive compositions, but if two or more cases of centering adjoin each other, they remain separate and unrelated: intuitively, *connectivity* seems a prerequisite for a case of hybrid centering to manifest itself. An exception does exist, though: in void-centered cases, were two or more adjoining but non-linked dissimilar centering modes to clearly “defer” to the same distant core, they could indeed constitute a centering hybrid, albeit an unusual one.

Linear Linking

With linear links one begins to discover the wide variety and nature of centering hybrids. To revisit Unity Temple, its hyphen of a narthex expressively links two different centering modes (10.1). The sanctuary, an iconic exemplar of a single core-centered shell, is given a measure of its special character by the shell’s replication in three surrounding levels, all focused on the single space of the central core.¹ While the chancel and organ loft occupy one of the four



1. Wright’s contemporaneous design for the Larking Administration Building extruded a similar version of this parti to a dramatic vertical extent. Both are prototypes of a sort for the “atriums” of modern times that are sometimes memorable and sometimes superfluous.

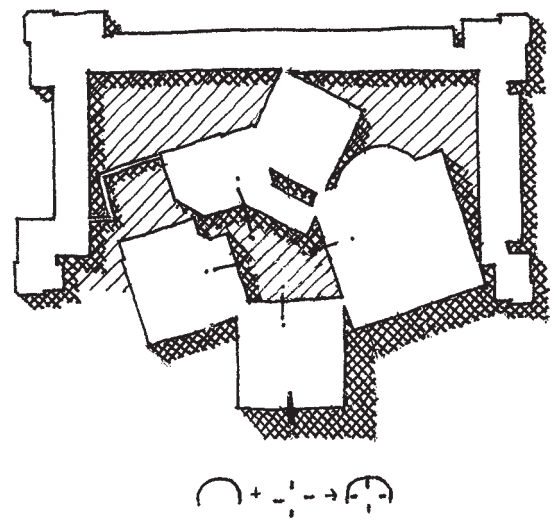
10.1 Frank Lloyd Wright: Unity Temple, Oak Park, IL, 1908.

sides, this exception doesn't materially compromise the imperative spatial order of the full single shell: these elements share in deference to the centrality of focus beneath the skylights. The building's less well-known Sunday school wing also features a full height core space, but its morphology is one of *radial increments*, of which a pair is engaged double-height and facing each other across the center. There are spatial likenesses between the two linked ensembles, but the experiences differ: the sanctuary accommodates a single inner-directed activity, while the wing is primarily devoted to separate class areas, the distinction expressed in the differing modes of centering. The linear link of the narthex, or "loggia" as inaccurately labeled by Wright, can be considered a single radial, "reversible"—aside from its initiating function as the entry—depending on whether one's destination is the sanctuary or the Sunday school. But clearly the central well of the sanctuary is the dominant core of the entire radial-ordered ensemble.

Touching

A project that was noted regarding this approach to forming also exemplifies touching as a tool for hybrid centering. The extended linear backdrop of Kahn's unbuilt Dominican Motherhouse continues around three sides as a partial single shell that lacks a core (10.2). The ensemble contained within is a *full* penumbra of radial increments surrounding a central void—seemingly a calm courtyard rather than a focus of form and activity for the project—with the partial shell surrounding it in turn on three sides. Touching effects the completion of the combined scheme of two centering modes as well as the contiguity of the inner grouping.

Variants involving the same centering family—shells & shells; radials & radials—seem less commonplace as hybrids, but they do occur among the many possible combinations. Chicago's Poetry Foundation is such a case (10.3). The building is arresting for its nested interior sequence of partial shells, configured



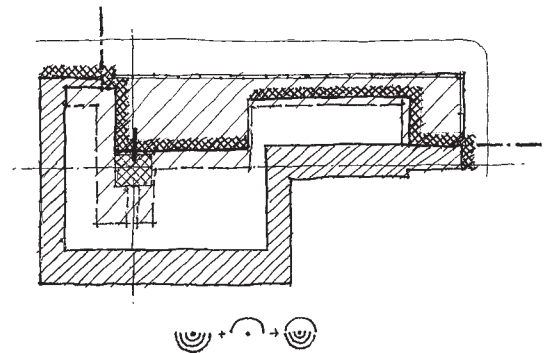
10.2 Louis I. Kahn: Dominican Motherhouse (unbuilt), Media, PA, 1967.

to tuck into the constraints of a partial city block, while progressing from a solid perimeter rim of offices to a more open spatial sequence held within it, opening in turn to a thin rim of double height space facing an urban garden. A seating arrangement at the monumental stair landing, deferred to from all directions, seems the core of this concentric sequence. The other half of the story is the partial single shell of the perforated zinc panel wall; while featuring dramatic openings to the streetscape, it exists primarily to shelter and complete the enclosure of the project. This visually permeable screenwall ultimately defers to the same core element. The extremities of this streetwall shell touch the outer limits of the inboard multi-shell sequence, forging a scheme of hybrid centering from differing shell variants.

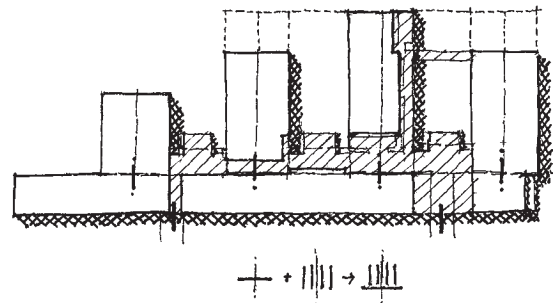
Enfacing

The utility for hybrid centering of elements brought together face-to-face is clear, especially in cases involving an aligned single shell:

- Recalling the Putterman house, its row of gabled volumes is an array of parallel radial increments without a core, while the wall to which they are enfaced is a parallel single shell of minimized thickness. Despite the clue of the entry opening, the wall alone would be far from identifiable as a case of centering: it depends on its hybrid juncture with the row of gables to endow its status.
- Thickening such a wall to the scale of a habitable linear element permits it to become a spine. As previously noted, elements are appended to one side of Oud's townhouses, its transverse wall an aligned shell enfaced by radial increments.
- The School of Architecture Building at Florida A&M is based on a related hybrid type in that the organization is diagrammatically similar, but its more elongated appendations are a case of parallel void-centered radials, enfacing the backbone of



10.3 John Ronan: Poetry Foundation Building, Chicago, IL, 2011.

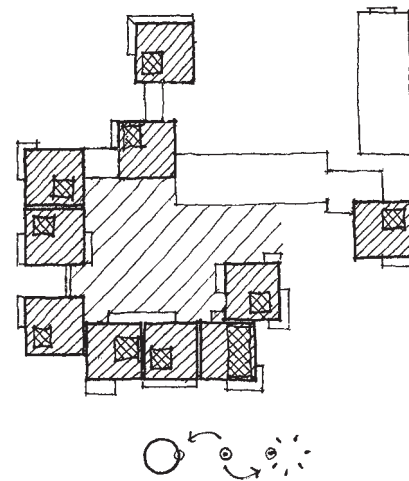


10.4 Clements/Rumpel: School of Architecture Building, Florida A&M University, Tallahassee, FL, 1985.

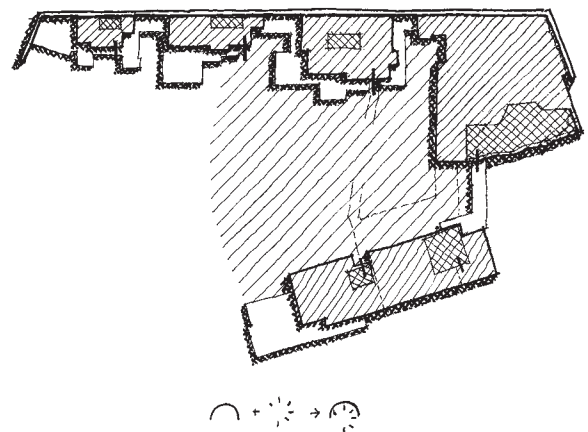
an aligned shell (10.4). The backbone’s status as a shell is established by its transverse entries; were circulatory structure clearly longitudinal instead, that element would read as a radial.²

The Sea Ranch Condominium is a far less single-mindedly linear case, affording a meta-mixture of interior- and exterior-oriented centering modes (10.5). Each foursquare condo is itself a single shell centered on the core of its four-poster, but the ten units aggregate, with exceptions, by enfacing each other.³ The resultant footprint is felicitously ambiguous: is the ensemble defining the central courtyard an approximation of an almost-full void-centered single shell, or is it a full array of radial increments? Regardless, the mostly enfaced elements are *themselves* core-centered shells, rendering the project a hybrid of two modes when the interior and overall orders are considered together.

As at the Putterman house, Aalto’s unbuilt Leverkusen Cultural Center features a “backbone” wall with incremental elements arrayed along its face (10.6). But an outboard wing constitutes an additional pair of increments. Taken together these elements aggregate as an array of radial increments that partially define a broad open court. The auditorium increment, while dominant in scale terms, does not really seem to function as a core for the project but rather as a first among equals. As at the Sea Ranch, each increment is itself a sort of full shell array with its own core of shared space, the departments and functions of the cultural center each being separately articulated and having its own entrance. With the U-shaped acoustic



10.5 MLTW: Sea Ranch Condominium, CA, 1965.



10.6 Alvar Aalto: Leverkusen Cultural Center (unbuilt), Germany, 1962.

2. Everything changes: some buildings have been demolished since this narrative began and those fates have been so noted where known. Buildings also get renovated and added to. At Florida A&M, radials have been lengthened, evened out, and the interstices between them infilled.

3. To one degree or another, many of the examples that have been discussed that involved a number of discrete increments can be discerned in this way, with identifiable centering modes at successive meta-levels. The Condominium is singled out due to the pronounced degree to which the core within each unit is expressed.

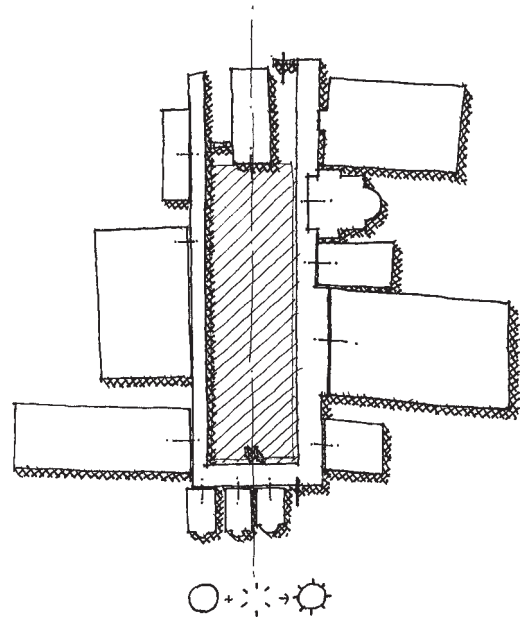
barrier wall acting as a partial shell, the enfaced juncture of the two centering modes—plus the increments functioning as shells in their own right—make up the scheme’s nature as a centering hybrid.

Full *closure* of a shared open space, not as a “core” but as a large-scale and well-defined urban focus, is exemplified by a definitive case from history, the Forum of Pompeii (10.7). The elongated rectangle of the civic forum itself was almost completely surrounded by a covered colonnade—a full single shell. But this served as a civic link to the buildings immediately adjoining outboard on all sides: temples, basilicas, markets and government offices. Such edifices of varied sizes and proportions, most featuring their own sub-centers, constituted a full penumbra of mutually enfaced or adjoining radial increments, all enfaced in turn with the intervening and connecting shell of the colonnade.

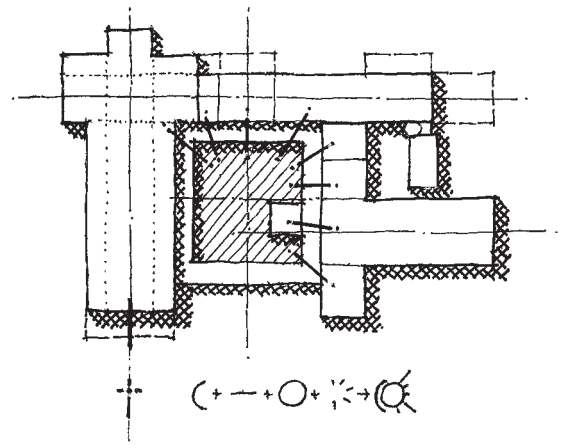
A circumferential colonnade appears again in a ubiquitous historic precedent, the abbey church and its cloister. The central cloister of Fontenay Abbey is a typically square, contemplative focus for the ensemble of abbey functions that surround and enface it (10.8). These elements comprise a rich variety of centering modes, the church relating to the cloister as a partial shell while the chapter house, great hall, refectory, and subsidiary volumes relate to the central focus as a mixed partial array of radials and radial increments. The church itself characteristically comprises a sub-ensemble of its own, the radial of the nave converging at a crossing along with the radial increments of the apse and transepts.

Embedding

Several means to craft centering hybrids for linking up sequences were introduced in the previous chapter, “embedding” among them. In the discussion of additive forming, two differing approaches to embedding were introduced—via a “matrix” of connective tissue, and via a direct collision of



10.7 Forum, Pompeii, Italy: configuration at eruption of Vesuvius in 79 AD.

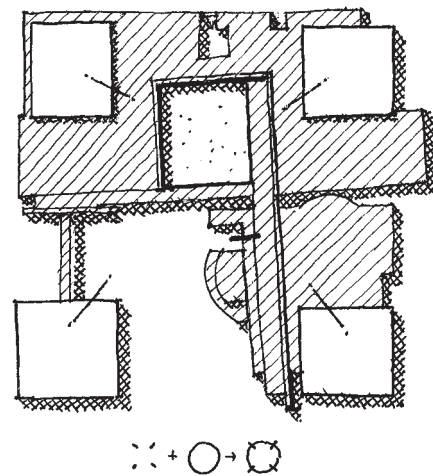


10.8 Cistercian Abbey of Fontenay, Bourgogne, France, 1147.

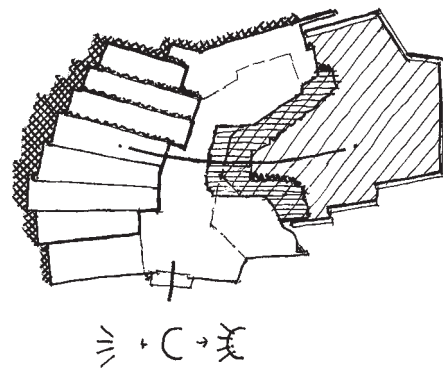
elements. But in this centering context such a two-part forming distinction is less of an issue, since they both serve the centering purpose in analogous ways. Serving to bridge the linking sequences via embedding, we have already seen the Johansen house and the Mönchengladbach museum analyzed as centering combos of various radial and shell modes.

The museum at Mönchengladbach uses embedding to craft a hybrid of a partial shell and a partial array of radial increments, sharing the entry element as core. Meier likewise employs embedding at his Frankfurt museum with the existing villa and its “clones” as quasi-radial increments initiating the scheme and defining the corners of the project (10.9). The hollow-centered infill material—a partial void-centered single shell—then insinuates itself so as to variously engage them, ultimately to be frozen in its indeterminate, roughly U-shaped configuration. The emplacement of the U-shaped wall in the central area defined by the pavilions is a distinctive enhancement to this basic vocabulary, affording a strengthening armature for the otherwise somewhat amorphous matrix aspect of the scheme. Elevated linear links further enhance the variegation of the ensemble as they provide connectivity.

Aalto’s museum design for Shiraz demonstrates how a wholly different approach to massing in the service of centering can still be governed and in fact enhanced by embedding (10.10). The galleries themselves comprise a partial radial array that lacks an apparent core. The lobby and other elements of the program clasp the galleries as if to draw them together, but ultimately defer to the sculpture garden beyond, as indeed do the galleries as well. Concentric with and embedded by the galleries, they comprise a partial *shell* that is also without a core. One visualizes the expansive sculpture garden, despite the enfolding exposures of the lobby, as more peripheral than focal, so it seems not to serve that purpose. The central lobby portion could, once developed, possibly have laid claim as core of the design, but as this graceful



10.9 Richard Meier: Museum of Decorative Arts, Frankfurt am Main, 1984.



10.10 Alvar Aalto: Shiraz Art Museum, (unbuilt) Iran, 1969.

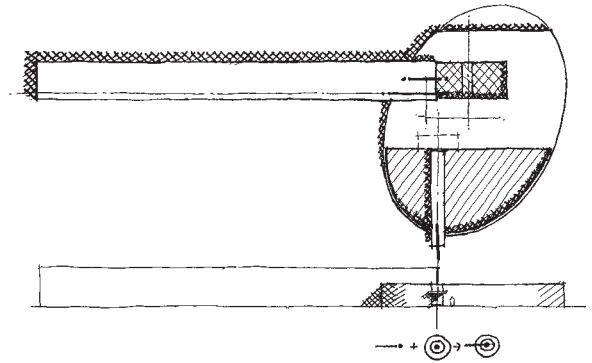
scheme will probably remain unbuilt one can only speculate.

