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The Persistence of Formal Patterns

Pairs of Complements, feminine and masculine, static and dynamic, the circle and the line, describe the profound duality of human experience. Folk dances all over the world are danced in either circles and squares or lines. The stone circles at Avebury (1) and the lines of menhirs at Carnac (2), the tipi and the longhouse, the Pantheon and the basilica, the centric space and the linear space: these are the two themes that dominate architecture. The organizational patterns that follow these two themes divide between those that focus on center, as in a courtyard, and those that distribute along a line in response to movement. The courtyard is a comprehensive pattern which can include the ideas of atrium, cloister, castle, square, and temenos. Within patterns that are organized in response to movement, two ideas, the circulation spine and serial progression, can be distinguished. These archetypal themes are essential ways of making space and of organizing groups of spaces. We see their reflections in countless idiosyncratic buildings.

The origin of a particular form is beyond our understanding. We can, however, observe the persistence of forms. Those that persist do so because they resonate so strongly in the experience of human beings that they are chosen again and again. Clear reasons for these choices cannot be articulated because such motives make up an elusive web of conscious and unconscious needs, desires, and associations.

The notes that follow represent an attempt to delineate themes that are easily recognized in buildings of different periods and in all parts of the world. To observe these patterns is to see in a way that moves between the layers of historical style within which architecture is generally categorized and presented.

The importance of a building does not lie solely in a formal pattern of organization, and emphasis on common themes does not lessen the importance of a unique work. Many indifferent buildings stem from archetypal diagrams. Ultimately, the building itself has architectural value. The individuality of a work, however, can be defined only when the building is placed in relation to others of a similar formal pattern.

Buildings which embody a single formal theme in absolute purity exist only in the imagination. To experience architecture is to experience a variety of patterns as rich as human nature itself.

The great buildings of the twentieth century share with those of the past a grounding in basic architectural themes. We recognize these archetypes beneath a variety of stylistic trappings. We respond to them and use them. Important communication is established. They are our tradition.

The Centric Space

The Image That Exemplifies most clearly the ideal of the centric space is Boulée's section drawing for the Newton Cenotaph (3). The model of the earth orbiting the sun, which generates the enclosing sphere, is a perfect diagram of centricity. It represents both the primacy of the center point (the sun) and the equivalence of all points on the perimeter (the orbit).

Two indigenous North American centric house forms, the i'go'o (4) and the tipi (5), illustrate both the fundamental methods of structuring a centric volume and the chronic dilemma of introducing entrance into a centric form. Both are sophisticated responses to the climate and the availability of materials.

The hemisphere and the cone are shapes commonly used to roof a round space. A center post is found in tents, medieval chapterhouses (6), and umbrellas (portable sediliae). A square is often roofed with a pyramid or transformed into an octagon or circle. A delightful example of the reconciliation of these geometries is the Abbé's kitchen at Glastonbury (7), where the four corners outside the octagon are four great fireplaces. All of these forms are higher at the midpoint than at the perimeter. A tension structure, which tends to sag at the center, is rarely used, no doubt because of drainage, but also because this type of ceiling depresses rather than expands the center, and thus opposes our memories of this kind of space.

The centric form suggests entrance only at the top center, as in the kivas of the Pueblo Indians (8); the bottom center, where it usurps the central focus of the space; or through a continuous series of openings around the perimeter. Entrance is most easily accommodated in the open pavilion. The gazebo (9) does not compromise the purity of the centric form.
The most common opening into an enclosed volume, however, is a single side entrance. The Pantheon (10) is a strongly centric building: the height of the interior volume is the same dimension as the diameter. Entrance is accomplished by piercing the drum with a single monumental door. This point is then exaggerated by the addition of a porch or temple front, which celebrates entrance and originally allowed the drum to face a defined public courtyard (11). Four entrances, equally spaced, maintain the purity of the centric form of the Baptistery of Pisa (12). Colonades surrounding the drum of the typical tholos (13) and of Bramante’s Tempietto (14) obscure the single entrance and preserve an image of consistency. A similar effect is produced by the interior colonnades of the Dome of the Rock (15, 16) and Santa Costanza (17, 18).

The Pisa baptistery and the tipi are examples of single-space buildings, though the extension of the centric form into rich and complex spatial compositions is also common. Santa Costanza and the Dome of the Rock follow the same pattern: a high center space surrounded by a ring of lower space. The same section applied to a square plan describes Hawksmoor’s Saint Mary Woolnoth in London (19, 20). Very few centric volumes are extended by more than one or two complete rings. Concentric rings lose vitality the further they migrate from the center, like those that follow the dropping of a pebble into water. The axes implicit in a square plan, however, can become the formal structure for any number of elaborations. The plan tends to become cruciform.

