2 From Mechanism To Vitalism. 
Rethinking The Paradigm Of Organization

As Kahn’s practical endeavors remained concerned with an abstract, and by implication mathematical understanding of nature, in his theory the focus shifted gradually towards issues of generation, and hence it came to increasingly incorporate questions of biology as well. Altogether, Kahn's theoretical statements first leaped the gap from the lifeless to the vital, or, as it were, from the rigid, restricted and inert world of mechanisms to the more adjustable, open and dynamic domain of organisms. Besides, via a strong influence of humanist concepts of spatial organization, the former homogenization of space was eventually replaced by a more compartmentalized approach that revealed itself through a process of individuation, i.e. the elaboration of a space’s inner function. Each of the differentiated spatial elements should enforce the entirety of the built organism, like the individual parts of an animal fulfilling various functional tasks.

Kahn first presented his deliberations at a conference in Princeton, held between December 11 and 13, 1953. The weekend after the presentation he summarized his thoughts in a letter to Tyng:

I advanced my ‘order-design’ thesis but added another area of design influence – ‘the nature of the space’ [...]. External shapes must wait until the ‘nature of the space’ unfolds, and before ‘order’ can be evolved or created.204

In a tripartite scheme, the “nature of the space” preceded “order,” from which, lastly, the “design” was derived. Half a year later, Kahn clarified the meaning of each term: The “nature of the space” was the general desire of what a building or space wanted to be; “order” as a double agent both referred to the permanent laws of nature and provided the necessary geometrical means to articulate them, while “design” underlined the influence of the changing circumstantial conditions besides making corporeal the previously defined will of what a building intended to be (Figure 61).205 Hence, Kahn’s theory progressed from the abstract towards the concrete in a linear manner.206

204 Tyng, The Rome Letters, pp. 76-7; letter 18 December 1953.
205 Ibid., p. 160; letter 10 July 1954.
206 Kahn’s division between the noumenal world of the “nature of the space” and the phenomenal realm of “design” corresponded closely with the Socratic distinction between a mundus intelligibilis made up of essential types, and the visible, substantial strata of becoming. For Socrates, the Good, like Kahn’s sense of “order,” symbolized a general intention to change the world from a random and chaotic state into an orderly constitution through the implementation of limit, reason and number. As Ernst Cassirer described it, “this universal, eternal, inviolable order governs the world and determines all single events: the path of the sun, the moon, the stars, the growth of plants and animals, the way of winds and clouds. All this is maintained and preserved, not by mere physical forces but by the force of the Good.” Cassirer, An Essay on Man, p. 100.
At the origin of a design’s generative process stood the biological metaphor of the seed inherent in the question of the “nature of the space:” “I believe the concept should be equal to that of planting a seed, in which the concept, that is, the result you are going to get should be quite clear.”207 To underline this argument, he stated years later: “It’s just as sure as when you plant an oak seed, you’re going to get an oak tree. The shape you don’t know, but it’s going to be an oak.”208 Akin to Kahn’s observation, Paul Klee in his lectures at the Bauhaus had suggested:

Despite its primitive smallness, a seed is an energy center charged to the highest degree. It comprises ineluctable impulses that will give rise to entirely different and highly characteristic forms. One seed will grow into a violet, another into a sunflower – not in the least fortuitously, but by its very nature – the one always a violet, the other always a sunflower.

A slumbering tendency rested in predetermined precision – “determined,” as Klee emphasized,

with reference to the underlying idea, to the logos, or, as the translation runs: the word, which was in the beginning. The word as a premise, as the idea required for the genesis of a work.209

In light of the fact that Kahn had been educated under Beaux-Arts guidelines, according to which a project should develop from the initial esquisse or rough sketch through the analytique to a complete submission for the Paris Prize competition, it is apparently more than a coincidence that the jury required a student’s final rendu

208 Kahn’s answers to questions at “The Invisible City – International Design Conference” in Aspen, 19 June 1972, in Wurman, What will be has always been, p. 163.
to conform to the spontaneously produced features of the preliminary sketch.\textsuperscript{210} As Kahn remembered, “[the esquisse] was registered as a first impression as to how the student saw the nature of the building.” Hence, the Beaux-Arts method systematically enforced the significance of the first idea, which had to be worked out in short, usually nine to twelve hours, en loge, meaning in isolation in a cubicle. As Kahn recalled, “the sketch depended on our intuitive powers. But the intuitive power is probably our most accurate sense.” Years later he declared:

I’m at my best when I talk about the nature of things – the nature of a library. It’s not derived so much from knowledge because the examples are very ragged. It is derived because you revere the sense of beginning. You don’t take anything for granted that has been done. You start as though a library had never been built. [...] The esquisse gave this sense of a source [...].\textsuperscript{211}

Regarding the elusive “nature of the space,” in Hellenic times the term \emph{nature} was closely bound up with the idea of an immanent motion or inner fire animating an organism’s morphological development.\textsuperscript{212} Therefore, in contrast to today’s use of the term as a synonym for the outer material world, nature called on a thing’s inborn character, its animating spirit: the German \emph{Naturell} being a remnant of this tradition. Aristotle, the biologist among the Greek philosophers, explained that

the primary and proper sense of ‘nature’ is the essence of those things which contain in themselves as such a source of motion; for the matter is called ‘nature’ because it is capable of receiving the nature, and the processes of generation and growth are called ‘nature’ because they are motions derived from it.\textsuperscript{213}

For Aristotle, \emph{na-ture} was etymologically equivalent to \emph{gene-sis}; thus, \emph{nature} was not only a noun referring to formed matter, but a verb relating to a process.\textsuperscript{214} Subsequently,

\begin{itemize}
  \item \textsuperscript{210} Regarding the esquisse’s faculty of being an immediate response to one’s first ideas, Michael J. Lewis in analyzing Kahn’s drawings and travel sketches remarked that he never used oil painting, which could be endlessly corrected, but “his most significant architectural drawings were invariably made with means that demanded swift execution.” Lewis, “Louis Kahn’s Art and his Architectural Thought,” in Von Moos and Eisenbrand, \textit{The Power of Architecture}, p. 80.
  \item \textsuperscript{212} For Heraclitus of Ephesus, it was a general law of nature that all things capable of nurture and growth contained within themselves a \emph{fire}, since things alive were warm and once the heat disappeared, they were dead. Likewise, Cicero quoting Zeno defined nature as a “craftsmanlike fire, proceeding methodically to the work of generation.” Cicero, \textit{De natura deorum} (Cambridge: Harvard University Press, 1933) II, § LVII.
  \item \textsuperscript{213} Aristotle, \textit{The Metaphysics} (London: William Heinemann, 1933) V, § IV.
  \item \textsuperscript{214} Cf. Aristotle, \textit{The Physics} (London: William Heinemann, 1929) II, § I. “Again, \emph{na-ture} is etymologically equivalent to \emph{gene-sis} and (in Greek) is actually used as a synonym for it; nature \emph{qua} genesis proclaims itself as the path to nature \emph{qua} goal.”
\end{itemize}
nature helped the Greek philosopher to differentiate between inanimate objects and things being injected with an inner spirit of generation, since “the common feature that characterizes them all seems to be that they have within themselves a principle of movement [...].”\(^{215}\) The final cause or telos, i.e. the sake for which something was done, Aristotle identified as the “soul,”

for just as mind acts with some purpose in view, so too does nature, and this purpose is its end. In living creatures the soul supplies such a purpose, and this is in accordance with nature, for all natural bodies are instruments of the soul; and just as is the case with the bodies of animals, so with those of plants.\(^{216}\)

To put it in more pictorial terms, a plant did not merely grow from the seed; the seed grew only because it wanted in its soul to become a plant, or as Kahn proclaimed: “[T]he psychic Existence Will calls on nature to make what it wants to be. I think a rose wants to be a rose.”\(^{217}\) Similarly, when inquiring as to the “nature of the space,” Kahn attempted to grasp what a space wanted to be, respectively capture, “the spirit and the will to exist a certain way. Design must closely follow that will [...].”\(^{218}\) Like Aristotle, who acknowledged that simultaneously with the soul other causes acted from without to influence an organism’s development, Kahn also recognized them, but insisted that they were unable to halt the formative power arising from the initial impetus within.\(^{219}\)

In sum, for Kahn the initial task of an architect was to distinguish the particular whatness that made a school a school or a museum a museum. In doing so, he attempted to discern a project’s general objective, the specific semen and intangible inner nucleus from which the creative force disseminated. In 1955, in the third issue of Perspecta, Kahn accompanied the presentation of a few of his projects with a short, psalm-like commentary entitled “Order is.” Emphasizing that order is, Kahn stressed his unswerving faith in the lawfulness of the natural world that might have also derived from his personal encounter with Einstein at Princeton in the late 1930s.\(^{220}\)

\(^{215}\) Ibid. In a general way, one could argue that irritability qualifies all things living.
\(^{216}\) Aristotle, On the Soul (London: William Heinemann, 1936) II, § IV.
\(^{217}\) From Kahn’s recording entitled “Structure and Form” for the Voice of America broadcast; 19 November 1960; Cf. 030.II.55.22, LIKC.
\(^{219}\) This argument had found further verification in the experiments of the German biologist Hans Driesch, who in 1895 separated the cells of a sea urchin embryo at the two-cell stage and found that each individual part developed into a smaller albeit complete sea urchin. Thus, physical laws as secondary parameters placed constraints on the development of organisms, but left the actual outcome governed by their primary genetic code undetermined.
In relation to Einstein’s well-known aphorism, “God does not play dice,” “order” in Kahn’s understanding did not imply beauty or ugliness, because nature unconsciously created variation after variation in following the same superior law. What differentiated their appearance was related to their specific natures and the influences of “design,” or the “form-making in order,” which incorporated the circumstantial directives:

The same order created the elephant and created man
They are different designs
Begun from different aspirations
Shaped from different circumstances
Order does not imply Beauty
The same order created the dwarf and Adonis

2.1 The Romanticist Roots of the Existence-Will

In Kahn’s earlier letter to Tyng elaborating his tripartite design philosophy, he mentioned another relevant aspect, namely the distinction between “feeling” and “thinking:” “Feeling is our great well of consciousness,” he wrote, “but some people always separate feeling from thinking and build their solution around thinking only.” In Kahn’s opinion, “feeling” captured the “nature of the space,” “order” and “design” all at once intuitively because the creative mind could not separate them. “BUT,” he insisted, “the intuitive needs help to actuate and direct his field to a single objective at time (to a building).”222 In this sense, while “feeling” was able to grasp the impervious will of what something wanted to be, “thinking” as the rational component was necessary to implement the intuitively grasped motives through a thoughtful understanding of “order.”

This distinction between “feeling” and “thinking,” where neither could function without the other, closely relates to basic patterns of Romanticist epistemology. On this basis, Henri Bergson in Creative Evolution (1907) made a similar distinction between “intelligence,” which had

the advantage of enabling us to oversee the future and of making us in some measure masters of events; in return, it retains of the moving reality only eventual immobilities, that is to say, views taken of it by our mind.223

221 Kahn, “Order is,” p. 59.
“instinct,” which was “reality itself.” Therefore, Bergson, like Kahn, expounded on the dualism between an intellectual capacity, which reasoned and broke down the continuity of life into successive quantifiable states, and an intuitive capacity, which recognized, but could not intellectualize the self-creative “élan vital.” Repudiating a complete rationalization of life, also for Kahn,

[the elements of knowledge have been assembled by men, since knowledge did not come out of the skies; our knowledge applies only to the physical world, the biological world defies description.]

Bergson partially agreed, since the “intellect,” which by “mathematical treatment” attempted to think the mobile by immobile means, was incapable of embracing a living being’s essentially durative nature:

While intelligence treats everything mechanically, instinct proceeds, so to speak, organically. If the consciousness that slumbers in it should awake, if it were wound up into knowledge instead of being wound off into action, if we could ask and it could reply, it would give up to us the most intimate secrets of life.

As a consequence, unconscious “instinct” combined with self-conscious “intelligence” would lead to “intuition” – an “instinct” that had become capable of reflection and could think organic evolution. For Kahn, too, “intuition” was “the sum of the whole universe [b]ecause basically we know by intuition everything that is to be known.”

Attempting to restore a more holistic, qualitative appreciation of reality, analogous lines of Romanticist thought had also penetrated the wider architectural discourse as Mumford affirmed in 1938:

[S]teadily, for the past generation, a transformation has been going on in every department of thought: a re-location of interest from mechanism to organism [...].

Also Kepes in *The New Landscape* demanded a more encompassing approach to design, which included both the rational and sensual capacities of man:

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224 The congruent establishment of the electron theory of atomic matter enforced the viewpoint that matter was essentially not a rigid form, but a vital process, and in order to grasp its inner frequency one had to get in touch with change itself.


The rationalism that has dominated our intellectual life, with its focus on abstract concept and quantitative measure, has brought us precision and breadth. These, however, have been paid for by a thinning of the richness and intensity of experience.229

The Hungarian called for unifying

the scientist’s brain, the poet’s heart, the painter’s eyes. It is an integrated vision that we need; but our awareness and understanding of the world and its realities are divided into the rational – the knowledge frozen in words and quantities – and the emotional – the knowledge vested in sensory images and feelings.230

Whether Kahn was aware of these developments in contemporary thought is difficult to tell, but it is verified that Romanticism played a seminal role in his upbringing. Kahn’s mother Bertha Mendelowitsch, who claimed to be related to the German Romanticist composer Felix Mendelssohn and his grandfather Moses Mendelssohn, the prophet of Jewish Enlightenment,231 was his tutor and guide. She had studied literature and music in her youth, and according to Kahn’s wife was an “expert upon Goethe,” besides considering Friedrich Schiller and Friedrich Nietzsche her favorite authors. As Esther remembered, Kahn had kept several German books as gifts from his mother in his library, which he could probably read, since only high German, along with some Yiddish, was spoken at his parental home.232

Taking a closer look at German Romanticism, one discovers a whole storehouse of ideas that correspond with Kahn’s attempt to articulate an organic philosophy of design. To begin with, in close analogy to Kahn’s concept of the “existence-will,” Gottfried Wilhelm Leibniz had speculated in his Monadology (1714) that all organisms derived from monads with unique psychic pre-dispositions:

[W]e see from careful research into plants, insects and animals that natural organic bodies are never the products of chaos or putrefaction, but always arise from seeds, in which they are doubtlessly somehow preformed.233

Subsequently, also for Goethe, a transcendent life force animated, ordered and controlled all nature, and denoting this being in line with Aristotelian epistemology as an intangible soul, Friedrich Wilhelm Schelling published On the World Soul in

230 Ibid., p. 20.
231 The author could not verify that Bertha Mendelowitsch was directly related with Felix and Moses Mendelssohn. Cf. Hans-Günter Klein, Die Familie Mendelssohn: Stammbaum von Moses Mendelssohn bis zur siebenten Generation (Berlin: Staatsbibliothek zu Berlin, 2007).
1798, and Gustav Theodor Fechner added *Nana, or the Soul-Life of Plants* in 1848. In the philosophy of Arthur Schopenhauer “will” stood for this inner principle of growth and unity in nature, which lay, however, outside the territory of etiological explanation. It was the vital force, formative principle, *anima-mundi, or archeus*, all of which denoted nothing else than an inexplicable X: “[T]he will is what is primary, the *prius* of the organism, which is conditioned by it.”

Accordingly, one could recognize the will as

the force that shoots and vegetates in the plant, indeed the force by which the crystal is formed, the force that turns the magnet to the North Pole, the force whose shock he encounters from the contact of metals of different kinds, the force that appears in the elective affinities of matter as repulsion and attraction, separation and union, and finally even gravitation, which acts so powerfully in all matter, pulling the stone to the earth and the earth to the sun [...] .

A central facet to Romanticism was also its transcendental attitude. By spiritual reconcilement or *intellection*, man’s soul entered the soul of the world, by which means the self merged into union with the universal spirit. For the Romanticists it remained the peculiar task of poets and artists to communicate this experience, the viewing through the phenomena of nature into the Divine *noumenon*. The visionary poet laid claim to a superior truth of vision, since with his feelings and intuition he was capable of sensing the ultimate reality beyond the measurable realms of matter. In analogous terms, the transcendental tradition in America regarded nature in a pantheistic sense as the *body of God*, all united by the spirit of the over-soul. Ralph Waldo Emerson, the ideological head of the movement, of whose selected essays Kahn owned a copy, emphasized the immanence of divinity throughout the perceivable world and the human capacity to decipher it within oneself:

> Throughout nature, spirit is present; that spirit is one and not compound; that spirit does not act upon us from without, that is, in space and time, but spiritually, or through ourselves. Therefore, that spirit, that is, the Supreme Being, does not build up nature around us, but puts it forth through us. [...] Who can set bounds to the possibilities of man? 237

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2.2 From Transcendentalism to Form follows Function

Central to the American Transcendentalists’ experience in the mid-19th century was the encounter with the continent’s pristine wilderness and native culture. In *Leaves of Grass* (1855), of which Kahn likewise owned a first edition print, Emerson’s contemporary Walt Whitman urged American poets to transmit the country’s spirit and incarnate its geography, seasons and forms of life. Overall, for a young country challenged with defining itself, the tremendous landscape provided the most valuable source of possible identification. Besides, in a nation whose first presidents – George Washington, John Adams and Thomas Jefferson – were all farmers, a virtuous relationship with the land, personified in the figure of the self-sufficient farmer, formed the backbone of democracy.

