Louis I. Kahn (1901-1974)

-Kahn reintroduced inspirational and spiritual values to an architecture which had become stereotyped into anonymity and abstractions
-an immigrant to Philadelphia in 1905
-was superbly Jewish in his fundamentalism, in his concept of order, and in his questioning mind
-studied architecture at the university of Pennsylvania between 1920 to 1924 under Paul Cret, following Beaux-Arts principles)
-taught Yale university between 1948 to 1957, and then at the University of Pennsylvania
-While he was teaching at Yale, he began to emerge as an architect of national prominence

1. Servant and Served Spaces
2. The idea of the hollow column
3. Order versus Design
4. Light

1. Servant and Served Spaces

-Kahn observed the natural circulation system of, for instance, how the heart pumps a life-sustaining supply of oxygen through the arteries to every cell in the body, and sought to translate it into architecture
-Kahn suggested that, if walls were opened up and made hollow, they could become actual rooms for the accommodation of ducts, pipes and wires.
-These rooms provide services to living spaces without invading them
-this was a way of keeping pace with modern materials and construction methods
-the architect no longer need to build massive support systems, the use of hollow walls was a natural outgrowth of the capabilities of concrete and steel.
-Building with voids, or what he called “hollow stones,” cooperates with the service needs of plumbing, electricity, heat and air conditioning
-The spaces designed to hold the services should not be thought of as voids or remnants, but as rooms, equal in importance to the living spaces.

“I do not like ducts; I do not like pipes. I hate them really thoroughly, but because I hate them so thoroughly, I feel they have to be given their place. If I just hate them and took no care, I think they would invade the building and completely destroy it. I want to correct any notion you may have that I am in love with that kind of thing.” (1959)

-this idea of the spatial organization bt. the servant and served spaces was one of Kahn’s influential contributions to contemporary architecture

Yale University Art Gallery, New haven, 1951-3

-this work is considered to be Kahn’s first mature work that realizes the idea of served and servant spaces

-The bldg. faced south to an active street.
-Kahn made this facade a windowless one to the street, modern, yet deferential to its neo-gothic neighbor

-Because of the blank façade, the entrance behind the façade is rather dark.
-It is enveloped in a mild darkness

-However, in sharp contrast, the North facade was given a view to a stepped garden and an expanse of glass in well-proportioned frames.

-the section shows the sunken garden in the north
-For the elevation on the north, Khan creates an elevation of a full glazing
-This treatment of the elevation was in a great contrast with the blank wall on the opposite side

-the gallery required flexible interior spaces that could be easily subdivided in a variety of ways
-exhibits were to be displayed on movable panels
-Kahn was therefore faced with the task of designing spaces that were as large and unbroken as possible
-For this purpose, Kahn adopted the clear division between servant and served spaces
-the mechanical facilities, elevators, stairways were grouped in a central shaft
-A stairway was set within a circular well

-The idea of the servant and served spaces is also reflected in the ceiling
-Because of its great strength, a concrete space frame composed of tetrahedral units was proposed by associate architect Anne Tyng for the spanning of the large unsupported areas
-Then, it was by chance found that the arrangement of tetrahedral units in the space frames was such that pipes, ventilation ducts, and electrical lines could be run horizontally from the central service core along hollows with the frames

-Kahn called the space frame a
“breathing ceiling”

-an extension of the idea of the tetrahedral structure into a skyscraper
-this city tower was conceived as a part of a proposed urban scheme for Philadelphia
-although it was never built, it represented a conceptual advance over the Yale Art gallery
-the entire structure, not just the ceiling-floor spans, was composed of a tetrahedral space frame

Triangular City, Philadelphia
1952-3

2. The idea of the hollow column

-an extension of his idea of the servant and served spaces

-he felt that the column no longer need to be merely a support; if it were hollowed out, it could become a shaft for carrying mechanical facilities.

-The hollow would carry electricity and ventilation, as a living artery transports oxygen and energy to each part of its system

-“Now the column must be hollow like the stem of a leaf or the trunk of a tree” (1954)

Richard Medical Center, University of Pennsylvania

-consists of three laboratory towers clustered around a central building that houses fresh air intake system and other services
-Kahn surrounded each laboratory tower with its own cluster of hollow service columns for the removal of exhaust fumes

-he discovered that the separation of the laboratories from the mechanical systems was a recognition of the building’s natural order: the rooms inhabited by working people should not be mixed up with the fresh air and exhaust system, just as our brains are not next to our lungs, and our food intake and elimination points are not side by side
-structurally, columns were set at a distance from corners
-by utilizing prefabricated space frame, Kahn created an open space with no columns

-Above each laboratory ceiling, there is a crawl space
-this space carries pipes, air ducts, and electrical lines out to each laboratory from the central utility shaft

The structural system is readily visible on the facade and in particular in the ceiling of the open entry porch.

