Transformation of Closed Form:

Design projection to "inhabit" cylindrical grain containers

by Daniel S. Krynytzky B.S.A.D.
Massachusetts Institute of Technology
Cambridge, Massachusetts, 1977

Submitted to the Department of Architecture in partial fulfillment of the degree Master of Architecture at the Massachusetts Institute of Technology, June, 1989

Signature of the Author

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Daniel S. Krynytzky
Department of Architecture
February 14, 1989

Certified by

. . . . . .

Maurice K. Smith
Professor of Architecture
Thesis Supervisor

Accepted by

. . . . . .

Imre Halasz
Chairman
Departmental Committee for Graduate Students

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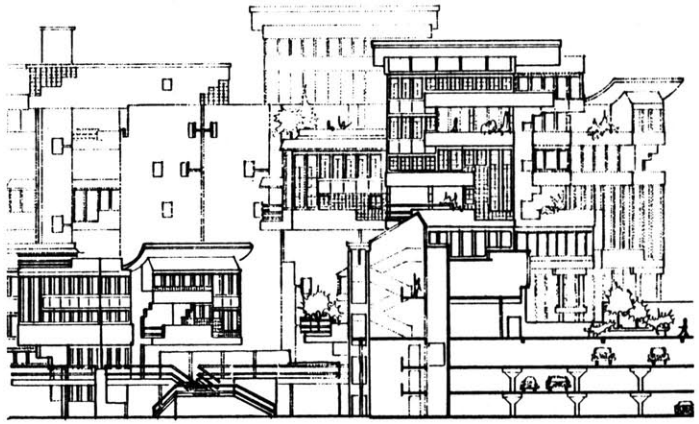


Abstract:

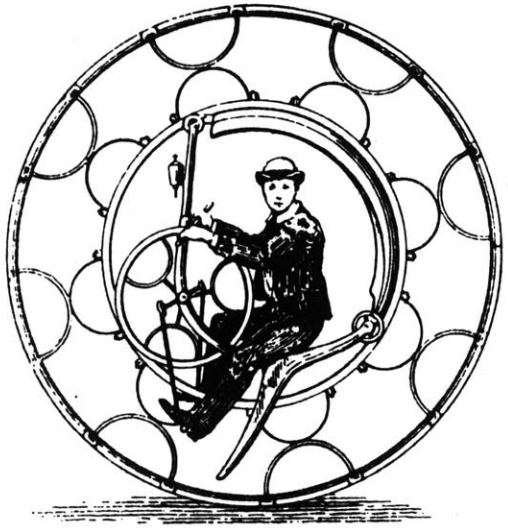
This thesis proposes the direct building of physical-spatial continuities with a generous range of sizes, from site size down to human size, producing an environment of multi-optional use. The work is partially reaction to certain modern tendencies in architecture that reduce the built landscape to closed, object-like, discrete physical elements. The disparity in the range of sizes from large to small intensifies the discontinuity in contemporary, mid-to-high density urban environments.

The design exploration entails the transformation of an abandoned series of packed cylindrical grain containers to a structure habitable as a mid-rise (10-12 stories) three dimensional built landscape. References describe select problems and examples of:

the circle as a geometric construct and some of its intrinsic behaviors
the circle-cylinder in architecture
built landscape transformations.

Thesis Supervisor: Maurice K. Smith
Professor of Architecture

American model.



Acknowledgements:

To my advisor, thesis buddies, indispensable helpers, and most of all to my family and friends who have put up with my neglect and erratic behavior through the past months.

Ladies and Gentlemen,

My mother thanks you, my father thanks you, my sister thanks you and I thank you.

J. Cagney
"Yankee Doodle Dandy"

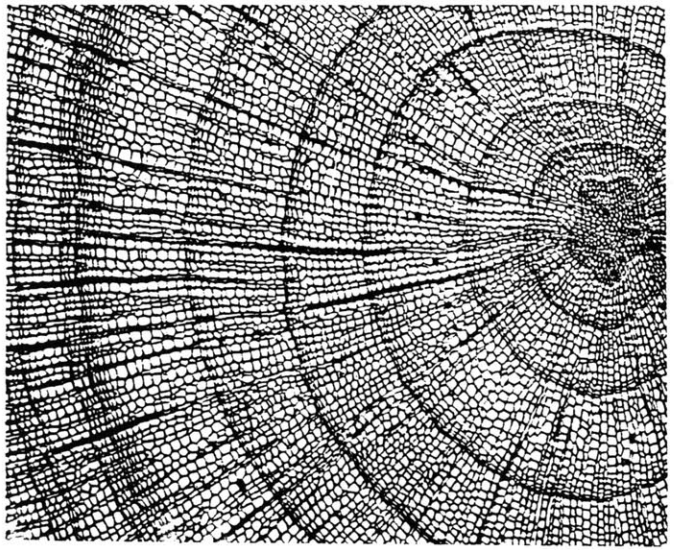
...and we'll have to dedicate this one to the Roses.

Table of Contents:

Introduction:

Observation of the natural landscape and its "inhabitants" (flora and fauna) can help us to understand the notion of closed form. For purposes of this discussion the form of the cell is closed, that is, the unit can be described within simply defined boundaries. The general behavior of the cell walls is designed to keep things in and to keep other things out. The shape is inwardly focussed with minimum surface area to volume ratio. It is a closed form. Removal of some wall or a distortion of the shape to generate reciprocal behavior with its atmosphere, can make it less closed. As we move up in scale to the size of the tree, we find that the "wall" must stay fairly intact but that the reciprocity with the surroundings can be increased tremendously, especially so in the plant kingdom. At human size, a tree has properties of the "closed wall" version of biological forms as well as being part of the habitable landscape. One can observe the tree as an object or inhabit its spatial territory.

The non-biological parts of the ecosystem - the terrain, rocks, mountains, rivers - comprise the rest of the elements in the landscape. The notion of wall seems to diminish. When one passes from the field to forest, or foothills to mountains there is no wall or gate, the boundary is difficult to define; there is a spatial continuity. On the contrary, a jump in a cold mountain stream convinces one that strong physical boundaries do exist in the landscape.



Cross Section of Root of Redwood

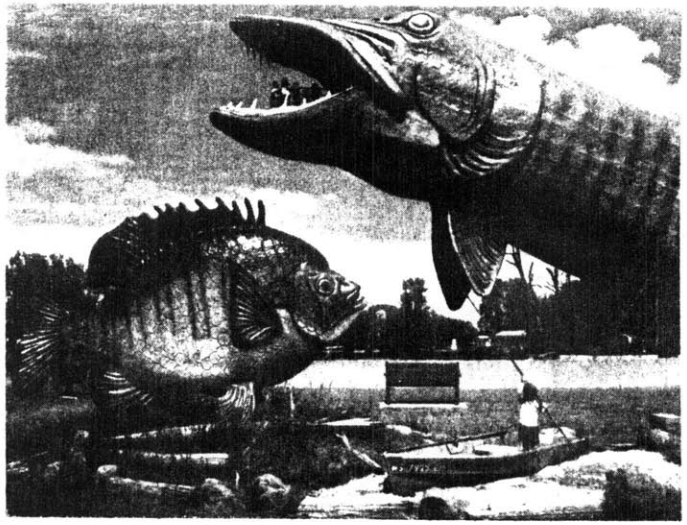
Tree of Right, Shaker Inspirational Drawing, 1845

Photo, I. Halasz

Reciprocities in the terrain, horizontally and vertically, generate "partially habitable" containments for occupation by biologic and non-biologic elements. The range in size and degree of these reciprocities as well as the range of containment and continuities provide for a rich cross-section of habitats and habitants.

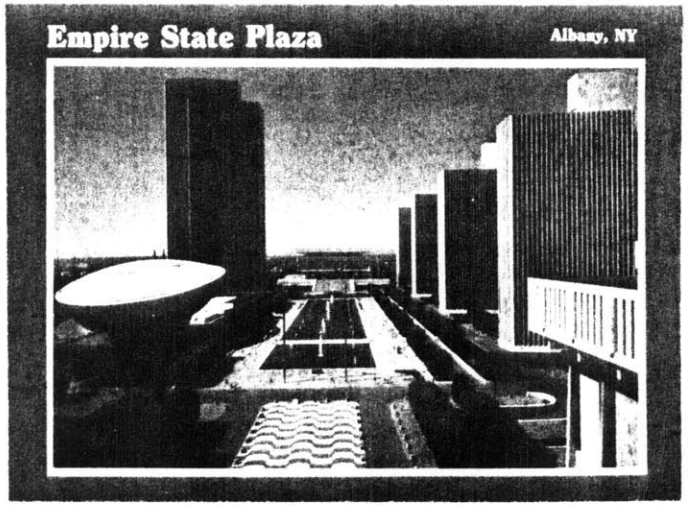
Transformation of the Landscape:

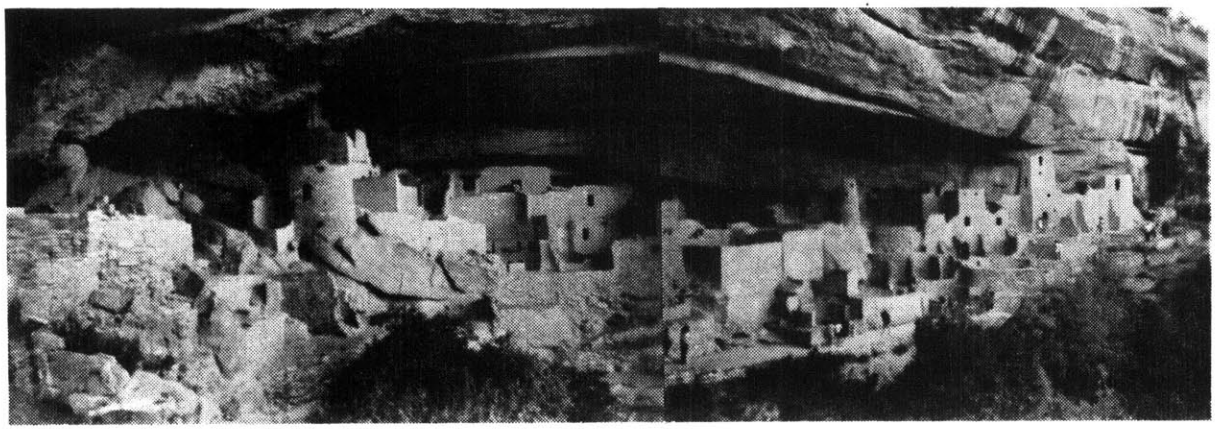
Decay, erosion, and growth are functions that transform the natural landscape. The laws of conservation of matter and energy remind us that these processes are not exclusively subtractive or exclusively additive behaviors, but rather actual rearrangements of material. Chemical erosion aside, mechanical alterations to the form of the landscape can be described at a macroscopic level with rules of displacement; hingings, rotation, substitution, aggregation, etc. The biological part of the natural environment distinguishes itself further by including cell-replication and growth in its behavior. If building is understood to be an extension of the landscape, it would seem that since it is not biological, then its transformation should include the general attributes of the landscape and not include the unique property of growth. A building is not an organism.



The National Fresh Water Fishing Hall of Fame - Hayward, Wisconsin

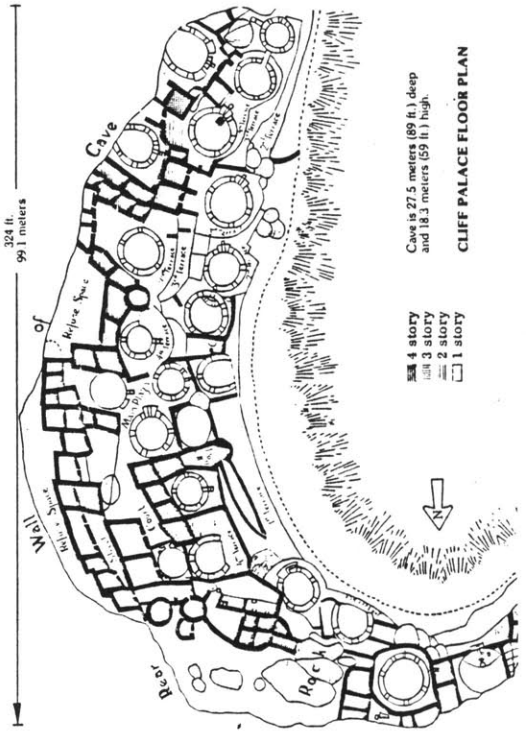
In other words, elements of the built landscape cannot shrink or swell as the need for larger sizes arises, but instead, larger sizes can be generated by aggregation and displacements of the smaller pieces or with the introduction of a different piece of its own form. This is not to say that there is not room for the occasional monument, or joke, but one can see a frightening norm developing today to treat buildings as internally focussed objects without regard to its relative size(s) or its relationship with the surroundings. One's walk in the city should be an understandable sequence of spatial experiences rather than discontinuous treks between individual artifacts.



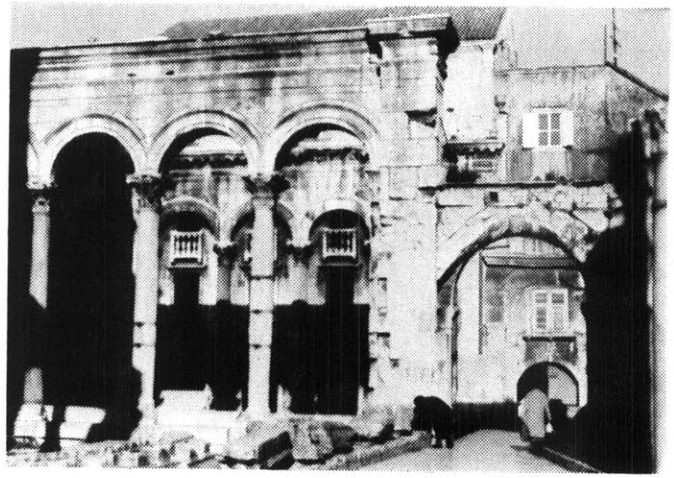


Mesa Verde, Anasazi Cliff dwelling - Colorado

Observations of the development of indigenous dwellings exhibits behaviors not unlike natural landscape transformations. The Anasazi cliff dwellings of the American Southwest show an integral/reciprocal relation with the site. Material was costly (labor intensive) so advantage is taken of the infrastructure quality and the partial containment offered by the indentation in the cliff. The degree of containment is intensified with partial walls; perhaps some of the cliff may also be removed. A secondary system, roof and closure elements, are added; eventually rooms and more buildings aggregate as the colony's use needs increase. Intervention into the landscape intensifies the existing degree of containment, transforming the landscape into a more contained and habitable form.

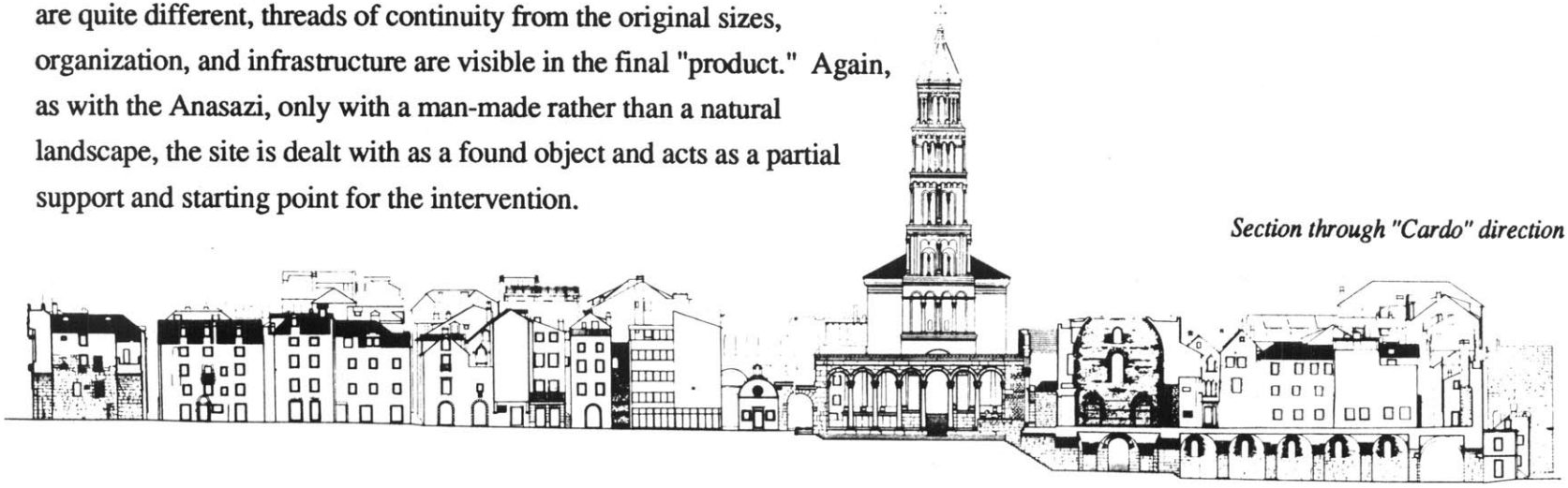


The city of Split on the north shore of the Adriatic Sea offers an interesting case study of evolving additive and subtractive processes. Originally constructed as a Roman coastal villa, the city has undergone fifteen centuries of continuous natural erosion and human interventions. The ruins of the Roman villa serve as infrastructure for a new occupation. The old walls were partially opened, intensified, and occupied. A medieval city of roughly the same size was added, this refortified by the Venetians which eventually was also partially dismantled and extended. The citizenry has had no problem in opening pieces of wall as light was needed, concurrently reusing the material to intensify, subdivide, or substitute in other areas.

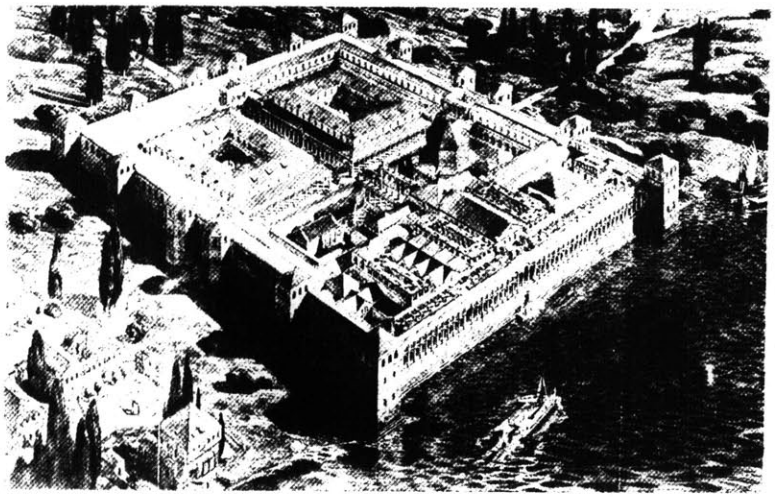


View of Peristyle - Split, Yugoslavia

Although the general organization and use of the successive occupations are quite different, threads of continuity from the original sizes, organization, and infrastructure are visible in the final "product." Again, as with the Anasazi, only with a man-made rather than a natural landscape, the site is dealt with as a found object and acts as a partial support and starting point for the intervention.