Leonardo’s sketches of centrally planned churches (21) illustrate this pattern. Santa Maria della Consolazione in Todi (22) is a clear example. It consists of a square block with a dome on top and an exedra on each of the four sides. This device of projecting bays on the cross axes of a square is also typical of Modern plaza and is used to develop the interior spaces and exterior forms of the great Turkish mosques (23, 24). In the design of the Unity Temple auditorium (25, 26), Frank Lloyd Wright follows the same formal rules for extending the square. Leonardo’s sketch could be the plan for Wright’s building.

The desire to make sacred a particular point or location often informs a circular plan, where the center appears to generate the volume. Sometimes this special location is already identified in legend or history. The Dome of the Rock was erected to enshrine the point from which Mohammed is reputed to have ascended on his Night Journey into Heaven. It is also the spot where God stayed the hand of Abraham as he was about to sacrifice Isaac. Medieval and Renaissance baptisteries create the sacred location, the font (27). These buildings do not center on a sacred location but, rather, on a symbolic act. They focus on rebirth and new life. A less sacred but no less centric form is the ingenious round barn of North America (28), in which the silo or haymow stands at the center and the animals radiate like spokes of a wheel.

The reverse of the sacred center is the perimeter, on which all points are equidistant from a center. At a round table discussion, all participants are equal. In the chapterhouse of a medieval English cathedral such as Wells (6), monks assembled in a circle as a group. The octagonal form with a bench around the perimeter houses, and at the same time symbolizes, the community. The kiva tells a similar story (29).
The essence of the centric idea is interior volume. The Treasury of Atreus (30) and the cupola tombs of the Etruscan (31, 32) are subterranean. These interior volumes are expressed in silhouettes of mounded earth, but frequently such spaces are completely buried inside a building. The breakfast room of Sir John Soane's house (33, 34) is nowhere to be found on the exterior. The octagonal rotundas of the Domus Aurea (35, 36), which is also embedded within a larger building, is no less powerful for having been completely buried under the Baths of Trajan.

Often the intrinsic potential of the centric idea has not been realized where it has been used primarily to organize other spaces. The rotunda solves the design dilemma posed by a bicameral legislature. The rotunda of the United States Capitol (57) upstages the two wings and provides a symbol of unity. But, in spite of its size, it is oddly empty of energy. Its real function is as an exterior symbol, not as an interior space. The rotunda plays this role in countless Beaux Arts schemes (38), where it merely acts as a circulation node, organizes other spaces, and sorts out knots of axes. The form has little inherent meaning; it marks no significant point; it celebrates no mystery. In the Roman precedents, however, such as the Domus Aurea, the centric spaces are the major spaces, in use as well as form.

THE ATRIUM

The courtyard, in its many forms, is the basis of building organizations in which many parts are gathered around a central void. It is expressive of the need of human beings to group together—to form a community—for mutual benefit or exchange.

At Santa Costanza, the ambulatory supports the energy and purpose of the major volume. The ring is auxiliary. When the surrounding spaces develop in size and importance and become the primary reason for the building, however, a trans-

formation occurs by which the center becomes the servant of the sides. The void organizes the surround and is necessary to make it workable.

The atrium house (39) is the most concentrated of the courtyard organizations. It is indigenous to areas around the globe. The atrium space permits circulation among the parts, admits light and air, and provides privacy. Because exterior exposure is provided by the court, this form lends itself to close packing and thus allows considerable density (40). James Stirling made direct use of the idea in developing a scheme for a barrack in Lima (41). In this project each family was to develop its own house around certain given elements: a square court in the center and a simple grid of columns and beams. Frequently, the exterior of the atrium house can be viewed only from within the center. The court is the designed element; the individual volumes that encircle it cannot be distinguished. The House of Pansa in Pompeii (42) illustrates that the atrium pattern need not have a regular exterior perimeter any more than the centric space need be readable from the outside.

The multi-storied version of the atrium plan is represented by the Palazzo Strozzi in Florence (43, 44, 45). The greater complexity of the program and the stacking of levels necessitate a circulation zone along the inner edge of each floor, so that the perimeter must be used for exposure. Hence the building is a free-standing block. The exterior is high, massive, and forbidding, but the interior courtyard is made to appear lower and delicate in scale.

In the nineteenth century the atrium of the palazzo was often roofed with a skylight, and the form came to be used in commercial buildings. The Bradbury Building in Los Angeles (46) retains most
of the characteristics of a palazzo. High-speed elevators permit John Portman's Hyatt Hotels (47) to stretch the atrium idea to an extreme. Department stores and office buildings such as Wright's Larkin Building (48) use skylights to bring light to the center of working floors.

The idea of the atrium is strongest when the center space is different in character from the outer perimeter of the building. Differences in scale and detail, as in the Palazzo Strozzi, are devices for achieving this distinction, a distinction not clear in a structure like the Ford Foundation Building (49), where the two office wings of the typical floor are double-loaded in plan. The fenestration patterns facing the court are similar to those facing the street and do not reflect a strong distinction between inside and outside. Another device is the use for the inner court of a geometrical plan figure that contrasts with the outer shape. A circle is set inside a square in the Palace of Charles V at Granada (50) and inside a pentagon at the Villa Farnese at Caprarola (51).