In artistic terms this focus upon the natural domain was first articulated in the *tableaux* of the Hudson River School. With their depictions of pastoral natural settings, they helped to reveal the beauty of their own land. Gradually this contemplation developed into a philosophy in its own right, in which nature, with its awe-inspiring grandeur, evidenced the powers of God. It is crucial to point out that the Transcendentalist’s almost religious reverence of nature and its harsh exploitation through industrial means occurred in parallel. For the poet Thoreau and others, certain safety measures had to be taken in order to guarantee the preservation of the country’s treasures before all was spoiled by reckless destruction by profit-oriented entrepreneurs. As a first consequence, national and state parks were gradually established, and the implementation of large natural retreats within the booming cityscapes would promptly follow.\textsuperscript{238}

In architectural terms Andrew Jackson Downing’s treatises set the tone in advocating American cultural independence: having no more patience with architects who created “copies of the temple of Theseus,” Downing demanded the authentic expression of a building’s purpose. In his opinion this manifestation should develop “freely, as a tree expands which is not crowded by neighbors in a forest, but grows

\textsuperscript{238} The first one, Yellowstone National Park opened in 1872. The Conservation Movement would find its champion in President Theodore Roosevelt, who further popularized the idea that environmentally important areas should be set aside for the common good. Leading the way in the erection of vast metropolitan parks and parkway systems were Frederick Law Olmsted Sr. and Charles Eliot. Olmsted, a farmer by origin and deeply impressed by Joseph Paxton’s Birkenhead Park in the suburbs of Liverpool, designed the exemplary Central Park in New York in 1858 together with the Englishman Calvert Vaux. Following the imperatives of the picturesque landscape tradition, as a *people’s garden* it provided the citizens of the rapidly expanding metropolis with recreational and sanitary amenities that, in Europe, were only accessible to the privileged class. Olmsted and Eliot’s Emerald Necklace, besides the latter’s planning of the Boston Metropolitan Park System pursued these civilizing intentions through the creation of ribbons of green inlets that not unlike Kahn and Tunnard’s “greenways” formed a continuous web throughout the city.
in the unrestrained liberty of the open meadow." While Downing was making his claims, Thoreau, whom Kahn admired as a "wonderful man in the sense of feeling for all living things [...]," also sensed that it was time to create an original American architecture: "What of architectural beauty I now see, I know has gradually grown from within outward [...] without ever a thought for the appearance." This last quotation closely echoes the dictates of Horatio Greenough, an American sculptor who had been a classmate of Emerson's at Harvard. In 1843, in the essay "American Architecture," Greenough postulated:

Instead of forcing the functions of every sort of building into one general form, adopting an outward shape for the sake of the eye or of association, without reference to the inner distribution, let us begin from the heart as the nucleus, and work outward.

Indeed, these sentences sound very familiar when recalling Kahn's insistence on the immanent will to be from which a design should evolve. At the root of Greenough's writings figured also the idea of differentiation, and

as its first result, the bank would have the physiognomy of a bank, the church would be recognized as such, nor would the billiard room and the chapel wear the same uniform of columns and pediments.

In the burgeoning industry Greenough recognized the first recognizable examples of his ideas, because "in all these structures character has taken the place of dilettantism."

A similar striving for the truthful expression of a building's inner purpose characterized the work of Louis H. Sullivan. In 1873, he commenced his architectural career in the office of the Philadelphian architect Frank H. Furness, whose father had studied with both Greenough and Emerson, while the latter would remain a lifelong friend of the family. Most acclaimed for his Pennsylvania Academy of the Fine Arts (1871-6) with its delightful enfilade of sky-lit exhibition spaces and the

240 Louis I. Kahn, "Interview with Via," 11 January 1969, in Wurman, What will be has always been, p. 45.
243 Ibid., p. 63.
244 Horatio Greenough, "Structure and Organization," in op.cit., p. 117.
245 At the time of Sullivan's apprenticeship, Furness collaborated with George W. Hewitt, the brother of William D. Hewitt, in whose office Kahn shortly worked between June and September 1922. Cf. "Louis I. Kahn: Draft Resume, c. 1930," 330.I.B.5, SAKC.
vigorously composed University Library (1888-91), Furness sought inspiration from nature and not the dead past: “In all cases the student must go for knowledge to the fountain-head, Nature.”246 During his stay in Philadelphia, Sullivan might have also encountered the paintings of Thomas Eakins, who, according to Whitman, was the sole artist of the time “who could resist the temptation to see what they think they ought to rather than what is.”247

Eakins had taught at the Pennsylvania Academy of Fine Arts since 1876, and among his students was James Liberty Tadd, who in his own right would be influential in teaching Kahn at the Public Industrial Art School between 1912 and 1914.248 In New Methods in Education: Art, Real Manual Training, and Nature Study (1899), the educator allowed his ideas to coalesce:

> Children love nature instinctively. Nature speaks as loud today as ever, and all should hear her voice. As Emerson says, we must ‘bend to the persuasion which is flowing to us from every object in nature […].’249

Through the close observation of the “Book of Nature,” the apt student would be given a golden key to decipher all knowledge within the Divine script:

> If God speaks at all (and who doubts it?), He speaks through His works, ‘There are tongues in trees, books in the running brook, sermons in stone, and good in everything’ (Shakespeare).250

According to Tadd, a common spirit that the pupils immediately perceived penetrated all of nature’s works:

> Bring something into the class room like a new bird form, or fish form, and all of the children follow it with their eyes, which seem to almost stick out; there is no lack of attention here, the magnetic influence is at work, the divine energy is flowing.251

Consequently, he inquired if the task of the teacher should not be to

> make them so familiar with things that even the mud and dirt and weeds will seem filled with beauty and mystery? […] Make them realize the force that is in every common thing, that holds together each flower and leaf and stone; make them realize that ‘matter and spirit are two sides of one fact.’252

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250 Ibid., p. 62.
251 Ibid., pp. 253-4.
252 Ibid., pp. 62-3.
In methodological terms, students should begin by drawing objects from nature (Figure 62) – as much as possible from living forms – and only later investigate the abstract geometries of cubes, pyramids, spheres or cones that were submerged in nature’s morphological constitutions. In a last step, imaginative forms that sprang from the pupils’ minds would follow. Focused upon drawing, but also encouraging plaster modeling and woodcarving, Tadd’s goal was to synthesize the student’s hand, eye and mind into one instrument. For that purpose, special exercises such as ambidexterity and memory drawing were invented, since drawing as a “universal tongue” should be as automatically employed as speech and writing.²⁵³ Rice, who first encountered Kahn in the Public Industrial Art School, remembered Tadd as a “remarkable man” and recollected that his classmate “was an outstanding student in that school, renowned for his sketches of animals at the Zoo.”²⁵⁴ Altogether, Tadd’s curriculum had a manifest effect upon Kahn, who would continue to regard drawing as one of the centers of his professional occupation.²⁵⁵

²⁵³ Ibid., p. 33.
²⁵⁵ From early on Kahn had shown surpassing talent, for instance by receiving a first prize for “Original Free Hand Drawing” from the Academy of Fine Arts in 1919. On his later lecture tours Kahn
Sullivan after working briefly for William Le Baron Jenney in Chicago began his studies at the École des beaux-arts in Paris. After venturing back, the skyscraper, like the Bayard-Condict Building in New York (1897-9; Figure 63), turned in his hands into a continuous vertical object instead of several ones piled on top of each other. While the grand figure communicated with the scale of the city, the fractal patterns of its idiosyncratic decoration corresponded with the user and passer-by on the street. Studying mineralogy and plant morphology, Sullivan also kept nature at the center of his investigations:

My conclusions have been reached not in the racket of cities, nor in the study of garrulous philosophies, nor in libraries, nor in schools, but in the bounteous open air, within the infinite peace of Nature [...].

continued to parade his skills in ambidextrous drawing. Kahn’s notebook entry describing a day sketching in Carcassonne is a perfect testament to how Tadd had imagined drawing to function: “From the moment I entered the gates, I began to write with drawing [...]. I began studiously to memorize in line the proportions and the living details of these great buildings [...]. At the close of the day I was inventing shapes and placing buildings in different relationships than they were.” Richard Saul Wurman and Eugene Feldman, (eds.), The Notebooks and Drawings of Louis I. Kahn (Philadelphia: Falcon Press, 1962) n.p.


Louis H. Sullivan, Kindergarten Chats and other Writings (New York: George Wittenborn, 1955; 1901) p. 114. The Kindergarten Chats, initially written in 1901 as a series of weekly articles, were revised
Condensing Greenough’s earlier dictums into the compendious formula of “form follows function,” Sullivan elaborated his theory in the Kindergarten Chats of 1901:

[S]peaking generally, outward appearances resemble inner purposes. For instance: the form oak-tree, resembles and expresses the purpose or function, oak; the form, pine-tree, resembles and indicates the function, pine; the form, horse, resembles and is the logical output of the function, horse; the form, spider, resembles and is the tangible evidence of the function, spider.

For Sullivan, form existed because of function, and “this something behind the form is neither more nor less than a manifestation of what you call the infinite creative spirit, and what I call God.”258 Following the Latin motto of finis origine pendet (“The end depends of the beginning”),259 Sullivan was aware that function, which sounded abstract and profound, in reality referred to that need [...] which is seeking or finding fulfillment. If you put an acorn in the ground, that acorn, containing the function oak, will seek the form oak, and, in process of time, will become an oak-tree.260

This quote, almost a paraphrase of Kahn’s earlier statement, underlines that the inner function was not as in its later Modernist use a rational cause, but primarily represented a telluric force enlivening all organic creation. Accordingly, Sullivan clarified:

In seeking now a reasonably solid grasp on the value of the word, organic, we should at the beginning fix in mind the values of the correlated words, organism, structure, function, growth, development, form. All of these words imply the initiating pressure of a living force and a resultant structure [...] whereby such invisible force is made manifest and operative. The pressure, we call Function: the resultant, Form.261

Moreover, in his last theoretical work A System of Architectural Ornament: According with a Philosophy of Man’s Powers (1924), Sullivan reasserted his belief that mankind in its creations should proceed just like nature from the inside out. The pamphlet opened with a drawing of a germ, a typical seed with two cotyledons containing sufficient nourishment for the initial stages of a plant’s development (Figure 64):

The Germ is the real thing; the seat of identity. Within its delicate mechanism lies the will to power: the function, which is to seek and eventually to find its full expression in form.

collectively in 1918. In 1934, Claude Bragdon republished them, whereby the latter’s The Beautiful Necessity: Architecture as ‘Frozen Music’ (Rochester: Manas Press, 1910) is noteworthy, too, in relation to Transcendentalist architectural theory.
258 Ibid., pp. 43-6.
261 Ibid., p. 48.
Wright, “the good pencil in the Lieber Meister’s hand,” in many ways followed Sullivan’s organic doctrines. In 1959, when requested by the Architectural Forum to contribute a testimonial on Wright’s work, Kahn responded:

Wright gives insight to learn – That nature has no style – That nature is the greatest teacher of all – The ideas of Wright are the facets of this single thought.263

Kahn had visited numerous of Wright’s buildings including Unity Temple (1906) and further Prairie Style houses in Chicago’s Oak Park area, the Robie House (1908-10), Fallingwater (1934-8) and the Johnson Wax Administration Building. Besides, Wright was a constant presence in Philadelphia during the 1950s: in 1951 the exhibition “Frank Lloyd Wright: 60 Years of Living Architecture,” organized by Kahn’s former partner Stonorov, commenced its global tour in the local Gimbels department store. In 1954, a large reception took place in Philadelphia on behalf of Wright’s receipt of the American Institute of Architects Gold medal, and the same year, his design of the Beth Sholom Congregation in Elkins Park (1954-9) was announced.264 To outline

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262 According to Wright, Sullivan was “always active and effective in the investigation of Nature. [...] In his every design a bit of Nature enters into a building.” Frank Lloyd Wright, Genius and Mobocracy (New York: Duell, Sloan and Pearce, 1949) p. 3.
263 Telegram from Joseph Hazen, managing editor of The Architectural Forum, 10 April 10 1959; Kahn’s answer is undated; Cf. 030.II.A.61.42, LIKC. Talisien, Wright’s family retreat and workshop in northern Wisconsin was based on the principles of Unitarianism and derived its name from his Welsh ancestors referring it back to mythic heroes “born from natural elements such as grains, trees, and plants.” Exemplifying the idea of self-reliance, the apprentices as part of their fellowships not only worked on architectural projects, but also as farmers and craftsmen to maintain the autonomy of the community.
264 “Frank Lloyd Wright plans Synagogue here,” in The Sunday Bulletin, 23 May 1954; Cf. 030.II.A.66.6, LIKC.
Wright’s general popularity at the time, In the Nature of Materials: The Buildings of Frank Lloyd Wright was according to Kahn a sort of bible among his students.265 Deeply influenced by Emerson,266 Wright, too, spotted in nature the principles to create a “living architecture:”

I know with what suspicion the man is regarded who refers matters of fine art back to Nature. I know that it is usually an ill-advised return that is attempted, for Nature in external, obvious aspect is the usually accepted sense of the term and the nature that is reached. But given inherent vision there is no source so fertile, so suggestive, so helpful aesthetically for the architect as a comprehension of natural law.267

As indicated in these lines, Wright’s study of natural forms relied on an in-depth analysis; he was like Kahn an abstractionist seeking the patterns behind nature’s superficial appearance:

What we must know in organic architecture is not found in books. It is necessary to have recourse to Nature with a capital N in order to get an education. It is necessary to learn from trees, flowers, shells – objects which contain truths of form following function. If we stopped there, then it would be merely imitation. But if we dig deep enough to read the principles upon which these are activated, we arrive at secrets of form related to purpose that would make of the tree a building and the building a tree.268

Nonetheless – and this is relevant in relation to Kahn’s later attitude, too – Wright insisted that architecture was ultimately not nature, but in Romanticist terms “a child of the spirit of man.”269

2.3 Spatial Differentiation and Square Compositions

What Kahn and Wright shared further in common was first a longing to constitute proportionally interrelated frameworks, in which, as Wright put it, “part is to whole as the whole is to the part;”270 second, a concern for basic geometries; and third, a coequal

270 Frank Lloyd Wright, “What’s the Matter with America?” (unpublished speech delivered in Los Angeles, 1954), in Uechi, op.cit., p. 132. For Wright, most of all “Gothic architecture approached the organic in character.” Wright, Genius and Mobocracy, p. XI.
emphasis on differentiation. Regarding the last and based on the precept that every problem contained its particular solution, Wright had indicated a longing for such individuation as early as 1908, when he demanded “In the Cause of Architecture:”

There should be as many kinds (styles) of houses as there are kinds (styles) of people and as many differentiations as there are different individuals.271

Difference, for both Wright and Kahn, possessed a clue to the essence of what something wanted to be. In a congenial way, Kahn criticized his earlier design of the Yale Art Gallery, saying that he would now “give the [director] spaces that were there and had certain inherent characteristics.”272 His subsequent ideological focus on differentiation clearly contradicted the spatial homogeneity derived from the universal space: “If you can now put columns as much as 100’ apart you may lose more than you gain because of the sense of the enclosed space disappears.”273

Kahn’s basic awareness to differentiate the elements of his architectural composition derived from his Beaux-Arts education, where he had learnt in Guadet’s Éléments et théorie de l’architecture (1901) to distinguish between “surfaces utiles” and “communications nécessaires.” This implicated that next to useful spaces, “no plan should ever be reduced to those useful surfaces only,” since there is always a need for openings, some neutral surfaces so to speak, which will link up the first ones, which will allow the accesses and the passages from one floor to the other, which will allow light and air to reach those parts that have no access to public space, and which will be, in a word, the arteries of the composition.274

This tendency to classify the compositional elements was further promoted in Talbot Hamlin’s Forms and Functions of Twentieth Century Architecture (1952) that divided a building’s structure into “structural elements” and five types of “use elements:” rooms for public and private utilization, service areas, passages for horizontal and vertical circulation, as well as areas for mechanical equipment:

A knowledge of this alphabet is essential to [the architect] as a knowledge of words to the writer or of notes to the musician. No building can exist without some of them, and upon their correct arrangement and design the success of the building, both practically and aesthetically, will almost entirely be founded.275

271 Wright, “In the Cause of Architecture,” p. 87.
272 Kahn, “Talk at the Conclusion of the Otterlo Congress,” p. 213.
Further evidence of Kahn’s attempt to define a more compartmented approach is found in his notebooks from the mid-1950s. Positioning his own approach in relation to the architecture of Mies van der Rohe and Le Corbusier, Kahn argued, while the latter felt “[w]hat a space ‘wants to be’ […],” the former did not sense it:

Mies’s order is not comprehensive enough to encompass acoustics, light, air, piping, storage, stairs, shafts, vertical and horizontal and other service spaces. His order of structure serves to frame the building but not harbor the servant space.276

These notes underline that the burgeoning concept of “the nature of the space” vehemently criticized the Miesian order. Contrasting its spatial continuity that permitted a large space to be divided into smaller ones, Kahn’s novel approach was to foster separate albeit hierarchically interdependent spatial units. Following their distinct nature, the individually defined rooms should assemble in a rhythmically coordinated organization of “served” and “servant” spaces to form a “society of rooms.”277

Tracing the origins of Kahn’s concern with individuation, it is notable that in 1931, in his first published essay, “The Value and Aim in Sketching,” the general ambition to recognize an object’s intrinsic qualities was already present: “We must learn how a steamship is to be given its character as devotedly as how a cactus plant can be given its particular character […].”278 In addition, in the illustration “The Plan of a City is like the Plan of a House” for the booklet You and Your Neighborhood from 1944 (Figure 65), Kahn revealed an early yearning to emphasize the diversity of atmospheres within a single building, as he compared each room with a separate part of a city.279 Likewise, Van Eyck had discovered evidence for the analogy of the house and the city during a sequence of study trips to Africa. While the chambers of a Dogon house represented separate bodily organs, the houses, in turn, were the organs of the city, and therefore, also conceived in the androgynous image of man (Figure 66).280 It was especially in

\[276\] Kahn, “Notebooks,” 288.III.15, RSWC.


\[279\] Again in close analogy, Wright had remarked: “[E]ach room has its own individuality and its use completely recognized in the floor plan. Dining room, kitchen, and sleeping rooms thus may become small buildings in themselves. All are grouped together to form a whole […].” Wright, Ausgeführte Bauten und Entwürfe – Studies and executed Buildings (Berlin: Ernst Wasmuth, 1998; 1910) p. 39.

\[280\] Cf. Aldo van Eyck with Paul Parin and Fritz Morgenthaler, “Miracle of Moderation,” in Viá, no.1, 1968, pp. 96-124; orig. published in Forum, vol.20, no.7, 1967. In the spring of 1960, Van Eyck visited the Dogon, who lived in some 700 scattered communities along the Bandiagara plateau in present-day Mali. The Dogon’s mud-brick houses and granaries virtually grew from the rocky cliffs, and all the products of their design, from a simple basket to the more complex granaries, were charged with extra symbolic meanings inherent in the geometries used: the circle standing for the sun and the square for the sky. Cf. Aldo van Eyck, “The Child, the City and the Artist,” manuscript (1962), 109.II.E.6.1, ILMC;
his project for an Orphanage in Amsterdam (1955-60) that Van Eyck addressed the reciprocal notion that every house ought to be like a small city and every city like a large house.\textsuperscript{281} The Dutch architect’s dogma to “conceive architecture urbanistically and urbanism architecturally,”\textsuperscript{282} also stretched back to the Renaissance. In \textit{De re aedificatoria} of 1452, Leon Battista Alberti had already wondered:

If (as the philosophers maintain) the city is like some large house, and the house is in turn like some small city, cannot the various parts of the house – atria, xysti, dining rooms, porticoes, and so on – be considered miniature buildings?\textsuperscript{283}

\textit{Fig. 65}: Louis I. Kahn, “The Plan of a City is like the Plan of a House,” 1944.

\textsuperscript{281} “Make of each window and each door a place, a bunch of places of each house and each city. Make also of each house a small city and of each city a large house.” Aldo van Eyck, “There is a Garden in her Face,” in \textit{Forum}, vol.15, no.3, 1960-1, p. 121. Cf. Vincent Ligtelijn and Francis Strauven, (eds.), \textit{Aldo van Eyck: Collected Articles and Other Writings, 1947-1998} (Amsterdam: Sun Publishers, 2008) pp. 291-2.


To remain with Van Eyck, as noted already in relation to his hexagonally planned Open-Air School in Amsterdam, he shared with Kahn an interest in the application of basic geometrical patterns. As the more than 700 playgrounds in Amsterdam prove, these exercises in arranging primary forms derived from a similar education under
Beaux-Arts guidelines at ETH Zurich,284 but also from Van Eyck’s personal exploration of the basic gestures of spatial communication in tribal African communities that, due to their isolated desert location, had remained largely unchanged.285 For him, it was the perfect place to discover the constant aspects of architectural form, since

Modern architecture has been harping continually on what is different in our time to such an extent that even they have lost touch with what is not different, with what is always essentially the same.286

Much in the vein of Kahn’s aphorism, “What was has always been – What is has always been – What will be has always been,”287 the Dutch architect – quoting James Joyce, “Anna was, Livia is, Plurabell’s to be”288 – regarded contemporary man just as lost vis-à-vis the world as the earliest man had been. He faced the same inexorable natural laws that made stone just as hard and fire just as hot today as it had been thousands of years ago. Similarly, Kahn would later affirm, “[t]he man of old had the same brilliance of mind as we assume we have only now.”289

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285 In 1943, just after graduation and intrigued by Marcel Griaule’s ethnographic account “Mission Dakar – Djibouti – Dogon, 1931-3,” Van Eyck conducted the first of his African journeys with the goal to reach the holy city of Kairouan; Medenine, the city of domes; as well as Ghadames, one of the jewels of the Sahara. Not successful on this occasion, he visited them only on later trips between 1947 and 1952. Cf. Aldo van Eyck, “Building in Southern Oases,” in Forum, vol.8, no.1, 1953, pp. 28-38. In Zurich, the Dutch architect made the acquaintance of Carola Giedion-Welcker, who introduced him to the artistic avant-garde that had – triggered by the opening of the Musée d’Ethnographie du Trocadéro in 1882 – shown a comparable fascination for tribal art forms half a century earlier.

286 Aldo van Eyck, in Newman, CIAM ’59 , p. 27. “Our problems are also those of eternal man – of archaic man. [...] Man is always the same, in all places on earth and in all times.” Van Eyck “Talk at the Otterlo Congress” (transcription of Van Eyck’s lecture on 11 September 1959), in Ligtelijn and Strauven, Collected Articles and Other Writings, p. 199. As Eeva-Liisa Pelkonen pointed out, in his own quest to uncover the underlying essence of architectural form Kahn might have also been influenced by the publication of The Shape of Time (1962) by the Yale art historian George Kubler, which “put forward the idea that rather than innovation and originality, art was about reworking existing paradigms and formal problems throughout history.” Pelkonen, Toward Cognitive Architecture,” p. 140. Earlier, Le Corbusier when describing the construction of the primitive hut in Vers une architecture had noted: “There is no primitive man; there are primitive means.” Le Corbusier, Toward an Architecture, p. 133.

287 Louis I. Kahn interviewed by Robert Wemischner, 17 April 1971, in Wurman, What will be has always been, p. 116.

288 James Joyce, “Anna Livia Plurabelle,” (1929) in Finnegans Wake (1922-39); and quoted by Van Eyck in “Kaleidoscope of the Mind,” in Via, no.1, 1968. Kahn’s quote also echoes the words in the book of Ecclesiastes (1:9): “The thing that hath been, it is that which shall be; and that which is done is that shall be done: and there is no new thing under the sun.”

It is no easy step to move on from the Dogon to Kahn’s urban studies for the Midtown of Philadelphia (1952-7), yet in both cases the use of simple geometric forms ordered the plan. In the early stages of the project, Kahn employed a modular triangular grid, while the most distinctive edifice was a cylindrical glass building that housed the bus station on the concourse level, a hotel in its peripheral wall and a department store in the darker middle zone. In the further development, Kahn devised several such volumes as parking garages that, like fortification towers, surrounded the city center and protected it from automobile traffic (Figure 67). Fascinated by the Martello Towers at the coast in Kent (Figure 68) as well as the cylindrical structure of Cecilia Metella’s Mausoleum on Via Apia in Rome (1st century BC) – here depicted in a *veduta* of Giovanni Battista Piranesi from *Le antichità romane* (1756; Figure 69) – the American architect formalized his parking facilities as similarly powerful and autonomous elements in the cityscape.290

Leaving Kahn’s urban studies aside, in his proposal for the Adath Jeshurun Synagogue (Figure 70), both the project’s individuated plan as well as its strict formal dictum were remarkable: bound by a circular car ramp orbiting the building, a triangular floor plan hosted in its corners three triangular hollow columns with skylit stairs. The absolute geometries of the building harshly opposed the surrounding sloping terrain, which Kahn left undisturbed as a preserve for “the enjoyment of nature’s designs.”291 Kahn’s use of such archetypical forms was fueled by the publication of Emil Kaufmann’s *Three Revolutionary Architects: Boullée, Ledoux and Leque* in 1952 (Figure 71). The study refocused attention on the work of this exceptional group of late 18th-century French architects,292 who had postulated an absolute architecture of...
Fig. 67: Louis I. Kahn, Study for Midtown Philadelphia, Pennsylvania, 1952-7.

Fig. 68: Martello Tower, Coast of Kent, England.
Fig. 69: Giovanni Battista Piranesi’s depiction (1754) of Cecilia Metella’s Mausoleum, Rome, Italy, 1st century BC. Postcard from Louis I. Kahn to Anne Griswold Tyng, 1950.

Fig. 70: Louis I. Kahn, Adath Jeshurun Synagogue, Elkins Park, Pennsylvania, 1954.
Fig. 71: Emil Kaufmann, *Three Revolutionary Architects*, 1952.
formal restraint that contrasted the excesses of the Baroque. However, Kahn seemed attracted not merely by the Revolutionary Architects’ preference for simple stereometric volumes, but also by their ideological aspiration to create a communicative architecture, an *architecture parlante*, which manifested a building’s capacity to enunciate the *caractère* inherent in a given task – indeed, a postulate that was akin to Kahn’s spatial rhetoric of articulating a building’s particular existence-will.

Their visionary proposals – in Boullée’s case of colossal Egyptian-Mesopotamian scale – were omni-directionally conceived with egalitarian façades on all sides, appeared detached from their pastoral surroundings – an aspect even more encouraged by the frequent elevation of the buildings upon pedestals – and encapsulated the guiding ideas of the Enlightenment and its breakthroughs in the natural sciences. For example, their pursuit to dismantle the five classical orders in order to constitute a more elemental basis of Euclidean forms coincided with chemistry’s gradual decomposition of the traditional four elements. In a way, the oxygen and hydrogen discovered by Lavoisier corresponded with the Revolutionary architects’ appraisal of the sphere, cube, and cylinder as the essential members of their *arché-periodic* nomenclature. Similarly, in the *Précis des leçons* (Figure 72) Durand had systematically classified designs according to a *periodic table* of primary forms, mostly the square and circle. With his rationalizing intentions, the “disposition” of the individual spaces as an *ars combinatoria* became the discipline’s main task. Turning the attention to a plan’s formal syntax, architecture implied the coordination of basic, clearly defined spaces, which were according to Durand “like words in language or notes is music.” Of this, Kahn, a passionate piano player, was well aware: “To the musician his writing means something beyond itself – it means sound, it means organization of sound.”

Kahn, between 1951 and 1955, in a series of small, unrealized single-family houses, continued to elaborate his paradigm of spatial differentiation. What connected the Fruchter, Jaffe, Adler and Weber de Vore Houses besides their compartmented structure was the application of the square as a formal unit. In the Fruchter House in Philadelphia (1951-4), three equally dimensioned, structurally self-contained square units – one for the living area, the bedroom, and the kitchen – surrounded a triangular courtyard. In the Jaffe House in Philadelphia (1954), the inner triangular courtyard was omitted in order to create a configuration solely made up of squares. If the arrangement of the squares surrounding the Fruchter House’s interior triangle was static, the overall organization of the Jaffe House was more dynamic:

293 Among the wide range of projects presented in Kaufmann’s publication, Claude-Nicolas Ledoux’s Guinguette in Faubourg St. Marceau (1780) in formal terms most closely resembled Kahn’s synagogue design.
296 Also during the 1950s, Albers ritualized the square in his “Homage to the Square” series.
The equal squares of 24 x 24 are placed as suits best the dictates of orientation view trees contours. [...] It is more adaptable and therefore more true to conditions of nature.\textsuperscript{297}

The subsequent projects of the Adler House in Philadelphia (1954-5; Figure 73) and the Weber de Vore House in Montgomery County, Pennsylvania (1954-5; Figure 74), attempted in their asymmetric arrangement to become as versatile as the Jaffe House. In both cases, each pavilion-like sub-volume was structurally and spatially complete, while in the Adler House four hollow masonry piers defined the corners of each space to provide “the avenues to harbor today’s complex mechanical requirements including complete air conditioning.”\textsuperscript{298} Kahn’s independent entities were of equal size, but of varied height and materials. Grouped so as to strengthen the composition in its entirety, simultaneously the autonomy of each was consolidated. Indeed, Kahn’s configurative approach conceived the individual elements in a manner such that their identity should not be lost in the process of repetition, but, on the contrary, be reinforced within the constituted whole.

\textsuperscript{297} Tyng, \textit{The Rome Letters}, p. 117; letter 16 March 1954.
Fig. 73: Louis I. Kahn, Adler House, Philadelphia, Pennsylvania, 1954-5.

Fig. 74: Louis I. Kahn, Weber de Vore House, Montgomery County, Pennsylvania, 1954-5.
2.4 Humanist Principles of Organization

In 1955, Kahn’s outlines on the compartmented space converged with the erection of a small Bath House in Trenton, New Jersey (Figure 75). Forming an overall cross-shape, four separate square structures, each topped with a pyramidal roof, surrounded an inner courtyard with a circular *impluvium*-like engraving on the floor. The sub-units were identical in size and each had four hollow columns in its corners that combined structural and functional tasks (Figure 76). In acknowledgment of the individual existence-will of each of the pavilions, the placement of non-bearing walls slightly differed in relation to the pavilions’ varying programs. In terms of geometry and contextual placement, the project again approximated the outlines of the Revolutionary Architects: its stereo-metric, omni-directional contours subjugated the natural givens,299

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299 As Kahn recalled, his insistence on differentiation had in fact brought him the commission: “They chose me because they felt by my submissions that I was the one man who did not repeat himself in his work and therefore they can expect a solution in keeping with their problem.” Tyng, op.cit., p. 183; letter 29 October 1954.
as Kahn had indeed designed a *perfect* building in the midst of the rough environment. Neglecting an interaction with its outer context, the design produced a static image paradigmatically developed from the inside outwards. Without windows, and therefore without a conventional façade, the self-contained composition avoided in its opaqueness a dialogue with the surroundings. Only a square shaped oculus, crowning each of the pavilion’s pyramidal hip roofs, delivered light to the interiors. The use of zenithal light further emphasized the autonomy of the project, as the only outside views related to the distant sky. Like the Pantheon in Rome with its crowning *opaion*, each substructure was an “inward-focused, upward-directed” universe.