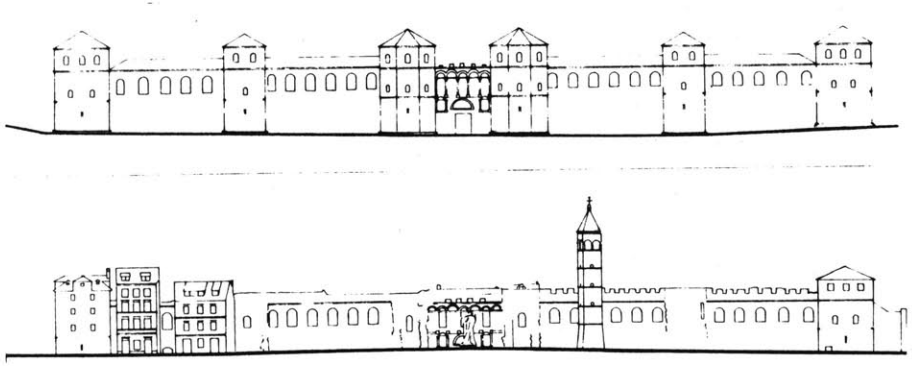
Section through "Cardo" direction

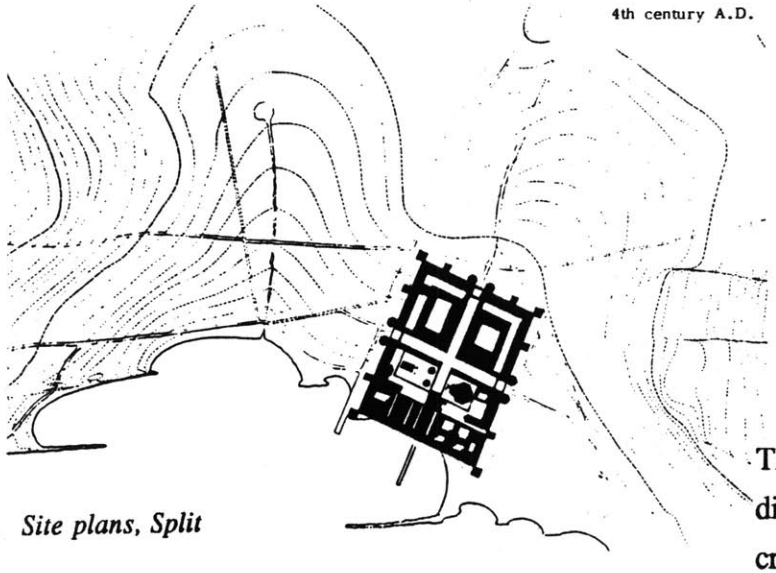


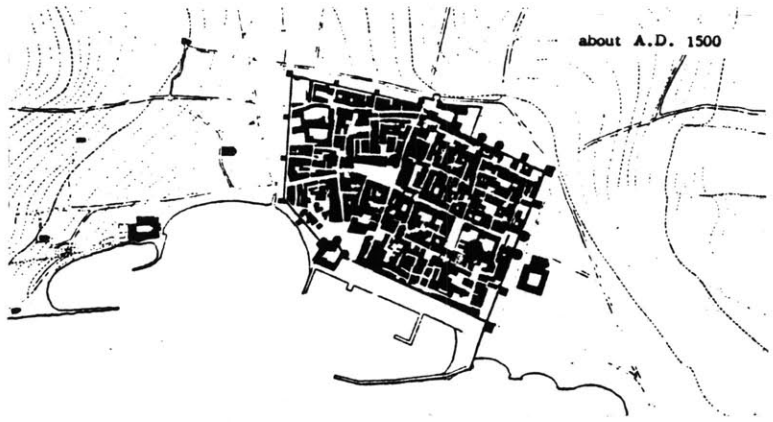
Reconstruction of Roman Villa

View of Roman wall at the water edge

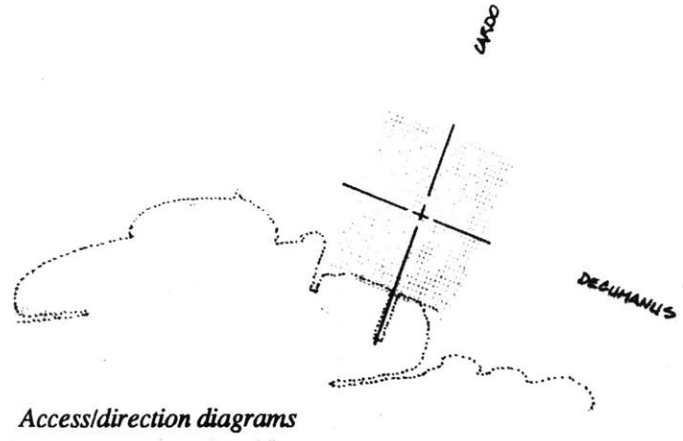
Elevations showing Roman Facade and its current state







Site plans, Split



Access/direction diagrams

These diagrams show the major directions of the access at three different times in the history of the site. The Roman system shows a cruciform plan based on the notion of two directions, Cardo and Decumanus. As the fortress was reinhabited and expanded in the Middle Ages, one can observe the development of a parallel major access along the water edge and along the partially deconstructed western wall. A new infrastructure was added to the west with an access system that exists comfortably as an extension to the original by maintaining a similar range of dimensions and by developing a recognizable version of the Cardo and Decumanus, based on the medieval system of "place to place" access as well as the building of diagonals. Still further to the West, a third system, developed in the 19th century, shows a parallel recognition of the initial Roman directions but within the more rigid geometric attributes of the Beaux-Arts. Observed in the site plans and of particular interest, are the consecutive fortifications, deconstructions, extensions and reinhabitations of the perimeter walls through history.

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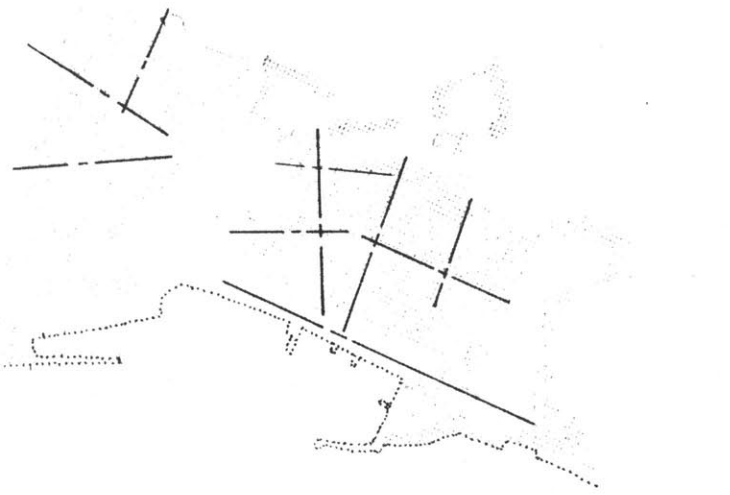
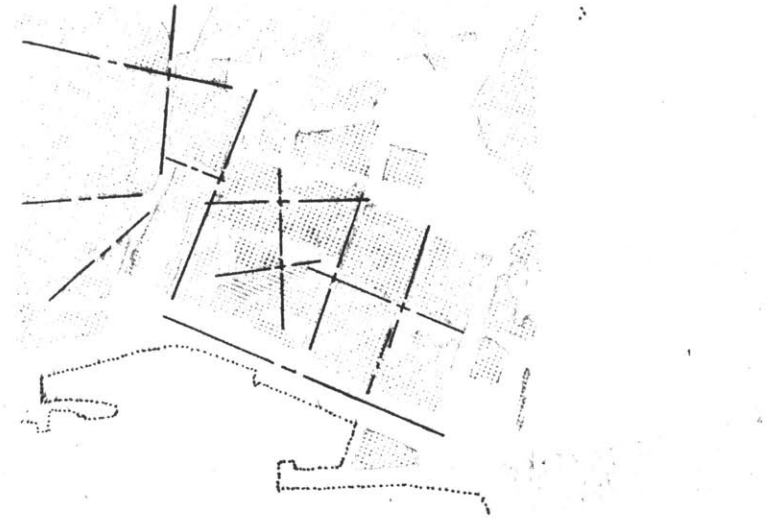
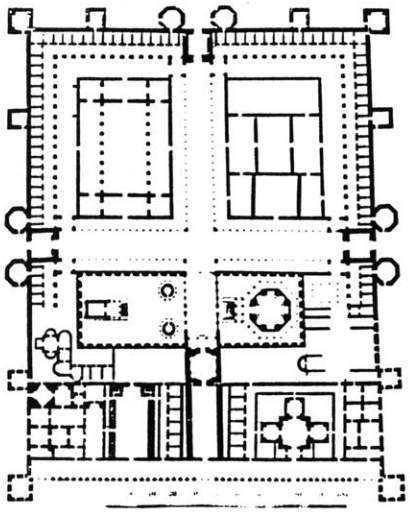






Plan of Roman Villa

Plan - current state

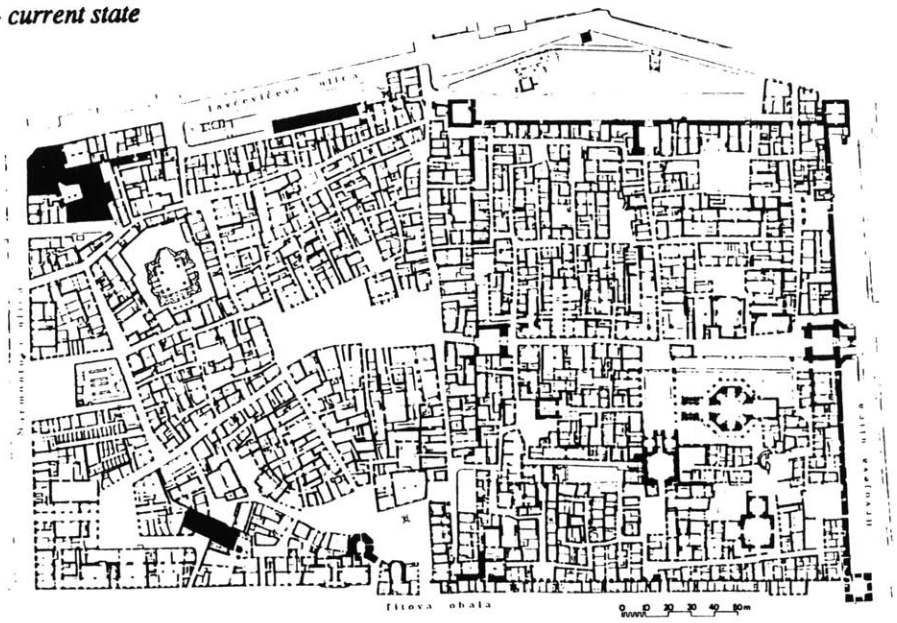


Diagram of Roman collective/access zones shows constant street dimension with controlling gates

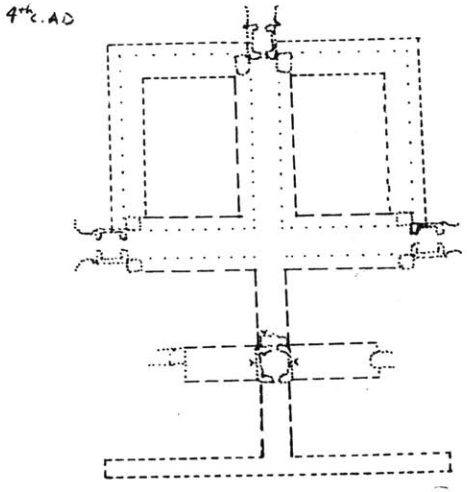
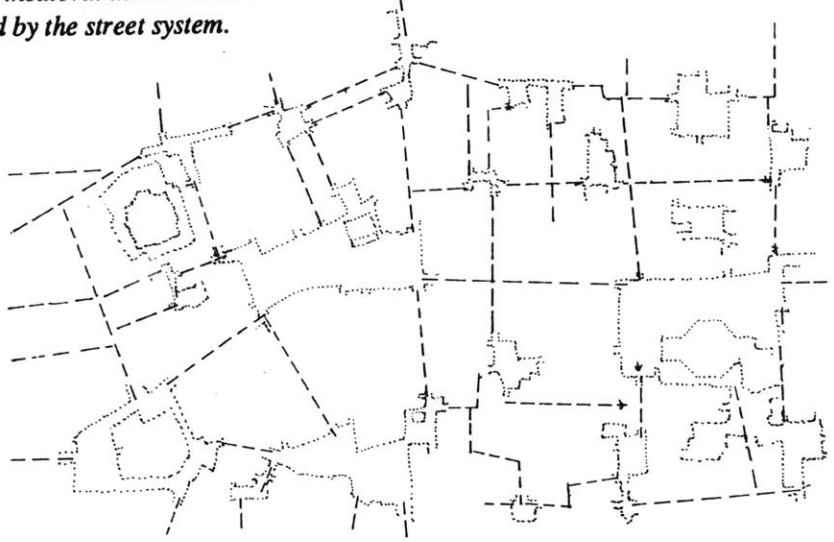
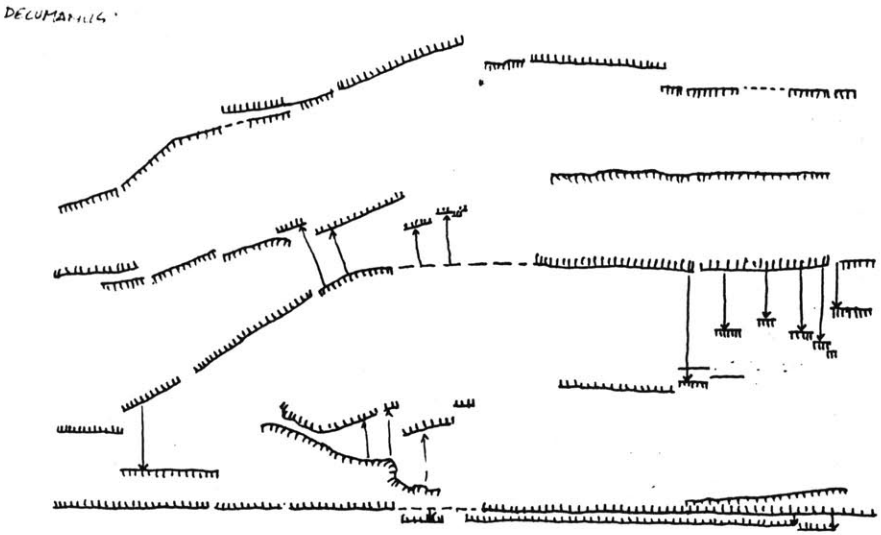


Diagram of medieval inhabitation shows block size collective areas linked by the street system.





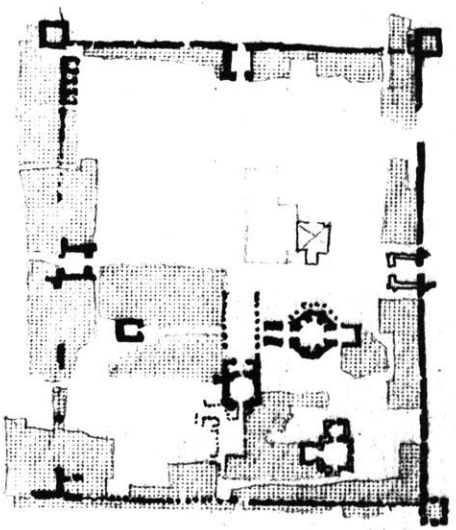


Diagram shows remains of Roman ruin and adjoining buildings.

Diagram of continuous edge definition along the access in the two major directions. Note that the large collective territories (shown by the arrows) are created by displacements of the edge along the access.

Circles

A circle can be constructed with one basic rule:

-It is the total set of points equidistant from another particular point (the center),

Two parameters complete the description of a specific circle:

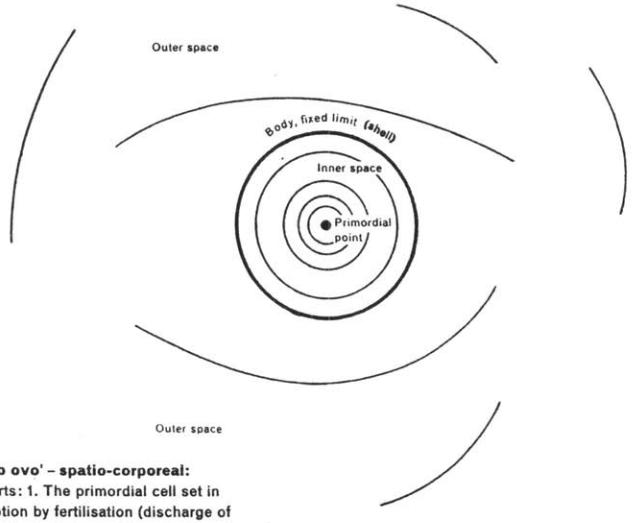
-the location of the center

-the dimension from the center to the line

Rotations and extrusions of the form lead to three dimensional constructs; cylinder, cone, and sphere. Without dealing with the specific properties of the geometric solids, we may look for commonalities in their associative qualities based in their circular origins.