Kahn's Exeter Library (52, 53, 54) powerfully combines the themes of centric and atrium. The center of the library is not used simply to bring light and air to the middle of a dense building. Here, the atrium space is a highly charged centric idea that coexists with an equally strong surround. The plan of the Exeter Library closely resembles the Leonardo central church, the Turkish mosque, or Unity Temple. Kahn develops the idea into a building within a building: the inner building of concrete holds the books; the outer building of brick holds the reading spaces. The two form the fabric of the atrium surround.

But there is, in fact, a third building, and this building encloses the central void. The concrete walls are the face of the internal void, not of the surrounding solids. The great circles locate the true center of the building, which is not simply in the center of the plan, but in the center of the volume. The sun occupies the center of the spherical volume in Boeckh's Newton Cenotaph. Neither person nor object occupies this center. It is a holy place, a place of mystery and reverence. It gives form to an essential spirit, which can never be written into an architect's program and yet, in the end, is more valuable than all those little spaces that words describe so well.

The Cloister

Around the Traditional Cloister (55), each of the elements of the monastery is distinguishable and yet is linked to the others by the common and continuous circulation element that encircles a central open space. The path, which belongs to the private world of the group, becomes the functional and symbolic unifier. One walks around the open space, not across it. It is a garden held apart, an outdoor sanctuary, a place of repose and contemplation.

Cloisters are usually rectangular in plan and are experienced in movement along a path. The four corners are important moments in the journey, a kind of calibration. Walking the cloister at Moissac (56), one senses additional rhythms created by the large piers at the midpoints of each side, the single and paired columns, and the repetitive beams of the roof structure. The plan of the cloister of the Cistercian monastery of Le Thoronet (57, 58, 59) is a trapezoid. The floor of only one side is flat; the others are sloped or stepped. The paving is composed throughout of stone and tile, but the pattern varies. The experience of each of the sides is unique. Walking this cloister is a rich journey.

Aalto's Town Center at Skynnsala (60, 61, 62) strongly recalls the massing of a medieval cloister. The dominant volume, however, is not a church but a town hall. Though the internal circulation route does
not encircle the entire courtyard, continuity is implied by the mullion pattern of the corridor glass which extends across the windows of the apartments. Le Corbusier's Dominican monastery of La Tourette (63, 64, 65, 66, 67) is arranged around a center court in the traditional manner. Indeed the peaked oratory vividly recalls the lavabo, the centric pavilion that houses the ablution fountain and which stands within the den formed by the cloister ring in monasteries like Le Thoronet. At La Tourette a continuous circulation system links all the volumes to each other. Only at the top floor, the level of the monk's cells, does the plan assume the familiar shape of the cloister. The roof alone, where the parapet permits a view of the sky and not of the neighboring countryside, is given the quietude and singularity of the traditional garden. At the level of the church the circulation path is pulled off the building mass and made to form a distorted cross. These passages are open only to one side, as in the traditional cloister, but the building masses they connect are lifted above the sloping earth and the courtyard is packed with constructions, thus denying the center the earthbound stability and repose of the cloister. And yet the allusion to specific elements of that tradition makes the act of denial powerful. We are reminded of what we have lost.

**CASTLE, SQUARE, AND TEMENOS**

The courtyard is often the product of the need for common defense, as is vividly explicit in the walled castle (68), which houses a community too extended to be accommodated in a concentrated atrium and too random in its movements to be accommodated in a cloister. The courtyard theme is also chosen frequently for urban housing because of its expression of communal values, the equality of its perimeter, and its efficient pooling of open space. The Karl Marx-Hof in Vienna (69), which retains many characteristics of the castle, unites workers actually and symbolically. The courts and gateways of the Yale residential colleges (70) suggest defensive strongholds in a less heroic but even more communal manner, since the only access to the living units is from the common space.

The courtyard shape has been applied to practically every conceivable building program. Paul Rudolph, in his Government Services Center in Boston (71), overlays the soft space texture of twentieth-century bureaucracy with the specific forms of Siena's Campo (72) and Venice's Piazza San Marco (73), hoping perhaps to instill some sense of community in beleaguered office workers. A critical condition of squares like the Campo or the Piazza San Marco, however, is that they each form a void in a thick urban texture. Each is supported by the energy of an entire city. Their edges are not so much edges of the space within as edges of the fabric without. The fortresses and housing blocks mentioned stand as identifiable communities and are generally approached and perceived from the outside first, but it is impossible to see the Campo from the outside; in this respect Rudolph's building differs radically from its model.