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300 Cf. Neil Levine, “Kahn’s Edge: The Provocative Historicism of the Trenton Jewish Community Center,” in Von Moos and Eisenbrand, *The Power of Architecture*, p. 106. Regarding the Pantheon, Kahn corroborated, “If architecture may be expressed as a world within a world, then this building expresses it well, even refining it, by placing the oculus, the only window, in the center of the dome.” Wurman and Feldman, *Notebooks and Drawings*, n.p. The Bath House, however, would be more accurately described as a doubly inverted structure, as not only the pavilions with their oculi were separate worlds in themselves, but also the inner courtyard was a detached universe. Interestingly,
Kahn’s application of a *quincunx* or cross-in-square plan relates the project to a wide array of possible references. Early humankind had placed a right-angled cross, inscribed either in a square or in a circle, on their settlements as a basic symbol. The Egyptian hieroglyph for a city was the cruciform, and later the Romans, in their founding of cities orthogonally crossed the *cardo* with the *decumanus* in order to transpose the *templum* of the sky to the earth (Figure 77). In “The Idea of a Town,” an article published under the auspices of Van Eyck as editor of *Forum* in 1963, Joseph Rykwert noted:

> It is difficult to imagine a situation when the formal order of the universe could be reduced to a diagram of two intersecting co-ordinates in one plane. Yet this is exactly what did happen in antiquity: the Roman who walked along the *cardo* knew that his walk was the axis round which the sun turned, and that if he followed the *decumanus*, he was following the sun’s course.\(^\text{301}\)

In simple terms, the cross-shape symbolized man’s aspiration to give the inaccessible and thus mentally threatening cosmos human measure and make one feel “at home in it.” According to Rykwert, the templum was

> to turn the hilltop on which it was performed into the centre of the universe. [...] The augur’s act in drawing his diagram on the ground changed the earth he touched from *anywhere* to *this, unique and only* place.\(^\text{302}\)

With similar motives of cosmic reflection, cruciform shaped churches – *bodily temples* – found wide application during the spread of Christianity.\(^\text{303}\) As a paragon served the Byzantine Church of the Holy Apostles in Constantinople (c. 536) with its far-reaching influence upon designs such as St Mark in Venice (1063-85) and St Front of Périgueux (after 1120; Figures 78, 79). Analogous to the disposition of the Trenton

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\(^{301}\) Joseph Rykwert (with an introduction by Aldo van Eyck), “The Idea of a Town,” in *Forum*, vol.17, no.3, 1963, p. 143. As a source Rykwert mentions Hyginus Gromaticus, a surveyor and near-contemporary of Vitruvius: “Boundaries are never drawn without reference to the order of the universe, for the *decumani* are drawn in line with the course of the sun, while the *cardines* follow the axis of the sky,” i.e. the *cardo* is pointing to the pole (the axis of the universe), while the *decumanus* follows the equinox of the rising and setting sun. Ibid., p. 117. Vitruvius described in detail the construction of an eight-sided wind rose to determine a city’s main directions. Cf. Vitruvius, *On Architecture*, I, Ch. VI, § 6-7.

\(^{302}\) Rykwert, op.cit., p. 116.

Fig. 77: Roman Templum, 6th century.
Fig. 78: St Front, Périgueux, France, after 1120.
Fig. 79: St Front, Périgueux, France, after 1120.
Bath House, all these examples employed bi-axially symmetrical Greek-cross plans, domical roofs, and hollow clusters of piers. Yet, they differed markedly in terms of materialization: compared with the glittering mosaics in the interior of St Mark’s, the Bath House’s constructive expression was prosaic and ascetic. This “lack,” to use Neil Levine’s term, reveals that Kahn’s assimilation of historical sources went not only formally, but also in constructive terms through a process of abstraction, which in the latter case implied to unmask the naked structure.

Simultaneously, Kahn found inspiration for his hierarchical space order in Palladio’s œuvre, as he stated: “A bay system is a room system – a room as an area flanked by its supports.” In the cruciform-shaped Villa Rotonda in Vicenza (1566; Figure 80), smaller cubicles, in which the human servants were installed, surrounded a circular master space at the core. Notably, Palladio compared the parti of a dwelling to a human body, whereby the noble and beautiful parts should be exposed and the ignoble but functionally essential ones hidden from sight. His assumptions stemmed from Alberti, who had traced the origins of partitio to

the process of dividing up the site into yet smaller elements, so that the building may be considered as being made up of close-fitting smaller buildings, joined together like the members of the whole body.

In 1973, Kahn termed the areas within the structural supports poché-spaces, and pointed out that the Basilica of St Peter in Rome (Bramante, Michelangelo, et al.; 1506-1626) had also made use of such hollow piers containing passageways. A year later, Kahn attributed these insights to his Beaux-Arts training:

From poché I learned the difference between the hollow wall and the solid wall. [...] I made the wall a container instead of a solid. That came directly from my training in Beaux-Arts. So did the idea of the service spaces and the spaces served.

304 Besides these similarities, also the application of quadrature should be indicated, which, involving a 45° rotation of nesting squares, produced like proportioned figures in a v2 sequence. Kahn would repeatedly apply this geometrical device to determine the position and size of his plan’s elements.


306 Cf. 288.III.15, RSWC. Kahn owned Palladio’s The Four Books on Architecture (1965; I quattro libri dell’architettura, 1570), besides a number of other treatises on Renaissance architecture: Filarete’s Trattato di architettura (1460-4; 1972), Francesco di Giorgio Martini’s Trattati di architettura ingegneria e arte militare (1478-81; 1967), Friedrich Peyer im Hof’s Die Renaissance-Architektur Italiens (1870) or Léon Palustre’s L’architecte de la renaissance (1892).


308 Alberti, On the Art of Building, I, § II.

A more recent example using spatial columns was Wright’s Unity Temple: its four freestanding, concrete piers housed mechanical devices and supported the cantilevered coffered ceiling with zenithal openings. Arguably, both the Unity Temple and the Bath House comprehended the structure as an organism, and this conception of the system as a whole encouraged greater cohesion, since all spaces were mutually dependent upon each other. In the Darwin D. Martin House in Buffalo, New York (1904) Wright had utilized a congenial strategy of spatial optimization to “realize the higher truth that form and function are one.” Consequently, mechanical devices such as lighting and radiators should find their proper place in the three-dimensional

composition, and Wright, just like Kahn, sought to build these into the primary spatial structure of his buildings.\footnote{131}

A couple of Kahn’s following projects – the unrealized Martin Research Institute for Advanced Science in Baltimore (1956-8) and a competition entry for the Washington University Library (1956) – related directly to the Trenton Bath House. As for the first, after having initially experimented with a hexagonal scheme, the project’s final stage consisted of a couple of one-story high structures placed on a precise east-west axis. On the western side were the entrance, library, dining hall and other communal spaces; all located within a square divided into nine equal parts. Once again employing multifunctional hollow columns in the corner of each individual square, the gable-shaped ceiling of the outer and middle units extended above the flat connection zones to generate an undulating roof structure. On the eastern side, the laboratory building had as an outline a stepped cross-figure and included four courtyards. Each separate ceiling was supported by a tree-like pillar made up of two rectangular shafts containing the functional devices, while the central part of each larger cross-module was raised above the outer ones in order to establish clerestory windows that allowed light to enter into the darker middle zones.

In the Washington University Library Kahn also employed a basic cruciform shape. The Library’s pyramidal massing, reminiscent with its stepped section of a Babylonian ziggurat, clearly followed the Revolutionary Architect’s doctrine of establishing autarchic masses that were activated by the simple play of light and shadow. Indeed, Claude Nicolas Ledoux’s description of his cross-shaped House of Education (1773-90) could just as well be used to characterize the elevations Kahn drew of his intervention:

\textit{What diversity when the rising sun spreads its shadow over the earth! What flickering effects when the moon traces labyrinths of light on the building?}\footnote{132}

While remaining detached from the context through its absolute shape, at least Kahn’s projected facades acknowledged the different intensities of light across the sun’s diurnal course as he applied varying sunscreens – horizontal \textit{brise-soleils} towards the southern sides and V-shaped metal elements towards the west – to prevent the interiors from becoming too gloomy.

\footnote{131} It should be supplemented that a basic cruciform disposition characterized many of Wright’s Prairie Style houses, which enabled the separate wings to take a better hold of the terrain and permit light to enter on all sides.\footnote{132} Claude Nicolas Ledoux, \textit{L’architecture considérée sous le rapport de l’art, des moeurs et de la législation} (Paris: Hermann, 1997; 1804) p. 348; transl. by the author.
2.5 Tartan Grids and Formal Gardens

Altogether, no other project exemplifies the transformation that occurred in Kahn’s architecture during the mid-1950s better than the unexecuted Jewish Community Center (1954-9) in Trenton. While the preliminary schemes articulated a cellular structure that related to an atomic comprehension of nature, the later bay system referred to Renaissance directives of spatial organization with interstitial rooms for services and circulation. The initial project was based upon the repetition of two interlocking polygonal figures: a small servant square and a larger served octagon (Figure 81). This basic configuration created a modular structure that could be extended horizontally, as well as vertically close-packed, although leaving some intervals. The vertical structure approached the tessellated configuration of a rhombicuboctahedron (Figure 82), which derives its name from the fact that twelve of the square faces lie in the same planes as the twelve faces of the rhombic dodecahedron, the bee’s polyhedron.

Since the invention of the microscope – and notably Kahn possessed one, too313 – scientists had immersed themselves in the study of organic tissues. Lord Kelvin’s suggestion of the 14-faced tetrakaidecahedron (Figure 83 top), which was also illustrated by Thompson in On Growth and Form and would be used by Tyng in her proposal for the General Motors Exhibit at New York’s World Fair in 1964 (1960-1),314 added a new polyhedron to the analysis. As Thompson verified, extensive quantitative studies of vegetable parenchymas were undertaken in the first half of the 20th century, which revealed that polyhedral shapes approaching the tetrakeidecahedral form, with an average of 13.96 faces were the typical form cells approximated (Figure 83 bottom).315 Kahn, or one should rather say, Tyng, pursued such strategies of close-packing in the design of the Erdmann Hall Dormitory in Bryn Mawr, Pennsylvania (1960-5; Figure 84). Her approach was pointedly dubbed the “molecular plan” by the college’s president,316 and according to Kahn

> a brilliant exercise of how one with a tremendous mind for geometry [...] how far with that knowledge it can come to almost the nonconscious ways of nature, that you can come very close to it as though you were just an agent of nature.317

His own proposal refuted this complete subordination to nature and reinforced an attitude of “man emerging out of nature,” since “without the help of man, nature would not have been able to serve man.”318

313 Interview by the author with Harriet Pattison, 11 June 2009.
314 According to Tyng, “[i]t is a shape formed by close-packed bubbles and provides maximum volume with minimum surface. All its joints are in the tetrahedral carbon bond.” Tyng, The Rome Letters, p. 198.
315 Cf. Thompson, On Growth and Form, pp. 551-5.
316 Cf. Tyng, op.cit., p. 205.
317 Prown and Denavit, Kahn in Conversation, p. 186. Concerning Tyng’s proposal, Kahn enclosed that it was “more true to geometry, which Anne Tyng knew much more about than I did [...].”
318 Ibid.
Returning to the Jewish Community Center, in late 1956 Kahn abandoned the close-packed scheme, since the rather small-scale cellular aggregate did not offer a solution for integrating the more public spaces of greater size as separate structural and spatial entities. Hence, a bay system was now introduced with hollow columns assuming both structural and functional tasks (Figures 85, 86). This proposition displayed a greater appreciation for the spaces’ particular existence-will: a higher gymnasium and an intermediate-height social hall surmounted the entire composition, while the remainder of the structure was serially arranged with lower, Bath House-like pavilions. An even lower and narrower circulation zone, the actual bays interconnected all the parts of varying height and size. The project’s clustered arrangement with consistently repeated domes crowned by oculi conformed with Van Eyck’s contemporaneously
designed orphanage in Amsterdam (Figure 87), this “casbah organisée” based on the configurative principles of Structuralism, but also classical references like the Roman imperial baths with their juxtaposition of clearly defined spaces within a superior tartan-gridded order. In the same breath, it recalled Vitruvius’ technique of linking the modulated parts of a building to the whole in order to attain a concord of correlation called symmetry:

For without symmetry and proportion no temple can have a regular plan; that is, it must have an exact proportion worked out after the fashion of the members of a finely-shaped human body.319

Kahn, having earlier rebelled against the doctrines of the Beaux-Arts system while attempting to be a thoroughly Modern architect, now returned to certain of its innermost

319 Vitruvius, *On Architecture*, III, Ch. I, § 1. When correctly applied, symmetry should generate recurrences of the same theme throughout the entire edifice and result in *eurhythmy*. 
Fig. 84: Anne Griswold Tyng, “Molecular Plan,” Erdmann Hall Dormitory, Bryn Mawr, Pennsylvania, 1960-5.
Fig. 85: Louis I. Kahn, Jewish Community Center, Trenton, New Jersey, 1954-9.

Fig. 86: Louis I. Kahn, Jewish Community Center, Trenton, New Jersey, 1954-9.
principles of composition: formal stringency, harmonic proportion, hierarchical organization, spatial individuation, and volumetric composition. This return to classical precepts was extended to the planning of the larger environs as well, as the appended site plan from 1957 shows (Figure 88). In collaboration with the Philadelphian landscape architect Edward A. Maurer, Kahn made extensive use of trees, which planted in gridded, regular masses enclosed and defined the exterior spaces of the pool area, parking space and community green. The formal landscaping extended the building’s inner logic into the wider terrain just as it had done in countless Renaissance gardens like the Villa d’Este in Tivoli by Pirro Ligorio (1559-80; Figure 89) or the Villa Lante in Bagnaia by Giacomo Barozzi da Vignola (1564 onwards; Figure 90).

George Patton, a landscape architect who was a fellow while Kahn stayed at the American Academy as an architect-in-residence, and with whom he would collaborate
extensively throughout the rest of his career, had analyzed and photographed numerous of these villas during his studies. What these revealed was an integrative approach to landscape design, in which buildings and surroundings merged into a unit of analogous formal articulation. Following the example of the Roman Sanctuary of Fortuna Primigenia in Praeneste (1st century BC) with its spectacularly terraced landscape and other Roman palazzos like the one photographed by Patton (Figure 91), Renaissance villas – just like Kahn’s intervention – sought an obvious connection between the buildings and their surroundings, at times making the ground floor patterns almost unrecognizable within the larger garden dispositions. Whether in Donato Bramante’s Belvedere Courtyard in the Vatican (1506 onwards) or the Boboli Gardens laid out in Florence by Niccolo Tribolo (1550 onwards), these landscapes generated a suite of outdoor reception rooms flooded with unlimited light and air. Their geometrical rigor asserted an attitude of dominance over the natural

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322 Kahn might have visited a number of these gardens during his stay at the American Academy in Rome. George Patton traveled extensively with Kahn (also to Greece and Egypt), and in his slide-collection images of the mentioned gardens, besides numerous others, can be found. Cf. 033.III.C (Roman slides in metal retainers), GEPC.
Fig. 89: George Patton’s Student-Drawing of Pirro Ligorio, Villa d’Este, Tivoli, Italy, 1559-80.
Fig. 90: Giacomo Barozzi da Vignola, Villa Lante, Bagnaia, Italy, 1564 onwards.

Fig. 91: Roman Palazzo and Garden.
domain; indeed, nature played a subordinate, almost extraneous part. This treatment of nature as a human commodity found its legitimization in Genesis (1:26):

Let us make man in our image, after our likeness: and let them have dominion over [...] all the earth, and over every creeping thing that creepeth upon the earth.  

It is probable that Kahn was at the time of the planning of the Jewish Community Center still in contact with Kiley, who in the contemporaneous garden layout for the Miller House in Columbus, Indiana (1955-8; Figure 92) showed very similar formal interests.  

Saarinen, who acted as the house’s architect, considered “architecture not as building alone, but the building in relation to its surroundings, whether nature or man-made surroundings.”  

Kiley extended this idea of unity between architecture and the land to encompass the entire relationship between man and nature:

Man is nature. Is that not exciting to realize? It’s not man and nature. It’s not man with nature. Man is nature, just like the trees. Both live and grow.

The ordered arrangement of this “Contemporary Palladian Villa,” as the Architectural Forum termed the Miller House in September 1958, was complimented in its geometrical outlines by Kiley’s design of the environs: “So I took this same geometry and made rooms outside using trees in groves and allées. And the whole thing becomes a geometry.”  

One of the rebels of the Modern landscape movement, Kiley, when serving during the Second World War in Europe, had come under the spell of the Baroque gardens of André Le Nôtre at Vaux-le-Vicomte (1656-61; Figure 93) – here again depicted by an image of Patton – Versailles (begun 1661) and Chantilly (1670-88):

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323 Dismissed from the abundant Garden of Eden into a world of disdain and torment, humanist landscapists in their ordered arrangements attempted to offer short moments of retreat from the secular disarray.

324 Kiley was a visiting critic at the department of landscape architecture at the University of Pennsylvania in the fall of 1957. The problem stated by Kiley was to develop a complete landscape design for the Miller House. Kiley was also looking forward to “seeing some of my old friends in the area;” letter Kiley to McHarg, 6 October 1957, 109.II.A.1.121, ILMC. Apparently, Kahn had introduced Kiley to Saarinen. Cf. Gregg Bleam, “Modern and Classical Themes in the Work of Dan Kiley,” in Reuben M. Rainey and Marc Treib, (eds.), Dan Kiley Landscapes: The Poetry of Space (Richmond, CA: William Stout Publishers, 2009) p. 81.


Fig. 92: Eero Saarinen, Miller House, Columbus, Indiana, 1955-8; Landscape Design by Daniel Urban Kiley.