Hotel P by Toyo Ito is a poetically simplified case of dissimilar embedded centering modes (10.11). Aalto's fan has folded up into the elongated minimalist radial of a single-loaded two-story room building embedding an understated oval, which presents a deft interplay of interiors and exteriors that is ultimately legible as a concentric sequence of shells. One enters and crosses a walled pool court to enter the lobby, then to discover an open garden courtyard at the building's very heart, which is the shared core of the ensemble. Axial links upon entry are artfully eccentric, recalling the traditional Asian convention of interrupted spatial sequence.

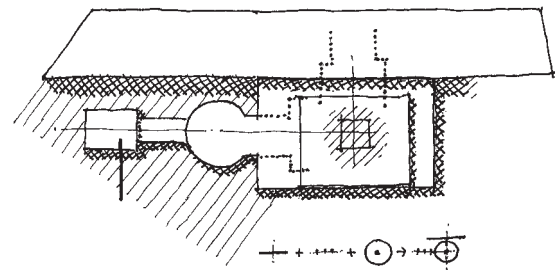
Le Corbusier's Salvation Army Hostel, referenced previously as a case of volumetric/planar dimensionality, is bolstered and centered at its face by a low-rise projecting pavilion. The destination both of stairs from the "planar" slab and of the entry progression from without, the central space is the core of the composition (10.12). With a rim of support and circulation functions, the pavilion is actually a full single shell. The slab relates to the core as an aligned single shell, while the entry progression of several dissimilar elements is a case of shell increments in sequence, its axis turned *parallel* to the slab. These two centering modes engage the core by virtue of mutually embedding its shell surround.

Superposition

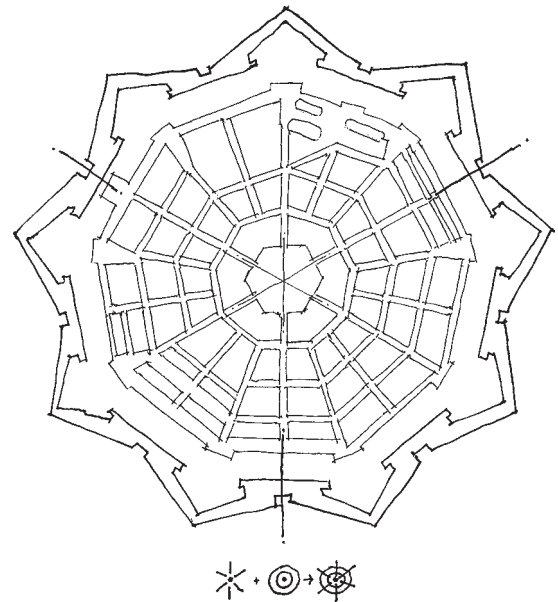
Just as forming strategies can involve fully overlapping design elements that have varied plan orientations, centering strategies can also employ a complete superposition of differing centering modes. At the urban scale, the fortified Italian town of Palmanova affords a rare built example of complete radial and shell arrays fully superposed (10.13). The fact that it is a relatively dull place by Italian town standards should tell us something about such literal-minded



10.11 Toyo Ito: Hotel P, Shari-gun, Japan, 1992.



10.12 Le Corbusier & Pierre Jeanneret: The City of Refuge, Paris, 1933.



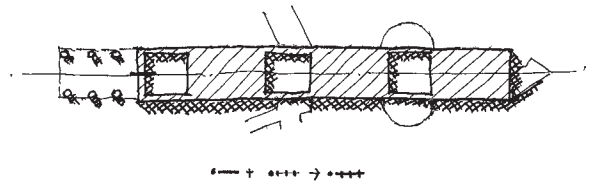
10.13 City of Palmanova, Italy, founded 1593.

symmetries. But in its rigidly diagrammatic way it is characteristic of large cities generally that have naturally evolved informal and irregular patterns of superposed radial and shell arterials.

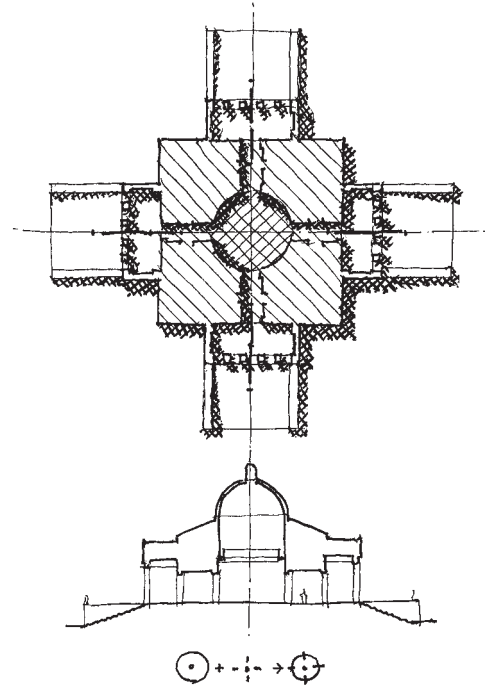
As with embedding, opposing categories crop up more often than do combos of more like-minded categories when it comes to cases of superposition:

- Pei’s East Wing at the National Gallery has been noted, its radial increments and single shell conflated into one integrated scheme.
- Isozaki’s museum takes the peripheral sequence of the East Wing and straightens it out, with shell increments in the form of several square circulation spaces superposed along the extent of its elongated single radial: both are focused on the core of the entry temple (10.14).⁴
- The Stockholm Library is an especially clear demonstration, its reading room hub both distributing radials and focusing the partial shell they link through.
- Palladio’s Villa Capra shows structural similarities to the library, but fleshed out with its single shell fully surrounding and engaging the core of the central circular hall. The four radial increments of the entry porches are superposed, their axes physically linked to the centerpiece (10.15).
- Stirling’s History Faculty Library is more ambiguous, but its elbow armature is legible as a partial radial array, superposed on an articulated array of partial shells (10.16). The predominant shell gesture ascends via its faceted glazed roof to a point of focus at the top of the elbow. Both modes share the core area defined by entry, vertical

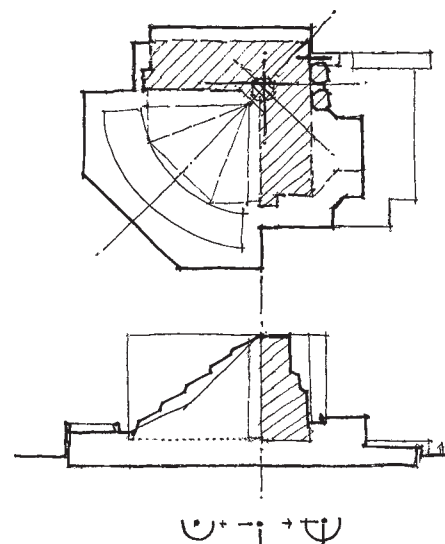
4. The most unique and architecturally commanding of the building’s components, this element seems to appropriately claim that status, despite the perhaps unfortunate circumstance that it is but the beginning of the of sequential experience.



10.14 Arata Isozaki: Okanoyama Graphic Art Museum, Nishiwaki City, Japan, 1984.



10.15 Andrea Palladio: Vila Capra, Vicenza, Italy, 1571.



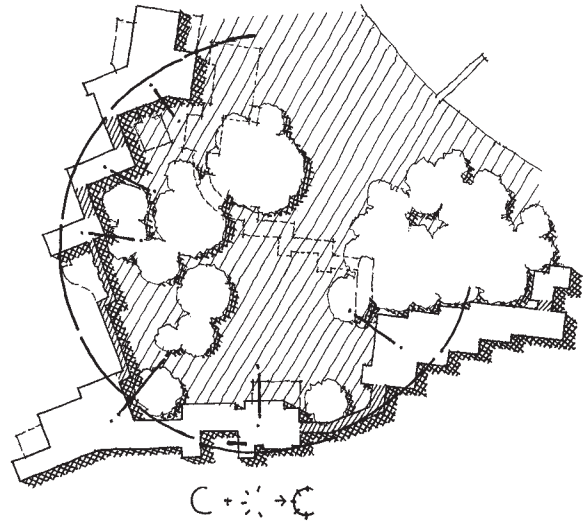
10.16 James Stirling: Cambridge History Faculty, Cambridge, England, 1968.

circulation, and the control desk overlooking its arc of supervisory sightlines.⁵

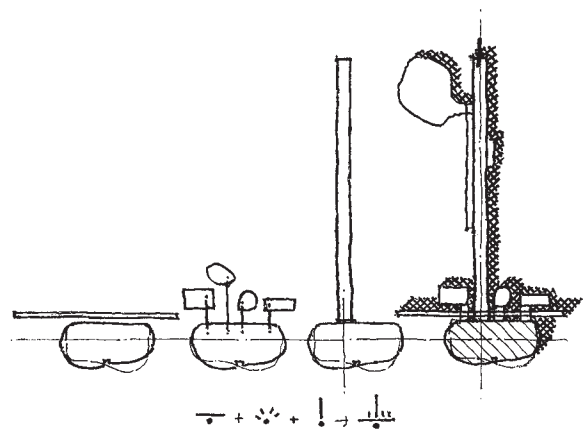
- The Louisiana Museum lacks a predominating core and features a varied partial array of radial increments, but its linear connector of a partial shell links up the pieces, crafting a single attenuated work of superposition (10.17). The increments defer simultaneously to the central lawn and to the seacoast beyond, partially screened by mature trees. Additions since the original design achieve a *completed* shell by virtue of linked underground elements which preserve the distant prospect.
- Wall House II returns yet again, now as a centering hybrid via superposition (10.18). The stack of living spaces comprises the core of the ensemble, dramatically engaged with an aligned single shell in the form of the freestanding armature wall. But the stretched corridor is a single radial that also terminates in the core of the living group, as well as engaging a remoted radial increment element at its foot, and the rest of the “blown back” service elements also append the living group as a partial array of radial increments. These several gestures add up to a bravura superposition of centering modes.

Graves’ Hanselmann House is also revisited, the architect having interpreted this design, one of his earliest realized works, as fundamentally a layering of three “facades:” the freestanding screenwall, the elaborated entry face, and the more solid rear wall

5. The architect’s characteristic games with ambiguity come into play regarding this interpretation. The “shell segment” rises to terminate at the topmost levels, while the elbow radials do not make it down to the ground floor: both factors signal a “Z axis” case as a plausible alternative interpretation of vertical embedding. As to the height of the glazed shell segment, Stirling has stated that he called for it to terminate at a lower level on his presentation model, concerned that the scheme as designed would be too hard a sell. (Lecture by Stirling, University of Tennessee, Knoxville, TN, 1976.)

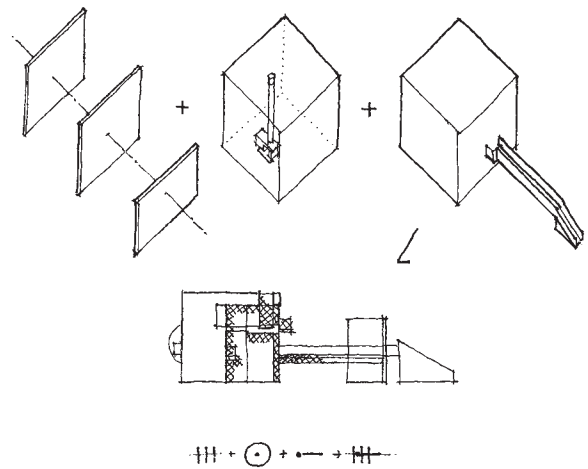


10.17 Bo & Wohlert: Louisiana Museum, Denmark, 1958 (subsequent additions dashed).



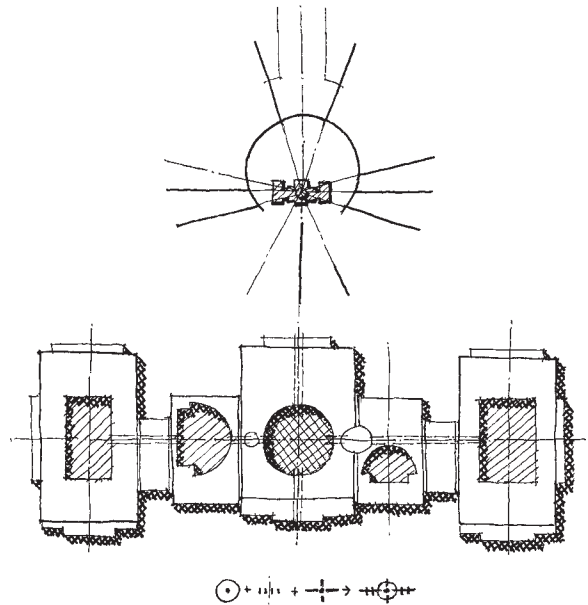
10.18 John Hejduk: Wall House II/Bye house (unbuilt), Ridgefield, CT, 1973. Built, Groningen, Netherlands, 2001.

of the living room, with its mural (10.19).⁶ The mural is composed in recursive fashion of aspects of the house and surrounding landscape, suggesting a reiteration and interpretation of the same themes, and fostering a sense of indefinite extension rather than focus and resolution. The three wall planes, approached frontally and penetrated in sequence, constitute an array of aligned shells without a core. But the nearly perfect cube of the house proper embodies yet another approach to centering, for once setting aside its embellishments of deformative and subtractive gesture the interior literally centers on an island fireplace, such that at its most basic the house constitutes a single shell with the fireplace as its core. Further, the linear element of the linking bridge is a crucial element in the composition that can clearly be perceived as a single radial—recalling that of Wall House II—but one which itself lacks a terminating core, short of considering that the cube of the house as a whole assumes that role. Regardless, it's fair to say that much of this seminal house's intrigue derives from its superposition of these three quite different centering modes.



10.19 Michael Graves: Hanselmann house, Fort Wayne, IN, 1967. Adapted from Francis D. K. Ching, *Architecture Form, Space, and Order* (New York, John Wiley & Sons, Inc., 1996), p. 45.

Looking to the past for exemplars of superposed centering, the U.S. Capitol is an assemblage that comprises several such modes (10.20). Viewed in its immediate urban context, the building as a whole is the hub for a series of converging radial streets. Within the Capitol itself, the domed rotunda is the impressive but rather empty core of a single shell. Over the course of the building's history radial increments appeared, initially enfacing the central shell to accommodate the early congress chambers and later linked to outlying increments for the House and Senate. Their chambers are in turn the cores of wings that function as single shells at the individual scale, but as radial increments in the context of the building as a whole. Morphologically, this aligned sequence of enfaced elements—all deferring to the



10.20 William Thornton, Benjamin Henry Latrobe, Sr., Charles Bullfinch, Thomas U. Walter, August Schoenborn, et al: United States Capitol, Washington, D.C., 1800; extensions 1850.

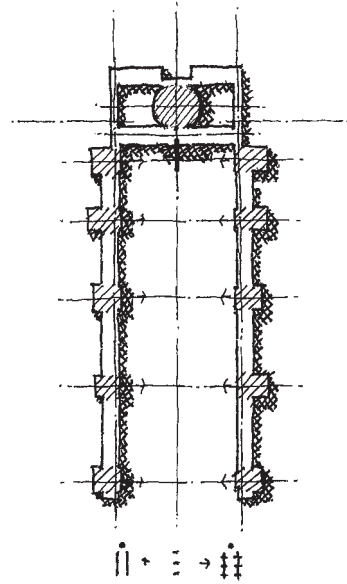
6. Karen Vogel Wheeler et al, eds., Michael Graves: *Buildings and Projects, 1966-1981* (New York: Rizzoli, 1982), p. 19.

mall axis and the meta-core of the Washington Monument—is distinguished by long corridors that link to the rotunda core.⁷ In terms of extent and function these corridors constitute radials, terminations of the full radial surround encompassing the building that have in effect continued into the interior. Axially opposed and terminating at the rotunda core, they form a radial array in conjunction with shorter east and west corridors. The Capitol emerges as the superposition of these three centering modes: the central single shell, the aligned array of radial increments, and the radial array, all converging on the common core.