In a square, the closure of the space is often implied by disconnected buildings. Across the delightful square at Pienza (74), the town's principal players confront each other: the church, the town hall, the palazzo, and the café. Closure can still be implied when buildings are spaced quite far apart. The New England green (75) is literally a common space, around which individual houses maintain a discreet dialogue that is quite in character with the New England temperament. Buildings or simply walls are often arranged to form an enclosed precinct, which becomes the field for a significant object or objects, a kind of temenos or holy ground. Three churches stand free in the center of the New Haven green (76).
At Ryoanji Temple in Kyoto (77) fifteen artfully placed rocks occupy a field of raised pebbles. Kahn's scheme for the Dominican convent at Medla, Pennsylvania (78), reflects in part the idea of the precinct, although in this extraordinary project it appears to be nearly impossible to experience the field within which the object buildings are set.

The precinct or temenos theme exists within individual buildings as well. At the Assembly Building at Chandigarh (79, 80), Corbusier uses the wall of offices to create a zone within which stands the great Assembly Hall, the top of which protrudes above the enclosing wall and portico. The baldachino over the altar in San Lorenzo Outside the Walls in Rome (81) defines a volume of space which stands free. Charles Moore makes use of this device for more secular purposes in his own house in Orinda, California (82). Philip Johnson's Glass House (83) is composed of discrete objects within a field defined less by the sides than by the top and the bottom.

THE LINEAR SPACE

In contrast to the centric space is the linear space. Again it is Boulée, who captures its character in his project for the National Library in Paris (84). The essence is line, the experience is path. Direction and movement replace center and axis.

Normally, continuous vaults or intermittently placed beams, trusses, or arches span the narrow dimension of the longitudinal volume (85, 86). A member which spans the length of the space is less common, although it is used frequently in Japanese timber framing (87). In Eero Saarinen's Ingalls Rink at Yale (88) the long dimension is spanned with a concrete arch. Occasionally, a line of structure down the center divides the volume into two bays. The center line of columns of Labrouste's Bibliothèque Sainne-Geneviève in Paris (89) displaces the center circulation into two parallel paths. A roof suspended from the two long sides is even more unusual, perhaps because, as in the centric form, a low center is at odds with our collective memory. Saarinen's Dulles Airport (90), outside Washington, has a suspended roof, but one does not traverse Dulles longitudinally. The movement of passengers is perpendicular to the axis of the space, and thus the experience of the building is that of a broad gateway.

The linear space is expanded in ways that parallel the enriching of the centric space. The side aisles of the classic Roman basilica (91) reinforce the center much as the ring of space reinforces the center in a centric pattern. The central nave of the basilican church (92) is generally higher than the side aisles, and clerestory windows bring light to the center. Its schematic section is identical to that of Santa Costanza (93). Although one does find basilicas with two sets of side aisles, one is more apt to find the linear space further enlarged through the crossing of one such space with another. The Latin Cross plan (93) lays a second linear space, the transept, across the first, the nave. The location of the transept toward the "east" end of the building, however, distinguishes this cross-axial arrangement from the Greek Cross, a centric form, where the crossing occurs at the center.

Means for terminating the linear space vary. Barns, which are often built on the basilica pattern, are usually cut off sheer (94). Saint Pancras Station in London (95) has a strong structural rhythm, but the form includes no hierarchy, no suggestion of end. The railroad shed simply butts against the back of George Gilbert Scott's Saint Pancras Hotel. The end of the Roman basilica (96) receives the thrust of
the linear space in a curved niche or apse. While there is no strong difference between the two ends of the Roman basilica, an important hierarchy differentiates one end of a church (97) from the other; this hierarchy is clarified when the side entrance of the Roman basilica is replaced by an entrance at the “west” end of the church (98).

In a church, the idea of progression, not just of passage, characterizes movement along the axis of the space. This is the primary difference between the early churches and the basilicas that were their models. The most succinct architectural expression of the idea of progression is the ancient megaron (99), of which one end is entrance, the other terminus. Its most elaborate expression must be the Gothic cathedral (100), where each step along the path of the nave articulates progression. The radiance of the choirs of Chartres and Vézelay (101) celebrates the culmination of a journey, a journey which, in the case of a pilgrimage church like Vézelay, may have lasted for months or years.

The form of linear space transcends any particular program. It can accommodate a barn or a cathedral. It has often been used to organize a library. The long, high, narrow rooms of Boble and Latrobe follow a tradition established in early monastic and university libraries, such as Michelangelo’s Laurentian Library in Florence (102) and the library of Trinity College, Cambridge (103), by Wren. The reading rooms of the Sterling Memorial Library at Yale (104) are patterned after these earlier models. In the same building, Rogers even employs the Latin Cross to shape the public circulation spaces of the library. The side aisles contain the card catalogues, the altar becomes the circulation desk.

Weight, more than any other twentieth-century architect, played on the theme of the basilica. The overriding idea of the Robie House (105, 106) is that of a long, double-ended basilican form with a high center and lower sides, which is weighted at the center by the fireplace mass. The Imperial Hotel in Tokyo (107) was filled with spaces of this kind. Even the ballroom was designed on a Latin Cross plan. The basilica form was so much a part of Wright and of us that its use here appeared completely natural.