-The elevation is defined by the vertical bodies of the hollow service columns
-concrete structural columns are exposed
-the corners are suspended between the columns
-Offices individual humane scale with brick
-small opening for study table and large openings for the illumination of the larger interior

Salk Institute, La Jolla, California, 1959-6 (client: Jonas Salk)

-The work of Louis Kahn was brought to Jonas Salk’s attention in the fall of 1959
-During this time, Kahn’s Richard Medical Research Building was under construction
-Salk told Kahn he needed 10, 000 square feet for each of ten research scientists, requiring a building nearly the same size as Richards

-To Salk, work at the frontiers of biological science necessarily raised broad questions about the future of humanity – the meaning of life, values, and the nature of man.
-Kahn welcomed these themes and they developed trust and friendship between them beyond the client and architect relationship

Salk Institute, La Jolla, California, 1959-65

Laboratories and Study areas (client: Jonas Salk)

-The site was, according to Salk, “not just any land or merely fine land, but the most beautiful coastal cliff property left in La Jolla.”
-The nature of the site made the scheme laid out horizontally, rather than vertically, which is the case with the Richards medical Research Building.
-Other than this site condition, the requirements for the laboratories and their mechanical needs were virtually the identical for both the Richards and Salk buildings

-Kahn’s original scheme–second version in 1961 to 1962–Kahn placed four identical two-story laboratories at the head of the ravine with two central courtyards.
-The first two laboratories had their own courtyard, and the remaining two had their own too.

-Kahn later revised the scheme for two reasons.
-Salk grew wary of the potential for disunity between the two groups of people who use and face different courtyards.
-Salk did not like the fact that this might cause unproductive competition between them.

-Kahn reduced the number of buildings from four to two.
-He created a subgrade story (next slide) so that each of the two buildings (of the revised design) had three laboratory levels

Each level measured 65 by 245 feet,
and adopted concrete truss system
(Vierendeel truss system: next slide).

Section of the Laboratory (Vierendeel truss system)

-The full nine-foot-high story created by the truss housed the requisite network of pipes and ducts. It became the service level for the laboratory located immediately below.
-The distinction between servant and served spaces are clarified vertically and clarified to a greater degree than the Richards Medical Research Buildings

-The study unit is distinguished from the laboratory to have its own distinctive atmosphere.
-The laboratories are long, utilitarian rooms arranged for the maximum efficiency of controlled experiments; the studies, on the other hand, are intimate enclosures designed for comfort and personal relaxation and expression.
-Simple oak details give these rooms warmth and livability.
-Windows look out to the central terrace and the ocean beyond.

-For the single central courtyard, Kahn’s original intention was to embellish the central space with trees.
-But, it was Luis Barragan, a Mexican architect, who advised him to empty it.

“I told him at first sight , . . . not one leaf . . . Don’t put one leaf, nor plant, nor one flower, nor dirt. Absolutely nothing. A plaza . . . will unite the two buildings and at the end, you will see the line of the sea.”
Luis Barragan, as quoted in *Louis I. Kahn: In the Realm of Architecture* by David Brownlee and David G. De Long, p. 334

-To some, a completely paved plaza was a harsh solution.
-Kahn tried some other schemes and acquired advice from other landscape architect, but eventually decided to accept the spirit of Barragan’s approach, but with a central canal in which water continuously runs towards the horizon.
-The canal connected the small square pool at the entrance to the court with a wide rectangular pool at its west end, which would then spill through a wall into a small pool in the lower garden (view of the water stream: next slide)

3. Order versus Design

Order *is*
Design is form-making in order
. . .
In order is creative force
In design is the means – where with what when with how much
. . .
The nature of space reflects what it wants to be
Is the auditorium a Stradivarius
or is it an ear
Is the auditorium a creative instrument
keyed to Bach or Bartok
Played by the conductor
Or is it a convention hall
In the nature of space is the spirit and the will to exist a certain way
Design must closely follow that will
Thru the nature – why
Thru the order – what
Thru design – how
. . .
The same order created the elephant and created man
They are different designs
Begun from different inspirations
Shaped from different circumstances