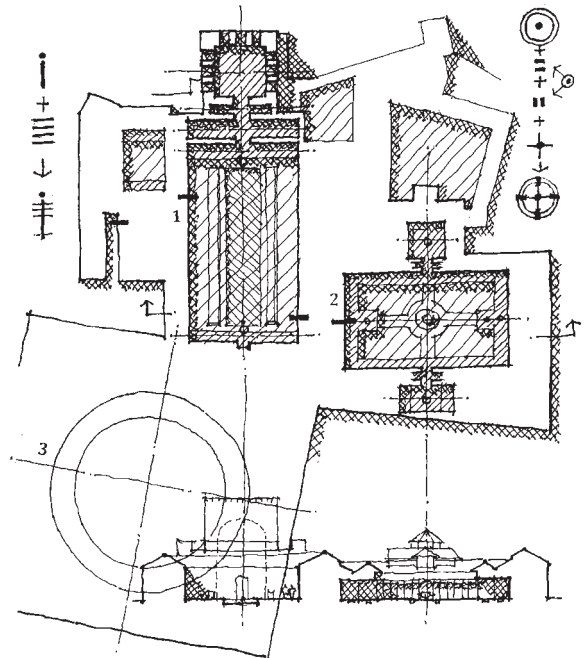
Latrobe's design work for the Capitol is indirectly linked to an earlier masterwork, for he was appointed to that post by Jefferson. At the University of Virginia, a composition of radials, radial increments and domed core again appears, and it demonstrates once more that “opposite” modes need not be a prerequisite for hybrid centering (10.21). Jefferson's great lawn ensemble was noted previously for its array of parallel radials and core, but also for its “pavilions and hotels,” a feature which, taken more fully into account, actually renders the ensemble a hybrid. Facing each other across the lawn, these villas are aligned arrays of radial increments, focused on each other and thus lacking a core as such.⁸ The conflation by superposition of these two unusual radial modes results in this iconic case of hybrid centering.

7. Washington D.C.'s grid is superposed by a network of cores and their radials, the Capitol and the White House predominating. But those cores in turn defer to the meta-core of the Washington Monument, establishing the well-known central cross-axes having the Lincoln and Jefferson Memorials as their opposite-hand markers. The Washington Monument ended up 300 feet off-center due to poor subgrade conditions at the crossing of the axes, the resulting necessarily “informal” departure from rigid axiality having arguably benefited this central ensemble of the capital.

8. While the linear elements constitute an array of aligned radials, these radial increment arrays require a formative act of “linear duplication” to thus appear twice in the composition.



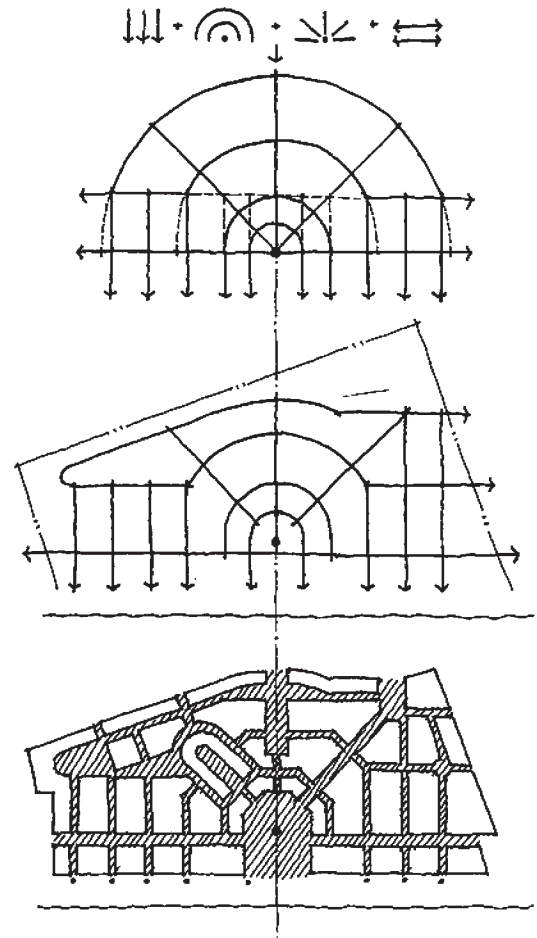
10.21 Thomas Jefferson: Great lawn building complex, University of Virginia, Charlottesville, VA, 1826.



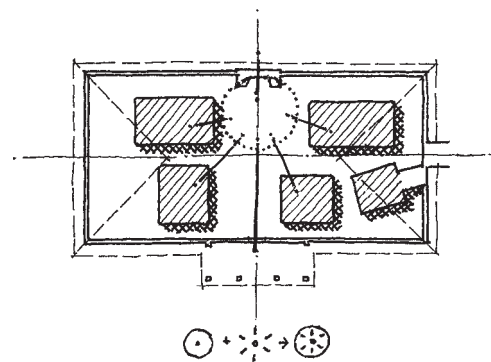
10.22 Palaces of the Alhambra, Granada, Spain: 1: *Palacio de Comares*. 2: *Palacio del Leones*. 3: *Palacio de Carlos V*. 13th–16th Centuries.

Further back in history, the Nazrid palaces of Spain’s Alhambra are famed for the decorative treatments of their interiors, but they also comprise applications of hybrid superposition that contribute significantly to their spatial experiences (10.22). The axial courtyard of the *Palacio de Comares* is a radial, while the lofty Hall of the Ambassadors is its terminating core. Four perpendicular radials are superposed, defining and embellishing this sequence. While the courtyard of the adjoining *Palacio del Leones* has similar axial proportions, its concentric gallery compels the wholly different reading of a full shell array, centered on the lion fountain as core. Simultaneously, a cross axis of watercourses superposes a full radial array. This is “nailed down” by two opposed replicate pairs of single shell pavilions, their role in the overall composition devolving again to one of radial increments. In contrast to these nuanced ensembles, the later *Palacio de Carlos V* is an unsympathetic and grandiose imposition, comprising a void-centered full shell array.

As a sort of bookend to Palmanova, which began this section, the coastal Florida development of Seaside is a completely planned town of modern times, but one clearly influenced by the past (10.23). The superposition of four centering modes forms its basic diagrammatic order. As at Palmanova, but halved to address the Gulf of Mexico, superposed radial and shell arrays emanate from the core area of the amphitheater and planned tower. An array of parallel radials, also addressing the sea, is superposed onto the full width of the property—called out by a terminating row of overlook pavilions. An open-ended radial in the form of the pre-existing coastal road, echoed by a parallel inland radial, traverses and anchors the composition. The successive superpositions require a series of subtractive accommodations to mesh the dissimilar modes. While more a resort than a town, Seaside has grown nearly to maturity since its inception and comprises one of the earliest and most influential exemplars of “New Urbanism.”



10.23 Duany Plater-Zyberk, planners: Town of Seaside, FL, planning begun 1979; design and implementation by various firms to the present. Idealized centering diagram; diagram adjusted to site footprint; simplified figure/ground town plan.

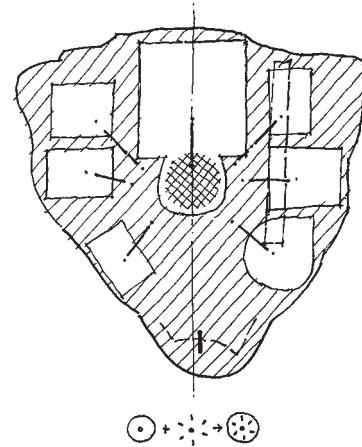


10.24 Moore Grover Harper: Jones Laboratory, Cold Springs Harbor, NY, 1975.

Encapsulation

Encapsulation brings about centering hybrids when one or more centering modes are entrained within an enclosing mode, yet all share a center:

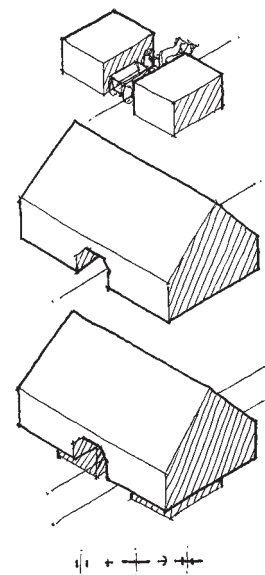
- Among additive cases cited, the Cold Spring Harbor lab stands out, the encompassing shell of the historic building itself and the partial increment array of shiny self-contained lab enclosures within both focusing on the core of the fireplace lounge area (10.24).
- At a very different scale, Coop Himmelb(l)au's Dalian Conference Center presents as a single warped and faceted volume, with deep soffit returns as if to convey a floating "mother ship" image (10.25). Centered on the opera hall within, it acts as a massive single shell. But an array of varied conference hall types are also centered on the opera hall as core, and function as a full array radial increments, encapsulated within this morphologically unresolved, parametrically developed single shell which shares their center of focus.



10.25 Coop Himmelb(l)au: Dalian International Conference Center, China, 2012.

"Z Axis" Cases

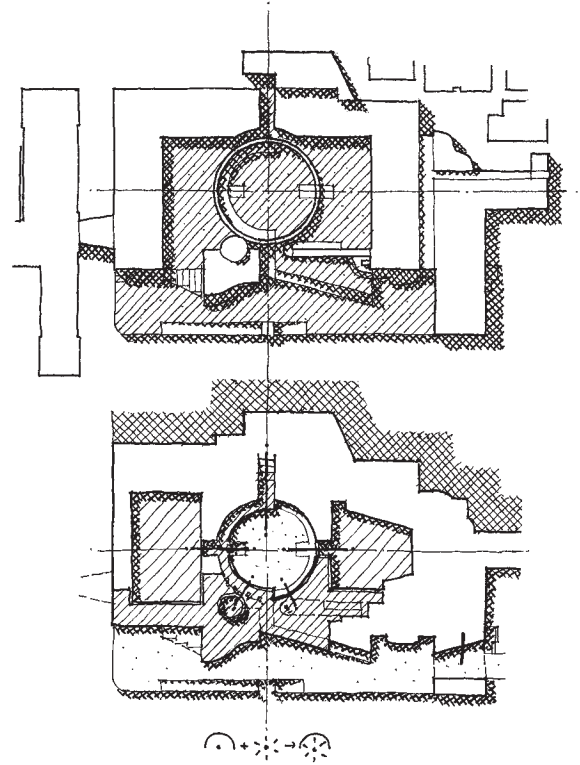
Continuing to follow the sequence of additive modes, vertically layered relationships also show up in hybrid centering, with differing modes engaged at differing levels to achieve functional and architectonic goals, generating hybrid centering ensembles in the process. To begin with a unique vernacular type, the cantilever barn of the southern Appalachians raises an archetypal house/barn volume above a pair of recessed square log "cribs" which shelter livestock, as do the dramatically deep cantilevers of the loft building above (10.26). Hay would be forked into the loft for storage from a wagon pulled between the cribs. A multitude of variations exist on the number and proportion of the cribs as well as the size and profile



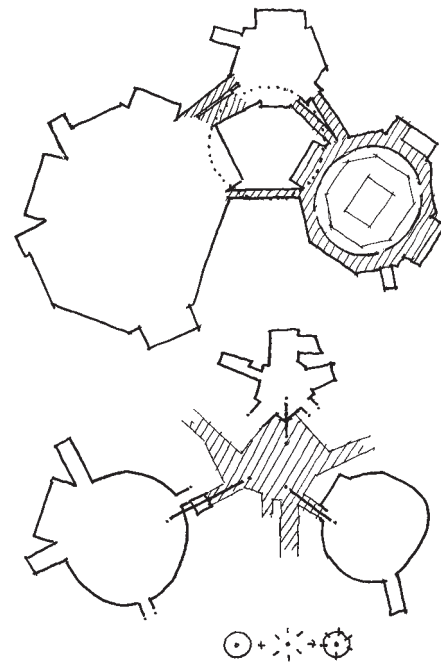
10.26 Typical vernacular cantilever barn of the southern Appalachians.

of the loft.⁹ The cribs read as radial increments, paired by replication, and the loft, typically featuring “cutouts” at the centerline of the eave exposures for drive-through headroom, reads as a single parallel shell. The two entities are vertically enfaced and share this through-passing axis that points to the absent core—in functional terms, the fields and meadows beyond and about, the barn serving as an elegantly framed staging point on the recursive cycles of the farm.

Stirling and Wilford’s *Neue Staatsgalerie* in Stuttgart incorporates partial arrays of both radial increments and shells, but as with the elements of the barns they exist on different levels (10.27). The ensemble is both undigested and masterfully assembled, diverse pieces and parts appearing unexpectedly at every turn. The conundrum of the roofless drum—a room and not a room—is the most “focal” space in the ensemble, yet one which is bypassed by all significant paths of circulation and has no programmed function; yet it is clearly the core of the scheme. Why this should be so, while the superficially similar centerpiece of the Northrhine-Westphalia Museum design seems a voided center, may have simply to do with the combined effect of greater accessibility from the museum proper (although the drum can seem something like the center of an English hedge maze, depending on which doors are locked) and its less light-well-like proportions. On the lower of the building’s two primary levels, a circumferential shell in the form of public circulation wraps three-quarters of the drum. Four radial increments adjoin this shell, including an opposed pair of changing exhibit space and lecture room, plus the smaller follies of the bookstore mini-drum and the ramp/ elevator “machine.” The former two are perceivable as forms from the interior only, being excavated from the poché of subgrade service areas. But at the upper level, the U of enfilade galleries comprises a second, entirely



10.27 Stirling & Wilford: *Neue Staatsgalerie Stuttgart*, 1984: upper and lower levels (subsequent additions not shown).



10.28 John Johansen: Mummer’s Theater (demolished 2014), Oklahoma City, 1970: upper and lower levels.

9. Marian Moffett and Laurence Wodehouse, *East Tennessee Cantilever Barns* (Knoxville, The University of Tennessee Press, 1993).

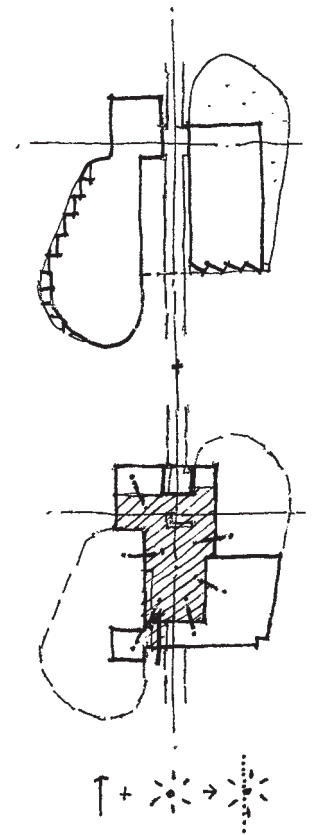
separate ensemble, a partial shell, differentially carved back to bypass the drum that is its focus.¹⁰

The classic case of the Mummery Theater was a similarly “stacked” hybrid but a less complex one, despite its elaborate presentation of chutes and piping (10.28). Discussed in the context of forming via linear links, its entry level can now be seen as an array of radial increments surrounding a voided center, at the confluence of access bridges and linking connectors to the three theater buildings. The main circulation level above was ordered by a single shell connector that linked up those elements. Recursively, each theater comprised its own full shell array of the central stage, surrounded by the audience, surrounded in turn and accessed by a circumferential gallery.

Discussed above as a linear formative hybrid, Hartsfield-Jackson Airport can serve as something of a placeholder for many spine-and-wings projects. The foremost of its parallel shell concourses also engages the domestic terminal, originally the core of the project, while the ensuing row of concourses comprises an array of parallel shells. This presence of a core would have been a rarity among the limiting cases of aligned shells, but here it is rendered eminently functional by virtue of the singular radial of the linking subway terminating at that core, the two modes synergized as a centering hybrid. While the above describes the airport structure as originally conceived, an international terminal now engages what was once the “tail end,” the concourses and subway now serving two masters in a dual core hybrid.¹¹

10. A set of further increments, including the original museum proper, the library, the music school, and a chamber theater remain as outer planets attached to the inboard shell of the galleries by seams or links; these artfully slip into the urban texture of pre-existing buildings adjoining. In the years since this project was in the limelight, a significant southward expansion has occurred that renders it a linear ensemble of linked and variously U-shaped elements.

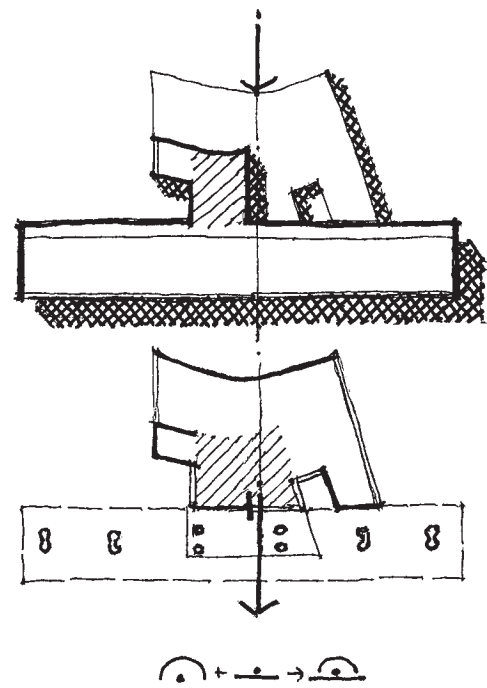
11. The great lengths of Hartsfield’s concourses and connector remove it from what we normally think of as architecture, and it notably lacks memorable spatial or formative treatments. But there is something to be said for a large airport, inevitably a place of stress and confusion, to strive for calm and understatement.