The churches at both La Tourette (108, 109) and Ronchamp (110, 111) are variations of the traditional basilica. The monastery church is somber; the pilgrimage church is flamboyant. La Tourette is a simple rectangular volume made up entirely of concrete planes and displaying none of the conventional rhythms. The only modifications are slopes in the floor and ceiling. These elements traditionally associated with the sides of the basilica, the monks’ chapels, are clapped to the outside of the nave. Even the organ is removed. In plan and section, Ronchamp is a distortion of the traditional form. The side chapels are rotated and stretched to act as light scoops. It is one of the few basilicas whose ceiling is lower in the center than at the sides. But here this lowing plane combines with curved and battered walls and the sloping floor to create an extravagant three-dimensional volume.

**THE CIRCULATION SPINE**

The linear space of the basilica is experienced as a complex but single volume. The secondary spaces do not draw energy away from the center but, rather, reinforce it. When these side spaces become the programmatic stuff of the building, the center becomes the servant and a transformation occurs, similar to the transformation from centric volume to atrium. The resultant linear circulation spine provides efficient access to a collection of parts, which are grouped more because of the common circulation system than because of any necessary relationship to one another. The spine is often the primary architectural expression of the
building, but it exists to facilitate circulation, and its length and position are determined by what it is designed to serve.

The linear idea does not prescribe a means of termination, although the skyscraper (112), expressive as it may be of upward energy, is confined within the limits of structural and mechanical feasibility. Horizontal spines, on the other hand, are easily extended. Cesar Pelli places mirrors at one end of the galleria on the top floors of the Pacific Design Center in Los Angeles (113, 114) to suggest infinite extension. Like a piece of conduit, a spine building is simply cut to a desired length.

The shopping street is a familiar double-loaded spine. Buying and selling have probably always been organized in this pattern. Even large-scale markets form themselves into streets. The clearest ancient prototype of a discrete spine building is the Greek stoa (115, 116), a generalized shelter often used as a market. Its colonnaded circulation gives access to a series of independent rooms. Repetitive independent units of housing lend themselves to a spine organization, as can be observed on any residential street (117). The double-loaded corridor carries this pattern into a multistory building, when efficiency replaces community as an organizing principle. In the Unit d’Habitation (118), Corbusier seeks to overcome the shortcomings of the double-loaded corridor by creating through-apartments that lock in section around a center corridor. By reducing the number of corridors to one on every third floor, he increases the traffic in each, and thereby increases the opportunity for exchange between the families. Clearly, the Unit is a design conceived in section. This is characteristic of complex spine buildings, where the section is used to solve many of the problems ordinarily worked out in plan, such as programmatic adjacencies and exposure.

The free-standing stoa illustrates the potential for asymmetry in the spine building, and many linear housing schemes have been developed asymmetrically to distinguish between two exposures. A continuous access gallery runs along one side of each floor of Aldo Rossi’s Galileettes housing in Milan (119), and the flats face the other side. The stepped section is an elaboration of this asymmetry. Corbusier’s scheme for Algiers (120) presents terraces to the Mediterranean and accommodates a motorway at the back.

These schemes raise questions of composition and length, which are chronic in the design of spine buildings. Corbusier’s yearns to be continued. Rossi’s is considerably longer, but with the giant, round columns, the architect introduces a change of scale which gives the building a reference point, a compositional center. Linear buildings are frequently bent to create enclosed spaces. In Harvey Court of Gonville and Caius College, Cambridge (121), by Sir Leslie Martin and Colin Wilson, the enclosed form of the courtyard collides with the desire to step the section toward the best orientation. James Stirling’s Florey Building at Oxford (122) wraps an open space but leaves one side open to the river and the view.

Section studies establish the relationship between circulation and the parts, but do not illustrate the singular act of entry. Since spine circulation is non-hierarchical by nature, it can be tapped at any point. The circulation ring of the Florey Building is punctured at the back at each level. The corridor of Kallman and McKinnell’s Exeter Gymnasium (123) protrudes at the end like a tongue. The Neighborhood Center at Beersheba in Israel (124) by Ram and Ada Karmi is made up of two spine buildings which together create a covered street; the two halves are offset in plan to form a place of entrance at each end.
The Beersheba Neighborhood Center stretches between two nodes of activity and makes use of the shopping center principle. Some of the most successful linear schemes are those which form new linkages within existing systems. The delightful London shopping arcades (125) create short circuits between busy streets. The Galleria in Milan (126) is a short cut between two major squares, the Piazza del Duomo and the Piazza della Scala.

It is possible to see a city as a complex of linear circulation systems. This perception dominated the 1960s, the heyday of the spine building. Studies for the Market Street Development in Philadelphia (127) show not the shape or face of the city but its arteries and veins.