Order versus design
-Order was the basic immutable law that governs the organization of natural and social structures
-Order does not aim at the beautiful; its manifestations in various designs are beautiful. The same order created the dwarf and Adonis
-In architecture, the order of structure is the sense of the intrinsic capabilities of building materials (brick, concrete, stone, wood) and elements (joints, supports, openings, rooms) that fit together and form themselves into characteristic shapes
-in this context, he asked questions of “What does concrete want to be? What does brick want to be?”
-This expanded to the spatial order of architecture, asking, for instance, “what is the house?” “Does the reception area want to be next to the kitchen?”

Form versus Design
In 1959, he adopted another term, form, and developed his idea. He differentiated form from design
-Kahn wrote,

“Form is ‘what.’ Design is ‘how.’ Form is impersonal. Design belongs to the designer. Design is a circumstantial act, how much money there is available, the site, the client, the extent of knowledge. Form has nothing to do with circumstantial conditions. In architecture, it characterizes a harmony of spaces good for a certain activity of man.”

-form meant the essence created by a certain relationship of elements in a whole
-the form stage of architecture is the stage at which a given arrangement of elements is envisioned abstractly rather than in a specific shape or size
-The form of a building is timeless; it is unaffected by the changing architectural styles
-Form is intangible. Design, on the other hand, is completely tangible
-In order to arrive at the final stage, the original form is tailored to fit circumstantial requirements

First Unitarian Church, Rochester, New York, 1959-69

-The church committee requested “a church of contemporary – or modern – design, of permanent beauty and real artistic value – rather than the exaggerated, bizarre or faddish”
-Their interest in permanence proved remarkably compatible with the increasing weightiness of Kahn’s architecture during the late 1950s

First Unitarian Church, Rochester, New York, 1959-69

“I drew a diagram on the blackboard which I believe served as the Form drawing of the church and, of course, was not meant to be a suggested design. I made a square center in which I placed a question mark. Let us say I meant it to be the sanctuary. This I encircled with an ambulatory for those who did not go into the sanctuary. Around the ambulatory I drew a corridor which belonged to an outer circle enclosing the space, *the school*. It was clear that School which gives rise to Question became the wall which surrounds Question. This was the form expression of the church, not the design.”

-Initial scheme started with a centralized plan.
-The central gathering space in the middle in the shape of dodecagon, the secondary spaces surrounding it.
-Rigorously symmetrical plan. Within the twelve-faced central space was a square auditorium ringed by concentric ambulatories and corridors.
-By creating two different circulation areas, Kahn intended to allow for different degrees of faith.
-This feature greatly appealed to the building committee

-In the final stage of the design, Kahn retained the centralized organization of his preliminary sketches, but abandoned the circular and octagonal aspects that had characterized every previous study.
-This time, he adopted exclusively right-angled scheme.
-The auditorium is now set it within a square with a corridor

4. Light

“A space can never reach its place in architecture without natural light. Artificial light is the light of night expressed in positioned chandeliers not to be compared with the unpredictable play of natural light . . . The structure is a design in light. The vault, the dome, the arch, the column are structures related to the character of light. Natural light gives mood to spaces by the nuances of light in the time of the day and the seasons of the year as it enters and modifies the space.”

Problem of glare

“I am doing a building in Africa, which is very close to the equator. The glare is killing, everybody looks black against the sunlight. Light is a needed thing, but still an enemy. The relentless sun above, the siesta comes over you like thunder.

. . .

I came to the realization that every window should have a free wall to face. This wall receiving the light of day would have bold opening to the sky. The glare is modified by the lighted wall and the view is not shut off. In this way the contrast made by separated patterns of glare which skylight grilles close to the window make is avoided.” (1960)

Keyhole window study, U.S. Consulate in Luanda, 1959

-used as a free-standing device for screening the sun’s glare
-this device was invented by Kahn after he traveled to Africa with the intention of designing the U.S. Consulate in Luanda
-During his stay, he observed that light, although necessary for life, became an enemy because it was so glaring

-he decided that every window should face a wall that would take the sun’s direct rays and reflect them into the interior spaces
-the outer walls with their keyhole-shaped openings were intended to protect the inner recessed glass from the sun’s full force
-because these outer panel would be separate from the wall behind them, Kahn was reminded of ruins in which gaping window frames revealed emptiness behind
-He began to think of the consulate design as a ruin wrapped around a building
-although the consulate was never built, Kahn was inspired by the glare-shielding walls he had invented for it.