10.29 Le Corbusier: Carpenter Center for the Visual Arts, Harvard University, 1962.

Le Corbusier’s Carpenter Center appears as a complex additive ensemble in formative terms, but its main ordering element is a nearly cubic volume centered on a large penetration—the route of the through-passing ramp—which arguably defines the ensemble in centering terms as a single radial, lacking a core, that engages a variety of subsidiary increments (10.29). The opportunity of developing any particular function or space as a core for the scheme appears to have been set aside in preference to this dominant gesture of the route through the elevated portal, the irony being that the contextual forces behind the parti are weak: the ramp is impractical as a pedestrian through route, instead comprising an excuse for an inspired if not particularly functional abstract composition. However, the ground level below *does* focus on a central lobby giving access to major functions, circulation, and reception, plausibly rendering that space the core of the surrounding array of collided increments. Carpenter Center turns out to be a hybrid of these two differing vertically engaged centering modes.

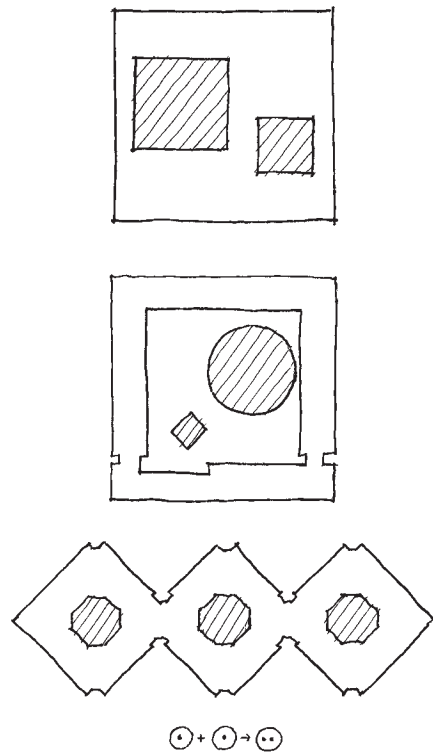
The Swiss Pavilion, also seen previously regarding its status as a formative hybrid, emerges as a centering hybrid as well (10.30). The dual role of the slab block as definer/divider and gateway is succinctly embodied in its levitation: the colonnade of pilotis is a gateway without boundaries, expressive of machine age optimism, and the raising of the slab block likewise transforms a barrier element into a more abstract, contemplative entity removed from direct involvement with the ground plane. The anchorage aspect of the service tower beyond is thus especially evocative: although the pilotis are massive and sculptural, they support a visually thin platform upon which the slab block appears to sit with weightless tenuosness, the service tower its only direct tether to the ground. The distinction is made even more emphatic by the articulation of the two elements: as opposed to collidive interaction, such as that seen in Wright’s Tomek house, the



10.30 Le Corbusier: Swiss Pavilion, Paris, 1932.

focal element of the tower is set back fully to the rear face of the soffit, and is made to appear semi-disconnected by the deeply notched reveal of the stair. Another device which contributes to a sense of almost tensile opposition is the concave sweep of the core's outboard face which results in a sort of role reversal: although "floating," the main mass is stiff and unyielding, while the anchorage element is more malleable and deformed along the axis of their linkage. At its base, the low-rise public and support volume comprises a crucial enhancement of the basic scheme, engaged and contiguous with the tower in the manner of a partial single shell. Herein lies the hybrid centering nature of the project, with the tower engaging this partial shell at grade while also engaging the aligned single shell of the room slab above, itself fully disconnected from the at-grade element. The stair/ service tower is actually a generous and open focus both at its ground level origins and at the room floors, clearly constituting the core of the ensemble.

One further distinguishing aspect of the design concerns the slab element itself, in that the thin, single-loaded room bay facilitates dissimilar facade expressions, the front open and fenestrated, the rear with punched openings in a monolithic stone cladding which continues onto the core. In this one respect the core is knitted into the fabric of the overall ensemble. The open front face is actually the exception to this façade treatment, as if most of its stone veneer had been stripped off, and the result is a very directionally-focused scheme as opposed to what is often a bi-directional approach. This coherent frontality, the hovering quality, the stretched connection of the core, and the distortion of the core's rear face all contribute to a taut sense of transverse forward movement in the direction of approach. The morphological energies implied in the image of the room building as aligned shell having been "unpeeled" from the core seem gathered and released with unusual directness.



10.31 Footprints: Charles Moore: Moore house, Orinda, CA, 1962; Le Corbusier: Palace of Assembly, Chandigarh, India, 1963; Louis I. Kahn: Erdman Hall Dormitories, Bryn Mawr, PA, 1965.

Replicative

The formative mode of replication finds a specialized place in the world of hybrid centering. Again, addition must be brought to bear as an initiating operation, but the ultimate result is hybrid centering via replication.

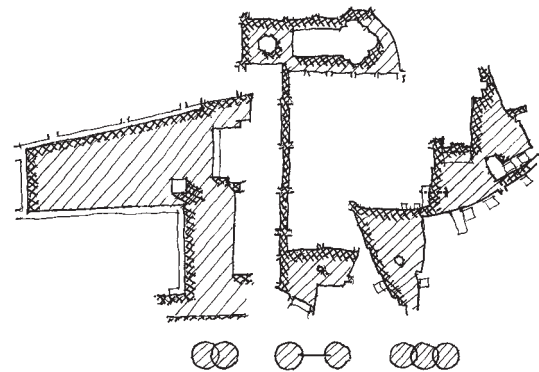
Cores

A familiar list of projects exemplifies the case of single shells with replicative cores, via varying scales and designs: Moore’s Orinda house, the Palace of Assembly at Chandigarh, Kahn’s Bryn Mawr dorm—are all based on multiple “co-equal” centering cores for a common enclosing shell (10.31).

The type can be discerned at the urban scale. Like most memorable cities and towns, Venice features a multiplicity of subsidiary cores, but the long history of its urban evolution has forged the linked pair of the Piazza and Piazzetta, clearly the hub of an otherwise labyrinthine urban entity. One often finds the duality of “sacred and profane” culture having crafted dual urban cores in such cities with deep histories: Florence’s Piazza Signoria is the defining urban focus of Florence, while its cathedral’s impressive mass is its counterpart, rendering the surrounding Piazza del Duomo as rather ill-defined residual open space. Wrapping up this sidebar on historic Italian urbanism, San Gimignano offers an unusual and experientially dynamic case of multiple urban cores, with *three* central piazzetti linked in diagonal sequence (10.32).

Grids

Intuitively, one considers an architectonic or urban grid as an *a priori* initiating strategy for the organization of a plane or a space. But hybrid centering has to do with the combination of centering modes to see where they may lead. Taking the case of parallel radials with a core at an “indefinite distance,” imposing a replication of this mode at 90° results in



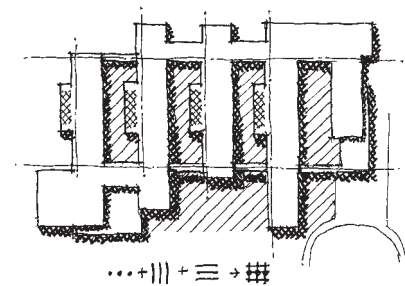
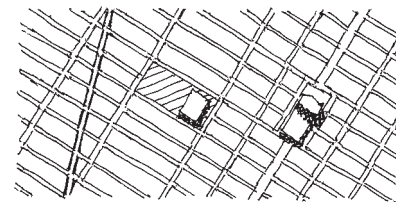
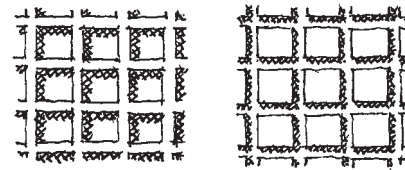
10.32 Piazza San Marco & Piazzetta, Venice, Italy; Piazza della Signoria and del Duomo, Florence, Italy; Piazza della Cisterna, del Duomo, and delle Erbe, San Gimignano, Italy (present day footprints).

a 90° grid (other angles resulting in other grids).¹² Seen in these terms a grid is a construct made up of more basic modes, resulting in a formative diagram of *planar duplication*. It is as applicable to as simple a scheme as Otaniemi's crossings of support spaces (or any number of analogous multiple-courtyard buildings) as it is to an urban grid of streets and blocks, each being the “negative” of the other (10.33). The outcome, lacking a core of focus as such, is a hybrid centering figure that has lost its axial orientation and any sense of center.

But in reality, sooner or later urban grids are informed in one way or another by interventions affording “regional” focus. Manhattan consists primarily of a vast grid of mostly identical rectilinear blocks (highly variegated, to be sure, within each block's confines)—but anomalies such as Broadway, Bryant Park and Grand Central Station comprise familiar examples of such interventions. (The obvious anomaly of Central Park is a different story, a sort of a core on a brodingnagian urban scale where the issues are fundamentally different from those of these centering arguments.)

Returning to the scale of architecture, there are two further points of interest with regard to the issue of grids. For one, the overlapped systems may clearly be of a different faith and order from each other. This is the case at Mahlum's Wilkes Elementary School wherein a rudimentary grid of two circulation paths crosses a set of five “bars” of functioning spaces, along with a number of infills and appendations corresponding to the above “anomalies.” Another observation, of notable significance to the thesis of a center of focus, is that this project applies linear duplication to result in *four* cores—the shared learning areas of classroom groupings. The particular issues of schools as a type bring the possibility of this “exception” to the fore, one less normative in most

12. “The grid can be seen as the overlapping of two or more linear systems.” Alexander Purves. “The Persistence of Formal Patterns,” *Perspecta* 19 (1982): 158.



10.33 Diagrams of grid as solids defining voids (courtyards) vs voids defining solids (urban grid); Excerpt of midtown Manhattan street grid with interventions of Broadway, Bryant Park and Grand Central Station; Mahlum: Wilkes Elementary School, Bainbridge Island, Washington, 2012.

other types and centering modes, but which should be noted as an anomalous yet very real option.¹³

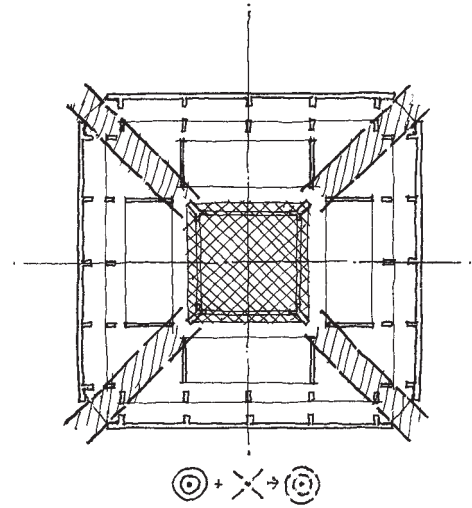
Subtractive

Subtraction in the sense discussed as a mode of forming does not lend itself directly as a tool to understand centering hybrids. “Cutting off” part of a particular centering mode results in, at most, a different centering mode and not a model for a hybrid. But with addition again acting as a “precursor,” interpretations present themselves that have subtractive removals as their basis.

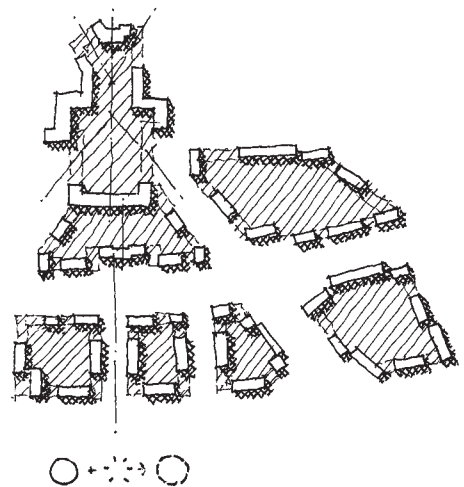
Subtractive Incrementation

Some designs characterized by “systematic interruption” can be plausibly visualized as being subject to a hybridization of intersecting modes, with the outcome being not the sum of the combo, as in superposition, but with negations—subtractions—where superpositions occur:

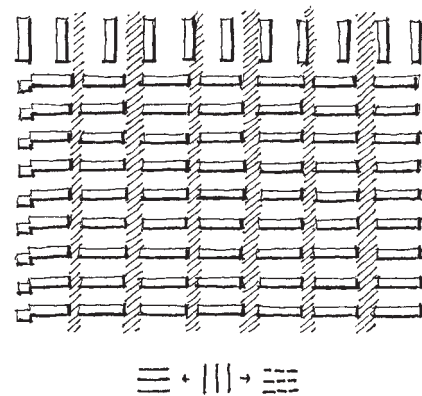
- Kahn’s Exeter Library, an array of concentric core-centered shells, could be interpreted as being conflated with a corresponding case of radials, the radials and shells visualized as mutually voiding each other, resulting in the open corners (10.34).
- The theme of quadrangles in collegiate, suburban and urban settings reappears in this context when the model of “interrupted” quads is examined. The Harvard examples of a full array of radial increments and of a single shell flank a middle ground, that could be considered a point along



10.34 Louis I. Kahn: Phillips Exeter Academy Library, Exeter, New Hampshire, 1971.



10.35 Oscar Hoff, planner: *Ullevål Haveby*, Oslo, Norway, 1913: partial site plan.

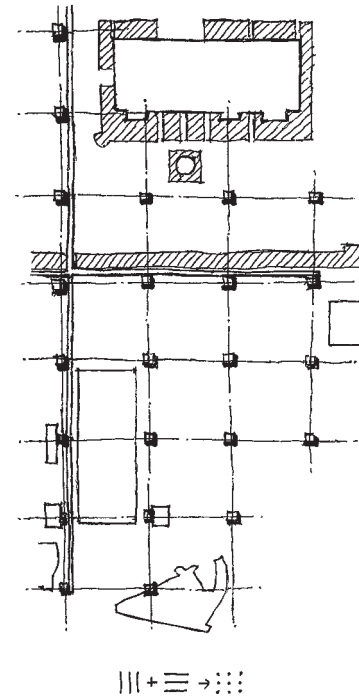


10.36 Ernst May, et al: Siedlung Westhausen, Frankfurt am Main, Germany, 1930.

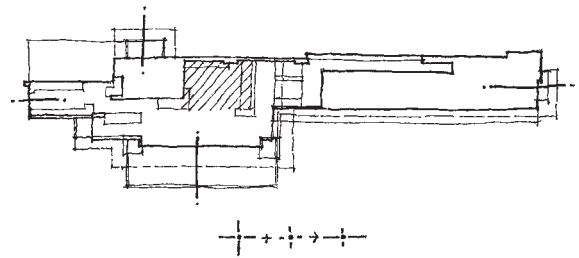
13. Unity Temple seemed at a glance to be a truly binuclear case of two cores, but the point has been made that the sanctuary actually dominates as the focus. Dual core/“void core” examples have also been noted, as at Säynätsalo, but these pairs differ in their very nature. Given the subjective nature of the issue, arguments can be made as to whether this or that project has multiple “cores” in the sense that has been discussed, but scrutiny generally reveals that one case will dominate. If not, the project is arguably suffers from a weak sense of order and focus—or simply exists at an “urban” scale wherein multiple cores become the norm.

a continuum between those two extremes. But a more pertinent model would be the hybridization of the two by subtractive incrementation: a pattern of increments negates, as it were, gaps in the continuity of the shell surround, resulting in a more incrementally buildable and penetrable ensemble, while still effectively defining central open space. A portion of the plan for Oslo's *Ullevål Haveby* affords one of innumerable examples with its array of variously shaped "incrementally interrupted" quads (10.35).

- Revisiting the approach of superposing parallel radial arrays at right angles (though again other angles will do as well), the mindset of subtractive incrementation brings about quite different results from that of replication. Several cases are possible: If two sets of superposed arrays are considered as having "opposing charges," one set could be visualized as being negated, taking the crossings with it. This is manifest at Germany's *Siedlung Westhausen*, a residential development all but devoid of variegation in the service of "scientific" planning (10.36). Identical rows of terrace housing are crossed by identical "negated" rows of streets and walks, peripheral arrays of perpendicular bars and stepped endpieces comprising the only exceptions to the original development's grid. The project recalls Hilbersheimer's hypothetical array of urban parallel radials.¹⁴ In another version, if *only* the crossings are seen as negated, an unhelpful diagram with small voids at the junctions results. But if the crossings are seen as mutually anchoring and remaining while the *links* are negated, the more interesting result is a planar array of "dots." It turns out to be the diagram of Tschumi's follies at *Parc de la Villette*, a grid at its most minimal (10.37).



10.37 Bernard Tschumi: *Parc de la Villette*, Paris, 1987.



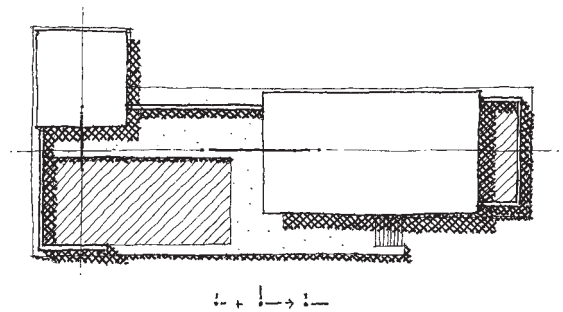
10.38 Frank Lloyd Wright: *Lloyd Lewis House*, Libertyville, IL, 1939.