Fig. 93: André Le Nôtre, Vaux-le-Vicomte, France, 1656-61.
THIS was what I had been searching for – a language with which to vocalize the dynamic hand of human order on the land – a way to reveal nature’s power and create spaces of structural integrity.³²⁸

Overall, Nicolas Fouquet’s château of Vaux-le-Vicomte with its axial layout had been the experimental ground that under Louis XIV evolved into the ordering principle of the entire French nation.³²⁹ Laid out upon the flat parterres was a basilica-like plan: three star-like avenues fanned out from the choir into the distance. At its summit was placed a statue of the ancient demigod Hercules, who as a champion of the Olympian order served as an appropriate symbol for the implementation of human order in the natural world.³³⁰

Next to Kahn and Saarinen’s shift towards classical strategies of spatial organization an entire movement toward modular design was noticeable in America at the time. At odds with the more dynamic plan libre, the classical overtones in Mies van der Rohe’s work provided the main incentive to the redirection, and in his wake a vast number of classically ordered structures were erected on American soil. In the General Motors campus, termed the “Industrial Versailles” by the Architectural Forum in November 1954, Saarinen with the help of the Californian landscape architect Thomas Church re-applied formal methods in the neo-classical landscaping as well.³³¹ Besides, both Johnson in the design of the Lucas House in Nantucket (1953) with its interpenetrating circular rooms, and Saarinen in the enigmatic MIT Chapel in Boston (1950-5), employed the circle – the Renaissance’s most precious shape.³³²

Summarizing the general situation, Nowicki – certainly in defense of his own tenets of structural optimization – pointedly stated in 1951: “We have to realize that in the overwhelming majority of modern design form follows form and not function.” Drawing a comparison between his times and the Renaissance, he pointed out that the

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³²⁸ Kiley and Amidon, In his Own Words, p. 13. Kahn was definitely not aware of Le Nôtre at the time, since Harriet Pattison only in the early 1960s introduced him to his work. Interview by the author with Pattison, 13 June 2009.
³²⁹ Le Nôtre’s attempts to order vast environments with long diagonals would not only be the model for Louis XIV sunbeam-like state system, but also had a decisive urban impact, since Pierre L’Enfant in Washington (1791), Georges-Éugène Hausmann in Paris (1853-69) or Edwin Lutyens in New Delhi (1912-29) relied on it.
³³⁰ French garden treatises of the 17th century referred to the process by which geometric shapes were transferred to the garden’s ground as pourtraiture. However, unlike in Italian gardens, the evergreens were not treated sculpturally, but instead the broderie was all cut down to the ground to allow views into the far distance. In the same way, water was not treated as a stage-like event, but found application in flat bassins allowing reflections of both buildings and sky. Cf. Vincent Scully, Architecture: The Natural and the Manmade (New York: St. Martin’s Press, 1991) pp. 221 ff.
³³¹ Initially, Saarinen intended to work with Kiley, yet the latter was still in active service and recommended Thomas Church. Cf. Gregg Bleam, op.cit., p. 82. Saarinen’s approach differed from Mies van der Rohe’s at the IIT campus, where Alfred Caldwell had contrasted the modular buildings with picturesque plantings.
³³² Alberti had demonstrated that all polygonal figures derive from the circle through simple geometrical operations. Cf. Alberti, On the Art of Building, VII, Ch. IV.
buildings of the Renaissance were crude when compared with the more structurally refined buildings of the Gothic period. For Nowicki, “[p]roblems of structure and materials became secondary in a period preoccupied with the aesthetics of form,” and somewhat describing Kahn’s development during these years, he added: “The discovery of [a] formal symbol of the unchanging laws of the universe seems to replace the invention of the form without precedent.”

2.6 From the Vitruvian Man to the Divine Proportion

In the beginning of 1956, Colin Rowe, who taught at the University of Texas at the time, sent Kahn a lengthy letter enclosed with a copy of *Architectural Principles in the Age of Humanism* (1949), written by his former teacher Rudolf Wittkower. Inquiring if Kahn had seen the recent *Architectural Review*, in which Banham had published “a deplorable article on the ‘New Brutalism,’” Rowe pointed out in regard to a discussion they had had in Philadelphia:

> You wanted to GROW a building, and I, I think, suggested that I wanted to COMPOSE it. [...] For me, your cubes, your hexagonal cells, are objective data with a life of their own in which one can’t intervene. [...] At the same time, although they are independent, they are in fact the acts of your volition.

In other words, while Kahn seems to have insisted on a natural outgrowth of a building’s order from its inner will to be, Rowe had alluded to the human powers to decisively articulate a design’s ordinance. The latter’s analysis broached a central topic, however,

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334 In 1947, Rowe had published “The Mathematics of the Ideal Villa.” Making an analytical comparison of Palladio’s Malcontenta (1550-60) and Le Corbusier’s Villa Stein-de Monzie (1927), the English critic deduced with the help of several diagrams the compositional principle of the tartan grid in both projects. In Le Corbusier’s case, once the primary *piloti* structure was positioned, a secondary wall system adapted itself freely to the programmatic needs. Cf. Colin Rowe, “The Mathematics of the Ideal Villa,” in *The Architectural Review*, vol.CI, no.603, 1947, pp. 101-5. This differed from Palladio and Kahn’s orchestration of spaces, where a similar bay system was made up of structurally and simultaneously space defining elements. Van Eyck’s design for his own unrealized Four Tower House in Baambrugge (1958-60) also employed an A-B-A-B-A ordering in an overall cross-in-square plan. Additionally, in the axes of the bays it employed four hollow columns, which contained the service rooms and supported the roof.

335 Rowe’s letter to Kahn, 7 February 1956. Also Rowe’s colleague Robert Slutzky met with Kahn, and described him as a person of “inner ‘knowingness’ [...] at all times I felt that I was conversing with a painter as well as an architect.” Slutzky’s letter to Kahn, 28 January 1956, 030.II.65.22, LIKC.
that is to say the question of the deliberate human versus the quasi-natural expression, for which Kahn only towards the end of the decade would find more elaborate answers.

As Wittkower pointed out in his study, Renaissance cosmology relied heavily on nature as a model to be studied, and indeed, the architect; seeing the world in terms of patterns, lines and geometry, should mirror its Divine laws. Consequently, architecture should not imitate nature in its passively produced and phenomenal aspects, its \textit{natura naturans}, but adopt its active principles of generation, the \textit{natura naturata} that Kahn identified with “order.” Mathematics was perceived as the abstract link between the measureless macrocosm of nature and the human-scaled microcosm of architecture as it made the natura naturata comprehensible and operable. The supreme example of this tendency, “by which the human race in its marvelous and various works seems to create a second nature in this world,” was Leonardo da Vinci, whose \textit{Notebooks} edited by Jean Paul Richter (1883) Kahn often browsed.

Referring to a description from Marcus Vitruvius Pollio’s \textit{De architectura libri decem} (c. 33 BC), the human body circumscribed within a circle and a square was visualized numerous times during the Renaissance, among others by Da Vinci (Figure 94). The \textit{homo quadratus} (c. 1490) demonstrated the underlying geometrical rigor of the human figure, while its architectural application – masterfully brought to expression in the House of Andrea Mantegna in Mantua (1476-1502; Figure 95) and the dominant formal theme of Kahn’s architecture at the time – pointed towards a more human architecture, since these abstract forms related a building’s geometry both to the larger cosmos and to that of a well-proportioned man. Underlining this argument, Alberti also referred the mathematical harmony (\textit{concinnitas}) of a building to the human body:

\begin{itemize}
\item \textbf{336} According to Kahn, “[o]rder is based on the nature of nature. [...] In physical order, every grain of sand is the right size, the right color, the right place. [...] There is nothing you can refute in the way of physical order. There’s no such thing as chaos in physical order. [...] Even an explosion is a manifestation of order.” Prown and Denavit, \textit{Kahn in Conversation}, p. 25.
\item \textbf{337} Irma A. Richter, (ed.), \textit{The Notebooks of Leonardo da Vinci} (Oxford: Oxford University Press, 1998) p. 61. Cicero had already postulated that “by means of our hands we essay to create as it were a second world within the world of nature.” Cicero, \textit{De natura deorum}, II, § LX.
\item \textbf{338} Interview by the author with Harriet Pattison, 12 June 2009.
\item \textbf{339} Cf. Vitruvius, \textit{On Architecture}, III, Ch. 1, § 3. In Giorgio Martini’s \textit{Trattati di architettura} (Milano: Edizioni Il Polifilo, 1967) Kahn could discern further examples of the human figure inscribed in the cross-floor plan of a church (I, f.11V Tav.18 and II, f.42V Tav.236) or in the shaft (body) and capital (face) of a column (I, f.14V Tav.24 and II, f.32 Tav.217).
\item \textbf{340} In general terms, prehistoric mythology by worshiping chthonic spirits was earth-bound, while the beginning of the historic era with the evolving God concept placed its beliefs in a transcendental otherworldly sphere. Consequently, in both the Sumerian and Egyptian civilizations, the focus shifted towards the infinitude of the stars, while earthly events seemed predestined by cosmic ones. The attack upon the telluric spirits in nature and the fostering of mankind as a god-like race was the central theme of Greek mythology.
\end{itemize}
Fig. 94: Leonardo da Vinci, *Homo quadratus*, c. 1490.
Beauty consists in a rational integration of the proportions of all the parts of a building in such a way that every part has its absolutely fixed size and shape and nothing could be added or taken away without destroying the harmony of the whole. [...] Without that organic geometrical equilibrium where all parts are harmonically related like the members of a body, divinity cannot reveal itself.  

Besides its focus on the human body, a second interrelated pillar upon which Renaissance architecture theory rested was music. Accordingly, Alberti declared:

> The numbers by means of which the agreement of sounds affects our ears with delight, are the very same which please our eyes and our minds. [...] We shall therefore borrow all our rules for harmonic relations (finito) from the musicians to whom this kind of number is extremely well known, and from those particular things wherein Nature shows herself most excellent and complete.  

This transfer from the audible to the visible called upon doctrines first enumerated by Pythagoras.  

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343 Since Pythagoras' times, music had been part of the educational syllabus, alongside arithmetic, plane and solid geometry, physics and astronomy. Music was regarded as the counterpart to astronomy:
exact divisions of a given string by a progression of whole numbers. This discovery led the Hellenistic philosopher and his disciples to extensive speculations that all things consisted of an underlying orphic harmony arising out of simple numeric relations.

In terms of proportion, Kahn, and above all Tyng, who would be intensely preoccupied with this subject in the following years, relied only partially on commensurable ratios as also utilized in the Renaissance, while focusing upon incommensurable ones that originated in organic patterns of growth. Discussed in detail by Thompson, the peculiar property of such generative sequences, perceivable for instance in the shells of the *Nautilus pompilius* or the *Triton tritonis* (Figure 96), was its accretion in successive steps of unvarying proportions, whereby the shapes increasing in magnitude showed continuous similarity of form.

One example of such a logarithmic series was the *Divine Proportion*, which reappeared in the Fibonacci series, and was noticeable in *phyllotaxis*, i.e. the arrangement of leaves and florets on a stem. In horizontal phyllotaxis, observable in the rosette of a sunflower, for example, left- and right-handed spirals intersected, whereas the number of spirals in each direction added up to adjacent numbers of the Fibonacci series. The enclosed illustration (Figure 97), derived from Arthur Harry Church’s study on the *Relation of Phyllotaxis to Mechanical Laws* (1901) and used by Tyng in “Geometric Extensions of Consciousness,” shows four possible examples of such a horizontal arrangement.

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the one apprehending the motions in the universe through vision, the other through audition. Continuing Pythagoras’ investigations to uncover the “music of the spheres,” Plato constituted the entire cosmos to rest upon the geometrical series of the double and triple interval sequence 1-2-4-8 and 1-3-9-27. Cf. Plato, *Timeaus*, p. 20.

344 Palladio, attempting to impart a symphonic quality to his projects, envisioned three-dimensional fugues in a triadic system based upon geometrical, arithmetic and harmonic progressions. Cf. Rudolf Wittkower, “Systems of Proportion,” in *Architect’s Yearbook*, no.5, 1953. The argument to transfer proportional laws discovered in nature to architecture would be continued during the Enlightenment; e.g. François Blondel entitled a chapter in his *Cours d’architecture* (1675-83) with “Proofs That Proportions Are the Cause of Architectural Beauty and That This Beauty Is Founded in Nature, Like That Produced by Musical Accords.”


346 Admittedly, Renaissance theoreticians were aware of the *Divine Proportion* and, in fact, the Italian mathematician Fra Luca Pacioli coined its name with his treatise *Divina proportione* (1509). Following the Renaissance’s anthropomorphic tradition, Pacioli deduced it from the analysis of the human body, because “in it is to be found all and every ratio and proportion by which God reveals the innermost secrets of nature.” Fra Luca Pacioli, *Divina Proportione: Die Lehre vom Goldenen Schnitt* (Vienna: Carl Graeser, 1896; 1509) pp. 193-4; transl. by the author.

347 Each number is equal to the sum of the two preceding ones and the fraction of the two last terms asymptotically approaches the numerical equivalent of the Divine Proportion. Leonardo of Pisa (c. 1180-1250), nicknamed *Fi Bonacci*, elaborated this series in the *Liber abbaci*.

348 *Quinqueloculina seminulum* with 2 and 3, *Sempervivum calcaratum* with 3 and 5, *Pinus pinea* with 5 and 8, and lastly *Euphorbia wulfenii* with 8 left and 13 right-handed spirals. *Phyllotaxis* is also observable in vertical direction, particularly in monocotyledonous plants, which are characterized by growth from a terminal bud, parallel-veined leaves and usually a tripartite arrangement of flowers.
Botanists had long recognized the uniqueness of these arrangements, and Thompson, too, insisted that

the old Greek and Egyptian geometers are not likely to have left unstudied or unobserved the spiral traces of the leaves upon a palm-stem, or the spiral order of the petals of a lotus or the florets in a sunflower.\footnote{Thompson, \textit{On Growth and Form}, p. 912.}

Nonetheless, it was essentially up to Goethe to comprise one “spiral tendency” of vegetation – shown here in a number of examples from a double page in Tyng’s “Anatomy of Form / Atom to Urban” from 1965 (Figure 98).

Fig. 96: \textit{Nautilus pompilius} (left) and \textit{Triton tritonis} (right).

As a sort of geometrical equivalent to the \textit{anima mundi}, the equally irrational Golden Mean was thought to propel organic creation in well-proportioned cadences. In the

\footnote{Asa Gray, \textit{School and Field Book of Botany} (New York: Ivison, Phinney, Blakeman & Co., 1869) p. 183 and Hubert Airy, “On Leaf-Arrangement,” in \textit{Nature}, Mar.6, 1873, pp. 343-4. In the case of a 3-ranked arrangement, a virtual line passes once around the stem until reaching after three leaves the one situated directly above the first one. In the 5-ranked two and in the 8-ranked three turns were needed to accomplish the same disposition. Cf. Arthur Harry Church, \textit{On the Relation of Phyllotaxis to Mechanical Laws} (London: Williams & Norgate, 1904).}
Fig. 97: Arthur Harry Church's *Relation of Phyllotaxis to Mechanical Laws*, 1901, in Anne Griswold Tyng, “Geometric Extensions of Consciousness,” 1969.
20th century, among others, Prince Matila Ghyka, a Romanian diplomat, novelist and mathematician living in Paris and London in the interwar period, further elaborated this correlation between the arts and nature based on the principal invariant of the sectio aurea. Analyzing the proportion’s peculiar properties in Le nombre d’or (1931) and The Geometry of Art and Life (1946), he argued that the Golden Section manifested a constant pulsating force, which paralleled the adaptive physical-chemical morphogenesis that obeyed the “principle of least action.” Ghyka related this “type of homothetic growth by intussusception or imbibition (from inside outwards)” with living organisms, whereas in crystals the growth was by “agglutination,” or simple addition of identical elements from the outside.350 Prior to this, Kepler had already hinted at the Divine Proportion’s quintessential role in the morphology of organisms:

It is in the likeness of this self-developing series that the faculty of propagation is, in my opinion, formed; and so in a flower the authentic flag of this faculty is flown, the pentagon.351

351 Kepler, The Six-Cornered Snowflake, p. 21. The Golden Section appears in the ratio between the pentagon’s side and diagonal. It occurs with great frequency in the flowers of dicotyledonous or exogenous plants (characterized by growth in concentric annual layers around a central pith, netted-veined leaves, and parts of the flower mostly in fives or fours), but also amongst marine animals
Having as many sides as diagonals, the pentagonal form suggested enhanced flexibility during periods of accretion, as it could easily switch between planar and stellate, that is pentagram, configurations. Among the school of Pythagoras and the masons of the Middle Ages, the pentagram was handed down with oaths of secrecy from one generation to the next.\textsuperscript{352} At the beginning of the 20\textsuperscript{th} century, the German Ernst Mössel analyzed Gothic cathedrals with the aid of “controlling circles,” and concluded that the Gothic Master diagram universally applied the decagon, whose side was in Divine Proportion to the radius of its circumscribed circle.\textsuperscript{353} Tyng, in “Geometric Extensions of Consciousness,” besides alluding to the work of Mössel also referred to Otto von Simson’s classic work \textit{Gothic Cathedral} (1956), from which she quoted:

‘In Chartres, proportion is experienced as the harmonious whole; it determines the ground plan as well as the elevation; and it ‘chains’ by the single ratio of the Golden Section the individual parts not only to one another but also to the whole that encompasses them all.’\textsuperscript{354}

Simultaneously with Mössel’s research, the American Jay Hambidge demonstrated that the Greeks had relied on “dynamic symmetry” suggestive of organic growth. Just like Mössel using graphic methods of analysis, Hambidge applied “root rectangles,” which asserted the Greeks’ ability to measure irrational \(\sqrt{ }\)-numbers graphically in the square, and questioned Vitruvius’ assumption that Greek architecture had employed solely commensurable modules.\textsuperscript{355} Fundamental to Hambidge’s analysis – as well as being key dimensions in Kahn’s plans – were firstly the square with its diagonal, which when ablated horizontally yielded the longitudinal side of a \(\sqrt{2}\) rectangle; and secondly, the square and the diagonal of its half, which in a similar procedure generated a “Whirling Square Rectangle” with Golden Mean ratios.\textsuperscript{356}

\textsuperscript{352} In his architectural sketchbook from the 13\textsuperscript{th} century, Villard de Honnecourt frequently sketched quincuncial delineations upon animals and the human figure.