The drawings of Sant' Elia (128) release the movement implicit in Boullée's stable basilicas (84). Linear megastructures (129) suggest an architecture in motion which makes its own context and appears to stretch to infinity. They remind one of both Darwin and Kerouac. These buildings often appear on legs, like the Unitè. They are not earthbound, not dependent on place, but make their own environment. This desire to move out across the land seems particularly American, and yet those long megastructures are a curious contradiction for Americans. The instant thrill, as it speaks of limitless possibility. It ignites the excitement of adventure. But these giant structures cannot be realized without phenomenal bureaucratic and personal cooperation. They depend upon the individual giving up the independence of mobility and ownership of land in exchange for a collective good. The mobile home is a more appropriate symbol of the American dream.

Two American building groups, however, that are organized along linear circulation patterns are inseparable from the land they inhabit. Jefferson's elegant, agrarian University of Virginia (130, 131) and Kahn's poetic, scientific Salk Research Center (132, 133, 134) were built nearly two hundred years apart at opposite ends of the country. The University of Virginia gathers the rural landscape into precincts, each of which is brought into focus by a brick pavilion. The pavilions face each other across a sloping lawn like partners in a graceful reel. Each represents a kind of constituency. The colonnade delicately laces them together into a linear system. The Salk Center overlooks the Pacific and maintains a more heroic and lonely stance. It engages the elements: earth, air, and water. The laboratory buildings are organized along a linear pattern of parallel circulation spines. The services run horizontally through the openings in the Vierendeel trusses, and the laboratory floors are bordered by open corridors. Private studies, which stand in the open court, break free from the insistence of the linear system. Kahn does not create a barrier between land and sea, like Corbusier does in his project for Algiers, but rather draws the buildings apart to permit connection, a connection symbolized by the narrow watercourse that flows along the center line and spills over the end of the court. It directs the view toward the horizon and toward the mystery of the unrevealed, a journey made not by the building but by the imagination.

**SERIAL PROGRESSION**

The serial idea builds upon the sense of progression that often characterizes the experience of the linear space. The essence of the idea is incremental change. The watercourse at the Villa Lante in Bagnaia (135, 136) bursts from a spring in the side of a hill and drops from terrace to terrace through a series of delightful hurdles until it finally comes to rest in a formal pool. The journey of the water from high to low, from natural spring to artificial basin, parallels a transformation of the landscape from artful nature to rational geometry.

Implicit is the notion of growth, of change through time. A scallop shell, a chank shell, a spray of fraxia, a pine cone, all are forms in nature that reveal a
pattern of growth. Symbolically, the scallop (137) carries the message of birth; the chank (136), the shell of Vishnu, the story of continuity.

The serial theme is most frequently seen in ornament. The towers of the Hindu Temple of Khajuraho (139) and the Chrysler Building (140) diminish to a resolution by reducing the size of the petal, much like an artichoke. The unique silhouette of a Thai temple (141) is developed by tucking gable under gable at the end of the roof. The Temple at Khajuraho (142) is composed of distinct pieces which are bolted against each other, but the ornamentation ties the group together in such an overwhelming way that it discourages any external perception of the individual parts. The expression of the building becomes that of continuous upward surge.

The pyramid of Zoser at Saqqara (143) is a solid mass contoured by successive steps, and is similar in profile to the library which Kahn designed for Washington University (144). The spiral is a transformation of the circle into a figure that embodies progressive change. Corbusier's Museum of Unlimited Extension (145) is a square spiral, which grows in plan. Much of the rigidity inherent in the diagram is overcome by using a pattern of interior openings that allow views across the spiral. Extended into three dimensions, the spiral has been used to contour both a mass, as at Samarra (146), and a void, as in the Guggenheim Museum (147). In each case, the spiral forms a continuous path. Corbusier's design for the Musée mondial (148) is likewise based upon a linear circulation path wrapped around a void, but the building narrows at the top to make the silhouette of a stepped pyramid.

While a spine building is based upon the distribution of parts at a constant pace, the serial idea includes acceleration. It is progressive, like the chambers of the prehistoric temple at Malta (149), but does not necessarily include a destination.

The refinement of perspective in the Renaissance and the development of illusionistic scenery for the proscenium stage (150) anticipated the fascination of the Baroque era with architecture perceived in depth. The new sensibility is illustrated at the Teatro Olimpico in Vicenza (151, 152). Scamozzi's illusionistic streets are grafted onto the back of the scaenae frons of Palladio's static Roman theatre, where they simulate views of tremendous depth. The alleé (153) became the favorite Baroque device, and radiating promenades became the imperial vision. The extended wings of Baroque palaces are apt to be arranged not so much to facilitate planning within as to create spectacle without. The succession of corners of a building like the Palace of Versailles (154), like stage flats, has an effect of increasing the perception of depth.

Alvar Aalto, a master of the baroque with a predilection for the serial, makes recurrent use of the same device. Aalto, however, develops the idea asymmetrical. The site plan for his town center at Säynätsalo (155) included a series of rectangular buildings, offset to reveal successive corners on a diagonal path. The series would have led to the mass of the Council Chamber. The Finnish Public Pensions Institute in Helsinki (156) illustrates Aalto's use of the device in the massing of a single building.