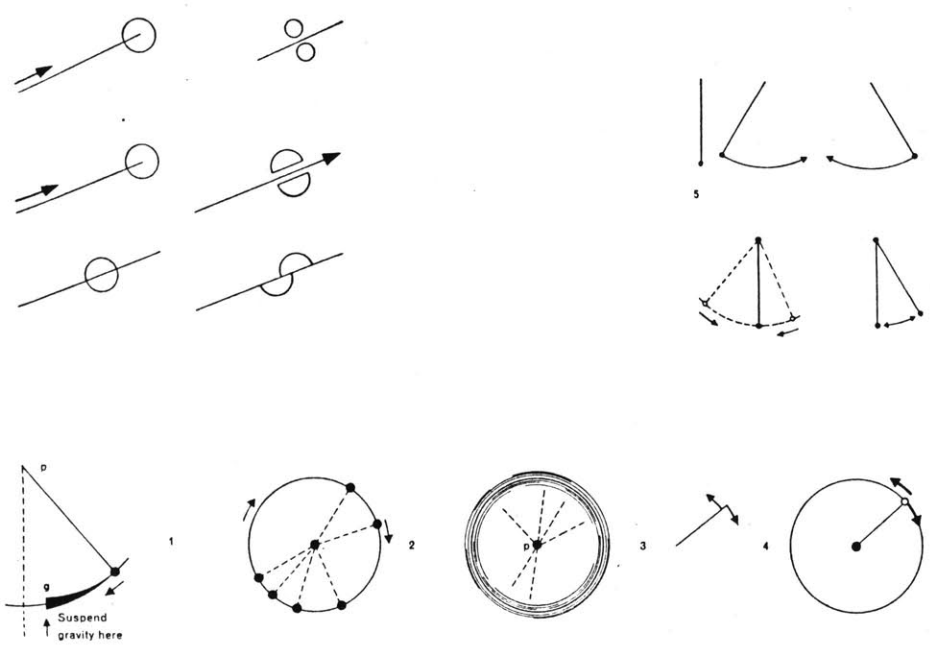
The area enclosed by the circle is the minimum that can be for any shape. We can consider the circle as a defensive, closed form, that is, it is the optimum shape in terms of keeping stuff in (or keeping it out) having no reciprocal relation between inside and outside.

The architectural equivalents, arches, domes, vaults, silos, etc, become habitable only by the removal of material, that is, the use of partial circles. Even the igloo, necessarily closed to the fierce Arctic elements, needs a hole through which to crawl. The wall structure is semicircular in section to provide a horizontal use surface for the inhabitants.



'Ab ovo' – spatio-corporeal:
Parts: 1. The primordial cell set in motion by fertilisation (discharge of tension with a complementary) and growing.
2. Inner space (in the egg, broken into yolk and white).
3. Limit of the thing-concept (shell), body.
4. The surrounding space (outer space).
The whole: spatio-corporeo-spatial.[1]

P. Klee, diagram



Circular movement of pendulum [3].
In this closed, endless movement, the need for countermovement disappears, and actually the pendulum abandons it under the new conditions. The purest form of movement, the cosmic form, arises through the elimination of gravity, of our bond with the earth. The circular form remains the same whether the movement is to the right or to the left. In the circle the dominant power is in the centre. The circle results from the primordial dynamics of a point connected with a dominant centre (by the power of constraint) [4]. All positions are possible; that is the symbol of dynamics.

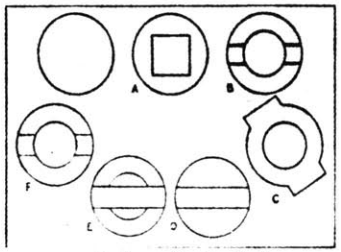
Yet the force of gravity is still at work. There is no perpetuum mobile. If we confine the eros of the pendulum to a special case—the arc of a circle—the plumb-line on the horizontal is still a fundamental symbol. A kind of compromise occurs. More and more, the line loses importance [5].

When the movement is jerky, tension makes the steady state mobile, and things that are already mobile are disturbed by its constraint. As a result we get irregular curves and spirals.

The circle. But something new happens when, as the pendulum[1] swings quietly back and forth, we suddenly think away the force of gravity [1]. Or if we swing the pendulum with so much force that gravitation is overcome. In either case the bond with the earth is broken and the cosmic form of motion sets in forthwith: the pendulum begins to swing round in a circle, which is the purest of dynamic forms [2].

P. Klee, diagram

Klee describes the circle as pendulum motion minus gravity. The dynamic nature of the circle is clear. Using this as a model for the form one can throw away the pendulum and be left with the pure shape. The center is understood and need not be built. Occupation of the center brings back the pendulum, perpetuously spinning and further intensifying the inward focus of the curve. Similarly, one might consider the radius demarcation and dimension as implying the centrifugal dynamic action, whereas the diameter, in setting up a displacement, builds a direction, the first step in reduction of the closed form.



Considering the absolute properties in the geometry of the circle it is no surprise to see it adopted in some capacity as a symbol of so many of the major religiouns as well as minor sects throughout the history of the world. Eternity, wholeness, equality, completeness, internal focus, all constitute meanings construed from symbol and icon. At the risk of drifting even further from the intent of this paper, an antedote from the Vietnam peace talks can shed some light on the universality of the relationship between meaning and the form of the circle.

After years of warfare the four major parties involved finally agreed to sit and talk peace. Disagreement on the seating arrangements delayed commencement of the meeting almost three months. North Vietnam and the V.C. were insistant that all parties concerned sat as equals with no divisions or hierarchies between them. South Vietnam and the V.C. were equally adamant to maintain a division between the four parties. Numerous versions of a subdivided circle were rejected in favor of a round table with two secretaral tables on either side a critical 18" away from the edge of the circle. Thus the North's insistance on unadulterated equality was satisfied by the completeness of the form, and the South accepted the secretarial tables as a virtual diameter subdivision creating two sides.

Times

CITY EDITION

Weather: Mostly cloudy today; chance of rain tonight, tomorrow. Temp. range: today 42-26; Thurs. 37-22. Full U.S. report on Page 93.

10 CENTS

EXPANDED VIETNAM TALKS BEGIN IN PARIS TOMORROW; ROUND TABLE AGREED UPON

DEADLOCK ENDED

Washington and Hanoi Agree on Seating After 10 Weeks

By PAUL HOFMANN

PARIS, Jan. 16—An agreement was announced here today for the opening of the expanded talks on the Vietnam war. The first session is to be held Saturday at 10:30 A.M. (4:30 A.M. New York time).

The accord broke a 10-week deadlock on procedural matters that had blocked negotiations on substantive issues by the participants in the conflict.

Under the terms of the agreement, representatives of the United States, South Vietnam, North Vietnam and the National Liberation Front of South Vietnam, or Vietcong, will sit at a circular table without nameplates, flags or markings.

Two small rectangular tables at each side of the round table but not touching it, will accom-

W. Averell Harriman, left, head of U.S. delegation, and Nguyen Thanh Le, Hanoi spokesman, meet newsmen.

New York Times, January 17, 1969

Tibetan wheel of existence

St. Vladimir the Great, J.C. & B.V.M.

Tribal circle dance

Muslim Talisman

Magic circle of the Covenants

Hindu cosmic diagram

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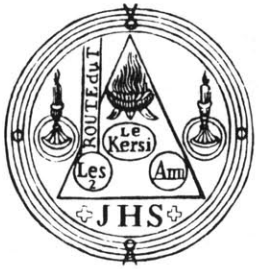
Hindu cosmic diagram.

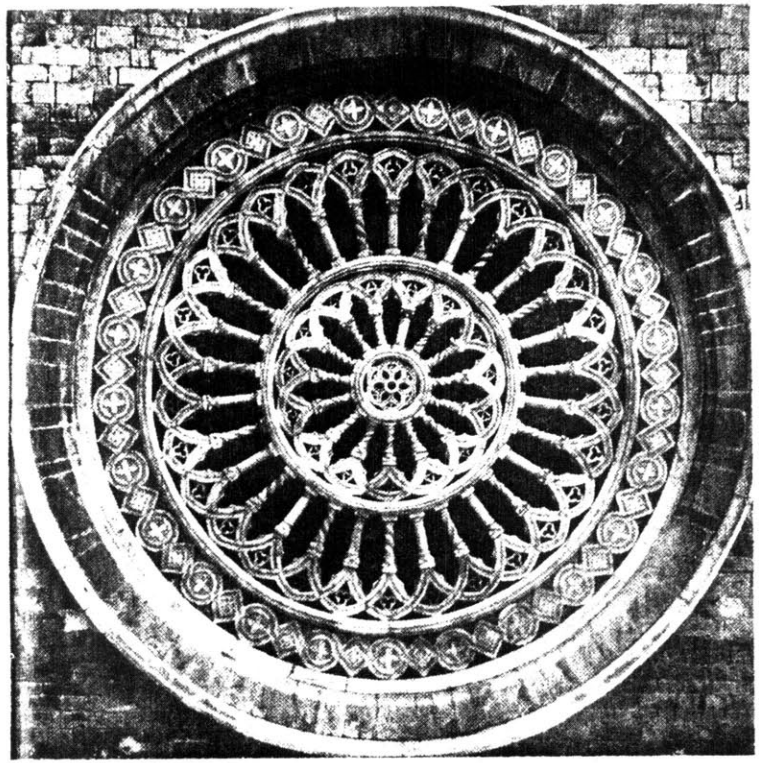
#47 ST. VLADIMIR, THE GREAT

OUR LADY OF THE SIGN

MAGIC CIRCLE OF THE COVENANTS



Demarcation - Intensifications - Subdivisions of a Single Circle



Rose-window of the Basilica of Santa Chiara in Assisi

Concentric demarcations

- controlled by the center by repetitive referencing
- the edge is a maximum limit of the diameter
- the form is reinforced by repetition at different sizes

Radial demarcations

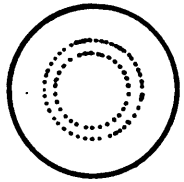
- physically marks the center
- in general, tends to ameliorate the edge
- when the demarcations make recognizable sub-forms they may tend to intensify the form

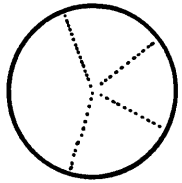
Directional demarcations

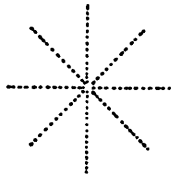
- can partially intensify center by marking the diameter
- the edge is least important as continuation of the field is implied
- only the diameter demarcation recognizes the form by making the center

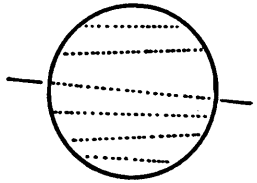
Displaced center

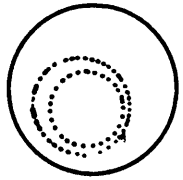
- intensifies the center where it is not
- edge is less reinforced
- less static form

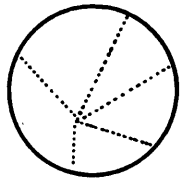


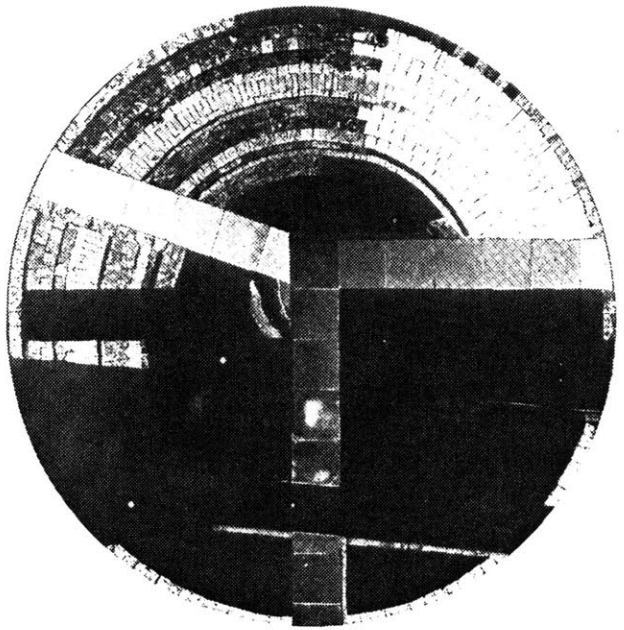










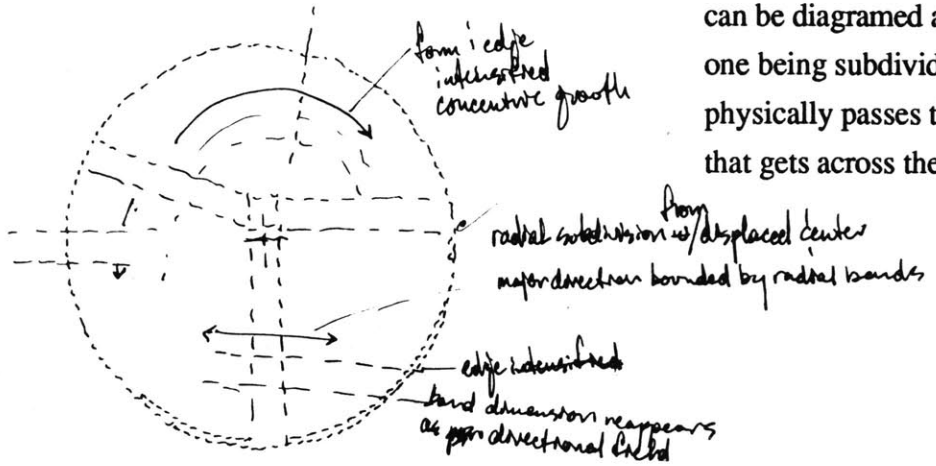


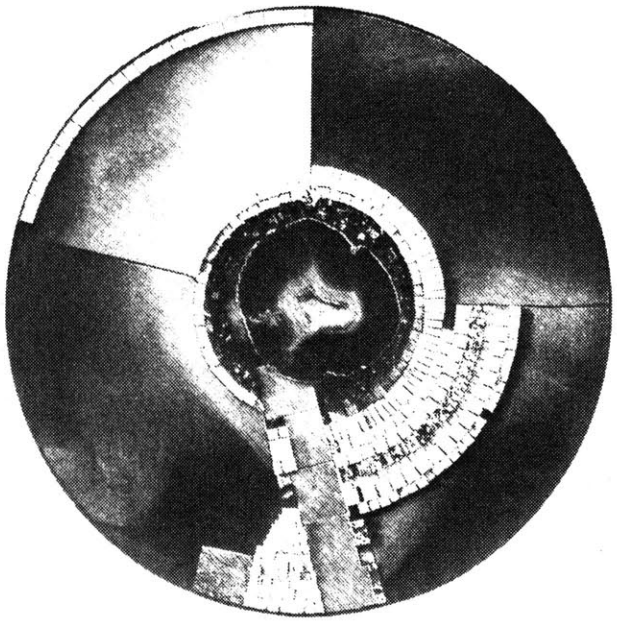
L. Schaffradt Stone Mosaics

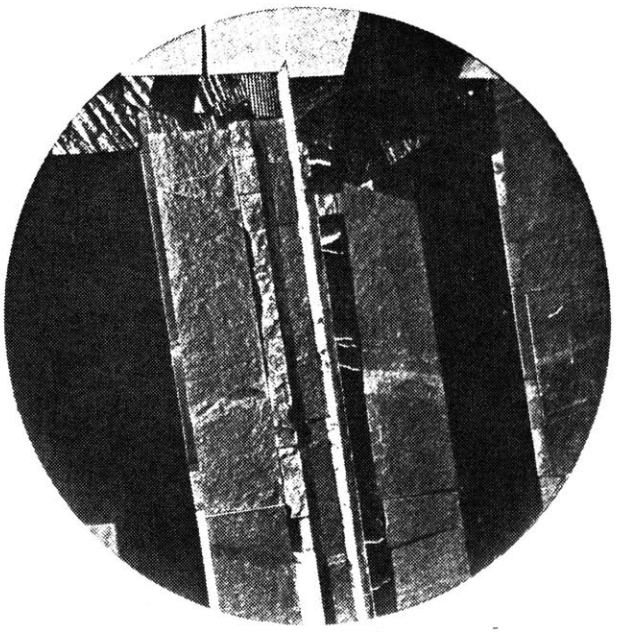
The stone inlay pieces, shown here, illustrate the demarcations previously illustrated. In (A) the square tiles radiate in three bands from a displaced center, one spoke passing through the center. Concentric rings intensify the top edge, while the bottom is banded horizontally. One course of concentric tile intensifies the bottom edge lest the directional banding wipe out the lower half of the circle edge completely.

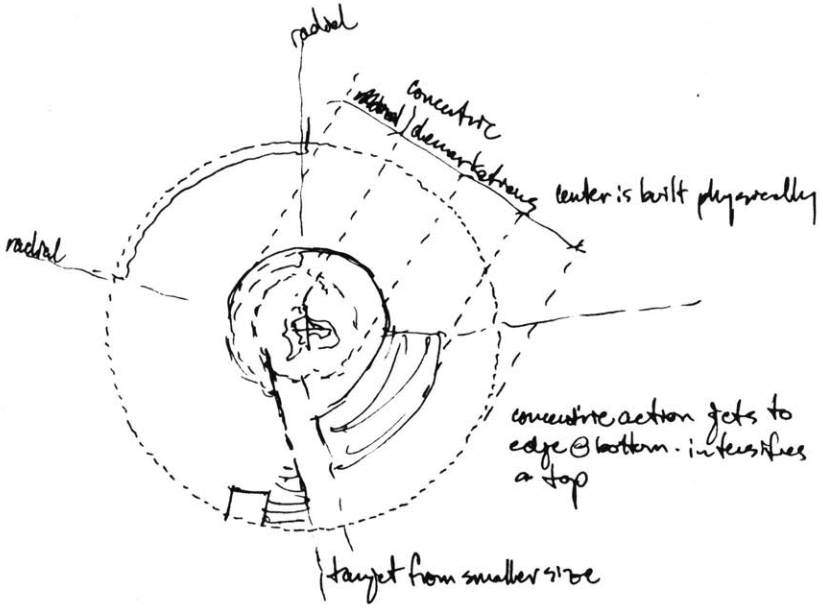
The center is physically marked in (B) intensifying the inward focus of the circle and lessening the dynamic possibilities of getting beyond the edge. Also note the exchange between concentric and radial demarcation at the lower radial band where the small tiles reinforce the radial behavior at the larger tiles. A larger tile, in turn, gets away and extends the concentric behavior of the small tile.