\textsuperscript{353} Cf. Ernst Mössel, \textit{Die Proportion in Antike und Mittelalter} (Munich: Beck’sche Verlagsbuchhandlung, 1926).

\textsuperscript{354} Tyng, “Geometric Extensions of Consciousness,” pp. 155-6. Tyng also called attention to the Golden Section’s appliance in the Cheops Pyramid (c. 2550 BC), as “[e]ach of its faces is formed by two half Golden Rectangles [...]” With reference to the shafts extending from the King’s chamber to the Pyramid’s outer surface, Tyng noted (p. 153): “The 31 degree angle is very close to the 31° 43’ angle of the diagonal in the Golden Rectangle [...]” Cf. Alicia Imperiale, “Dynamic Symmetries,” in Schaffner, \textit{Inhabiting Geometry}, pp. 86-91.


\textsuperscript{356} The unique property of the \(\sqrt{2}\) rectangle is the fostering of another self-developing series: infinitely halved or doubled, it always maintains the same proportion. Inscribing a new diagonal into the \(\sqrt{2}\) rectangle and repeating the geometrical process from before, the \(\sqrt{3}\) rectangle is generated. This process can be reiterated until it yields the \(\sqrt{5}\) rectangle, which corresponds to a square with the
Equally intrigued by the Divine Proportion was Le Corbusier. In his youth he had learned to appreciate nature’s inner workings through his teacher Charles L’Eplattenier, who forced him to “draw from nature – not landscapes, but elements of plants. He would push us towards an understanding of how things go together.”

The lesson learnt was simple: mathematics was the “key to the door of miracles,” since “the masterpieces of art are in consonance with nature; they express the laws of nature and themselves proceed from those laws.” For Le Corbusier, at the heart of the universe stood in Romanticist terms the “axis” – an intangible “sounding board that is set vibrating” once one sensed something to be in harmonious proportion and along which man is organized in perfect accord with nature and, probably, with the universe: an axis of organization that must be the same as the one along which all phenomena and all objects of nature align. [...] If we stop in front of the Parthenon, that is because the sight of it makes the inner chord sound; the axis is touched.

Le Corbusier’s geometrical investigations to unite man, nature and technology culminated in the development of the Modulor during the Second World War. Assessing that all great architectural periods had built according to an anthropomorphic codex of dimensions, the Swiss-French architect intended with his proportional system to transcend the “inhuman” metric regime. The basis for the Modulor’s humanization of space was a prototypical person six feet tall – in the appended sketch, like the Vitruvian Man, delineated within a circle and square (Figure 99) – subdivided at its navel according to the Golden Section, “the most stringent of all laws, but also the most impalpable, the most inward that existed.”

In 1972, Tyng severely criticized the Modulor in a lecture called “Adam and Eve: Symmetry and Asymmetry.” She argued that Le Corbusier had put too much emphasis on a series relying on the specific height of one person, “rather than on a forming principle diagonal of its half ablated on both sides – a form of special prominence, since it again related to the Golden Section and was according to Hambidge’s analysis employed in the Parthenon (447-32 BC) by Ictinos and Callicrates. Cf. Jay Hambidge, *The Elements of Dynamic Symmetry* (New York: Brentano’s, 1926) p. 90. As Thompson indicated, the Greeks were also familiar with the number series 2:3:5:7:12:17 etc., which similar to the Fibonacci series, though starting with two, converged to a v2 value. Cf. Thompson, *On Growth and Form*, p. 923.

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360 Le Corbusier, *Modulor 2* (Stuttgart: Deutsche Verlags-Anstalt, 2003; 1955) p. 26; transl. by the author. This Golden Division was repeated in the deduced parts to generate a fractal matrix of numbers that was additionally subjoined by a second series, double the first one. A hundred years earlier Adolf Zeising had measured numerous Greek statues and human bodies concluding that the Divine Proportion defined every facet of their constitution. Cf. Adolf Zeising, *Neue Lehre von den Proportionen des menschlichen Körpers* (Leipzig: Weigel, 1854).
During the preceding decade, she had become a true expert regarding its properties:

In spite of the fact that scientists have often treated it with amused indulgence, I believe that the so-called Divine Proportion will be recognized as a universal forming principle – a basic link between atomic structure, molecular structure, biological structure, psychic structure, and human creativity.
Tyng alluded to DNA as another indication of the ratio’s relevance:

If you think of the DNA molecule as a twisted ladder, the rungs of the ladder turn around its center one tenth of a circle with each turn. This ten-sided figure, or decagon, has the property of its sides being in Divine Proportion to its radius [...].  

Tyng addressed a wider public with her studies about the Golden Section in the exhibition “The Divine Proportion in the Platonic Solids,” held at the University of Pennsylvania in 1964. Explaining the exhibition’s intentions, she wrote to Whyte:

Motivated by a dissatisfaction with the static ‘pure’ forms developed by Buckminster Fuller, I undertook a search for underlying principles ordering the relationships between the five regular three dimensional solids as the basis for meaningful asymmetry and transitions in scale-principles which might be the basis for the creation of more humanized forms.

In other words, Tyng had begun to search for a connection between the “symmetric” Platonic forms and the “asymmetric” ratio of the Divine Proportion. While preparing a subsequent exhibition catalogue called “Anatomy of Form / Atom to Urban” (1965, unpublished), she verified her results in a letter to John D. Entenza:

The principles which I have discovered (or rediscovered) bring together both ‘geometric’ and ‘organic’ forms – the first as static form and the latter as form-in-process. It seems that the Platonic Solids express geometric principles and the Divine Proportion expresses the organic principle [...].

The proposed sequence (Figure 100), which Tyng liked to compare with Kepler’s planetary model, acknowledged the following building up of the regular solids:

[T]he tetrahedron edges form the diagonals of the cube; the corners of the cube are centered on the faces of the octahedron; the 8 corners of the cube coincide with 8 of the corners of the dodecahedron; all of the corners of the dodecahedron are centered on the faces of the icosahedron.

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361 Anne G. Tyng, “Adam and Eve: Symmetry and Asymmetry;” lecture held at the Franklin Institute in Philadelphia, 20 October 1972, 030.II.45.64, LIKC.
362 Tyng’s letter to Whyte, 4 August 1964, 074.II.A.6, AGTC.
363 Tyng’s draft of a letter to John D. Entenza, 28 February 1965, 074.II.A.6, AGTC. Tyng was well aware of having only “rediscovered” a geometrical link between the Platonic Solids. Plato had mentioned that the perfect bodies were “capable in part of being produced out of one another by means of dissolution [...].” Plato, *Timaeus*, § 53 C – 55 D. As Tyng noted in “Anatomy of Form / Atom to Urban,” her analysis also referred to the work of Campanus of Novara, a 13th century Italian mathematician, who had considered the Golden Section to orchestrate the five Platonic Bodies in an *irrationali symphonia*.
The central protagonists in this transformation were the dodecahedron, one of the “higher solids” with its reflexive, the icosahedron (both contained the Golden Section: the dodecahedron having 12 pentagonal faces and the icosahedron having its vertices on three centrally, orthogonally crossed Golden Rectangles), and the cube, one of the “simpler solids,” with its dual the octahedron and the tetrahedron. Remarkably, the sides of the dodecahedron and cube stood in Divine Proportion to each other, since the cube side was a diagonal of a pentagonal face. This was for Tyng the key to connecting the higher and simpler bodies. She verified her theory with several other examples of “sacred cut” divisions in the Platonic Solids, while for her a particularly impressive one was the division of every edge of the simple octahedron with the “subtle asymmetric proportion” to produce the higher icosahedron: “A most fascinating fact – the asymmetric division of a regular solid produces another complete regular solid.” Altogether, Tyng, in contrast to Ghyka, sought to accentuate

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366 All simpler solids related to a $\sqrt{2}$ progression: the side of the tetrahedron being the diagonal of the cube, while the octahedron side was half the one of the tetrahedron.
the continuity between the living and non-living forms, and the fact that living forms themselves have evolved from systems or arrangements of matter which are not considered alive.

Hence, she recognized no absolute dualism between the inorganic and organic, as the all-encompassing Golden Ratio unified both:

Unity of form found in a spiraling atom, the spiral of the nautilus shell, of leaves around a stem and of the spiraling galaxy Ursa Major nine million light years away is convincing evidence for the existence of underlying principles for all natural forms in the universe.368

In her dissertation “Simultaneous Randomness and Order: The Fibonacci-Divine Proportion as a Universal Forming Principle” (1975, advised by Fuller), she summed up her studies and also used Pascal’s Triangle – a numerical scheme to register the accumulation of repeated tosses for heads or tails – as further proof. Noticing that the sums of its diagonals yielded the Fibonacci numbers, she concluded: “It is probable that all physical form through the evolutionary process of probabilities in time and space include these ratios.”369 Ultimately, it was a safety net to catch chaos – it is really a process that builds up randomness, and out of that randomness you have a spontaneous simple order again.370

2.7 The Building as Organism

In the Alfred Newton Richards Medical Research and David Goddard Laboratories Buildings (1957-65), situated on the campus of the University of Pennsylvania in Philadelphia, culminated Kahn’s concerns for the individuation of spatial functions. Teaching studio courses at his alma mater since 1954,371 under the auspices of its new dean G. Holmes Perkins the school transformed from a historicist Beaux-Arts institution into a Modernist interdisciplinary one.372 With twenty-two new faculty

368 Ibid.
371 For all dates concerning people’s tenures at the University of Pennsylvania, the author relies on the University of Pennsylvania Bulletin – School of Fine Arts, AAUP.
372 As G. Holmes Perkins remembered and probably referring to the A.R.G., his “own contacts with Kahn began in the mid-1930s with the founding of a secessionist group of architects (headed by Hudnut, then dean at Harvard) dedicated to research on housing, architecture and urban design. Kahn became president and I secretary just before the outbreak of war which spelled the death-knell of our fledgling Society.” Perkins, “Louis I. Kahn: Conception and Meaning,” in Architecture and Urbanism, extra edition, November 1983, p. 221.
appointments throughout the first two years of his tenure, Holmes Perkins initiated a *Golden Age* in Philadelphia. Within the novel regime, Kahn together with Rice and Le Ricolais taught a master course in a loft space underneath the roof of Furness’ Library Building.

By the time of the first project presentation in June 1958, Kahn had conceived a basic scheme of three interconnected, seven-story high towers distributed in a swastika-like formation around a central, eight-story high utility tower. During the same summer, the commission expanded to include laboratory facilities for biology, which Kahn integrated in two additional towers placed towards the property’s western end. The rotating pinwheel formation indicated that Kahn was not satisfied with a purely static order, as it added a dynamic spiral impetus to the configuration, which contrasted with the inner restfulness of the squares.\footnote{373 The two later biological towers, again square-shaped, were added in such a way that a virtual Golden Rectangle outlined the perimeter’s intervention. With the aid of such reference frames Kahn introduced a novel mathematical exactitude to his design. Cf. Klaus-Peter Gast (foreword by Anne G. Tyng), *Louis I. Kahn: The Idea of Order* (Basel: Birkhäuser Verlag, 2001). Le Corbusier employed comparable “tracés régulateurs” as “a guarantee against arbitrariness,” while Alberti had suggested to verify compositional harmony with similar *lineamenta*.}

Once again, the general disposition was antagonistic with respect to its site that featured the “Bio Pond,” officially known as the James G. Kaskey Memorial Garden – a remnant of a once five-acre grand botanical garden designed by John M. MacFarlane – in its back (Figure 101). Even though the façades had windows and the towers’ fluctuating clustering allowed natural light – in fact, too much – to enter on all sides, the basic scheme derived predominantly from inner, compositional considerations.

In contrast with the formal landscaping that had characterized the Jewish Community Center’s later stages of planning, this time an informal landscape surrounded, or rather *confronted*, the clear geometry of Kahn’s composition (Figure 102). On this occasion, Ian L. McHarg in collaboration with Patton (unexecuted design for the plaza) was the landscape architect.\footnote{374 Kahn and McHarg had already collaborated on the Martin Research Institute, whereas the latter’s influence was especially noticeable in the four courtyard designs of the Laboratory Building, because this was a major research area of his at the time. Cf. Ian L. McHarg, “The Court House Concept,” in *Architectural Record*, vol.122, no.9, 1957, pp. 193-200.} A central passageway connected the irregularly planted front lawn with the botanical garden in the back. In short, two dramatically different perceptions of nature collided: one promoting a geometric understanding of natural growth, the other emphasizing the beauty of unbridled nature. While the mutual benefit remained questionable, one should not discount McHarg’s overall influence in heightening Kahn’s ecological awareness. A Scottish Presbyterian by origin, McHarg had come to the United States after the Second World War in order to study landscape architecture and city planning at Harvard.\footnote{375 Since classicism was still being preached, McHarg would not be introduced in Harvard to the ideas and personalities that would later influence his work – Olmsted, Eliot, the Prairie Style} After his studies, he returned to
Scotland, and in 1954 asked Holmes Perkins, his former professor, if he saw any academic opportunities worth pursuing. Well, the latter did: McHarg became assistant professor of city planning in Philadelphia with the responsibility of developing a department of landscape architecture that should rival Harvard’s, the only one at the time.

Yet, returning to the project, not only was each of the studio towers a separate spatial entity (Figure 103), each steeple had additionally attached at its periphery smaller and even higher rising service sub-towers (Figure 104) that housed either the escape stairways or mechanical facilities such as air-ventilation ducts and the means to carry water, gas and vacuum tubes. Kahn, in collaboration with the mechanical engineer Fred S. Dubin, had recognized that the researchers often infected animals with germs and worked with poisonous isotopes as well as noxious gases. Hence, taking into account the necessity of clean air, the service tower had at its base four external nostrils for the intake of fresh air, which was then drawn up to an engine.

Fig. 101: Louis I. Kahn, Alfred Newton Richards Medical Research and David Goddard Laboratories Buildings, University of Pennsylvania, Philadelphia, 1957-65.

landscape architect Jens Jensen, or some of the younger rebels on the East and West coast. The English landscape approach, which McHarg had learnt to appreciate in his youth, was bypassed as well, as were the natural sciences and ecology.

376 Distinguished were the escape towers by two parallel walls leading higher up at top.
Fig. 102 Landscape Design by Ian L. McHarg, 1960.