In his competition design for the Reval Museum (157), where he uses the technique to organize interior space, Aalto arranges several large galleries in response to the direction of travel and view of the visitor. The stepping occurs not only in plan, but in section as well.

In Reval, stepping combines three independent rooms. At Imatra, in the Church of Vuoksenniska (156, 159), a single volume is contoured in this manner. Here, the practical need to subdivide the church led to a breakdown of the sanctuary into three fanning curves. The theme
returns in one of Aalto's last works, the church at Rauno in Italy (160), where the nave breaks into four arched fans, nested in cross-section.

In his scheme for the Swedish Chancel-

lory Competition (161), Gunnar Asplund

uses an asymmetrical fan to reconcile the

irregular geometries of the site. He de-

velops a series of wedges which vary incre-

mentally. The Italian hill town (162) is

a vernacular example of a serial com-

position, which results from the architec-

tural ordering of the natural landscape.

Stepped terraces contour the slope, and

the fanning plan accommodates the curve

of the hillside. The hill town's picturesque

asymmetry is made up of individual, but

similar, pieces, a series of individual

moves gathered together in one direction

into a resolved composition. University

College at Urbino (163, 164), by Gian-

carlo di Carlo, is a studied re-creation of

not only the image of the hill town, but also

its circulation patterns; the easy climb of

ringed paths is combined with the direct

ascent of flights of stairs. The plan that

follows is one of a layered fan, the dia-

grammatic plan of innumerable hill towns.

The stepped hillside of the Greek the-

ater (165) is recalled in Richard Wagner's

opera house at Bayreuth (166), where Wag-

ner reintroduced acoustics and sight lines

as the determinants of form. The Bayreuth

theater anticipates a generation of en-

closed auditoriums like the Radio City

Music Hall (167), where ceilings as well as

seats ripple in concentric waves.

At the Finnish Technical Institute in

Ouuninen (168, 169), Aalto creates a cam-

pus plan that is as representative of the

serial theme as the University of Virginia

is of linear circulation. Ranks of rect-

angular buildings step away from the

focus in plan and in section. The focus is

a theater form, stepped in section to

provide a series of light monitors for the

lecture halls below.

Breaking a mass into increments which

nest together in an elegant asymmetrical

composition often creates a bewitching

piece of "sculpture" at the scale of the

model. It is worth remembering, however,

that one of the most common uses of the

serial idea is to ornament another form. A

model of a serial mass may have richness

that the model of a primary form does not.

As a building, however, the serial idea is

as dependent as any other on its architec-

tural development.

THE GRID

The grid can be seen as the overlap-

ping of two or more linear systems. In

many ways the rectilinear grid makes up

the texture of our lives. It plans our cit-

ies, structures our buildings, locates our

geography, and defines our wanderings.

The grid is distinctly experienced when

the pattern is used for circulation, be-

cause the circulation grid is a weaving

together of linear paths. In Kahn's design

for the Jewish Community Center at Tren-

ton (170) the grid of the major spaces is

interlaced with a secondary circulation

grid, forming a plaid. This device is sug-

gested by earlier buildings, such as the

Romanesque church of Sant' Francesco in

Perugia (171).

The grid organization is a clear and

easily grasped pattern. It is often used

when complex building groups, or even

entire towns, are designed at one time

and constructed rapidly. The huge monas-

tery palace of Phillip the Second, the

Escorial (172), is structured on such a

pattern. The passages weave an extraor-

dinary variety of structures into a coherent

whole. Candels and Woods duplicate the

circulation grid on several floors at the

Free University in Berlin (173). Cor-

busier's project for the Venice Hospital

(174) was composed of square sections,

each bisected in both directions by cor-

ridors. These corridors linked together to

form a circulation grid, which Corbusier

proposed to graft into that supremely non-

Cartesian city.
As opposed to the circulation grid, the column grid is not so much a pattern of experience as it is a structural system. It may denote the aggregation of finite spatial units, or it may suggest the infinite field of the Cartesian grid. A grid of coordinates makes possible the exact location of any point, but, without something to define, it is mute. Its order does not grow out of human need for congregation and ritual, for myth and memory. The skeletal frame and the flat slab are the architectural equivalents of the Cartesian grid.

They imply no direction, no center, no hierarchy. They are not the sum of spatial units. They are a universal condition.

Mies van der Rohe uses the three-dimensional grid to rationalize the structural frame of a tall building and to order the planning within it (175, 176). From within, however, perception of the grid is usually obscured and its regularity is discernible only from without, where it appears as a pattern ornamenting a surface.

Corbusier uses the ambivalent column grid to establish a steady pulse against which variation may be read (177). Corbusier, however, was the first to vary the regularity of that grid, even to omit columns on occasion. In many of his buildings the columns are not perceived as the independent pattern they appear to be in plan, but rather as pieces in a three-dimensional collage (178).