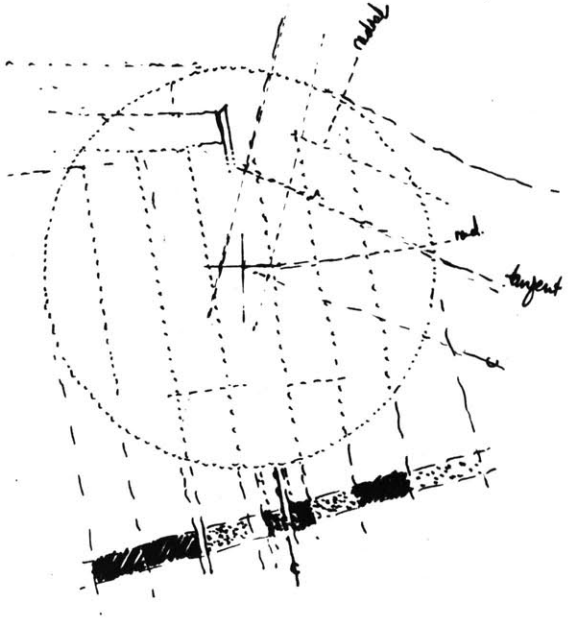
(C) shows the intersection of two major directions. The vertical bands can be diagramed as fairly consistent dimensional repetitions, the center one being subdivided into smaller strips, the lightest of which physically passes through the center. In addition, it is that narrow strip that gets across the opposing direction.



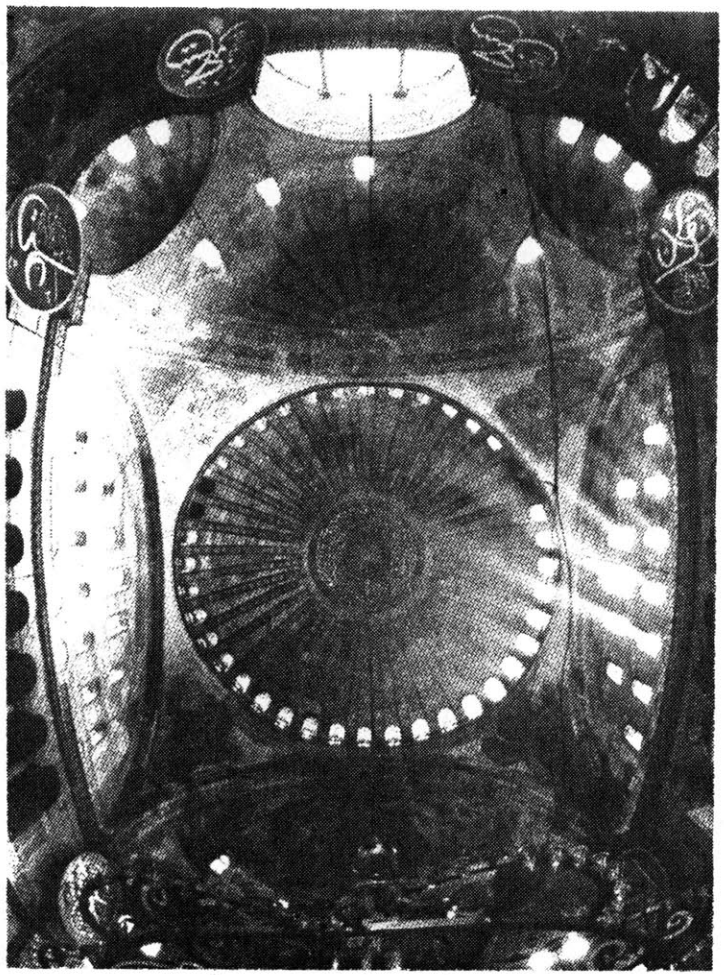




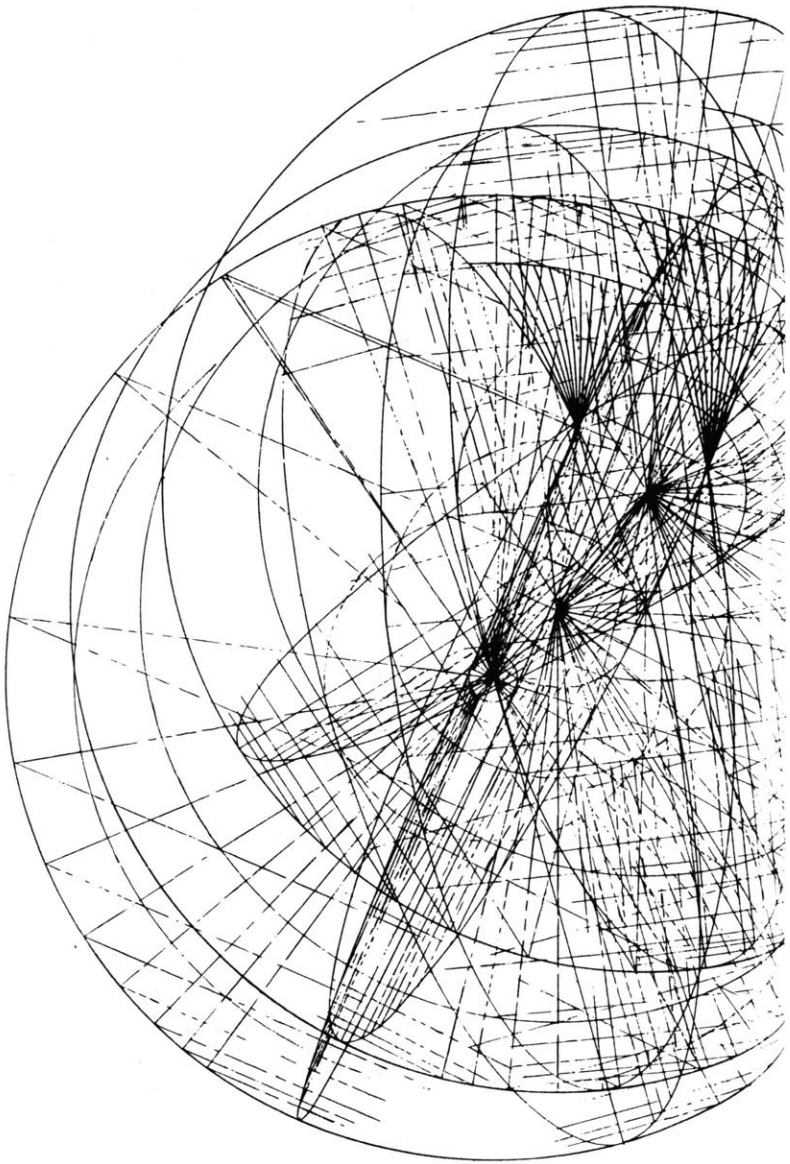

radial
concentric
deviation
center is built physically
radial
concentric action gets to edge @ bottom - intensifies at top
target from smaller size


radial
rad.
tangent

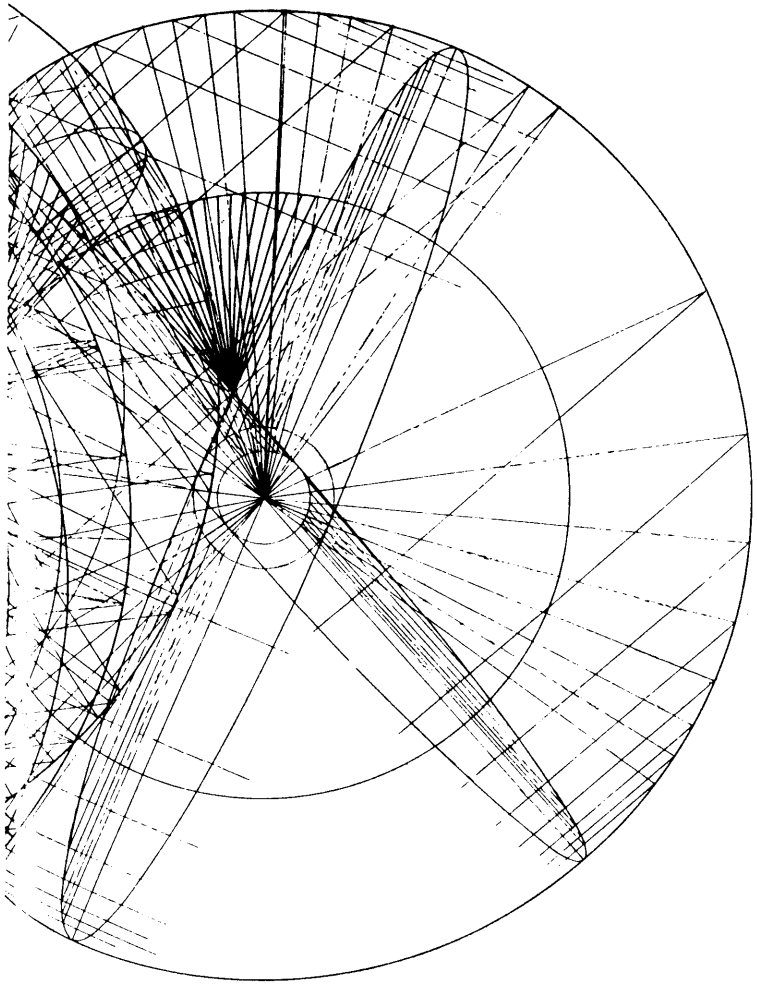
Relations in Multiple Circles:



Haga Sophia, Constantinople

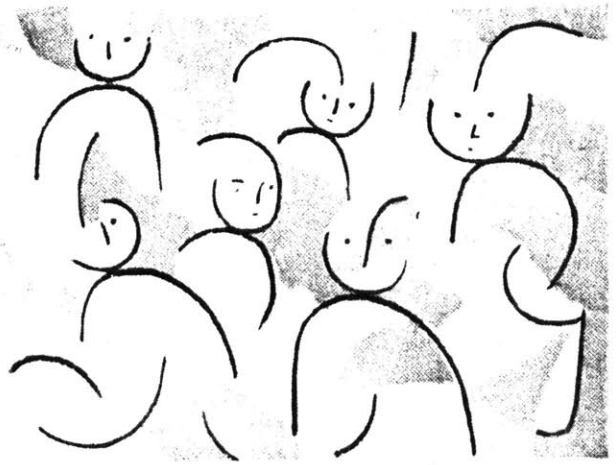


J. Utzon-geometric construction for Sydney Opera House

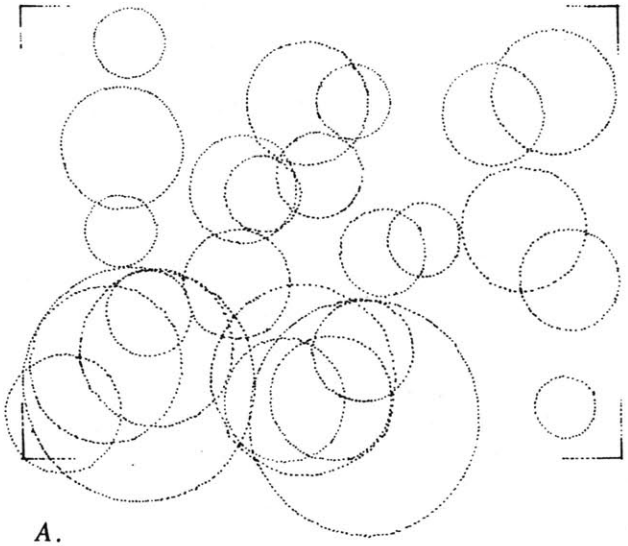


This short exercise attempts to find associative relationships between individual elements in what might generally be described as an open field distribution of circles.

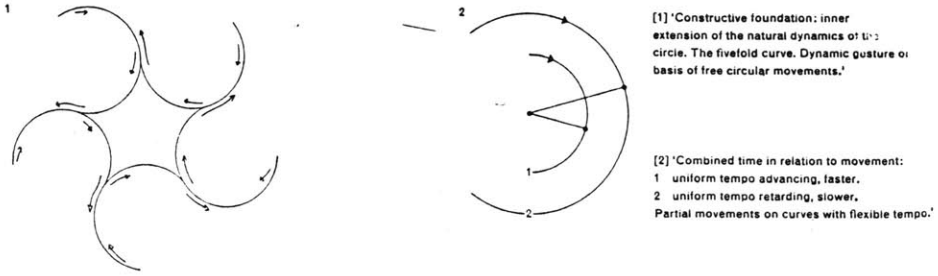
Diagram (A) shows completion of the partial curvatures into circles to determine their relative size and location. Diagram (B) basis itself on Klee's diagram which show the zone and direction as being the most intense at the tangent. (B) establishes these tangencies as major directions and projects beyond identifying the circles through which the projection passes at or near the center. Diagram (C) shows the same, with projections orthogonal to the tangent direction.
(D) illustrates circles in which the center zone is marked by edges of light and dark surfaces. Finally (E) goes back to the initial partial curvatures, extends the tangents and notes the penetrated circles. Of particular interest is this diagram are the territorial exchanges between semicircles.



P. Klee, Sextet of Geniuses



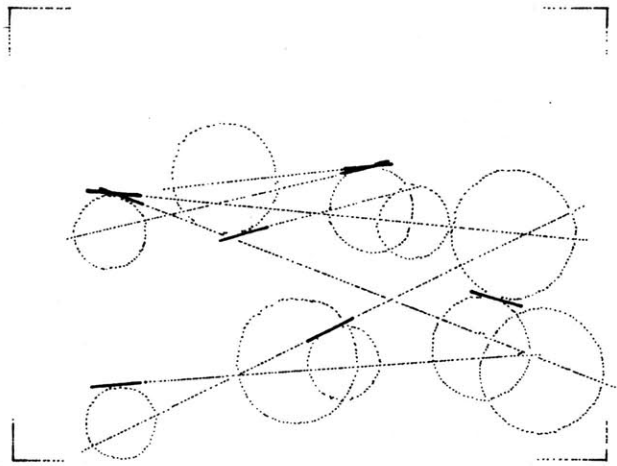
A.



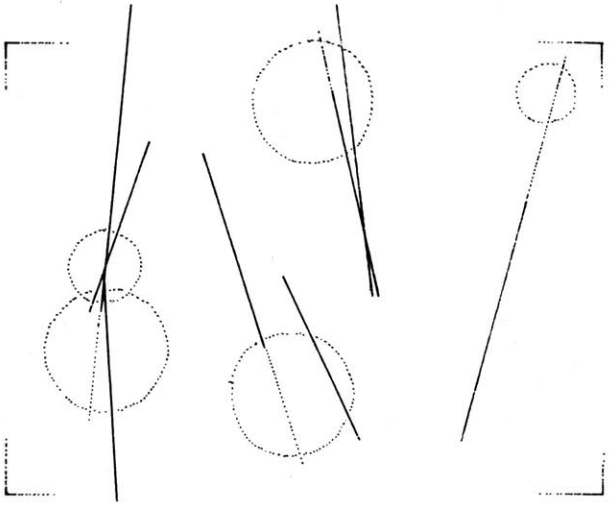
[1] 'Constructive foundation: inner extension of the natural dynamics of the circle. The fivefold curve. Dynamic gesture of basis of free circular movements.'

[2] 'Combined time in relation to movement:
1 uniform tempo advancing, faster.
2 uniform tempo retarding, slower.
Partial movements on curves with flexible tempo.'

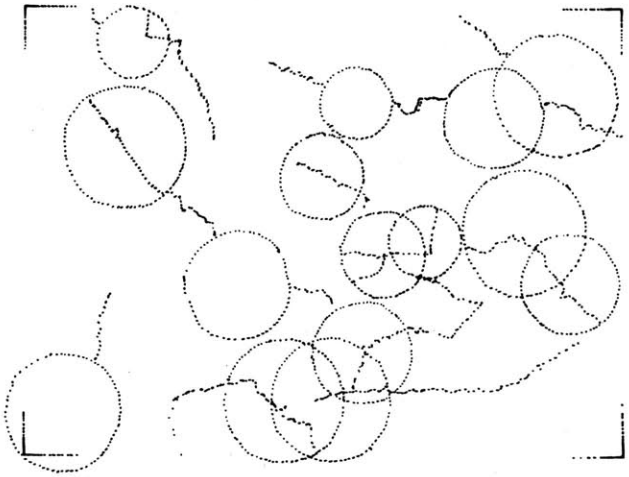
P. Klee, diagram



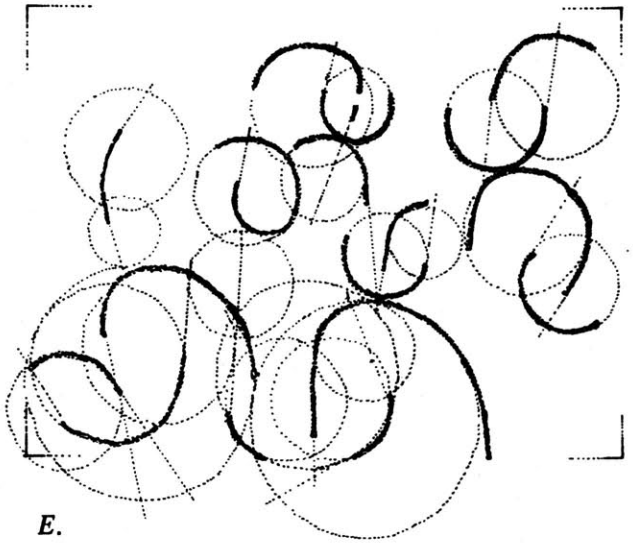
B.



C.

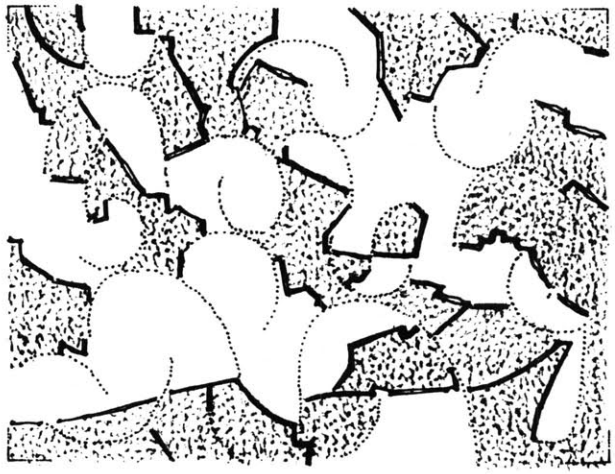


D.