Fig. 103: Louis I. Kahn, Alfred Newton Richards Medical Research and David Goddard Laboratories Buildings, University of Pennsylvania, Philadelphia, 1957-65.
Fig. 104: Louis I. Kahn, Alfred Newton Richards Medical Research and David Goddard Laboratories Buildings, University of Pennsylvania, Philadelphia, 1957-65.
From Mechanism To Vitalism. Rethinking The Paradigm Of Organization

room on top. The conditioned air was blown down in two distribution shafts – notably hidden from sight in the central tower – to be breathed into the studios. The vitiated air was finally dispersed through the exhaust sub-towers with their stacks high above the roof. The concealment of the distribution and the simultaneous dramatization of the exhaust- and intake shafts, giving “them a monumental dignity they barely deserve,” yet, which “the profession at large has persistently underdone,” prompted Banham in his critical examination of the project to conclude that a “curious mixture of the obscure and the over-explicit” characterized the building.377

Notably, the Smithsons in a competition entry for the extension of Sheffield University (1953) had applied comparable exhaust-stacks to express the building’s mechanical intestines. Peter Smithson visited the United States between September and October 1957, and encountered Kahn in Philadelphia.378 Most noteworthy for Kahn were Smithson’s remarks on how he had entered the country through Hoboken in New York:

We were all shocked, because it was such an unsightly way of coming to the United States. [...] Then Smithson said, No, I disagree with you all. I think that’s a reality.379

To remain in England, Denys Lasdun’s Cluster-Block in Bethnal Green, built between 1957 and 1960, in its arrangement of four apartment towers around a central service shaft was akin to Kahn’s basic constellation, while Michael Webb, a founding member of the London-based group Archigram, with his student project for the Furniture Manufacturers Association Headquarters in High Wycombe from 1958 provoked the emergence of a new high-tech architecture. Promoting the sculptural expressionism of an edifice’s mechanical and structural entrails, this tendency culminated in the building of the Centre Pompidou in Paris (1971-6) by Kahn’s later employee Renzo Piano in collaboration with Richard Rogers.380 Likewise in Kahn’s case, the entire spatial structure was treated as a hollow system, since an exposed three-foot-deep omni-directional concrete web of Vierendeel-elements supported the floor

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378 Cf. Airletter from Peter Smithson to Kahn, 27 November 1957; 030.II.A.58.56, LIKC. Smithson also inquired whether Kahn could forward publication material for Architectural Design that was preparing a special issue on American architecture. Eventually the English architect published an article about Kahn’s work in Architect’s Yearbook (no.9, 1960, pp. 102-18) that ended with the prophetic words: “Louis Kahn will soon be a very great architect.” In October 1959 the Graduate School of Fine Arts of the University of Pennsylvania exhibited the “Work of Three English Architects,” including the Smithsons, James Sterling and William Howell.
380 The Centre Pompidou deliberately exposed all its services, and by designating to each function a separate color (yellow for electricity, red for circulation, blue for water, green for air, white for the structure) an intricate superstructure of pipes and tubes resulted.
slabs. This open truss system, just like the hollow ceiling in the Yale Art Gallery, contained the mechanical devices such as pipes, conduits, ducts and exhaust hoods (Figure 105). For the first time Kahn had managed, thus, to integrate both the horizontal and vertical utilities in hollow spaces, and consequently liberated the studio areas from any mechanical obstructions. Again, Banham recognized a “schizoid tendency,” tough, since Kahn had frankly exposed only the horizontal services, while vertically he felt “impelled to clothe them in pseudo-monoliths of positively Ledolcian monumentality.”

Writing for The Guardian on the occasion of a special exhibition devoted to the building at the Museum of Modern Art in New York in 1961, Peter Collins in “The Will to Form” approved the project’s organic quality, describing it as “not a building of beauty, but one of character.” In its acceptance of heating, lighting, ventilating and other mechanical equipment as architectural determinants, he noticed a “complete lack of formal allusions.” Not obliterating the structural fabric and the other services, they co-existed in harmony just like “the natural forms of organic life, where physiological and anatomical elements are intertwined.” Kahn himself would have subscribed to this description, as he liked to compare the mechanicals in the building with different parts of the human body – the air system being the lungs, the plumbing the blood vessels, the electrical network the nervous system, and the skeleton the structure:

Integration is the way of nature. We can learn from nature. How a space is served with light, air and quiet must be embodied in the space order concept which provides for the harboring of these services.

Considering these imperatives, Kahn’s daughter, Alexandra Tyng, also noted:

From his understanding of how the trunk and branches of a tree carry nourishment to the leaves and how the heart pumps a life-sustaining supply of oxygen through the arteries to every cell in the body, Kahn conceived the idea that a building should have separate spaces for the mechanical system that provides ventilation, electricity, and plumbing to every room. His perception of the order inherent in living forms inspired his idea of the order of servant and served spaces.

In this sense, Kahn’s following statement from 1973 is revealing, too:

I see a building in an anthropomorphic way, as a body. I don’t want to be conscious of how my body functions. I always expect it to be tremendously resourceful.

381 Later, parts of the open structure had to be covered up with false ceilings, though, since dust interfering with the scientists’ experiments could easily settle on the beams.

382 Banham, op.cit., p. 206.


385 Tyng, Beginnings, p. 31.

Thus, answering the demands of spatial optimization, the Richards Laboratories also reapplied the dictums of structural proficiency. Kahn employed poured-in-place concrete for the independent service sub-towers, later covered with brick, and the central utility tower. Released from supporting the studio towers that relied on their own structural system, these shafts, nevertheless, visually anchored the buildings to the ground. The studio towers’ structural members – always two H-shaped stanchions moved to the third points of the square on every side – supported the ceiling’s Vierendeel structure. Its concrete members were precast, pre-stressed, and later portions of the horizontal framing were post-tensioned. By means of the pre-stressing process, the columns and girders decreased in size and their internal reinforcement turned them factually into a continuous structure. Besides, the Vierendeel girders cantilevered to leave the corners open, whereas its outmost vertical members were omitted in order to reduce the load.387

Fig. 105: Louis I. Kahn, Alfred Newton Richards Medical Research and David Goddard Laboratories Buildings, University of Pennsylvania, Philadelphia, 1957-65.

Altogether, the towers closely resembled the Wright-inspired Open-Air School in Amsterdam by Johannes Duiker and Bernard Bijvoet, planned and erected between 1927 and 1930 (Figure 106). This comes as no surprise, since during his first visit to Europe in 1928, Kahn was enamored with Dutch architecture and had received from Jan Federic Staal, another exponent of the Amsterdam School and member of the *Wendingen* editorial board, a letter of introduction to his colleague and director of Public Works in Hilversum, Willem M. Dudok, with the request that the latter would show the young American Duiker’s local Zonnestraal Sanatorium (1926-9).388

Like fine cabinet works, Kahn’s structural elements were assembled on site. Watching a crane move the 25-ton members around like “matchsticks,” Kahn realized the gross amplification of man’s naturally given powers through technological aids. Collaborating with Kahn on the structural design were the local engineers Sheldon A. Keast and Raymond A. Hood. They recommended as a consultant the Estonian-born and German-educated August E. Komendant, who after his immigration to the United States in 1950 had established a pre-casting and pre-stressing plant in Lakewood, New Jersey (Figures 107, 108). Kahn visited the plant with his students in the fall of 1956 and went “into ecstasy seeing all these new possibilities.”389 He immediately recognized the opportunity to continue his rational investigations into prefabricated construction that had commenced a decade earlier.390 Besides, with Komendant, Kahn had now recourse to another remarkable engineer: while Le Ricolais remained an authority in speculative-theoretical issues, his compatriot, who also joined the faculty in 1960, would advice him in more pragmatic-practical tasks. With regard to his own structural doctrines, Komendant maintained that there could be

only one rational structural solution: the solution which carries out the purpose of the project and satisfies all conditions with maximum efficiency.

In his opinion, a system, where no single element could be omitted without the carrying function losing its wholeness, was by its very nature aesthetically satisfying:

The appearance of a structure should express all its embodied qualities and, without any mystery, should make the observer directly aware of what the structure is or is expected to be.391

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390 In pre-fabricated structures, and in pre-stressing in particular, Komendant recognized the advantage of a more homogenous state of stress distribution, a better control of cracking in the tensional zones, a reduction of costs, and lastly an elongation of the structure’s lifespan.
Having studied at the Technical University in Dresden (graduating with a doctorate in 1938), Komendant then returned to Estonia and erected a number of concrete structures such as grain silos (Figure 109), hyperbolic cooling towers, bridges and stadium roofs in the Baltic countries (Figure 110). In 1944, he escaped from the arriving troops and found employment in the American Army Headquarters in Heidelberg, mainly rebuilding damaged bridges and studying the German highway system. After the end of the war, Komendant was assigned to studying German submarine shelters on the French

Fig. 106: Johannes Duiker and Bernard Bijvoet, Open Air School, Amsterdam, The Netherlands, 1927-30.

392 Cf. Authorization to study damaged reinforced concrete bridges and other structures from the Office of the Chief Engineer, 19 September 1945, U.S. Army Headquarters European Command, 027.II.263, AEKC.
coast in order to explain their almost unharmed survival of the allied air attacks. Komendant’s collaboration on the Silvenstein Dam with Franz Dischinger, a pioneer in concrete shell construction, during the end of his stay, was most remarkable. Intended to help overcome Bavaria’s energy shortage, the dam, if executed, would have been the second largest in the world after the Hoover Dam in Colorado.

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393 Once in America, the state authorities immediately contacted Komendant, since he owned “extensive documents pertaining to protective shelters and their effectiveness.” Cf. Letter from L. Wilkinson, director of New York State Civil Defense Commission, to Komendant, 22 August 1950; 027.II.263, AEKC.

394 Not only the sheer magnitude was remarkable, but also the dam’s novel construction method. The structural principle, for which both received a patent in 1950 and which Dischinger considered “probably the most relevant invention in this area in this century,” was based on the idea of using instead of a massive wall – 42 meters thick at the valley bottom – four separate cylindrical concrete shells, which together totaled not more than 15 meters. Cf. “Grosse Pläne für die Sylvenstein-Talsperre,” in Süddeutsche Zeitung, no.88, 17 April 1950, 027.II.263, AEKC; and Telegram from Dischinger to the board of the German Concrete Society, 16 March 1950, 027.II.11, AEKC.
Fig. 108: August E. Komendant, Concrete Pre-Casting and Pre-Stressing Plant, Lakewood, New Jersey, 1950 onwards.
Fig. 109: August E. Komendant, Grain Silo, Tartu, Estonia, 1941.
2.8 Trees, Plants and the Design from the Inside Out

Looking for references for Kahn's project, one inevitably comes across the many sketches of towers he had made during his journeys. From the early drawings of Caesar’s Tower at Warwick Castle, the *cortile* of Villa Rufolo in Ravello or San Gimignano’s mighty steeples, to the later depictions of lighthouses along the shores of New England or the bulwark-like shafts of St Cécile Cathedral in Albi – all these examples share in common an emphasis on verticality and multi-functional hollowness. Furthermore, Kahn was deeply fascinated by castles, which despite their pure volumetric outlines, appeared to emerge naturally from the terrain. Owning books on the subject such as David MacGibbon and Thomas Ross’ *Castellated and Domesticated Architecture of Scotland* (1887-92), he also had a number of photographs and illustrations of such defense edifices in his slide-collection – for instance the appended Orford Castle on the Suffolk coast in England (12th century; Figure 111).395

Kahn used the plans of Comlongon Castle near Dumfries in southern Scotland (15th century) in his article “Remarks,” published in *Perspecta* in 1965 (Figure 112), wherein he noticed that these fortification buildings demonstrated a *poché*-strategy of spatial optimization: a hollowed out exterior wall harbored auxiliary spaces that adjusted their form to the varying functional and strategic needs.396

In addition to these architectural sources, Kahn’s intervention correlated with different natural configurations. For instance, his proposed air cycle was similar to the ventilation principles employed by termites in their tower-like constructions to maintain a steady temperature and degree of moisture. Perforated like a sponge in order to soak cool air into an underground cellar, the heated air is dispatched through chimney-like tops (Figure 113).397 Furthermore, as owner of Louis Figuier’s *Vegetable World: Being a History of Plants, with their Structure and peculiar Properties* (1867), Kahn had ample opportunity to discover in it the basic constituents of an organic design ideology that focused upon the plant as a model of operation. Already in 1954, in a letter to Tyng, Kahn had drawn a hollow stem and stated next to it:

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396 A similar scheme of spatial organization characterized Kahn’s Bryn Mawr Dormitories (1960-5), where smaller-scale student apartments surrounded three obliquely connected introvert community spaces.

Fig. 112: Comlongon Castle, near Dumfries, Scotland, 15th century.

Fig. 113: Termitary, Avash National Park, Ethiopia.
“Now the column must be hollow like the stem of a leaf or the trunk of a tree.” Possibly, Kahn was referring to *On Growth and Form*, in which Thompson alluded to the increased mechanical efficiency of tubular structures as exemplified by “the quill of the bird’s feather, the hollow shaft of a reed, the thin tube of the wheat-straw [...]”. Calling attention to the work of the Swiss botanist Simon Schwendener, who had “elaborately investigated the factor of strength in the cylindrical stem, which Galileo was the first to call attention to,” Thompson remarked that the resistance to bending was at least twenty-five times as great as it would have been had the six main bundles been brought close together in a solid core.

Admittedly, in the Richards Laboratories the vertical cores were not placed like natural stems in the center and, in fact, except for stiffening they did not structurally support the studios. But the comparison still holds true in functional terms: a multi-purpose hollowness characterizes plants, exemplified here in a section of *Equisetum hyemale* (Figure 115), through which every vein of the leaf remains in continuous interaction with the imbibing roots.

Beforehand, Wright had excessively relied on plant analogies as well, while employing hollow columns in the Larkin Building in Buffalo as early as 1904 (Figure 116). Placed at the building’s peripheral corners, hollow pylons of equally monumental scale as Kahn’s housed the stairways and utility ducts, and next to these, three even higher shafts contained the building’s air-conditioning system. In the Unity Temple the centrally placed cores virtually carried the cantilevering roof like the crown of a tree. “Breaking-up the box” as a reply to his general distaste of the *Chicago Frame* – this “hideous efflorescent boxing in of humanity” – Wright postulated:

Conceive now that an entire building might grow up out of conditions as a plant grows up out of soil and yet be free to be itself, to ‘live its own life according to man’s Nature.”

Further incorporating these principles in his high-rise projects, in St Mark’s-in-the-Bouwerie in New York (1929) a central arrangement of hexagonal cores supported the
overhanging apartments. While this concept later found execution in the Price Tower in Bartlesville (1952-6), Wright had earlier used it in the Johnson Wax Administration Building:

Cantilevered from the giant stack, the floor slabs spread out like tree branches, providing sufficient segregation of departments vertically. Elevator and stairway channels up the central stack link these departments to each other. All utilities and the many intake and exhaust pipes run in their own central utility grooves, arranged like the cellular pattern of the tree trunk.\(^{406}\)

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\(^{406}\) Wright, “Frank Lloyd Wright,” p. 77. A similar indivisible fusion of structure and space had unveiled itself in Kiesler’s project for a Department Store in 1925. His “Tensionist Skyscraper” was also anchored to the ground by only one central hollow column, which included elevator shafts, heating and cooling systems, besides supporting a continuous floor-succession that rotated spirally upwards.
In Racine, not only the tower-structure, but also the horizontally extending working hall appeared like a forest of columns: numerous freestanding dendriform piers supported circular ceiling trays, i.e. the foliage. Nervi used a similar strategy of tree-like construction, although magnified to giant proportions, in the Palazzo del Lavoro in Turin (1959-61), whereas Kahn, as mentioned earlier, had appropriated such a scheme in his designs of the Parasol House, the Martin Research Institute, and would later re-apply it in the Olivetti-Underwood Factory in Harrisburg (1966-70) and the Hurva Synagogue in Jerusalem (1968-74). In this context, Fuller’s description of the Dymaxion House, which Kahn kept in his files, is of interest, too:

The structural character suggests the tree form, with a central stem containing what might be termed the elements which give life to the rest of the house, which spreads out from the stem as limbs do from the trunk of a tree.

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**Fig. 115:** *Equisetum hyemale.*
Fig. 116: Frank Lloyd Wright, Larkin Building, Buffalo, New York, 1903-6.
A common parameter among all these tree-projects was their insistence on developing the compositional structure from the inside outwards. In Kahn’s case, a method of organic organization emerged that widely ignored, at least at this point, the outer circumstantial factors. From the contemplation of the inner purposefulness was deduced a functional and compositional interdependence of the plan’s constituent elements, or as Wright had clarified many years before:

Organic building is natural building: construction proceeding harmoniously from the nature of a planned or organized inside outward to a consistent outside.\(^\text{409}\)

Kahn, too, considered his buildings to be living entities, in which each discrete spatial unit had its particular hierarchical role to perform in the built organism. Accordingly, in 1957 he stated: “A building is like a human, an architect has the opportunity of creating life.”\(^\text{410}\) Only from a mutual cooperation of the serving and served components did the vigor of the whole fabric arise, and in a reciprocally interactive manner certain spatial organisms were subordinated to others, since they possessed a different functional role. Likewise, Cuvier had testified:

It is in this mutual dependence of the functions and the aid which they reciprocally lend one another that are founded the laws which determine the relations of their organs and which possess a necessity equal to that of metaphysical or mathematical laws, since it is evident that the seemly harmony between organs which interact is a necessary condition of existence of the creature to which they belong and that if one of these functions were modified in a manner incompatible with the modifications of the others the creature could no longer continue to exist.\(^\text{411}\)

Similarly, for Kahn a building’s inner disposition occupied a fragile state of organic-geometrical equipoise – no member could be removed without destroying the whole.