Kahn’s idea for glare-shielding walls, 1960

The hollow column as the filter of light

-As early as 1954, Kahn had the idea that the column could be hollowed out so that its periphery became the filter for light entering the column

-in 1961, Kahn began the Mikveh Israel Synagogue project in Philadelphia

-here, he inserted non-structural cylinders act as diffusion chambers.

These hollow columns inserted into the exterior walls at intervals operated as what Kahn called “window-rooms.” These window-rooms contained and directed light into the sanctuary

--Daylight shines through their exterior openings, ricochets around the inside of the columns, and filters subtly through openings into the synagogue

Mikveh Interior Column Studies

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Sketch by Kahn

The effect of natural light and the architecture of shadow and color

-In 1954, Kahn spoke of light’s relation to structure purely in terms of mechanical needs. But by 1960, Kahn articulated the intriguing thought that the structure of a room is defined by its light. This was beginning of a more metaphorical and spiritual approach to light
-For Kahn, structure and light were inseparable. Kahn saw structural elements of architecture such as the column, arch, dome, and vault in terms of their various ways of molding light and shadow, and thereby of figuring in design
-natural light was the only true light for Kahn
-Kahn was intrigued by the nuances of mood created by the time of day, the weather, and the seasons. He also saw the magical effects of light as it touches the surface of a building. Light washes over the walls, differentiates the faces of a three-dimensional solid, and fills interior spaces through openings.
-He believed that the changeable quality of daylight gave life to architecture because one’s relationship to a building changed according to the light surrounding and penetrating it
-Kahn believed that there was no such thing as white light. Light’s ability to give life to architecture is dependent on it own life, its changeability-For this reason, no space was truly a space unless it received the life-giving touch of natural light

Light as the source of life

Preliminary sketches for silence and light drawing, 1971

Light and Silence

-In 1967, he invented the concept of silence and light. This incorporated light to architecture in its most metaphysical sense

-silence is the realm from which light emerges. Silence is the emptiness with the potential for life

-it is a desire that is not already existing, but grows towards existence

-silence, the desire to express; light, the means of expression

-at the threshold where silence and light meet, an inspiration arises

Kimbell Museum, Fort Worth, Texas, 1966

-Kahn create spaces with the unique quality of light to house private collections by Mr. and Mrs. Kay Kimbell

-based on repetition of a vault structure with local modifications to create courtyards
-the structure is composed of six parallel cycloid vaults. -Each vault is 20 feet high, 100 feet long and 23 feet wide.
-the public level is completely vaulted and naturally lighted.
-It rests serenely on a podium that contains the museum services
-the Westernmost vaults create three sheltering porticoes that open onto the forecourt and its flanking pools (next slide)

-the eastern side is set as the parking area one story lower than the front porch
-The entrance from the parking area is at the basement of the building (section: next slide)

-In this project, the idea of servant and served spaces is still observable
-services were positioned within void spaces between the vaults
-Interior galley is a column-less open space for flexible layout

-the building’s structural elements are concrete
-The vault is roofed by lead.
-travertine panels are inserted into the structural frame, sitting on top of a concrete podium

-In the interior, the structural frame is also exposed
–As in the exterior, travertine panels fill in the structural frames
-Kahn also adopts white oak for screen walls, paneling and detailing

-Khan’s treatment of light
-Down the length of each vault runs a narrow slit through which direct sunlight enters the building.
-The eight-foot channels that link the vaults contain ducts above their aluminum soffits
-A reflecting device consisted of a double curve of perforated metal, installed in 10-foot lengths below the slit.
-Light spreads evenly over the sides of the vault so that it washes down the walls into the room
-this device also filters out rays that would be harmful to works of art

-Kahn had a conviction that works of art would reveal new characteristics with every mood of natural light in which they are viewed
-using electric lamps was only for auxiliary illumination
-With the realization that colors are created by the changeable play of sunlight, Kahn designed the museum to include open-air courts.
-He anticipated each court a special hue and intensity of light depending on such factors as dimensions, degree of enclosure or openness to the sky, and reflection of the sky on water, concrete and travertine