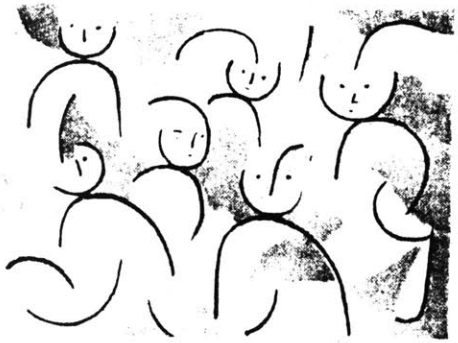


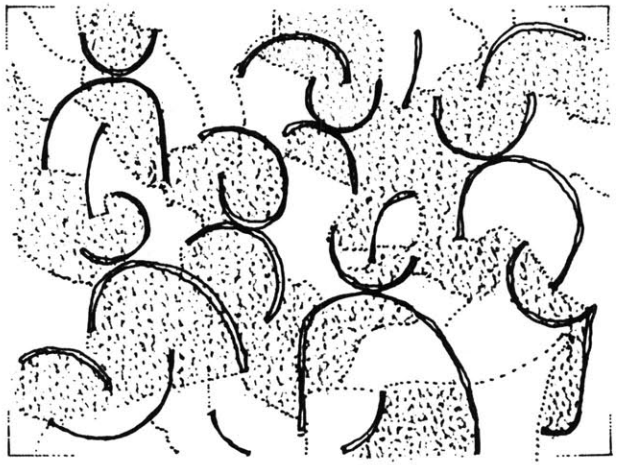
E.

Diagrams (F) and (G) are reversal transformations. In (F) the light to dark relationships remain while the hard lines disappear, the softer edges becoming bolder. In (G) the relationships of the hard and soft edges remain while light patches reverse with the dark,. Diagrams (H) and (I) build upon the reversal diagrams by selectively using demarcations from them. The intent is to develop a habitable "architectural" plan, building an access continuity across the field and a range of "closed" versus "open" spaces. Hard edges representing extruded walls and a secondary system consisting of beams and upper floor levels are established using the multiple directions found in the original painting.



F.

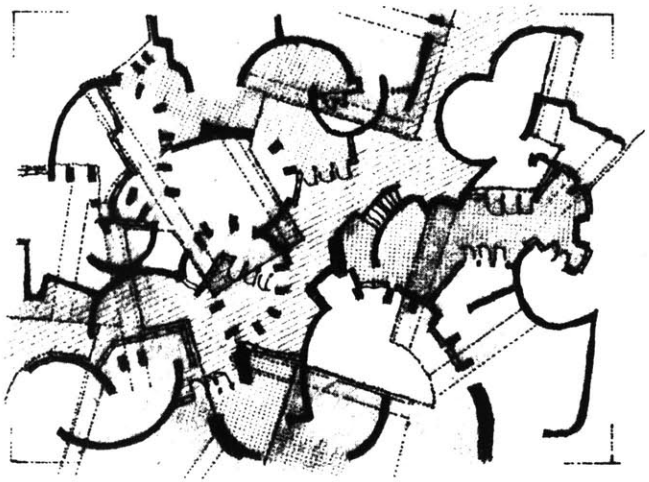




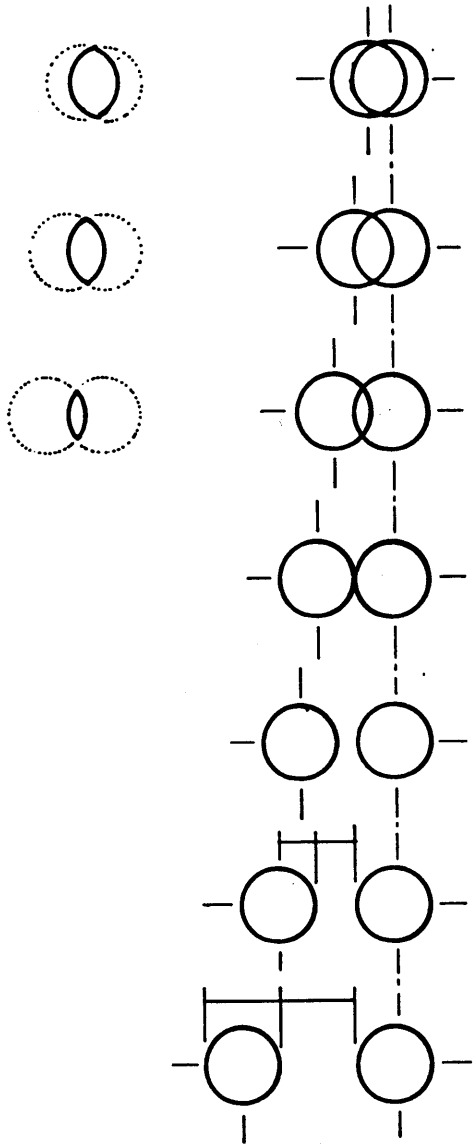
G.

H.

I.



The diagrams on the following pages attempt to classify certain dimensional and adjacency relationships between circles and between a circle and a straight edge. The hope is that they may be useful as a type of catalogue system whereby a library of architectural and other references can be built. A select set, a scrapbook, of images follow, illustrating the relationships shown in diagram.



centers internalized
dimension of center to center (c to c) < radius dimension,

reciprocal centers reinforced
geometric stability c to c = radius

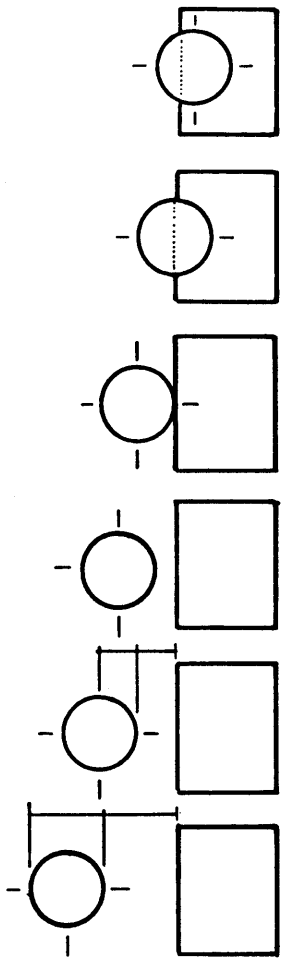
independent centers
radius < c to c < diameter

tangent edges
c to c = diameter, D

Free edges
c to c > diameter

radius dimension stability
radius = edge to edge
c to c = 3D/2

dimensional diameter stability
diameter = edge to edge
c to c = 2D



line passes within edge of circle

center marked with perpendicular relationship to edge

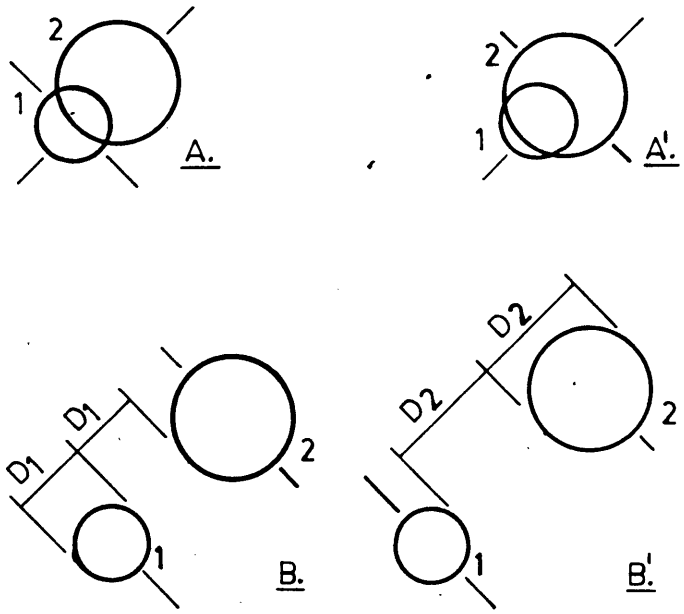
circle is static, "fixed", at the diameter and center

tangent

free edges

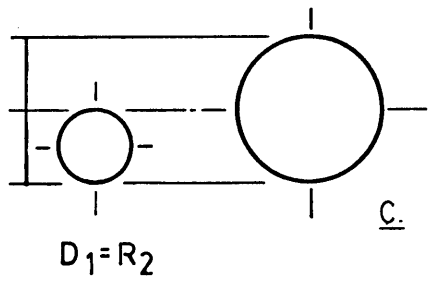
radius dimension stability

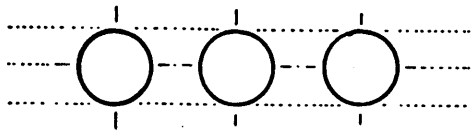
diameter dimension stability



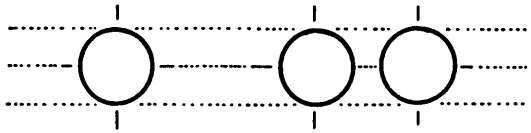
Needless to say, these relationships do not only exist in circles of the same size but can also be used to describe circles of differing dimensions.

In (A) the large circle (2) reinforces the center of the small circle (1). (A') reverses the relationship - the small circle reinforces the diameter of the larger one. The diagrams of figure (B) and (B') illustrate, in a similar fashion, two versions of a dimensionally stable displacement. (C) shows a special case where the diameter of the small circle is exactly one half the dimension of the large one. This sets up possibilities to intensify tangent to center and tangent to tangent registration.

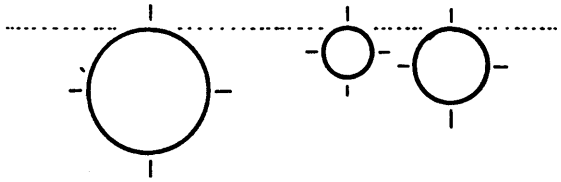




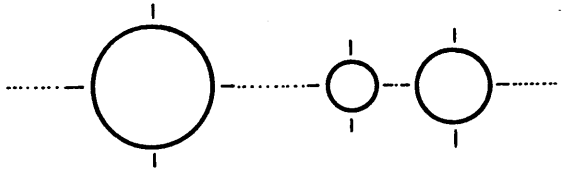
Registration at regular intervals



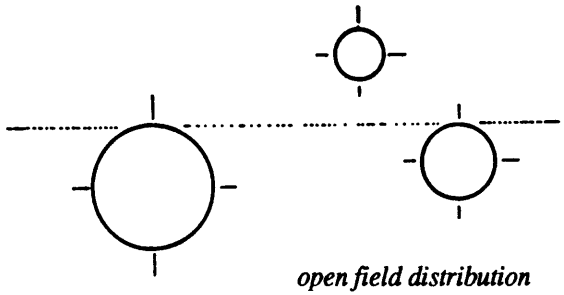
Registration at irregular intervals



Registration at differing sizes, center registration

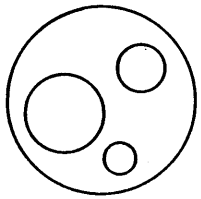


Registration at differing sizes, edge registration

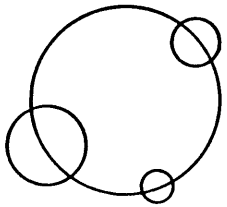


open field distribution

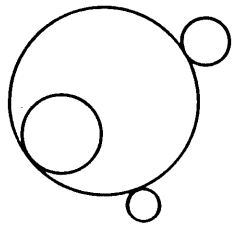
Fig D.



enclosure



centers

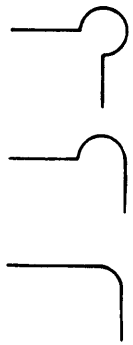


tangents

Fig E.

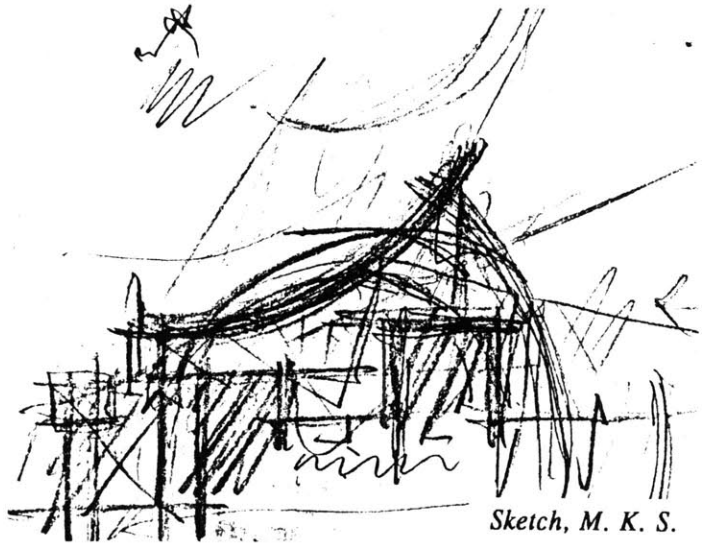
Since the circle is an omni directional form, it takes a minimum of three to establish registration. Figure (D) shows four cases of registration serially transformed from regular spacing and equal dimension to the fifth case in which there is no registration or constancy of dimension.

Figure (E) shows an organization of the three circles governed by a third larger one.

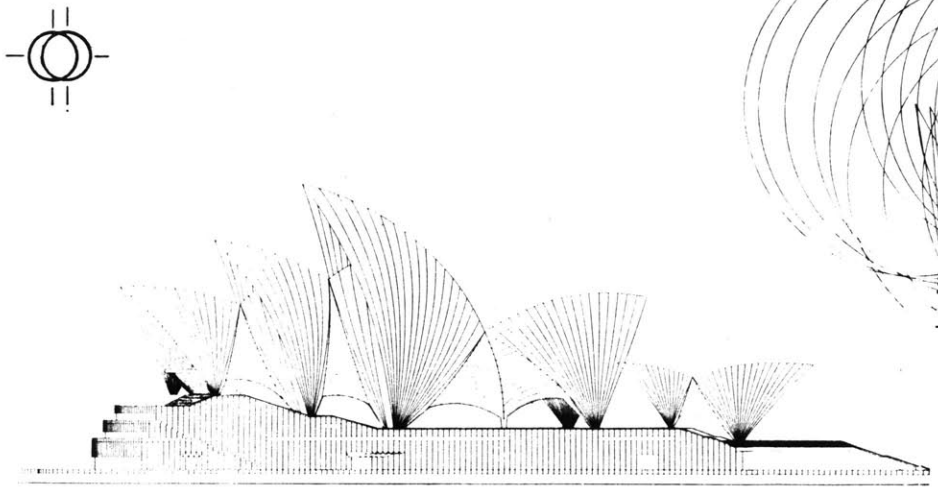


Hinging-

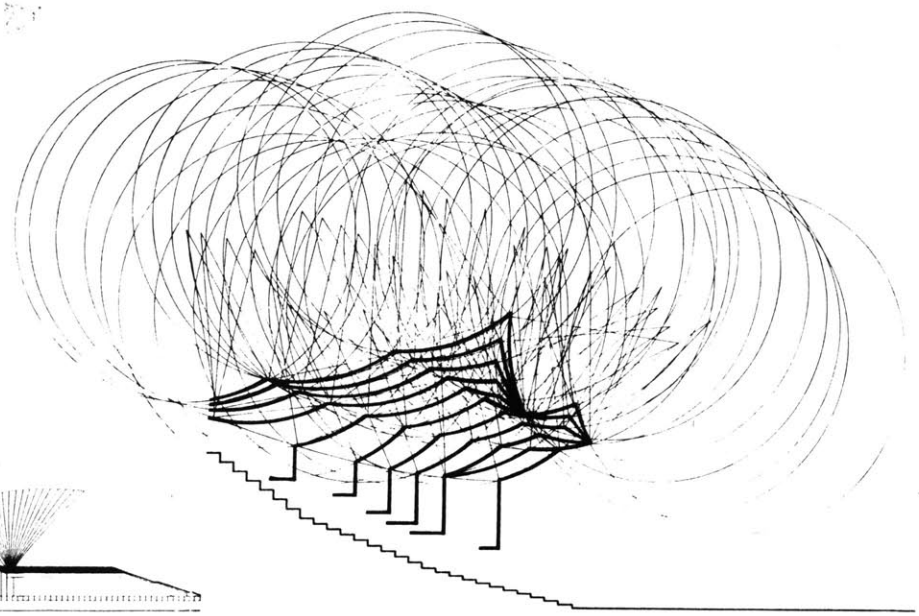
The roof system of the Sydney opera house by Utzon is geometrically constructed by slight displacements of circles. Partial curvatures in the West Elevation aggregate to a fan shape, "open" to the horizontal and the light, with the curvature coming down + perpendicular to the ground. The center of the curvatures are not in the body of the building but somewhere below it. The Minor Hall celing section shows the center up and away from the building resulting in a profile that mirrors the concave/convex relationship found in the roof. Ulzon plays on this relation by making the more closed form of the concave roof section more "open" to the light while reversing the open form of the convex ceiling, building it as continuous surface, closed to the light.



Sketch, M. K. S.