14. Referenced in Stern, Fishman & Tilove, *Paradise Planned* (Monacelli Press, 2013); *Ullevål Haveby*: p. 559; *Siedlung Westhausen*: p. 455.

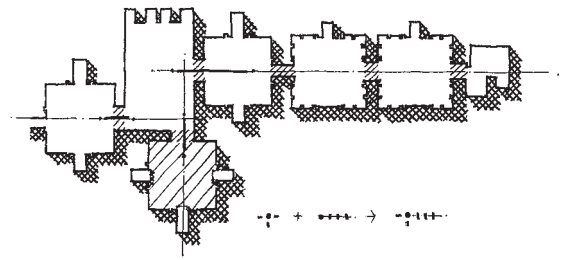
Subtractive Accommodation

The conflation of two centering modes can have another subtractive effect of sorts, as if a full array of each loses some of its parts in the process in preference to the other, the result being a mixup of two “remainders.” Some passing references demonstrate the versatility of the case:

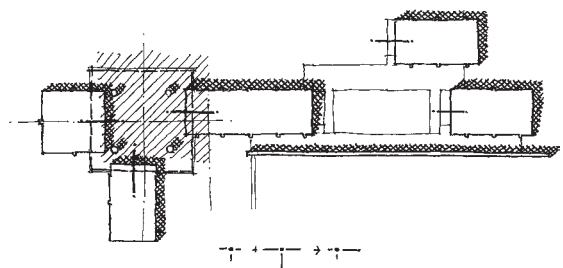
- Wright’s Lloyd Lewis residence, a pinwheel variant, alternates characteristically attenuated radials with broad radial increments (10.38). Neither opposed pair on their own would suffice to read convincingly as a centered array around the core of the fireplace seating area, but taken together these alternating parts achieve the completed hybrid that is one of the architect’s most elegant Usonian houses.
- Mies’ Barcelona Pavilion is a minimized case of the type, its two elements emerging at right angles from the open court and pool in the shared corner (10.39). The ensemble invests that space with an ambiguous sense of simultaneously public and private character: it is the place of entry, yet also a belvedere slightly elevated and separated from the street, and a shared space for the “life” of the place: its elevation, partial enclosure and shared focus endow it as the core of the project. The fact that it is a pool rather than a space to occupy evokes a slight irony that is in sync with the elegantly nonfunctional nature of the rest of the pavilion. An aspect of public/private ambiguity is fully in accord with the pavilion and its rooms that have no corners, doors, or functions. Given the elongated sweep of the main pavilion the scheme is properly perceived as the pairing of a radial—its weightless roof plane sliding laterally off the U-wall in the direction of the open center—with the radial increment of the support element.



10.39 Ludwig Mies van der Rohe: Barcelona Pavilion, Spain, 1929 (demolished 1930; reconstructed 1986).

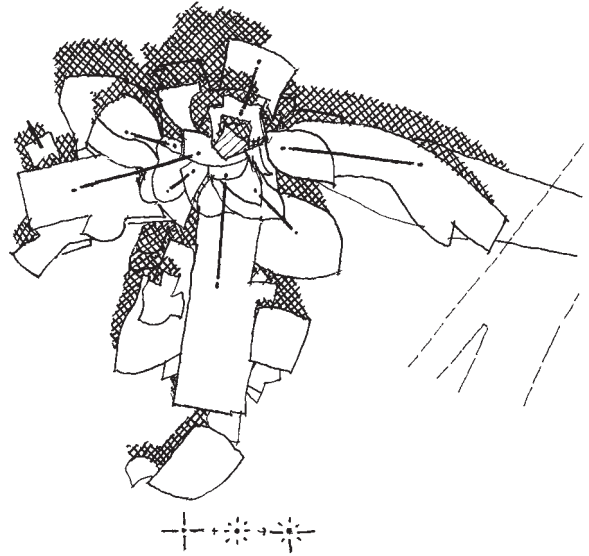


10.40 Louis I. Kahn: Richards Medical Research Laboratories, University of Pennsylvania, Philadelphia, 1961.



10.41 Philip Johnson: Erik Boissonnas house II, Cap Benat, France, 1964.

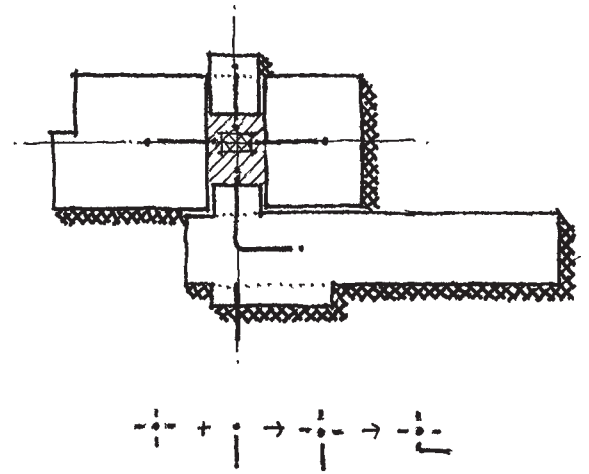
- Kahn's Richards Medical Research Building employs radial increments, joined via linear links to a central core in an informal pinwheel array (10.40). But one of the three increments replicates itself axially, becoming a linear array of incremental *shells* instead of the typical radial increment, by virtue of subtractive accommodation. The fact that the increments switch hats depending on the relationship involved is an indication of the importance of spatial order in making such an interpretation; the fact that they are perfect squares in plan helps facilitate the dual-role reading. A significant issue: while an open ground floor in one case serves as a generous entrance experience for the labs, the central core is devoted to service and circulation functions only, and would not be a particular "focus" for the labs other than in these strictly functional respects.



10.42 Frank Gehry: Guggenheim Museum Bilbao, Spain, 1997.

- Johnson's Second Boissonnas house recalls some of the basic order of the Richards Labs (10.41). Three elements enfacing the open sheltered core transition in sequence and proportion from radial increment to radial, the mix comprising a partial array. Further "offspring" increments extend the elongated axis further, seeming to be fragmented remnants of the radial element.
- The Guggenheim Museum Bilbao, notwithstanding its striking compositional attributes at eye level, devolves in centering terms to a full hybrid conflation of radial and radial increment arrays, unmistakably focusing on the core of the entry atrium (10.42).

In some cases a reappraisal of a project in centering as opposed to formative terms can bring about a change in the perception of its organizational nature, correcting a misapprehension pertaining to the formative order. The Viipuri Library is a case in point, for in the chapter on limiting cases its apparent lineup of slipped longitudinal volumes appeared to



10.43 Alvar Aalto: Viipuri Library, Viipuri, Finland (now Vyborg, Russia), 1935.

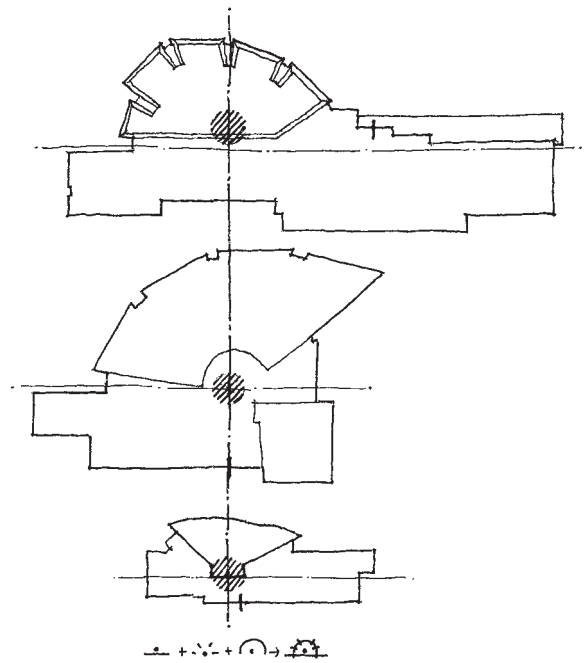
signal a case of aligned shells, partly on the basis of the earlier discussion of deformation via shear. The nature of the building's core remained somewhat unresolved, leading to an object lesson in the present context (10.43). The library's sophisticated interplay of internal organization as it varies from floor to floor challenges a simple reading of centering modes, but an effort to conflate the organization of the interiors arguably reveals an order not of aligned shells but of another case of subtractive accommodation: a full array of en faced elements clearly centering on the core of the circulation desk. The elements comprise three radial increments, and a radial—the extended element housing the well-known auditorium, aligned sideways to the core by virtue of deformative bending—thus contributing to the previous interpretation.

Deformative

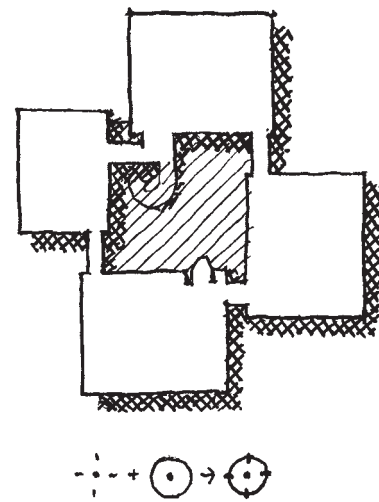
Morphing

Shaw's Leyswood and the Bangladesh National Assembly House were cited earlier in a discussion of morphing as a linking mechanism, wherein two centering modes blend one into the other morphologically across the divide. Aalto's set of three libraries affords another object lesson in the use of this hybrid centering approach (10.44).¹⁵ The bookstack/ reading rooms display the outer "notches" characteristic of radial increments frozen at the point of partial transformation into semicircular shells, exemplifying a state of morphing. The three schemes form a progression of sorts: Rovaniemi is still aggressively articulated at the perimeter and overhead; Mount Angel's notches are more vestigial with circumferential openings predominating on the interior; and Seinäjoki embodies the transformation virtually completed, only its bookstacks remaining radial in form.

15. Actually hybrids twice over, the libraries of Seinäjoki, Rovaniemi and Mount Angel each flank a circulation desk core with a sweeping bookstack/ reading room volume on one side and an elongated service/ entry element—an aligned shell—on the other, the two being mutually embedded.



10.44 Alvar Aalto: Library, Rovaniemi, Finland, 1968; Library, Mount Angel Abbey, Oregon, 1970; Library, Seinäjoki, Finland, 1965.



10.45 I. M. Pei: Everson Museum of Art, Syracuse, NY, 1968.

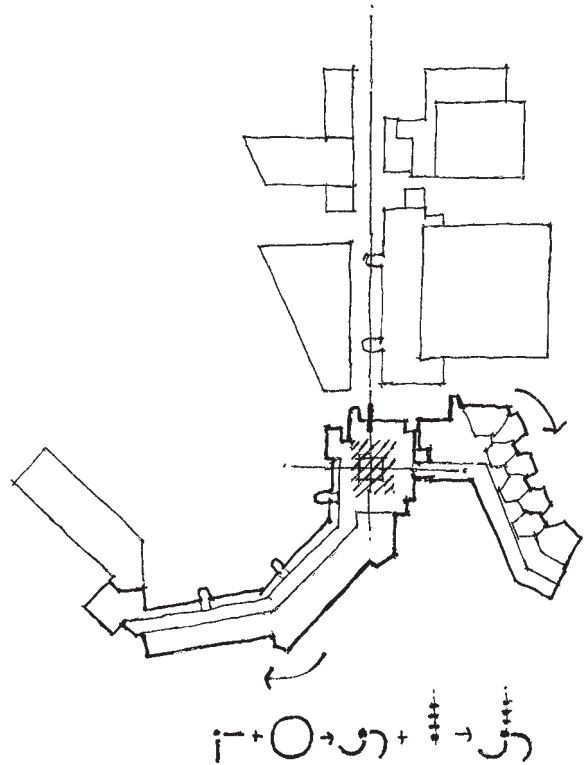
Pei's Everson Museum employs four gallery volumes to define its core, the interior sculpture court (10.45). Expressed as separated volumes on entry level, the upper floors of these surrounding elements are joined by spanning bridges that permit a continuous circular course connecting these apparently discrete increments: the actual form as well as the physical circulation of these schemes shows the beginnings of a morphological shift. Toward the other end of this same kind of shift, the "explosive" case of Kahn's Goldenberg house retains clues of individual identity in the form of its distinctive peripheral notches, but the contiguous roof configuration signals a scheme well on its way to becoming a shell around the central court, the core of the scheme.

Deformative Accommodation

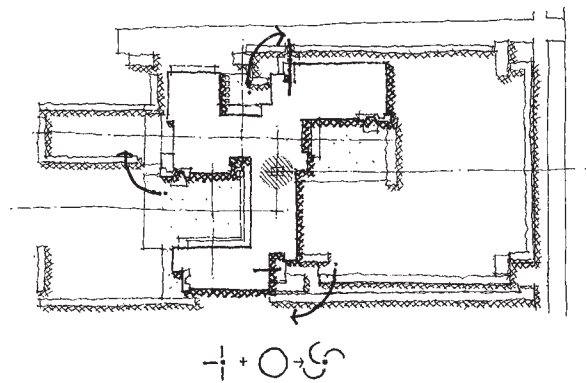
The prequel of addition can lead to a result that is dominated by deformation, but in a manner structurally different from morphing. Certain combined modes of forming can lead to an "intermediate" morphology that partakes of both but results in something new:

- At Andrews' Scarborough College, two open-ended linear wings housing all the college facilities radiate informally from a central commons, bending in consonant segments approximating the curves of a spiral in response to site topography (10.46). The bends are sufficient to suggest the beginnings of a departure from a rudimentary partial radial array, in response to the imposition of a single shell as a limiting case. As the two extremes represent the opposite poles of centering, such a spiraling pattern comprises another means of hybrid mediation between them, the two extremes *accommodating* each other in the sequence of transformation.¹⁶ Scarborough's

16. This image of deformative accommodation is not meant to be taken too literally, as if multi-armed spirals are found midway on a process of coalescing into a ring via a "spin cycle," leaving the detached core behind.



10.46 John Andrews; Page & Steele: Scarborough College, Toronto, 1969 (showing later expansion).

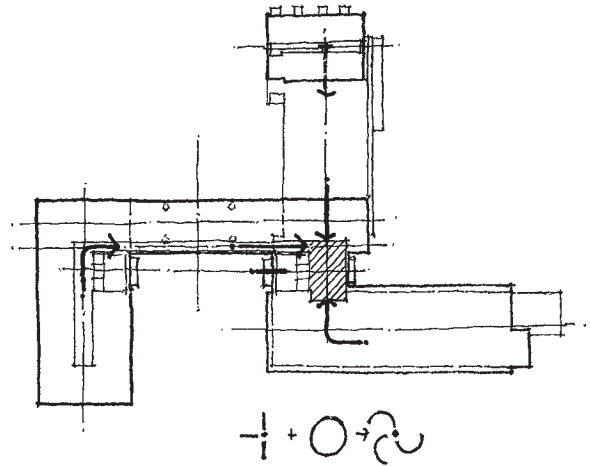


10.47 Rudolph Schindler: Schindler house, Los Angeles, CA, 1922.

further additions over the years have come to define a dominant axial order not subject to the bends of the original wings. The differences are so pronounced that this later construction does not read so much as a third radial as an array of shell increments, sharing its core that with the earlier partial radial ensemble.

- Los Angeles’ Schindler house employs an analogous approach but with three radials, and now bent at 90 degrees as they diverge from a central fireplace core (10.47). A virtually complete integration with the site, its sequence of outdoor “rooms” extending the corresponding interiors, demonstrates the value of the parti when contextually developed to the degree seen in the architect’s masterwork. The three elbows arise directly from the house’s unusual program of one each for two studios for two families, plus one for the kitchen and guest wing. The structure of bent radials plays a large part in the rich spatial nature of the house and site, demonstrating that spiral-based variations on the asterisk can inform a wide range of pertinent applications from the necessarily obvious to the sublimely indirect.
- The Dessau Bauhaus also features three wings terminating in 90° rotations—one a *vertical* rotation—all abetted with subtractive and additive subtexts (10.48). The bent wings terminate at the entrance hall and main stair, arguably an unsatisfactory “core” for a project in general since it is the point of entry and circulation rather than more of a focus for the life of the place. But it’s fair to say that this is frequently the case in architecture, a hub of circulation often naturally migrating to the geographic core of a scheme.¹⁷

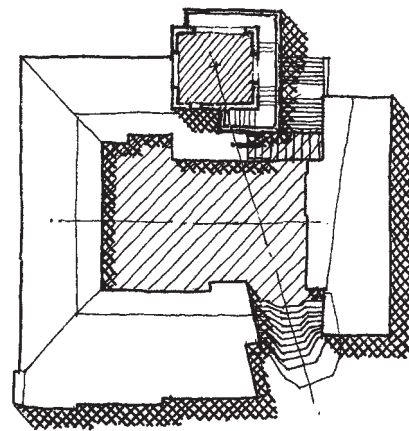
17. The point of entrance has been allowed to steal the limelight in the design of any number of castles, villas and McMansions, the grand hall leading to the anticlimax of less impressive interiors. Wright famously understood the merits of an understated entry leading to the surprise of the expansive space beyond, the sequence crafted for the benefit of the indwellers rather than for impressing visitors or passers-by.