Kahn’s increased attention to fostering a project from the inside out was further demonstrated in a couple of unexecuted private house designs. The Morris House in Mount Kisco, New York (1955-8) again used the square as a basic formal unit, but on this occasion the entire constellation was fiercely heaped together and dynamically arranged. An overall geometrical form no longer determined the building’s appearance. Instead, an internal vital impulse had seemingly erupted that ascribed to each space an appropriate position and form. A more didactic albeit not less dynamic order concretized in the Goldenberg House in Rydal, Pennsylvania (1959; Figure 117). Its basic configuration rested upon a triple-layer structure: in the center a square court was surrounded by a corridor, which itself was embraced by a series of servant spaces with dormer windows, while the served rooms radiated around the periphery. The distinctiveness of each zone was stressed by their changing light conditions: the

\(^{409}\) Wright, *Genius and Mobocracy*, p. XIII.


sky-lit servant zone was distinguished from the introvert corridor, while the outer chambers were side-lit and through large windows interacted with the landscape. This time the vividness of the volumetric composition was not obtained through the dispersed assemblage of individual spatial elements, but by means of 45° diagonals and fluctuating room dimensions.

With their extreme sensitivity towards internal needs, both houses were paradigmatic examples for Kahn’s current design approach: starting from the seed “house” the intervention gradually assimilated with the more informal conditions to become “a house.”412 Conveying a sense of expansion in his sketches (Figure 118), the Goldenberg House extended into a living entity like a blossoming flower. Its spaces rather than being constrained into a Procrustean bed extended freely with respect to their different natures, since “there was an existence will for this house not to be disciplined within a geometric shape.”413 In sum, Kahn’s assumptions – from the

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412 Cf. Kahn, “Talk at the Conclusion of the Otterlo Congress,” p. 208. In a last step, no longer influenced by the architect, the house became “a home,” which is the building as used by its occupants.

413 Louis I. Kahn, “A Discussion recorded in Mr. Kahn’s Philadelphia Office in February 1961,” in Perspecta, no.7, 1961, p. 13. A similar broken geometry characterized the work of the Finnish architect Alvar Aalto, as illustrated for example in his Säynätsalo Town Hall (1949-52) and his own Summer House in Muuratsalo (1953). Fracturing an initial, preconceived geometrical order, a grouping of programmatically and contextually well-adjusted volumes resulted. Kahn had met Aalto, the son of land surveyor, on the occasion of different juries and symposiums during the 1950s. Since 1940, Aalto had been teaching at MIT, where also Kahn was a visiting professor between February and June 1956. Moreover, Kahn owned Nils Erik Wickberg’s book Finnish Architecture (1959) with a personal dedication by Aalto.
anti-Cartesian diagonals that broke with the grid-order to the appreciation of every spatial unit as a singularity, thus, exaggerating rather than eliding differences – fundamentally opposed the International Style’s basic tenet of homogeneity. Speaking at the University of California in Berkeley in 1960, Kahn agreed:

Our buildings have a tendency to look completely insensitive to an activity. They tend to look alike. Office buildings look like apartment buildings, maybe with a few balconies that differentiate one from the other; actually they appear alike, the same kind of building.\footnote{Louis I. Kahn, “On Form and Design;” speech held at the 46\textsuperscript{th} meeting of the Association of Collegiate Schools of Architecture, University of California in Berkeley, 22-3 April 1960, in Latour, \textit{Writings, Lectures, Interviews}, p. 107.}

Kahn’s criticism was mainly directed at late Modernism’s obsession with modularity and universal spaces, but did not confront its orthodox roots. This is no surprise since the emancipation of the outer shape from the interior needs had been one of the main imperatives of early functionalist doctrine with its origins in the writings of Greenough, Sullivan and Wright. Once the American doctrines had spread to Europe, mainly through the publication of Wright’s \textit{Wasmuth Portfolio} and the exhibition of
his early work in Berlin (1910), a whole generation of European architects – initially mostly German and Dutch, but after the Second World War also many Italians influenced by Bruno Zevi’s Wright-inflected *Verso un’architettura organica* (1945) – became determined to develop the architectural project through a closer inspection of the inner functions.

As summarized by Le Corbusier, “from the inside, work outwards. This rule, I think is equally a law of nature and of architecture,” the ambition was no longer to constrain a building from the outside into a prescribed corset, but instead await its unfolding from the inner premises. This search for the natural form had found its most incisive expressions in the Concrete and Brick Country Houses of Mies van der Rohe. Simultaneously, Hugo Häring, who was sharing the studio with him in Berlin, built a Farm in Garkau (1922-3) that achieved an exemplary melding of its formal and functional features. During the following years, Häring elaborated his ideas of an organic architecture:

> The given task is clear: it is to draw up the house from the interior, from the vibrant processes of living and also to compose according to this principle. The exterior is no more *à priori* given, it only reveals itself like all the outer forms in nature reveal themselves.

While sharing this longing for an enunciation of the inner programmatic pressures, Häring’s formal vocabulary differed decisively from that of Mies van der Rohe, but also that of Kahn, Wright, and Le Corbusier. Attempting to avoid any abstract notions of geometry, the German architect emphasized a freer, more fluid volumetric articulation. While Häring in Romanticist terms regarded man as an unconscious outlet of nature’s continuous plastic force, the others stressed a more hybrid juxtaposition that allowed man to rise above nature through the intelligible recourse to geometry.

### 2.9 Man is and is not Nature

Regarding the question of what distinguished man from nature, Kahn gave a more definite answer in his keynote lecture at the 11th C.I.A.M. meeting in Otterlo in September 1959, by stating:

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416 A couple of years later, Häring explained: “We search to make our demands for expression applicable in the direction of the vital, in the tendency of the becoming, in the line of the agitated, in the course of an organic conformation, because the way of designing in accordance with the fulfillment of the purpose is also the way nature designs.” Hugo Häring, “Wege zur Form,” in *Die Form*, vol.1, no.1, 1925, pp. 3-5; transl. by the author.


Nature is not concerned with form, only man is concerned with form. It makes it according to circumstances. If it meets the order of things in the nature of things, it will make any form that answers to the very nature of things. That is why we have what we call such peculiar-looking animals. Because there is a certain existence-will in this kind of thing which produces itself into this kind of animal and nature is not concerned about form – but we are.419

Quite explicitly, Kahn positioned man apart from nature, giving him powers of formal choice, while nature was a sort of unconscious automaton. Van Eyck, who helped organize the congress, responded with similar ideas in his final talk called “The Moment of Realization:”

It is in the nature of art that it should be different from nature. [...] Art has its own kind of logic. It looks illogical beside nature’s logic, but so does nature’s logic look illogical beside that of art – beside that of man. [...] The moment of realization is what is crucial [...] The art is the jumping: how you take off, when, and where.420

To stay with Kahn, what had formerly been split into the three parts of “Nature of the Space,” “Order” and “Design,” at the end of 1959 coalesced into the novel terminology of “Form and Design.” “Form” replaced the elusive “Nature of the Space” in terms of designation, but remained identical in terms of content: through “Form” one ought to grasp the intrinsic characteristics of a program, space or material by asking what is the essential difference between one thing and another, what constitutes its essence, “its nature against any other nature.”421 “Design” still referred to the tangible parameters of the changing circumstances and was but a simile of the original idea; while “Order,” nature’s universal lawfulness discernable through geometry, linked the two domains:

Form has no existence in material, shape or dimension.
A design is but a single spark out of form;
It is of material and has shape and dimension. [...]
I recall the beginning as Belief.
It is the time of realization of Form. [...]
And then I recall the adventure of design when dream-inspired
Form must answer to the laws of order so as to be.422

Kahn elucidated these thoughts in the lecture “The Scope of Architecture” held at the Cooper Union on 20 January 1960, which provided the basis of a recording for the Voice of America broadcast on the 19th of November the same year.423 Its revised
transcript was subsequently reissued in a number of publications with the appended diagrams (Figures 119, 120). Most importantly, Kahn distinguished physical nature that he regarded as the measurable “order” and “maker of all existence,” and which was graspable through “thought,” from the immeasurable invocation of what something wanted to be that he detected in “feeling.” Accordingly, he wrote:

> Realization is the merging of Thought and Feeling in the closest rapport of the mind with the Psyche, the source of what a thing wants to be. It is the beginning of Form. Form encompasses a harmony of systems, a sense of order and that which characterizes one existence from another. Form is what, design is how.424

As a result, a building should not become a mere victim of circumstantial decisions, but instead always evoke its original inspiration:

> A great building, in my opinion, must begin with the unmeasurable, go through measurable means when it is being designed, and in the end must be unmeasurable. The design, the making of things, is a measurable act. At that point, you are like physical nature itself, because in physical nature everything is measurable [...]. But what is unmeasurable is the psychic spirit.425

With regard to Kahn’s stringent separation between the measurable and immeasurable, the following statement from his notebooks further clarifies his intentions:

> Nature is the maker of all things, the psyche desires things and challenges nature to make that which expresses the inexpressible, that which cannot be defined, that which has no measure, that which has no substance ... love, hate, nobility.426

In this sense, nature was in Kahn’s epistemological system simply a necessary instrument that raised his intelligible visions from the ineffable grounds of the imagination to the palpable properties of reality. Nature did not know “how beautiful the sunset is,”427 and therefore was regarded by Kahn as a principally dull affair, producing infinite variations in a symphony of laws without any awareness of the beauty of its actions. Just as Kahn claimed nature was unconscious of its own activities, so Plotinus stated (in Emerson’s borrowing): “Nature is but an image or imitation of wisdom, the last thing of the soul; nature being a thing which doth only do, but not know.”428 In contrast, mankind existed consciously, but in order to give

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424 Ibid.
425 Ibid.
427 Ibid.
**Fig. 119:** Louis I. Kahn, “Form and Design,” 1960.

**Fig. 120:** Louis I. Kahn, “INA – Spirit of Life,” 1960.
its psychic longings presence, it needed to consult nature. A few years later, in 1967, Kahn summarized: “We need Nature, but Nature doesn’t need us.”

Yet, and this may sound paradoxical, in nature too there was a psyche and a consciousness, since in Kahn’s opinion a tulip or an ant had an individual “existence-will,” too, which demanded and gave life. In support of this hylozoistic hypothesis, Kahn stated in 1969:

I would say the desire to be, to express, exists in the flowers, in the tree, in the microbe, in the crocodile, in man. Only we don’t know how to fathom the consciousness of a rose. Maybe the consciousness of a tree is its feeling of its bending before the wind. I don’t know. But I have definite trust that everything that’s living has a consciousness of some kind, be it as primitive.

Therefore, Kahn ultimately regarded nature in a twofold way: first, as an unconscious tool that he termed the “workshop of God” in 1962; and second, as a living thing that was pervaded by an inscrutable vital spirit just like man. In an ambiguous way Kahn could remain both dominant over nature and simultaneously acknowledge that a unitary, unfathomable “will to be” guided both human and organic development. Hence, bridging the opposition between confronting and participating in nature, Kahn believed in a holistic interconnectedness of all life, while always acknowledging mankind’s superior “will to express.” By implication, man in Kahn’s epistemology was in a dipolar way both an immanent part of nature and simultaneously transcending it:

The whole motivation of presence is to express. And what nature gives us is the instrument of expression which we all know as ourselves, which is like giving the instrument upon which the song of the soul can be played.

Kahn envisioned the “soul” as being a kind of prevalence – not a single soul in each of us – but rather a prevalence from which each one of us always borrows a part. This applies to every living thing, be it a flower, be it a microbe, or be it a man or an animal. Every living thing. And I feel that this psyche is made of immeasurable aura, and that physical nature is made of that which lends itself to the measurement. I think that the psyche prevails over the entire universe.
What Kahn called here “psyche,” he had in late 1959 termed “INA”:

So I invented INA. Now the reason is that there can be consciousness without will but there can be no will without consciousness. So INA is pure consciousness without will. [...] INA is the same for all living things – The character of will is different – This makes a rose different from a man.⁴³⁴

Consequently, the different “existence-wills” emerging from the INA were certain tendencies (Figure 120), which moved in one direction or another to make one nature different from another. Likewise, Schopenhauer had insisted that every particular thing manifested a certain aspect of the “universal will,” so that various grades of will existed in relation to varying causality: While “causes” operated in the realm of physics and chemistry, “stimuli” were active in vegetal life, and “motives” stirred the life of animals including man. In Kahn’s case, the INA laid the basis for a trans-subjective philosophy, which regarded the entire universe as being interlinked by a unitary force from which all life emerged. Such a hylozoistic cosmology had indeed been the basis upon which primitive mentality rested, and as Cassirer noted, “a fundamental and indelible solidarity of life” characterized its existence,⁴³⁵ resulting in a deep conviction that man had to cooperate with nature’s powers.

As stated, Kahn would have subscribed to such an attitude, yet he posited a similar strong belief in the uniqueness of man. Altogether, Kahn’s philosophy at this point entered a new sub-level, since he was analyzing the hitherto only marginally touched workings of the intangible. As noted by Alexandra Tyng,⁴³⁶ Kahn’s theory of “realization” was not unlike fecundation, in which the complementary gametes of egg and sperm fused through meiosis into one cell, the zygote, to initiate a new life. Likewise, Kahn’s antithetical notions of “feeling” and “thought” merged in a flash of “realization” to spark a new existence-will in “Form.” A few years later, in 1966, when lecturing at Berkeley, he acknowledged:

The fetus is a perfect record, a complete record, of how we were made – right from the very start. I believe it to be one of the most occupying of studies – [that] of human existence.⁴³⁷

power in its function, just as it becomes manifest within ourselves. In all likelihood, it is itself a form of matter, although it cannot be perceived with the same senses as the more familiar kinds of matter. Yet it is in these familiar kinds that it must reveal itself. It must function in union with matter. Permeated with matter, it must take on living, actual form.” Klee, The Nature of Nature, p. 63; notes dated 27 November 1923.

⁴³⁴ Kahn’s letter to Harriet Pattison, 29 December 1959; reprinted in Tyng, Beginnings, pp. 159–60. Comparably in Plotinus’ philosophy, in a triad system the One (hê̂n), the source of all being, informed the Divine Mind (noûs) that represented reason and knowledge (Kahn’s “order”). Beneath, the Cosmic Soul (psychê) as the vital principle (physis) consisted of a Higher or Celestial Soul (comparable to Kahn’s “INA” or “psyche”), and a Lower Soul or logos (Kahn’s “existence-will”), which penetrated all matter. Cf. Plotinus, The Enneads (London: Penguin Books, 1991).

⁴³⁵ Cf. Cassirer, An Essay on Man, p. 82.

⁴³⁶ Cf. Tyng, Beginnings, p. 31.

During the planning of the Richards Laboratories, Kahn had been in contact with David Goddard – namesake of the Biological Towers, director of the division of biology and chairman of the department of botany at the University of Pennsylvania. Goddard was a specialist in cell theory and was quite aware that a cell’s nucleus contained as a blueprint all the necessary information to construct and maintain a new organism. The genetic code, just like Kahn’s “Form,” offered a potentiality, since “in the start lies the seed for all things that must follow. A thing is unable to start unless it can contain all that ever can come from it.”

Besides, in an organism the multitude of cells with their specialized functions are bound together by a perplexing quality that maintains perfect coordination of its members and functions, i.e. every part is constantly permeated by a self-contained higher principle that controls the entire development. A similar analogy can be made with regard to a hive or formicary where in a concerted action presupposing a transcendent mind all ants and bees perform different interrelated tasks to constitute one super-organism. From a biological standpoint, a principle of unity within multiplicity, a mysterious inner center baffling all analysis, monitors an organism’s different cell activities. Besides this binding concept within an organism, the DNA and its decoding processes are interchangeable: the codons as the genes that encode the proteins, amino acids as the basic letters of the DNA, and the molecular unit ATP (Adenosine-5’-triphosphate) as the universal currency of intracellular energy transfer are nearly identical among all living beings. Consequently, bio-chemical analysis essentially verified Kahn’s hylozoistic concept of the INA. Even more, since all life forms rest on continuous cell divisions that range from one generation to the next, they must have descended from one common ancestor cell into which the spark of life once emanated. Kahn acknowledged, too, that man through his intuition was
in contact with this “odyssey of our making through the billions [...] Recorded in your intuitive are all the great steps and momentous decisions of the making.”

this unitary life basis: “All organized beings, from the humblest to the highest, from the first origins of life to the time in which we are, and in all places as in all times, do but evidence a single impulsion [...]” Bergson, *Creative Evolution*, pp. 270-1. Using the analogy of a gush of wind at a street corner dividing into diverging currents, each individual only retained, however, a certain degree, a particular “existence-will” in Kahn’s terms, of the universal stimulus.  