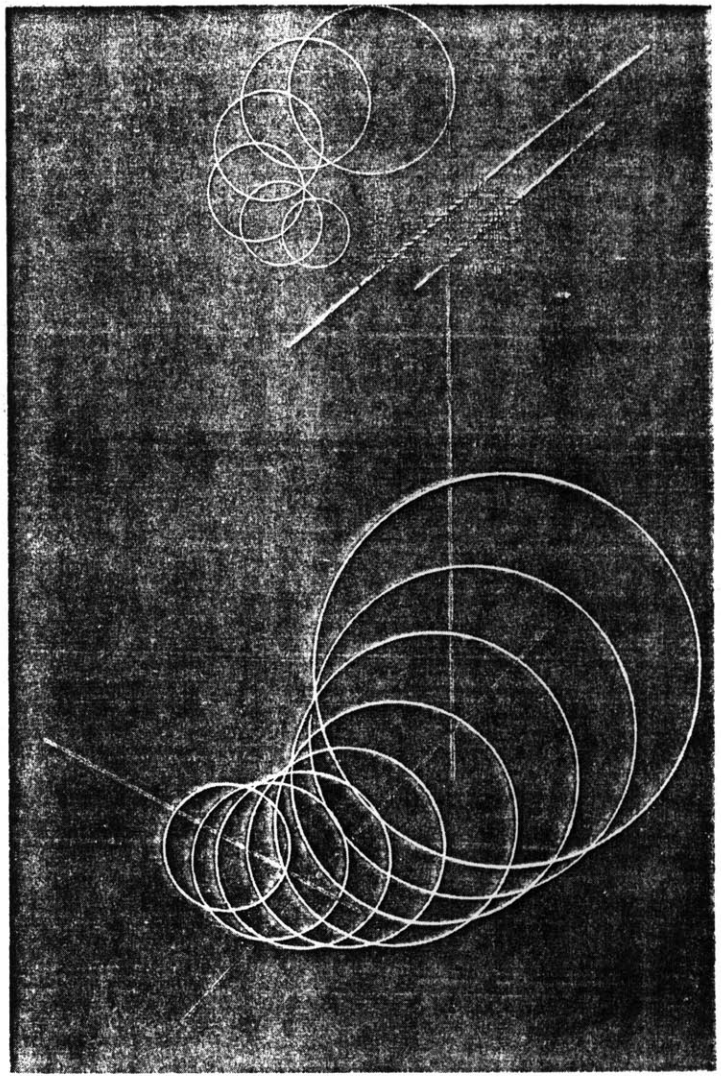
J. Utzon, Sydney Opera House, 1965



Minor Hall, geometrical drawings, superimposed section

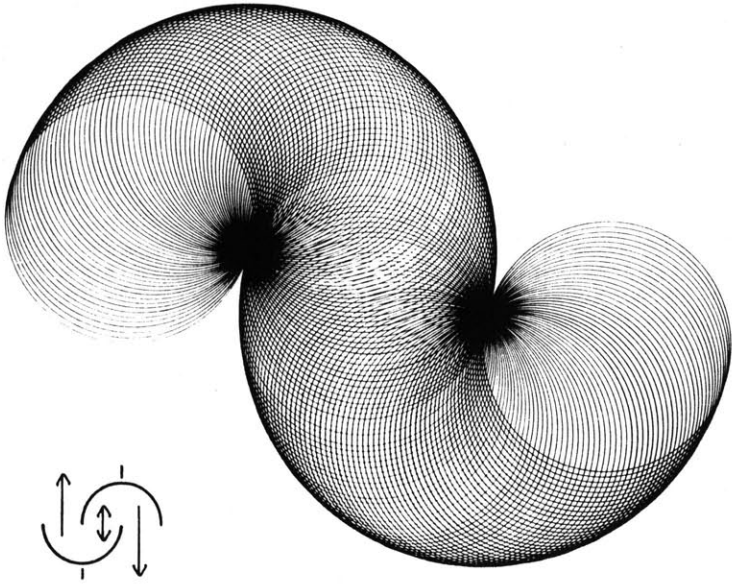
"Linear Compositions" by Alexander Rodchenko, pictured at right, shows two actions. The top set of circles is constructed with each circle reinforcing the center of the adjacent larger circle. The bottom set is serially organized by narrowly overlapping circles where alternate circles reinforce each others centers.

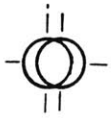
The slightly displaced circles in the exercise below aggregate such that the resultant larger form includes two opposed semi circles with mutually reinforced centers.The territorial exchange between the semi circles resembles these found in Klee's "Sextet of Geniuses" (E).

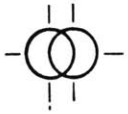


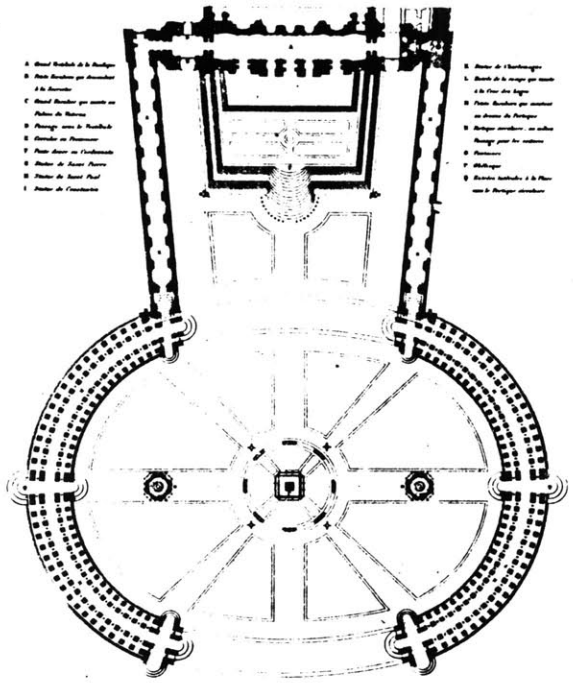
A. M. Rodchenko, Linearism, 1920, oil painting

Exercise from the Institute of Design, Chicago, USA, 1960

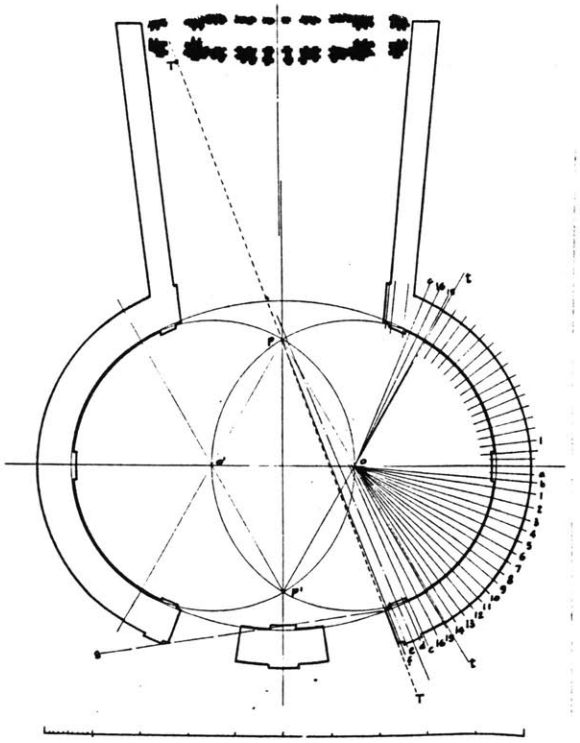




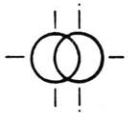


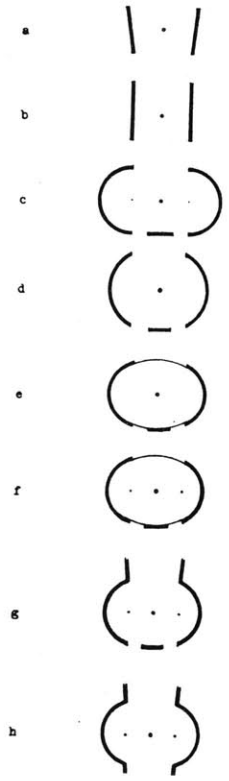


Bernini Piazza, Obliqua 1667, Letarouilly's plan



Colonnade layout



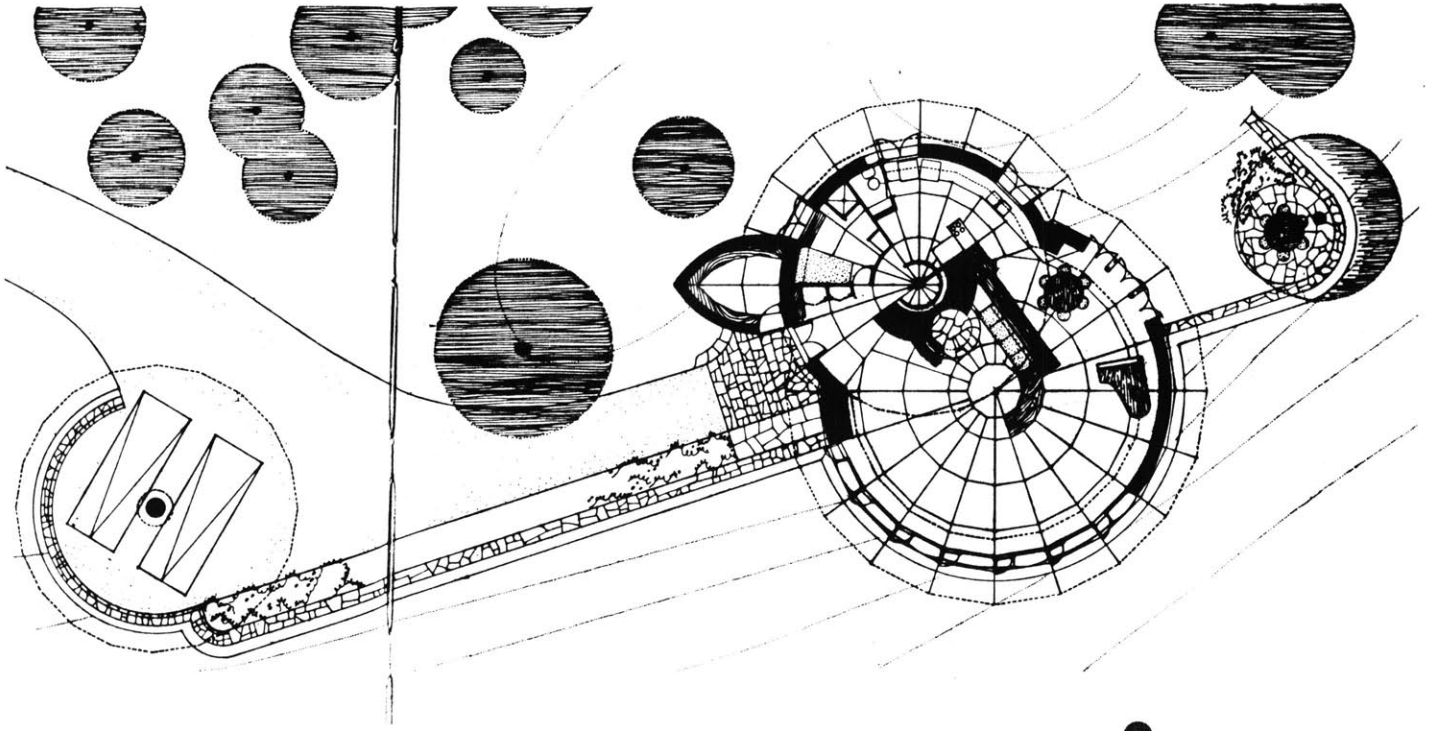


Development of Bernini's design for the Piazza Obliqua: diagrams

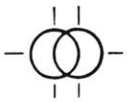
a. Trapezoid
b. "Square"
c. Two Semicircles
d. Arcades
e. Medal I
f. Medals II/III
g. Vatican Plan
h. Revision of 1667

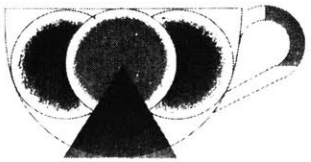
Oval constructions

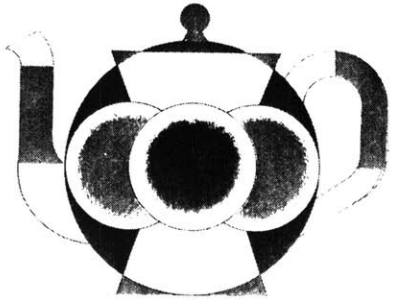
In Bernini's design for the Vatican, two circles with mutually reinforced centers are used to construct a larger oval. The colonnade layout comes radially from the circle centers. Note, however, that though the center of the ellipse is occupied, the adjacent sculptures are displaced into the partial containment of the semicircles, equidistant from the center of the ellipse and the edge of the semicircle. The geometric centers of the circle remain free. The mirrored deployment of the semicircles results in a one to one territorial exchange that retains the closed nature of the form. "Removal" of the material along the broad edges of the oval allows passage of the major access direction.



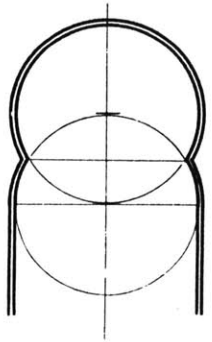
F. L. Wright, Friedman House, Pleasantville, N.Y., 1950





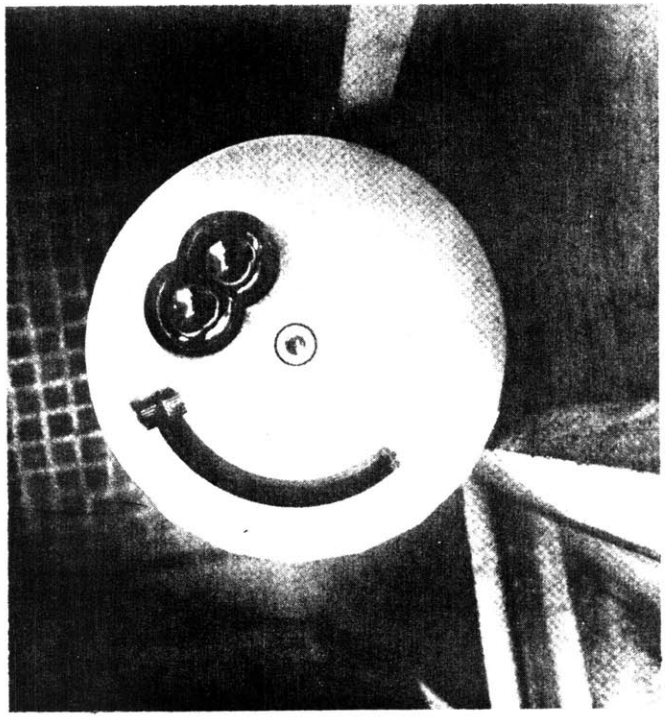


Rodchenko, Teacup, Teapot, 1922

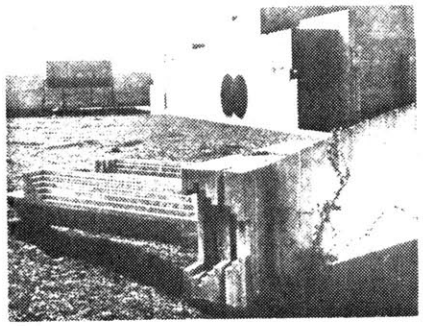


Moslem arch

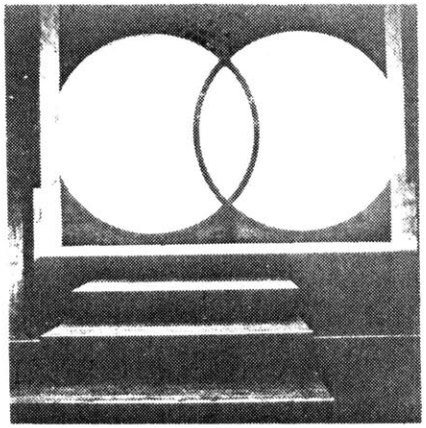
Demarcations in Wright's Friedman house show mutually reinforced centers while still employing different size circles as the larger form. The retaining wall with planting builds a band, the edges of which are tangent to the carport and the small circle of the house while maintaining a perpendicular (center/diameter) attitude to the largest circle.

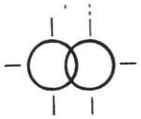


C. Scarpa, holy-water stoup in chapel



C. Scarpa, cemetery at Brion, 1969

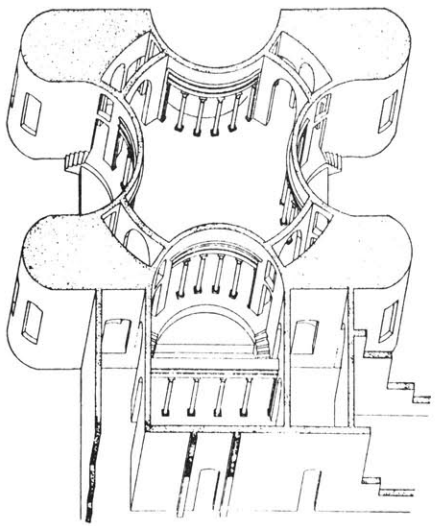




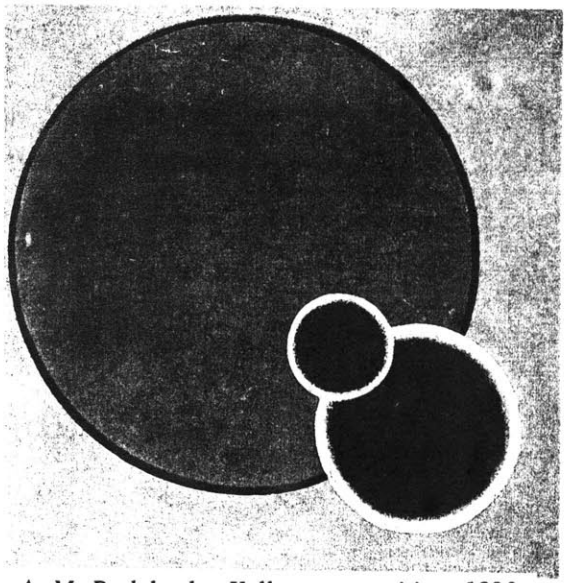
Surface definition in the circles at Brion becomes line definition in the actual zone of overlapping. The shape formed by this overlapping can be found in several Wright plans (see Friedman house, Guggenheim Museum). The perpendicular edges at the points of intersection make this an identifiable special case of overlapping circles.

'Kino' cigarettes, 1924. 33 × 24.5.