10.48 Walter Gropius: Bauhaus Building, Dessau, Germany, 1926.



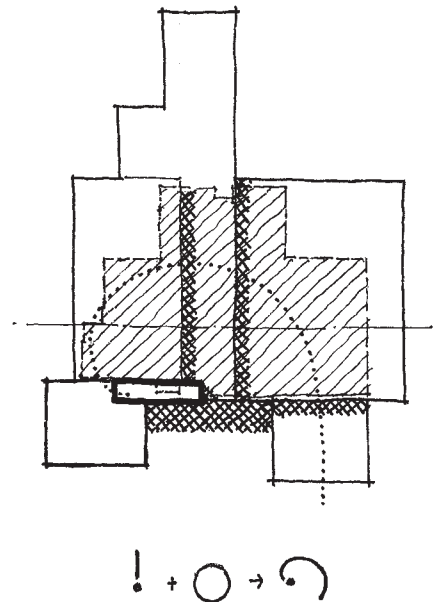
10.49 Diagrammatic derivation of single spiral via deformative accommodation.



10.50 Alvar Aalto: SÄynätsalo Town Hall, Finland, 1951.

- Such multi-armed spiral cases of deformative accommodation suggest the question of what the outcome would be with the simplest initiating case of a single arm: a single radial with core. This arguably affords an origin state for the single spiral, as manifest in the deformative “torque” cases of Part One (10.49). A mutual accommodation of single radial and partial shell begins a sequence that, with the crucial assumption of repetitive iteration, results in the ideogram of a single spiral. This could be an Archimedean spiral as in Wright’s Gordon Strong project, or the logarithmic spiral of Goff’s Bavinger house, among other spiral geometries. The Wright project, as well as most of the torque cases cited, is actually an example of a conic helix, representing the world of three-dimensional spirals.
- Other single-arm radial cases may be found when a partial shell with void center is combined with a core-centered counterpart, resulting in a *duality* of focus. This demonstrates deformative accommodation by virtue of the inability of the two differing modes to claim the same center: one or the other or both must make way. Centered on its elevated courtyard, the originating partial shell of the Säynätsalo Town Hall is joined by an equally important component, the elevated council chamber volume that reaches up to dominate the composition as its unmistakable core (10.50). With the shell-surround simultaneously perceived as a radial terminated by this core and as a partial shell surrounding the void center of the courtyard, the hybrid outcome is a particularized version of a single spiral.¹⁸

18. The town hall features two significant gaps breaching the shell-surround, and their differing characters encourage different formative interpretations: The conventionally orthogonal entry steps read as an “intentional” gap in the composition, while the irregular grass steps evoke a case of tensile fission, as if the flanking cross-sections were “originally” joined as one element—a partial single shell.



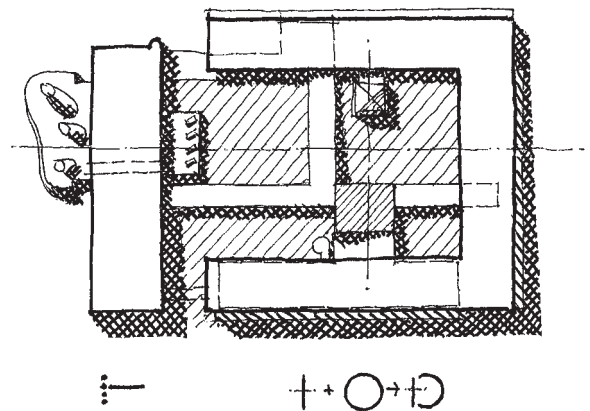
10.51 Frank Lloyd Wright: Fallingwater, Ohio, PA, 1935.

- Wright’s Fallingwater was discussed in formative terms as a synthesis of multiple partis. Seen now in centering terms, there are certain similarities to the Säynätsalo project: the expansive living room—here outer-directed rather than inner-directed as is the town hall courtyard, is nonetheless also an unfocussed centerpiece—a “void center” (10.51). Of course the fireplace and chimney mass engage to provide a peripheral core of focus, while also anchoring a sort of radial backbone along the house’s uphill flank. The centering hybrid of these elements again results in a single spiral, descending as another conic helix via the composition’s rotationally stacked planes.¹⁹

* * *

The La Tourette Priory also recalls the Säynätsalo project in superficial plan terms, being a U-building likewise facing a separated closure element across an open center, but no correspondingly focused core element dominates its composition (10.52). As noted in the discussion on La Tourette as a formative hybrid, a sideshow of diverting smaller characters and linking elevated corridors mills about the “courtyard,” but none is clearly first among equals. The main chapel across the end is clearly the priory’s focus of attention, form and function, but its blank demeanor and broad extent prevent a reading as core of the composition. As opposed to the town hall with its side-by-side pair, here the void center and massive chapel, the sacristy centered at its base, make up a quasi-axial sequence—a perhaps ironic result in a project where some effort has been made to expunge the devil of symmetry. But clearly the blank sidewall of the main chapel does not focus axial attention, and the largely buried sacristy, despite its bold array of trapezoidal “light cannons,” does not command the center of

19. Single- and multi-armed spirals comprise a ubiquitous geometric device in art, design and nature, the grandest example being the spiral-armed galaxies. The combination of compelling movement and compelling symmetry renders both devices a temptation for over-obvious applications, but the cases here utilize this geometry in subtle and surprising ways.



10.52 Le Corbusier: *Couvent Sainte Marie de La Tourette*, Éveux, France, 1960.

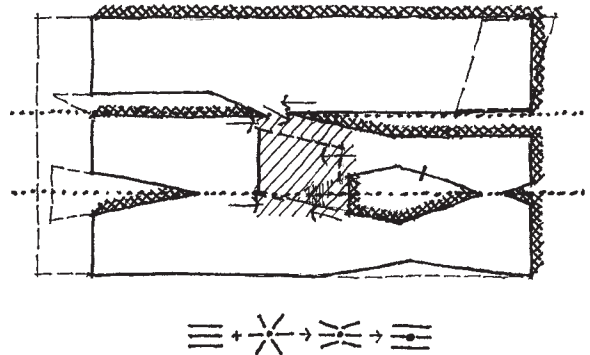
attention either. In fact the contemplative program of the priory would appear to have led to a de-emphasis of such worldly notions as a clear axis of focus.

As Holl notes, the contrasting elements appended to the chapel, linked by a subterranean corridor beneath it, may be a little-known defining gesture at La Tourette, being a passage from the hard-edged geometry of the sacristy to the undulating space and freely expressed oval light cannons of the side chapel.²⁰ As such this sequence constitutes a single radial, its initiating experience leading to the “multiple core” of the chapel—a second centering hybrid hidden within the context of the large-scale elements of the design. Formatively a binuclear ensemble as was Unity Temple, here a radial links the sacristy’s orthogonal preparatory experience to the colorful cave-like mysteries of the side chapel and its stepped row of altars: a series of centers instead of a single focus, in keeping with the priory’s objective of individual contemplation.

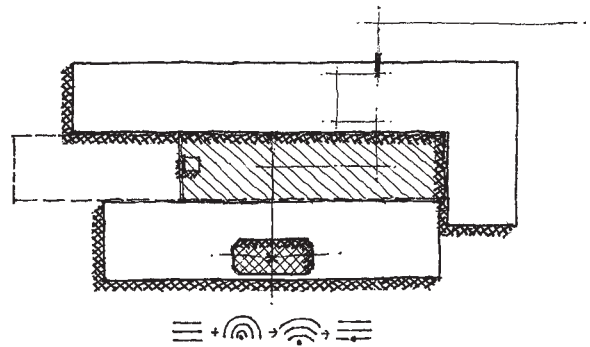
* * *

Centering modes that are more distantly related can also be combined through deformative accommodation, to incorporate fundamental aspects of both for the benefit of a project. Revisiting the de Young Museum, the interior presents a clear spatial core in the form of Wisley Court, the centroid and crossroads space of the museum, with connective passages and stairs extending in all directions (10.53). But the building’s array of replicated bars embodies the centering mode of parallel radials, which conventionally defer in the direction of their long axis, either toward a terminating core element or otherwise to the understood “distant core.” However, the evolving sequence of centering modes is primarily but an armature to understand the basic approaches to centering and the relationships among them: no rulebook demands the core of an “aligned”

20. Steven Holl, *Parallax* (New York, Princeton Architectural Press, 2000), p. 33.



10.53 Herzon & de Meuron: de Young Museum, San Francisco, 2005.



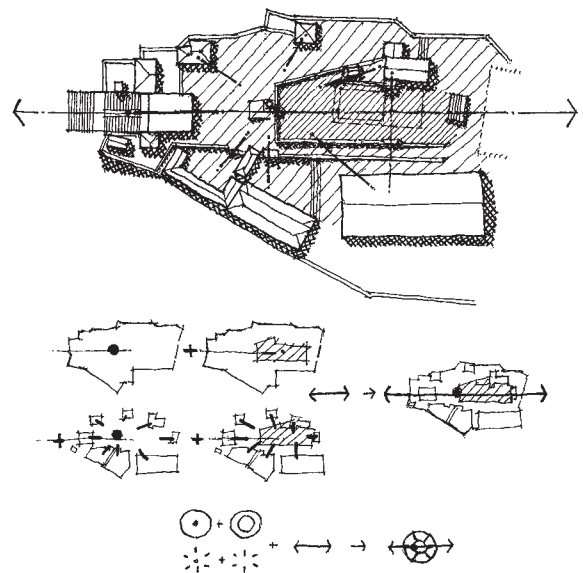
10.54 Tod Williams & Billie Tsien: The Barnes Foundation, Philadelphia, 2012.

parti must be located foreground of its fabric. In the case of Wisley court, the angled walls that deflect the connective network and articulate the diagram of parallel radials are in fact radial lines of passage, converging at that central space. While far from a literal radial pattern as represented in the “asterisk” cases, the reality of the experience evokes this mode. Ultimately, a full radial array centered on this core has acted in deformative accommodation with the simultaneously present mode of parallel radials, to achieve this version of hybrid centering with the core situated centrally. The willful oddity of the torqued tower does not participate directly in this scheme of things, but adds some spice to the recipe.

In revisiting another museum, the Barnes Foundation, it is also revealed to be more than en faced parallel radials pointing in the open-ended direction, for the scrupulously reconstructed ensemble of the original galleries have a clear focus in the dominating two-story gallery at its center (10.54). The new “light court”—the inner of the three bars—is an impressive feature of the greatly expanded museum, but it fundamentally serves as a generous corridor and event venue that gives access to support facilities, exhibition galleries, the garden, and most importantly the legacy galleries themselves, in fact ultimately to this room, the core of the entire composition. Experientially if not morphologically, the passage from the building entry to this focal space is one of penetrating through a series of concentric shells, via a series of twists and turns that contrasts with the linearity of the parti, to reach their core. The design partakes of parallel radials pointing to the “distant core” of the outdoors, and of partial concentric shells which *do* focus on a core. Each centering mode, one of radials, the other of shells, accommodates the other such that the goals of both are achieved.

* * *

For a final case of deformative accommodation, the Athenian Acropolis demonstrates that, as with variants



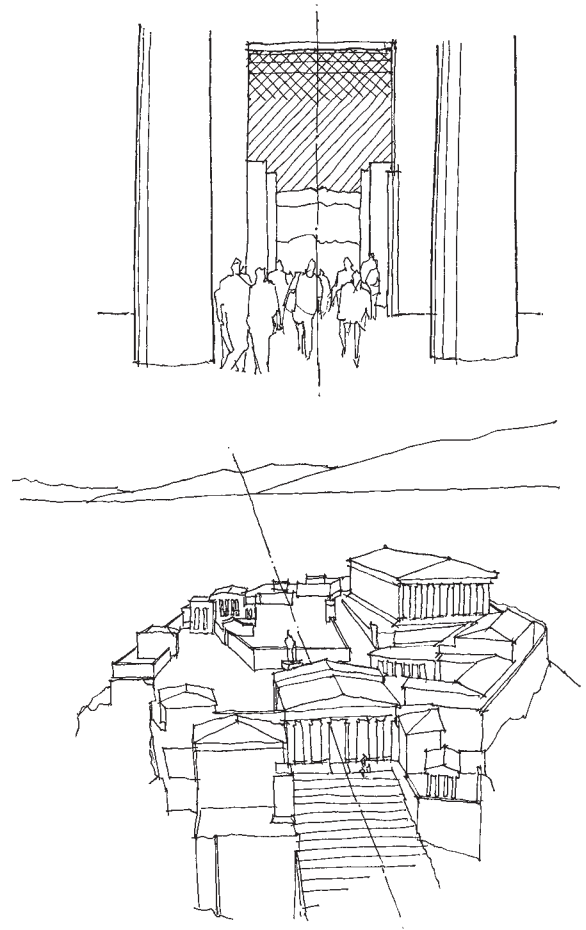
10.55 Acropolis, Athens, Greece (as during the 400’s BC).

on shell centering, an array of radial increments can also serve two masters (10.55). The statue of Athena Promachos was once a strong focus for the buildings that constitute the radial increment grouping. But an imposing plinth of central space, itself once the site of an older temple to Athena, directly adjoins the statue. The Parthenon, Erechtheion, Propylaea and other surrounding structures or compounds defer both to this “void center” and to the core element of the statue.²¹ This plinth is also surrounded by a variegated but continuous platform of peripheral space, variously defined by the perimeter wall of the Acropolis and the more elongated of the flanking structures. Legible as a single shell by virtue of these bounding conditions, this circumferential periphery *also* defers both to the core of the statue and to the raised central plinth. In yet another hybrid gesture, the ensemble as a whole is clearly ordered by the Propylaea axis.²² Looking to the west, it serves to dramatically frame the Aegean and the hills of Salamis Island, a vista that features paired peaks flanking the axis. In the opposite direction, the axis skirts the Athena statue, marks the plinth’s centerline, and continues east–northeast, through the site of the altar of Athena and into the distance beyond, pointing to another understated pair of peaks—the “horns of Hymettos”—part of a ridge of hills rising toward the south (10.56).²³ Whether the

21. The Erechtheion and the Parthenon were built after the destruction of the old temple. While clearly the most prominent of the monuments on the Acropolis, the Parthenon nonetheless joins the others in a peripheral centering role. Each of the buildings embodies its own internal approach to centering, adding the factor of meta-scale to the hybrid qualities of the Acropolis. The Parthenon’s two inner chambers, for example, could be viewed as an asymmetrical case of replication, surrounded in turn by the single shell of the peripheral colonnade: a hybrid building embedded in a hybrid ensemble. Such an order of nested hybrids is not at all uncommon.

22. Issues of experiential sequence at the Acropolis have been discussed by Choisy, Eisenstein and others, grounded first in the Propylaea axis and leading to carefully ordered perspectives. The comments here concerning a dual central focus are in no way meant to set such issues of the Acropolis as experienced in “four dimensions” into a secondary role of importance. Such an awareness of the importance of the elements of architecture and urbanism as perceived sequentially in movement is crucial to the understanding of most of the case studies herein.

23. Discussed in Vincent Scully, *The Earth, The Temple and the Gods* (New Haven: Yale University Press, revised edition 1979), p. 181.



10.56 Acropolis: Eye-level view to West at Propylaea; Aerial view to East to Horns of Hymmetos (Redrawn in part by permission from rendering by Calvin Durham, at <http://fineartamerica.com/featured/acropolis-of-athens-restored-calvin-durham.html>).

ensemble that evolved over centuries on the Acropolis deliberately took these subtle distant markers into account is a matter for historians' debate, but regardless, the possibility of an axial tie to elements in the distance is a compelling exemplar of how a design focus can and should be influenced by distant but pertinent contextual aspects.

* * *

Several of the above cases of centering hybrids—the Acropolis, Scarboro College, the Aalto libraries—were found to be something more: they comprise additive constructs of two differing entities: one a centering mode and the other a centering hybrid. A dedicated search would surely find more such mixed-breed cases. And a corresponding more basic case of multiple centering modes, no hybrids involved, is also feasible, as exemplified by the mixed ensemble of the Getty. All this leads in turn to the realization that nothing theoretically prevents two (or more) cases of hybrid centering to be thus mutually related, becoming *multiple* centering hybrids.

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Chapter Eleven

CONCLUSIONS

There is probably no convincingly “unified theory” that ties this all together in some fully integrated way, nor should there be. That said, one mission has been derive a rudimentary theory of sorts, by virtue of having a look at some typologies that have long existed to varying degrees, and expanding upon them to arrive at a more comprehensive view of forming and centering as basic building blocks of architecture. Most of the designs discussed here probably entailed some degree of consideration of these issues, but most likely on a fragmentary if not subconscious basis in many cases. The hope is that this study has afforded some useful elemental clarity in the midst of the bewildering complexity that architecture and its design process so often entails: not to devise some sort of kit of parts, which would be the last thing one would wish for the rich mix that such design can and should be, but to add a measure of insight and overview to both clarify and enrich the process.