The hypostyle hall comes closest of all ancient examples to the twentieth-century universal space epitomized by Mies’s design for a convention center (179, 180). The Hall of One Hundred Columns in Patmos (181, 182) is spanned in two directions and emphasizes neither orientation. The fact that the entrances do not fall at the centers of any side reinforces the sense of this room as a universal space.

Many Islamic mosques have enormous floor areas. The columns, which the plans show in a grid pattern, structure in the individual spatial units of which the rooms are made up. The Great Mosque of Cordoba (183, 184), one of the largest and most beautiful, was formed by placing a series of vaults side by side; the long sides of the vaults are supported by columns. The Friday Mosque in Isfahan (185, 186) is a collection of domes; each dome rests on a square bay.

For Kahn, architecture began with the room. The large gallery floors of his two museums are composed in the same manner as those of the two mosques. In the Kimbell Art Museum in Fort Worth (187, 188), vaults are grouped side by side. The British Art Center at Yale (189, 190) is a collection of twenty-by-twenty rooms. On the top floor these rooms read clearly as individual volumes, each lit from a center skylight in the manner of the Friday Mosque.

All three twentieth-century architects use the rectilinear grid in the service of stronger formal ideas. This was also true of architects in the past. In the twentieth century, however, one does not sense the grid as an embodiment of the transcendent geometry that gives a building like Brunelleschi’s Santo Spirito in Florence (191) a sacred power. Our use of it does not express a faith in the divine mystery of geometry; rather, it represents a regulating order or a technological convenience.

**COMBINATIONS**

These themes are not discrete categories, and like themes in music they may be varied or combined. Concentrated building groups, like the monastery (55) or the agora (192), which reflect a variety of human activities, are apt to include structures that represent a range of patterns. Individual buildings are also composed of several themes, although one may clearly dominate.
The grid is frequently the fabric of a building and exists in harmony with a second idea. In Kahn's British Art Center the two themes of grid and atrium are locked together: the building reads primarily as two atriums on the lower floors and a grid of individual spaces on the top floor. The Friday Mosque in Isfahan bears a kinship to the British Art Center in more than its grid fabric. It, too, centers on a courtyard. The Museum of Fine Arts of the West in Tokyo (193, 194) is woven of the grid and the atrium together, but is dominated by neither one. It is a three-dimensional composition of planes and forms, unique and idiosyncratic.

The serial theme is also apt to take a secondary role. It is used to develop the centric form of Turkish mosques, the atrium space of the Guggenheim Museum, and the basilican volume of Aalto's church at Imatra.

The linear spine frequently organizes the interior of a courtyard building, like the one at Goulville and Caius College, Cambridge, or an atrium surround, like the one in the Exeter Library. The quintessential spine building, the Unité (195), however, stands completely alone.

The linear space and the centric space are not as easily merged, though they are often placed side by side, as when the baptismal stands opposite the basilica (196). The space often joins in sequence. The Pantheon is a centric volume with a linear entrance (197). A straight, walled path leads to the domed Treasure of Atreus (198). Maderna grafts a full-scale basilican nave onto centric Saint Peter's (199). The two ideas are less separable, however, in the basilican church that terminates in a round apse (200), where passage and destination are fused in a powerful story of faith and exaltation.

Linear paths passing through a centric space illustrate the crossing of these two fundamental ideas. Overlapping the cross onto the circle creates a powerfully symbiotic pattern. It is a form of mandala, and it occurs again and again in myths of holy places. The Tibetan mandala (201) shows four elaborate gates at the cardinal points, where the wall of the precinct is broken. These gates are laid flat in the two-dimensional image. The Lamb occupies a circle at the intersection of the four rivers of Paradise in the center of the Heavenly Jerusalem (202). Plutarch's account of the founding of Rome by Remus is the story of man imbuing his place on earth with cosmic meaning: first, a round pit, the mundus, which represented the cosmos, and around it a circular boundary plowed by bullock and yoke. This circuit was interrupted at the four points where the two axes crossed the circle. Part of the reason, perhaps, for the extraordinary vitality of Palladio's Villa Rotonda (203, 204) is the symbolic energy of its mandala form, in which two axes cross at the central origin of the rotunda and project, uninterrupted, into the landscape.

It is, however, in the true merging of the centric volume with the linear volume that the combination of the two ideas finds its most profound architectural, not symbolic, expression. No building combines the circle and the line more powerfully than the Hagia Sophia (205, 206). Centric space embodies the longing for withdrawal and nourishment, for center, for stasis. Linear space expresses the urge to move out, to reach, to act. The interior volume of the Hagia Sophia combines these two profound human conditions, not as symbols juxtaposed, but as a single space. If works of architecture can resonate with this much energy across generations, it is because the spirit they embody is communicated in forms to which we continue to respond. These forms and patterns make up a living language that is understood by all human beings. For the architect, this reservoir of traditional form is a source of nourishment and challenge.