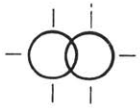
A. M. Rodchenko,
"Kino" cigarette pack, 1924

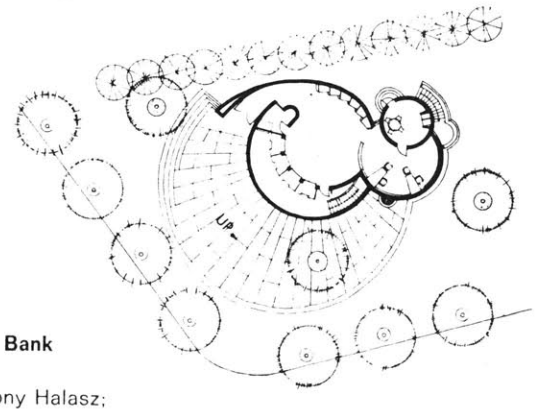


Hadrian's Villa, Pavillion of the Academia, Roman

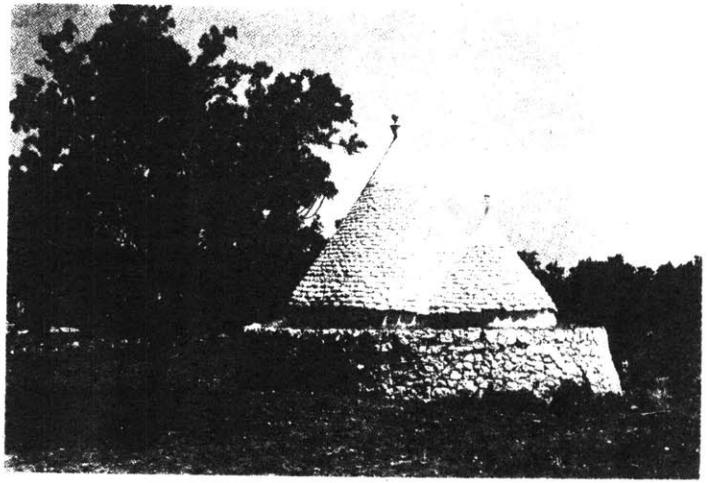


A. M. Rodchenko, Yellow composition, 1920

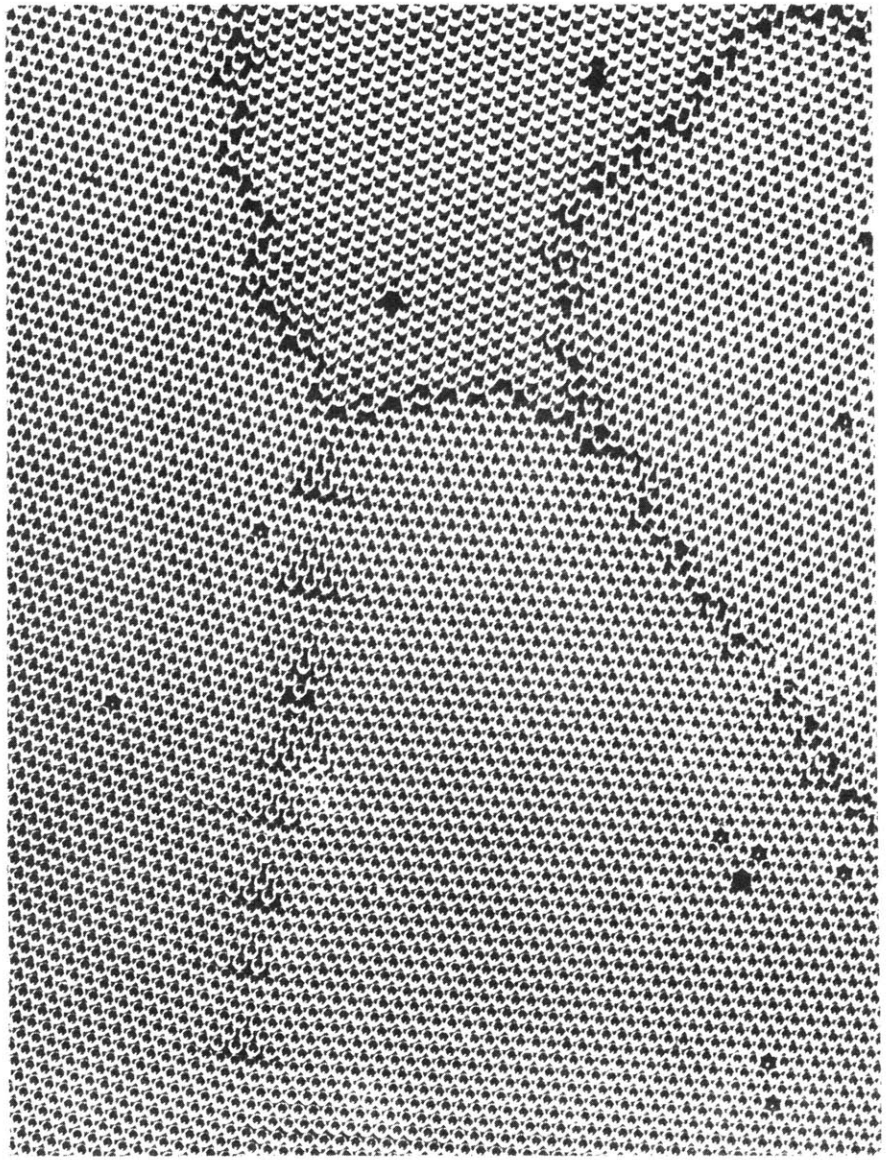




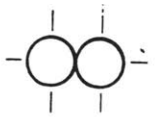
National Shawmut Branch Bank
109 Cambridge Street
architects: Imre and Anthony Halasz;
Clancy, Inc.



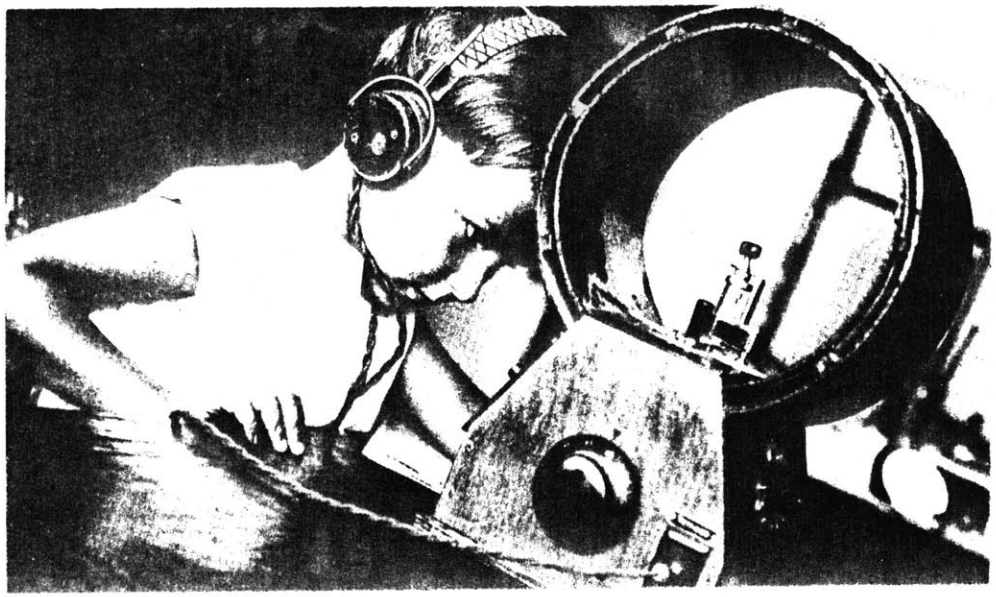
Trullo domes, Ceglie Messapico, Italy.



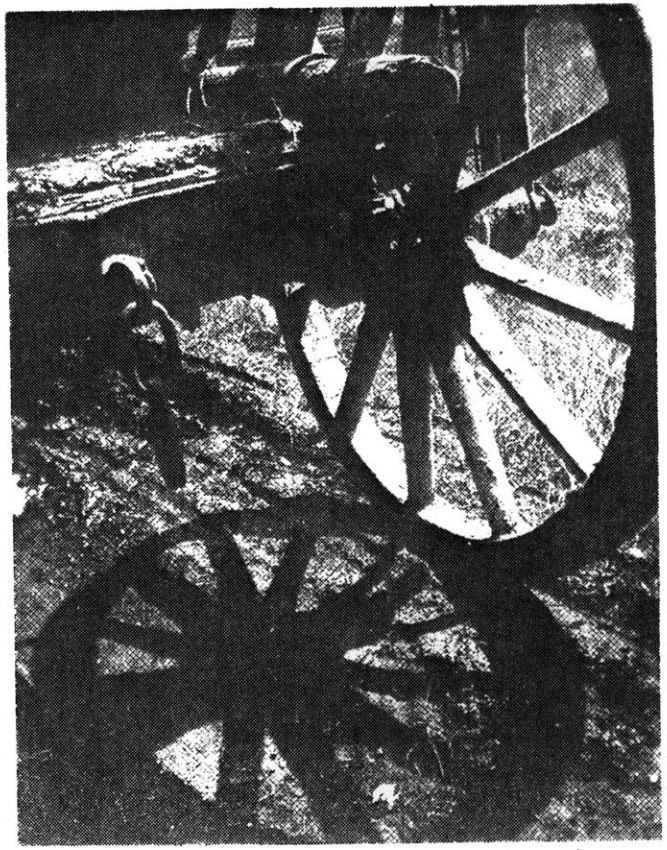
C. S. Smith, soap bobbles, magnification x 7



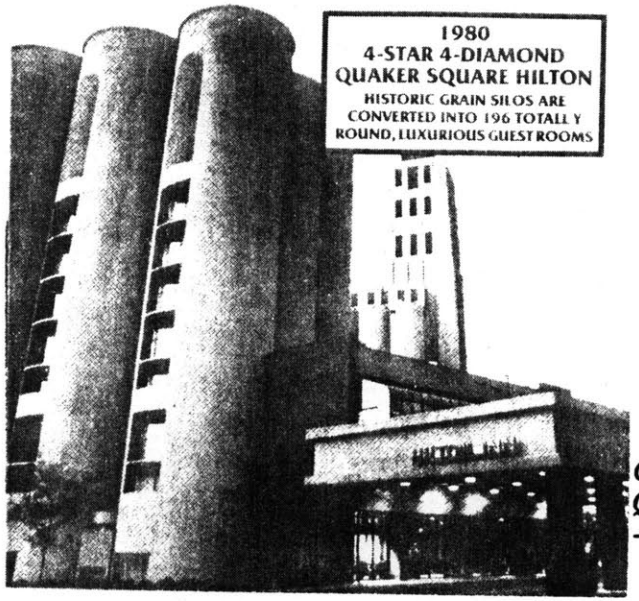
Tangencies are found in any packed field of circles or spheres. Fissures in the field of soap bubbles at left show "grain boundaries" where zones of differing orientation meet. The cartwheel, tangent to the ground surface, also has the same relationship to its own shadow.



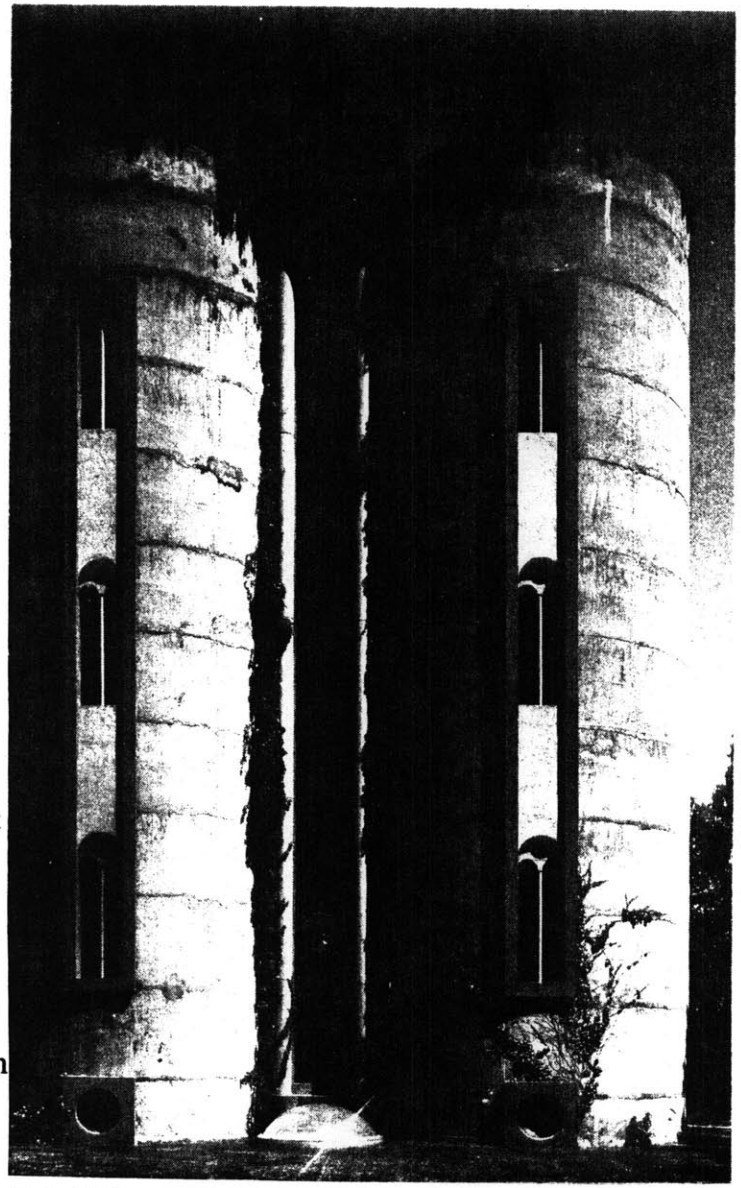
A. M. Rodchenko, "Listening to the Radio", photograph, 1929



H. Schurrmann, "Cartwheel", photograph, 1931



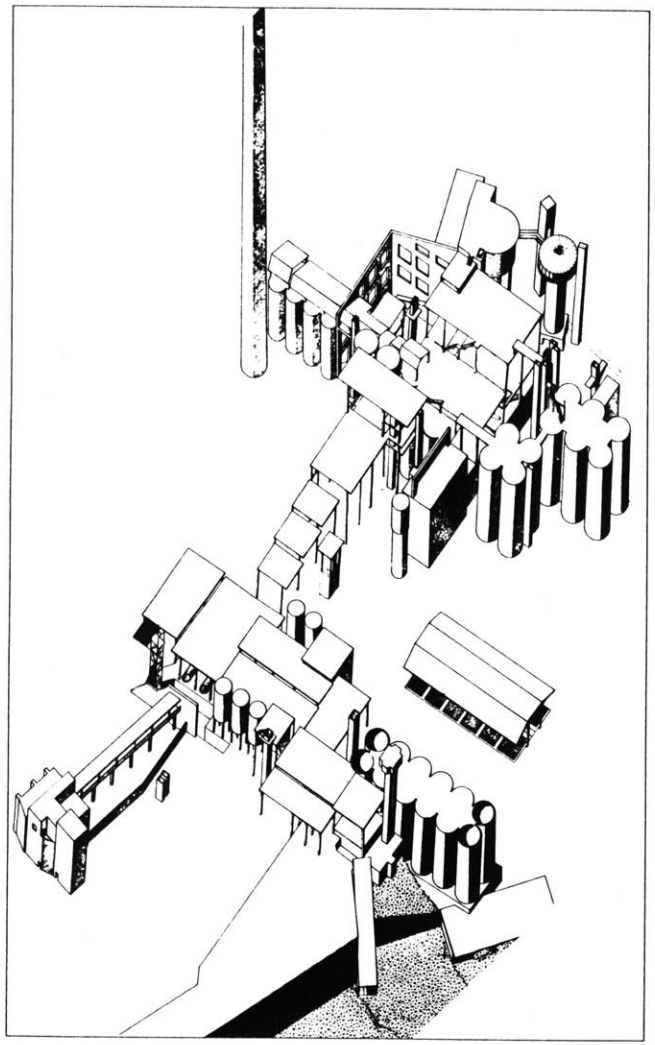
Curtis and Rasmussen, Quaker Square Complex - Akron, Ohio, 1980



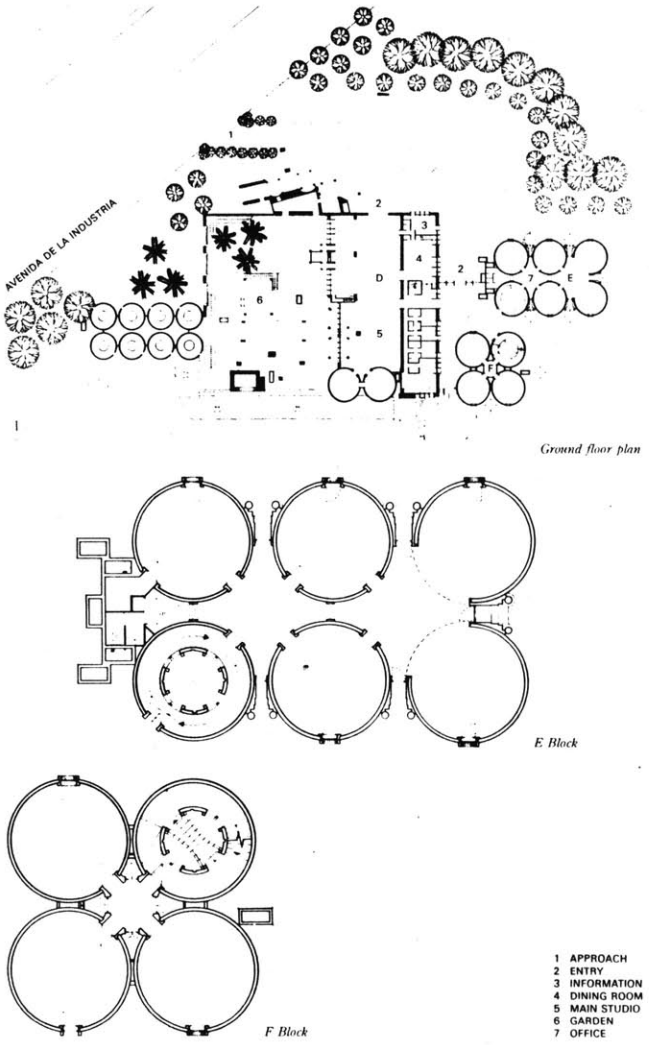
R. Bofill, Studio residence - Barcelona, Spain, 1975

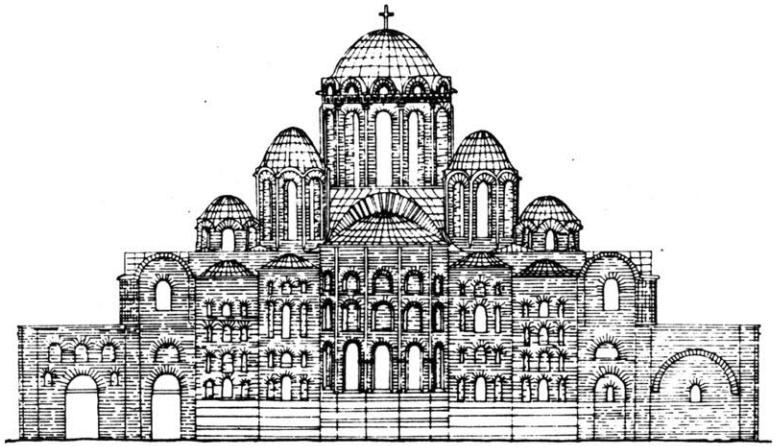
Pictured are two existing silo inhabitations. The Hilton project does little in terms of attempting to open the form of the silos or creating territorial exchange between them as is evidenced by the brochure; "196 totally round luxurious rooms". Twenty five thousand lineal feet of 7" thick reinforced concrete was cut for door and balcony penetrations.