As a wrapping-up effort it seems useful to seek some patterns that relate the modes of forming to each other, that relate the modes of centering to each other, and to then look in turn for some connections between these two sides of a coin.

Forming Modes Related

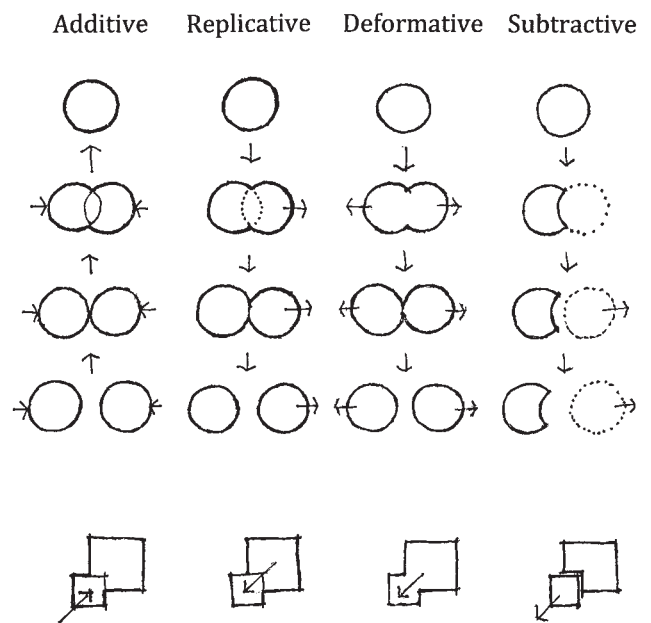
Venn diagrams, if one stretches some points as to the ways they were intended to graphically communicate, help to demonstrate the familial connections and individual differences among the four modes of forming discussed in Part I (11.1):

- A sequence representing some options for addition begins with adjoining elements, leading to touching, embedding, and complete coincidence (appearing as a single element when both are isometric).
- Another interpretation of the same sequence demonstrates replication, wherein an initiating singular element leads to overlapped duplicates—as in mitosis—and ultimately to separation of the replicates.¹ Deformation is represented by a similar version of the same sequence, but in terms of “fission:” whether by tension, shear, bending, or other of the deformative analogies, the originating element is distorted and/or divided.
- Subtraction requires a different take on the sequence, the initial element leading to the arrival of a “ghost” element that overlaps the original, removing or negating the sector common to both and leaving the original with that portion subtracted.

The differences within the figures aside, the four Venn sequences superpose exactly, a demonstration of the close morphological ties among these formative modes.

An analogous but more architectonic sequence based on the square may afford a clearer representation of the similarities and differences of the modes:

1. These first two have the same diagrammatic appearance, aside from being represented in opposite directions of transition. But it is that very distinction that merits regarding replication as a discrete mode of forming: addition brings multiple elements together, while replication grows a sequence of multiples from a single initiating element.



11.1 Two diagrammatic representations of the four formative modes.

- Addition is represented by a subsidiary square imposing itself collidively on that figure from the periphery.
- Replication, again something of an inverse operation, is represented by a case of singular regression: a reduced-scale replicate *emerges* from the initiating square.
- Deformation imposes force alone on an initiating figure; nothing is physically added or removed. Tensile or “explosive” forces are represented as a “herniation” emerging from the initiating figure. (Other forces of deformation aren’t as directly amenable to this diagram.)
- Subtraction involves the removal of a sector of the initiating figure. The sectioned portion remains in the diagram, a “break line” clearly demonstrating that excision, not deformation, is the case.

While still a selective and abstract representation of the four modes, these figures will again occupy the same footprint if superposed. Ultimately the point of these exercises is to bring home the close relationship among them: while not a “continuum,” they are not isolated constructs but instead constitute a close-knit family of formative approaches.

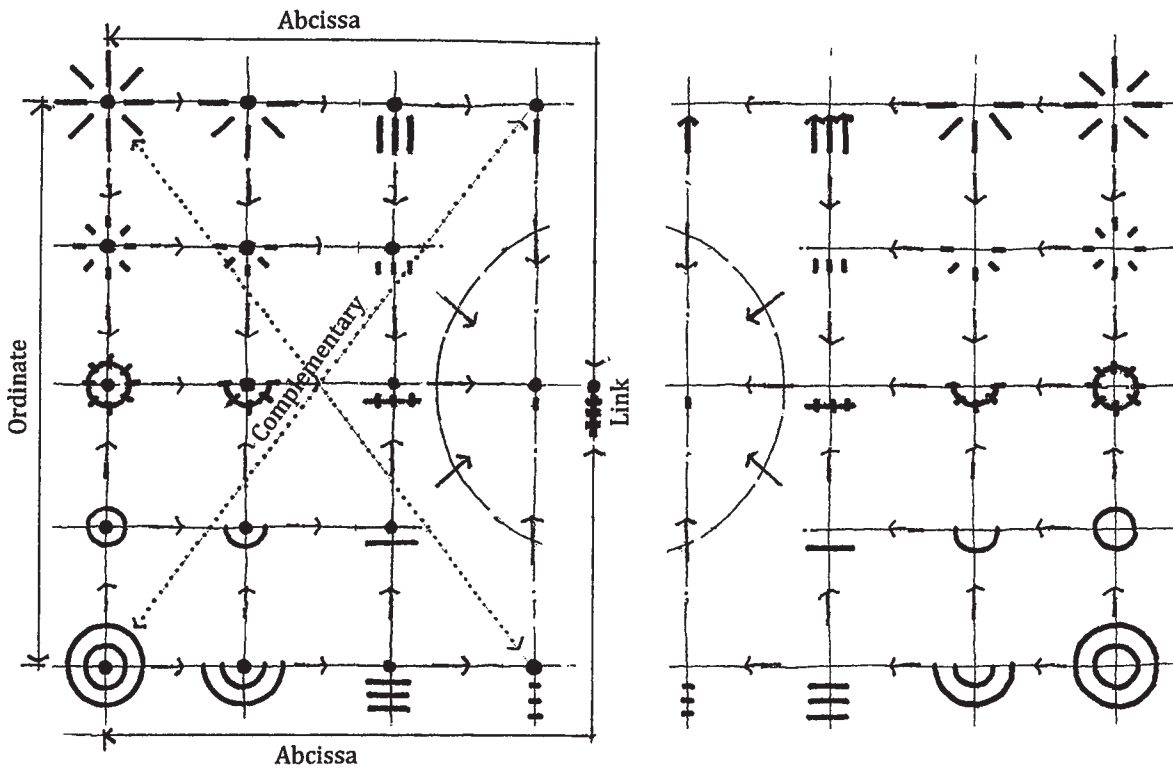
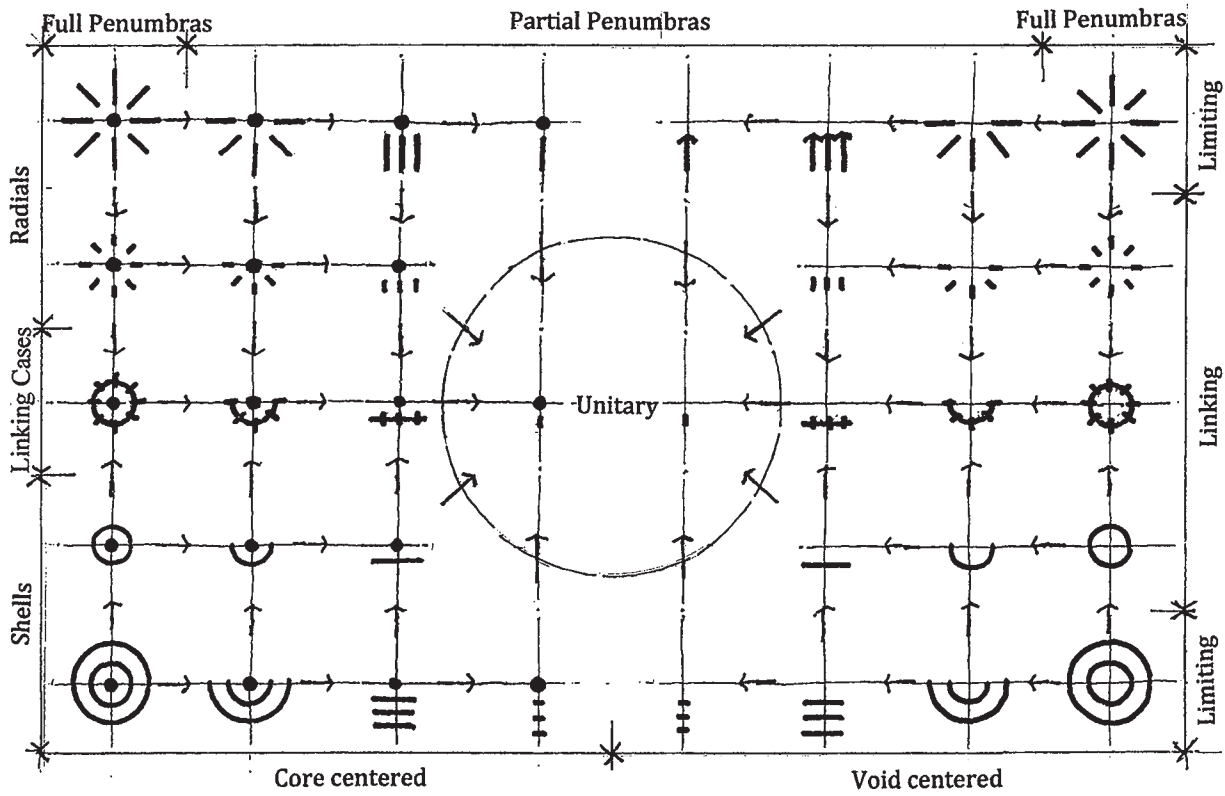
An overriding benefit of having gone through the systematic process in Part I of examining the formative modes and their variants is a greater clarity and breadth of thinking as to forming options. While it’s true that “too much” perceived clarity can lead to an uninteresting predictability, and while it’s possible that subjective intuition in their application might result in a desirable synergy, a more likely result would be ineffective conflict and disarray. They are not a kit of parts, but diagrams of approaches.

Centering Modes Related

In Part II, the discussions of centering modes addressed two basic and otherwise identical sets of cases: those with a clear core element of focus for the immediate ensemble, and those without. Each of those discussions was structured in turn as limiting or linking cases, the former represent a set of “full extents” and the latter a range of more truncated and contained versions. Each of these sets was further divided into radials and shells: the former configurations focusing into the center, and the latter encapsulating it to one or another degree. Examples culled from the wide range of available centering *hybrids* then demonstrated that linking connectivity between these diagrammatically opposed centering modes is not only achievable, but central to a fully considered investigation of centering as an important design issue. By overlapping and assembling these five sets of variables, an integrated matrix results that permits the relationships among all these aspects to be visualized. (11.2)²

A rich variety of transition sequences thread their way through this figure. The ordinate path between the “asterisk” and the “bullseye” involves the variable of *radius* extent—linked midway by the hybrid case—while the “abscissa” paths from those limits involve *circumferential* extent. A corresponding attempt to bind these two abscissa sequences into a continuous path requires jumping out of the matrix format to allow a linking hybrid to bind them together, and this is achieved by a hybrid of the singular radial and the incremental shell array. Recalling the trunk of Isozaki’s Okanoyama museum, the figure is both linear and incremental. When *both* radial and circumferential extents vary in the course of a sequence, a variety of angular paths through the matrix results. One of these angled links recalls Purves’ observation: “Pairs of complements, feminine and masculine, static and dynamic, the circle and the line, describe the

2. It should be clear that this matrix doesn’t illustrate the many possible hybrids that may result between *non-adjacent* modes.



11.2 Integrated matrix of centering modes, and transition sequences through the integrated matrix.

- Expressive of “refuge” but circumstantial to solid cores (Jacobs house).
- Uneventful “void centers” (House X).
- A “form core” requiring an understanding that it is not the focus of the project—as in the service cores of tall buildings—and that a supplementary centering element is needed if there is to be a satisfactory sense of place (World Financial Center).

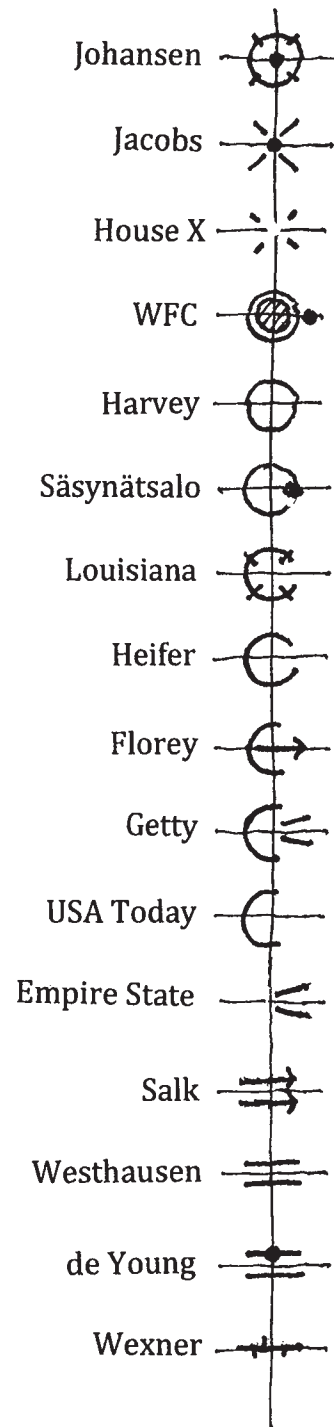
“Void” center cases may be:

- A “courtyard” type, which may be unengaging (Harvey Court), unless a focus exists either within it or at its periphery (Säynätsalo)
- A “semi-focused” type, wherein attention is focused on a partially defined area, which may be desirably meditative (Louisiana), but which may risk a diffuse, unengaged quality (Heifer).
- A semi-focused version that directs attention to a region beyond, desirable if that region is intriguing (Florey), or a “prospect” (Getty), but again, diffuse and unengaging if it is not (USA Today).

“Indefinitely distant” center cases may be:

- Aspirational, as embodied in high rises (Empire State), or focused distant vistas (Salk).
- Unengaging (Westhausen) unless hybridization implants a core within its fabric (de Young).
- Lacking in satisfactory focus, even if eventually sequenced (Wexner).

A slightly different take, specific to this study’s unscientifically selected sample of core-related



11.4 Ideograms of centering cases cited.

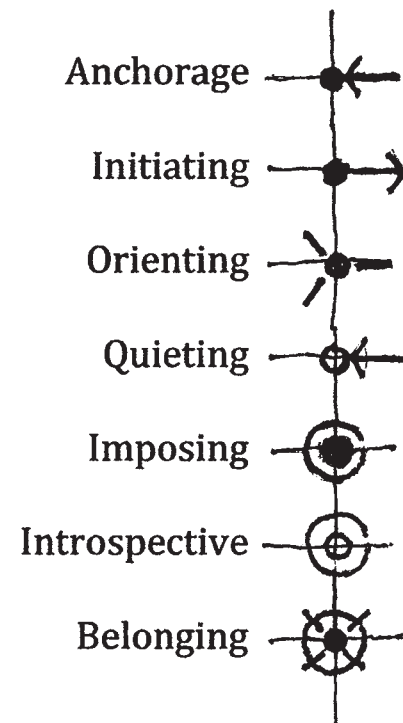
projects, reveals several provisional clusters based on their “*roles*” (11.5):

- “Anchorage:” Long Wharf; Wright houses; Gaffney; Vanna Venturi; Fire Station 4.
- “Initiating:” Isozaki; Sakler.
- “Orienting:” P&G; Tang; Bauhaus; Aalto libraries; History Faculty.
- “Quieting:” Fontenay; Hotel P; Haystack.
- “Imposing:” MIT; Thompson Center; National Gallery East; Capra; Capitol; High Museum; Hercules; Ford Foundation; Tokyo Forum.
- “Introspective:” Stuttgart; Unity; Exeter; Chartres; San Vitale.
- “Belonging:” Asplund Library, British Museum; Franzen; Wayzata; Johnson house; Condo One; Johansen house; Hines; Ledge house; St. Andrews; Bangladesh; Crowell; Lister, Baker; Meier houses.

In short, and not surprisingly, such cores vary from non-spatial anchorages, to places of entry or orientation, to places of heightened experience (some of which may, ironically, diminish the individual’s sense of identity), and ultimately to places that afford a heightened experience for life activities: a sense of belonging.

* * *

“Seeking a center” is a subconscious motive at best when it comes to the large body of built form. There are many projects without any apparent center, or at least which require a special effort to discern one. And there are simply ineffectual cases of centering. But very anomalous projects can nonetheless be effective, by virtue of such factors as affording a good response to a difficult site, being a convincing part of



11.5 Ideograms of core-related roles.

a larger whole, or engaging the benefits of significant outlooks. Beyond such cases, “effectiveness” could be provisionally defined as evidence of considered attention to a center in some form or fashion.

As postulated by Alexander, there is or should be a hierarchy of “wholes:” nothing exists in a vacuum. A building’s nature ideally reveals itself as a whole, meaning that it is organized in a manner that evokes a sense of “completeness.” In cases where the building is clearly a part of a larger whole, as in so many urban contexts, the building depends on the larger whole to help define its nature, and the larger whole may correspondingly depend on the impact of the building for it to be best evoked or manifest. If the project does not do its part, both it and its larger context will lack completeness.⁵ Alexander’s “wholes” and the issues of core or center that have been the concern of Part II are not exactly equivalent, but they share the goal of embodying a project with a sense of enduring life, focus and connectedness. If what we are calling a center is diffuse or absent from a project, those qualities will be absent: it will be essentially dead, a sad fate for both the design and those persons with whom it interacts.

Forming & Centering Modes Related

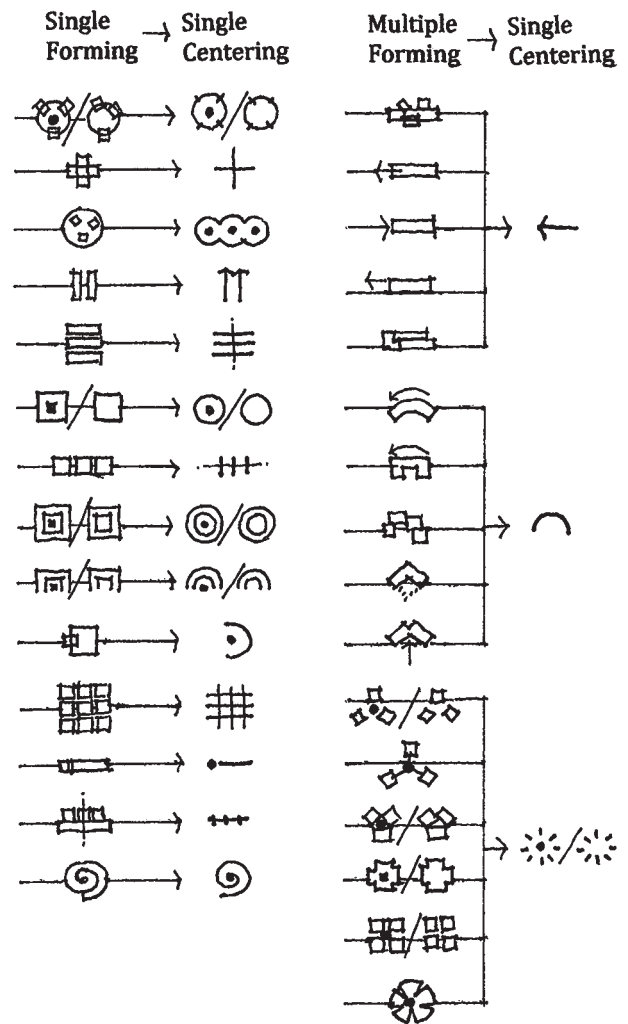
As discussed in the last chapter, the two are indeed structurally related, by virtue of each forming mode serving as an initiating platform that permits centering modes to follow. But there is more to be said about their interactions. A chicken-or-the-egg issue prevails when it comes to these two families

5. Paraphrased in part from Christopher Alexander, Hajo Neis, Artemis Anninou & Ingrid King, *A New Theory of Urban Design* (New York, Oxford University Press, 1987). Reference to a hierarchy of wholes recalls the recurrence among some centering cases of “meta-centers,” when a particular centering mode finds itself part and parcel of another centering mode at a macro scale—a nesting of modes which could in theory expand to further über-levels, though in reality a reasonable limit is soon reached. Projects wherein this was noted as an integral part of their centering natures include Sea Ranch, Leverkusen, the Getty, the U.S. Capitol, and the Athenian Acropolis. Surely these are but a small sample of projects featuring this mode of concentric order, structurally reminiscent of the “fractal regress” in an inverse sort of way.

of modes, yet it doesn't take much cogitation to conclude that "forming comes first." Picking and choosing among the centering modes as an initial exercise in a design problem is guesswork at best, the exception being a project driven from the outset by an overriding preconception. A body of information normally must exist as a precursor to getting involved with these modes. In the most rudimentary way this would consist of the project's program and its internal relationships, often in the form of a "bubble diagram." This is the point at which such an initial diagram—aptly reminiscent of the formative mode of linear links—can begin to be adjusted to test initial centering options. So forming is a first step, but centering is hidden within that first step as its ultimate organizational basis. If a centering mode is simply not in evidence, this marks a weakness in the scheme.

As noted in the introduction, the panoply of factors that make up the constraints and opportunities involved in developing architecture and urbanism have been "set aside" for the sake of clarity in order to make the points that have constituted this discussion. But their actual consideration from the outset of a design process is crucial. One distinction throughout this narrative is that formative and centering modes should be issues of conscious concern on a par with those of the program, the site, the client, the budget, and the rest—forming as a conscious choice for development among modes or their combinations; centering as enabled by the forming process to enhance focus in a work of architecture.

The modes, examples, and hybrid potentials of forming, in all their permutations of dimensionality, had to be examined separately from those of centering, because the sequence and typology of their subcategories differ so completely. It would have been too complicated to jump back and forth to cover both in one analysis of a given project: the structured discussions of forming or of centering, one or the other, would have been atomized in the process. In fact, the same held true within the subject



11.6 Ties of affinity between some forming and centering modes.

of forming, regarding the need to disentangle issues of dimensionality from the initial study of formative modes. All those forming issues returned to the same pot for the subsequent analysis of centering modes.⁶

Having been through that process, it's revealing to consider the "structural affinities" between the two sets of modes. For example, the linear regression of Kahn's Phillips Exeter Library bears a diagrammatic resemblance to its centering mode as a full shell array. An informal such review reveals two orders of relationship (11.6):

- Some formative and centering modes have morphological affinities on a one-to-one basis.
- But some centering modes have affinities with *multiple formative modes*.⁷ The kinships shown vary widely, another justification for the separated analysis of these types.

That said, a return to the matrix of centering modes (11.2) reveals many such affinities more directly if

6. A final defense seems appropriate for the assertion that there are but four formative modes and not some other number. One could argue, for example, that replication is but a special case of addition, but the point has been made regarding its fundamentally different nature. Certainly forming could be sliced and diced in other ways, and developments in the unknown future may well call for this, but the basic categories (and their many subsets) seem to have held up well throughout the scrutiny of many case studies. Correspondingly, as for the analysis of form as manifested in "dimensionalities," this may initially sound simplistic, as regards the boiling down of the huge body of what we know as architecture into elements that fall—intervening ambiguous cases aside—into one or another of three categories. But this highly reductive analysis of projects by dimensionality has proven to be a useful "first order" effort, working in tandem with the formative modes to clarify the basic partis of works of architecture.

7. The formative affinities shown here for "full radial increment" arrays would also apply to full radial, partial radial, and partial radial increment arrays. Note that a significant number of the formative modes among the one-to-one affinities are variants of replication, which is no surprise given the sequential repetition that characterizes the ideograms of these and of their corresponding centering cases. But this is not to say that there is any closer equivalence between them beyond this morphological resemblance. The realities of designed form signified by these ideograms may vary greatly, both as regards to forming and to centering, just as with the other affinities shown.

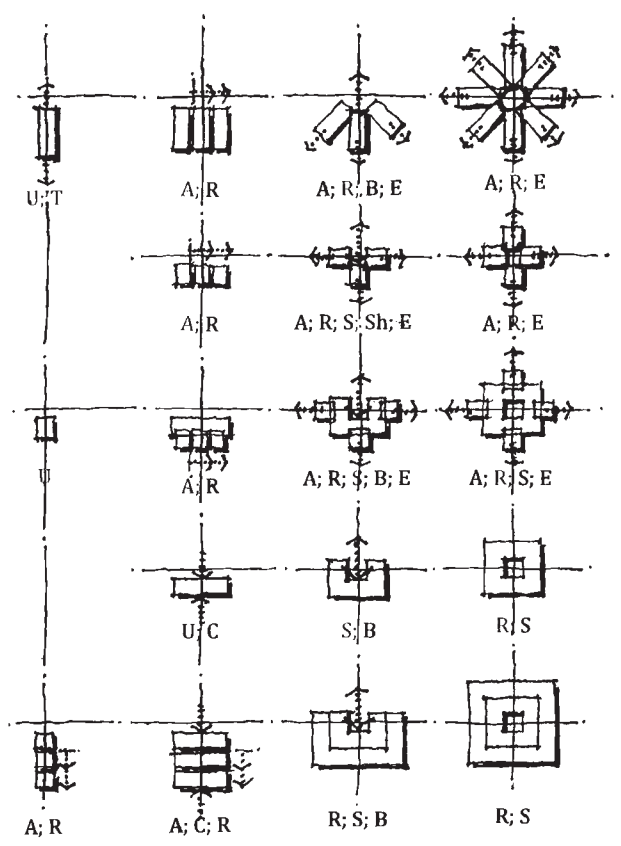
those abstract ideograms are altered to become more architectonic—given rudimentary form and extent as space-defining shapes (11.7). Many of these centering modes may indeed find themselves expressive of one, two or more *formative* modes. Such correspondences have cropped up here and there throughout the course of this book.

* * *

It may have been more pertinent to title this final section something like “postscript” rather than “conclusions.” In the end, the bulk of conclusions to be derived are inherent in the whole body of the discussion, wherein case studies have worked together to reveal the systematic outlines of forming and centering modes and the way they are embodied—whether well or less well—in works of architecture and urbanism throughout history. The role of these concluding comments has been one of putting the pieces together in a way that makes a little more sense out of it all.

One reason to have studied the implications of these modes—their variety of sequences, potential hybrids, and the case studies they exemplify—bears on two goals: to enable the characterization of architectural intentions at a highly simplified level, and to demonstrate that there is a virtually unlimited range of variants involving the modes of forming and centering. The “characterization” may be in the form of after-the-fact analysis of designed or built projects for the purpose of discerning useful lessons for the future, or it may also serve—at any of a variety of steps—to inform a design process underway.

Another reason, which is the motivation to have developed this study, lies in the dual satisfactions of rediscovery and elucidation: to have brought together a large and diverse body of work—some admired, some flawed—and to have devised a structure of comparative study that puts them on an equal footing, facilitates insights, and brings clues to the forefront as to the most basic underlying nature of their form and focus.



11.7 Integrated matrix of centering modes (void-centered portion only shown) with ideograms revised to be more architectonically expressive. Key to legends below each figure of formative modes they may represent:

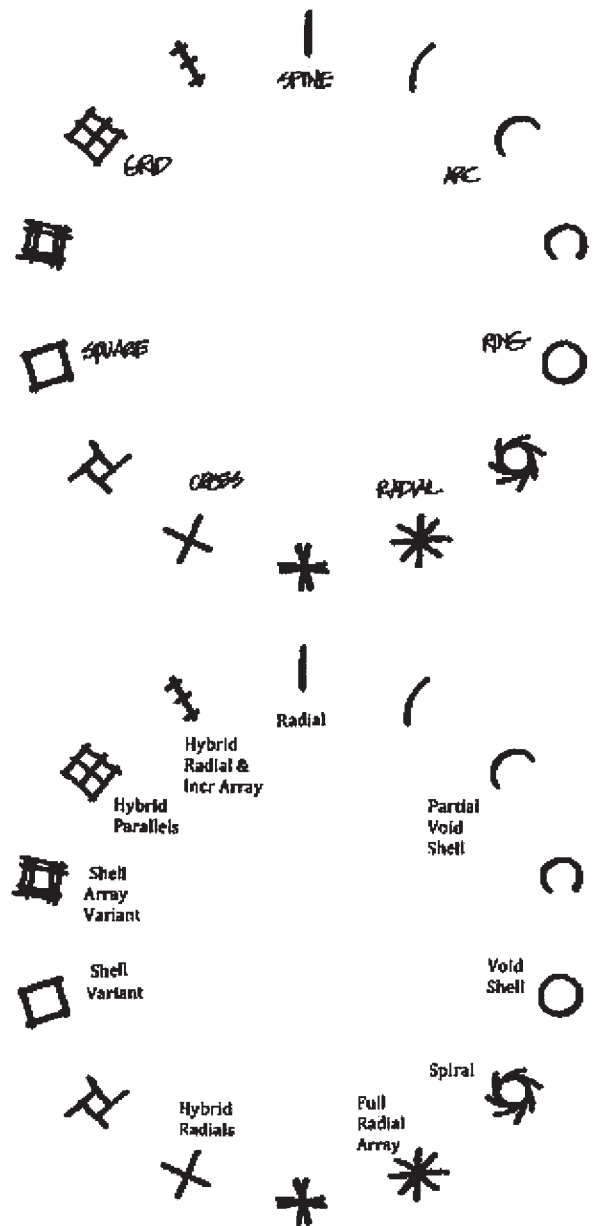
- U: Unitary
- A: Additive
- R: Replicative
- S: Subtractive
- T: Tensile
- C: Compressive
- Sh: Shear
- B: Bending
- E: Explosive

Appendix 1

A Centering Mode Transformation Ring

This figure was developed independently of this book. It represented an attempt to relate the basic orders that appeared in a career niche market of exposition park and fairground planning and design. Each named figure in the upper ring was discernable as the basic order of numerous plans, which were designed before any such attempt had been made to find some sort of overarching sequence of types. The projects that embody the figures responded to the usual suspects: existing conditions, site, cultural and environmental context, program, client, budget, et al. This circle of ideograms, with its intermediate “morphing” figures, illustrates a closed continuum of types.

The second copy of the figure replaces those titles with the names of corresponding centering types that have been discussed in this narrative. Several features are of interest, particularly the directness with which an involution of the void shell, via converging spirals, transitions to the “opposite” pole of the full radial array.



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Appendix 2

On Rudolf Schwarz's *The Church Incarnate: The Sacred Function of Christian Architecture*

This book was published in 1923 by Schwarz, a German architect of churches— notably St. Michael, Frankfurt—and of postwar reconstruction efforts.¹ I was first introduced to it many years ago by one of my architecture school mentors. His interest was not so much in Schwarz's extensive and elaborately poetic Christian theory as in his conceptions of space and spatial sequence, visualized in evocative diagrammatic line illustrations.

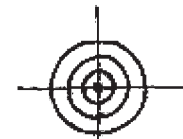
Having rediscovered this book after producing the foregoing effort, I was struck by the similarities of many of its “centering modes” to his own theoretical constructs of seven “plans:” spatial archetypes for collective worship. It seemed of interest, with apologies for otherwise omitting his arguments that would be impossible to concisely summarize, to present the somewhat self-descriptive titles of these plans and adapted versions of his pertinent diagrams employing this book's vocabulary of centering ideograms. Hopefully they embody his essential graphic intentions. While grounded in issues of Roman Catholic theology, the diagrams—clearly requiring having the book in hand to discern more than a rudimentary measure of their meaning—would seem, though Schwarz might disagree, an illuminating and thought-provoking set of centering approaches for assembly partis generally.

1. The 1958 edition in English by Henry Regnery Company, Chicago, was reprinted by Nabu Public Domain Reprints.

The First Plan

*Sacred Inwardness:
The Ring*

Full Shell Array w/ Core



The Second Plan

*Sacred Parting:
The Open Ring*

Partial Full Shell Array; Radial;
Partial Radial Array; w/ Core



The Third Plan

*Sacred Parting:
The Chalice of Light*

Partial Full Shell Array; Partial
Single Shell; Radial; Dual Core



The Fourth Plan

Sacred Journey: The Way

Parallel Radials; Parallel
Shells; w/out Core



The Fifth Plan

Sacred Cast: The Dark Chalice

Partial Shell; Radial w/ Core;
Parallel Shell w/out Core



The Sixth Plan

*Sacred Universe:
The Dome of Light*

Full Radial Array w/ Core



The Seventh Plan

*The Cathedral of All Times:
The Whole*

Full Radial Array; Partial Shell;
Radial; Parallel Shells; Dual Core



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ABOUT THE AUTHOR

Kenneth M. Moffett has been obsessed with art and architecture since his early youth. Upon graduation from the School of Design, North Carolina State University, he was awarded the Paris Prize for a year's travel and study in Europe. After intern years with The Architects Collaborative, the firm established by Walter Gropius, a move to East Tennessee led to the founding of the architecture and planning firm BullockSmith, of which he remains Design Director. The firm has done a wide range of award-winning work nationwide and abroad. Numerous trips and conferences have enhanced his discernment of architecture and urbanism past and present—its errors as well as its achievements. He and his wife reside in the house he designed in 1977 and has added onto ever since. He engages in a wide variety of art, music, writing and community activities. His daughter, an artist, resides in London.

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Travel

Visits to many of the buildings and places discussed in this book during travel in Europe and North America over the course of 40 years.

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