Ricardo Bofill's project in Barcelona goes little further in its intervention, a strong point being the landscaping and semi-inhabitation of the roof scape. Though both projects are more or less simple vertical subdivisions of the silos, they are valuable reference for the proposed exercise, as they deal with the existing site as a "found object" and a useful infrastructure for human inhabitation.

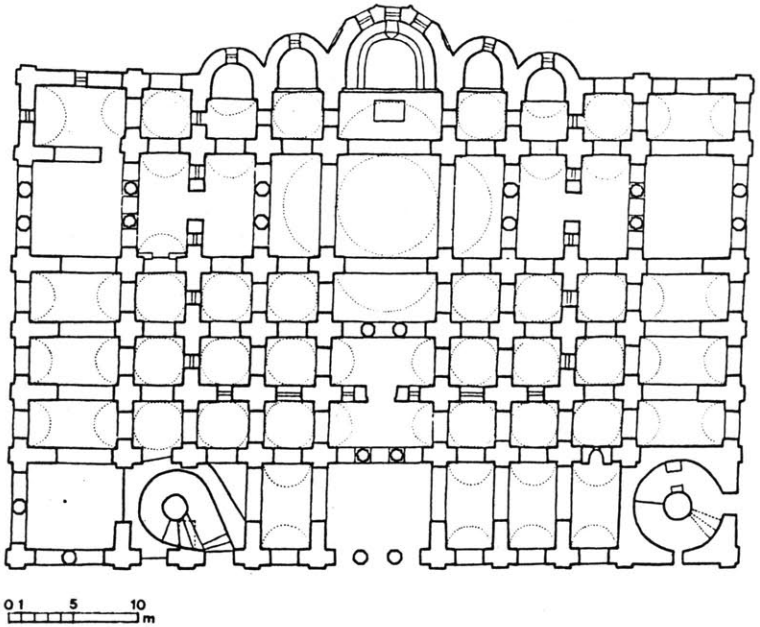


R. Bofill, drawings, 1975





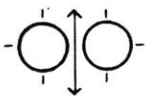
St. Sophia, elevation

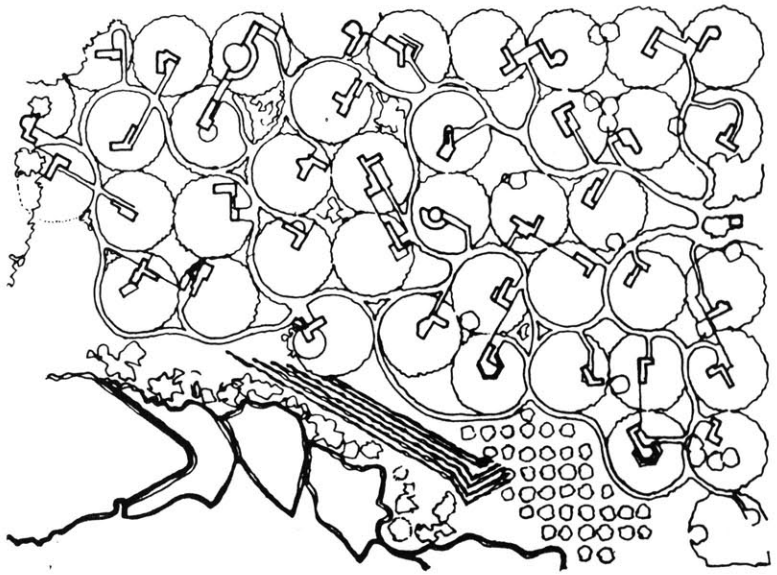


St. Sophia, plan

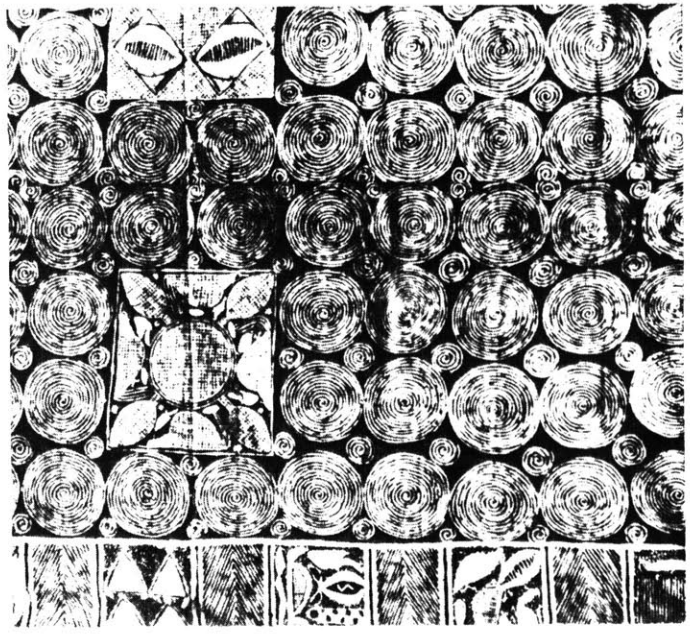
Kiev, St. Sophia, 988

F. L. Wright, Galesburg Country Homes, site plan - Kalamazoo, Michigan, 1947





Nigerian cotton cloth

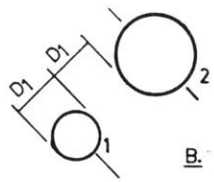


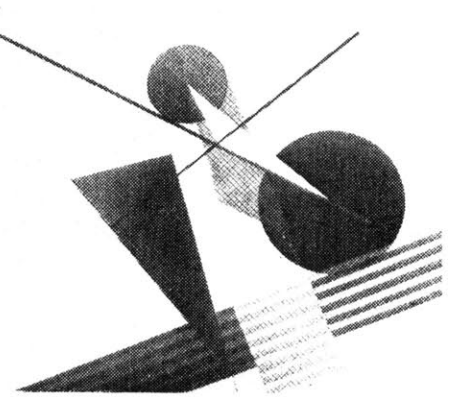
Two versions of more or less packed circular fields are shown. The domes of St. Sophia in Kiev show a regular aggregations of nearly packed circles where the slack space between is generally filled with structure. Wright's site plan for Galesburg shows a similar nearly packed organization where the slack space between circles becomes of dimension and open for access. The weaving shows the field in certain areas and becomes very nearly packed completely in other parts as between the second and third row from the top.

In the top painting by Moholy-Nagy the small circle is displaced from the larger by its own diameter dimension while the distance from the center of the larger circle to the edge of the smaller equals the diameter of the large one, i.e. the diameter of the small circle is half the dimension of the large one. The long side of the white triangle is intensified by a line from tangent to center.

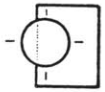
The diameter of the small lower circle in the bottom painting, is reinforced by the horizontal line though no part of the line actually gets into the circle. Note the hinging behavior this same circle as well as in the larger circle.

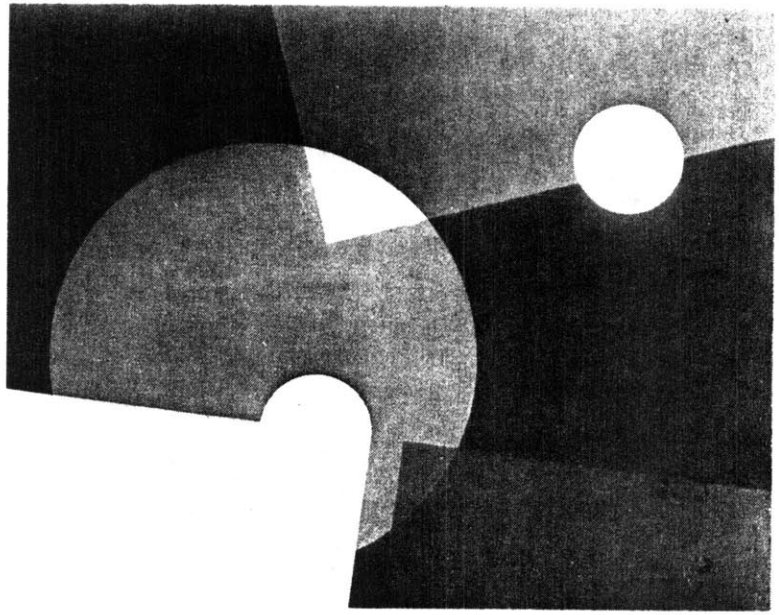
L. Moholy, AXXI, 1925

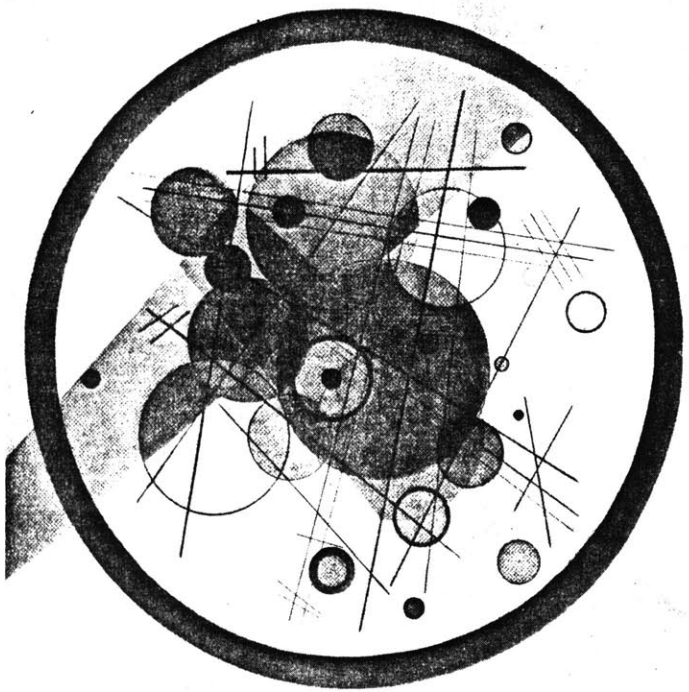




L. Moholy, Am 7, 1926



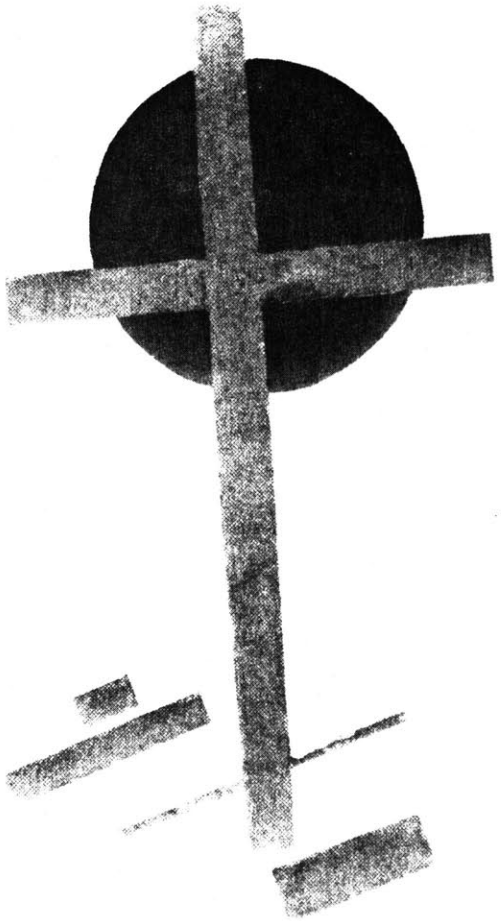




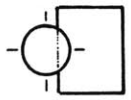
W. Kandinsky, "Circles in Circle", 1923

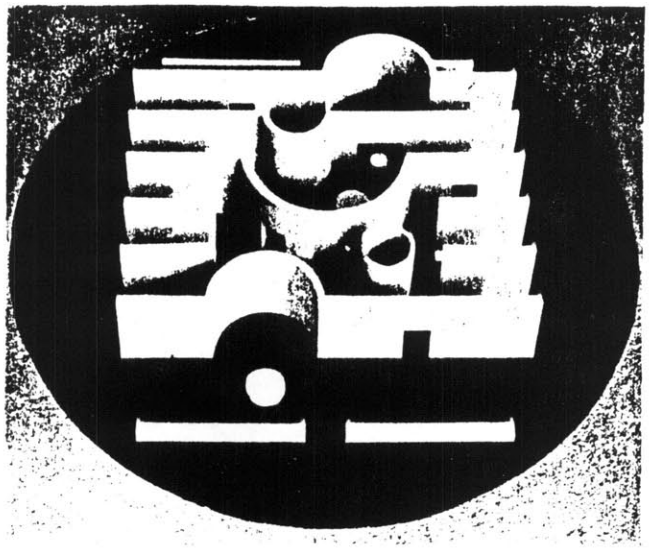
Kandinsky's "Circle in a circle" shows nearly all of the relationships described; reinforced centers, enclosures, slight, overlapping. Tangencies are harder to find as is any sort of registration. Some smaller circles do become "free" of intersection while still within the bounds of the largest circle.

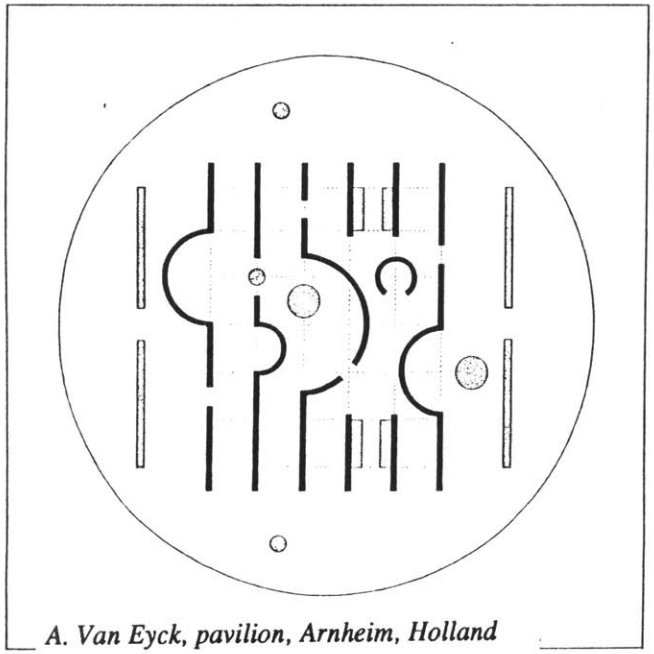
Malevich's "Suprematist construction" is just that. The major bands intersect as a displaced center of the circle while the smaller bands below take a slightly different direction, in effect, using the circle as a displaced hinge.



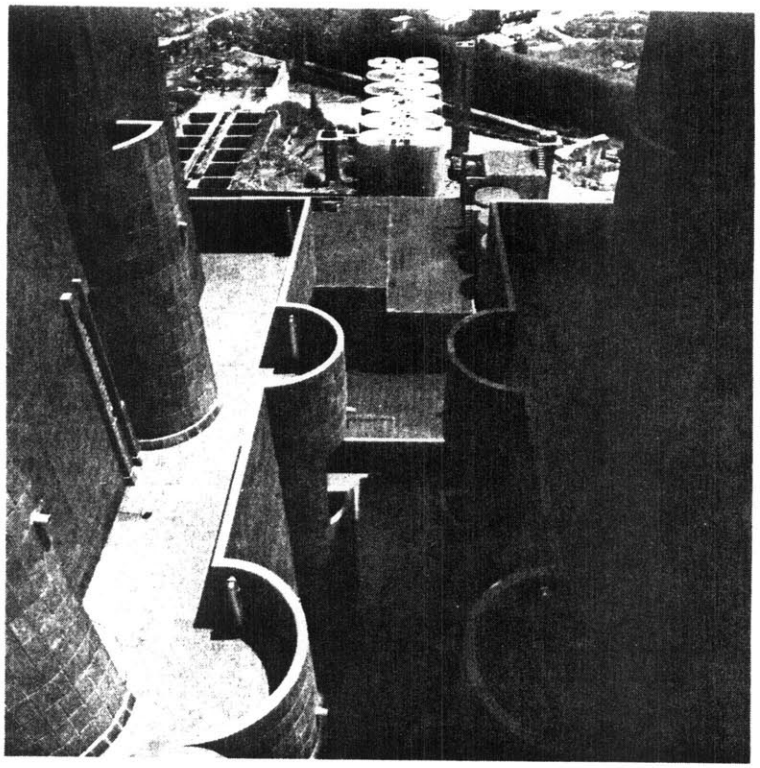
K. Malevich, "Suprematist Construction", 1922



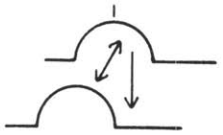


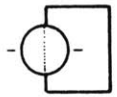


A. Van Eyck, pavilion, Arnheim, Holland



R. Bofill, housing, Barcelona, Spain, 1976

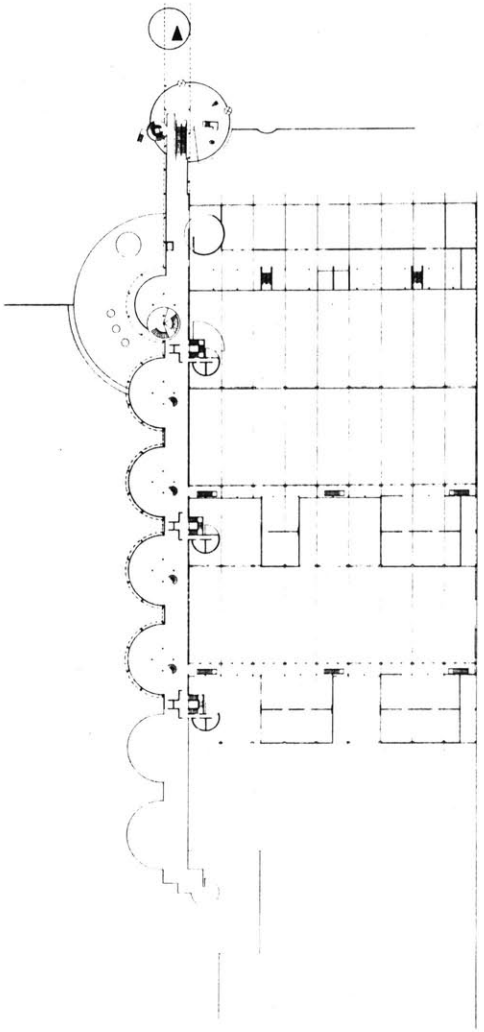




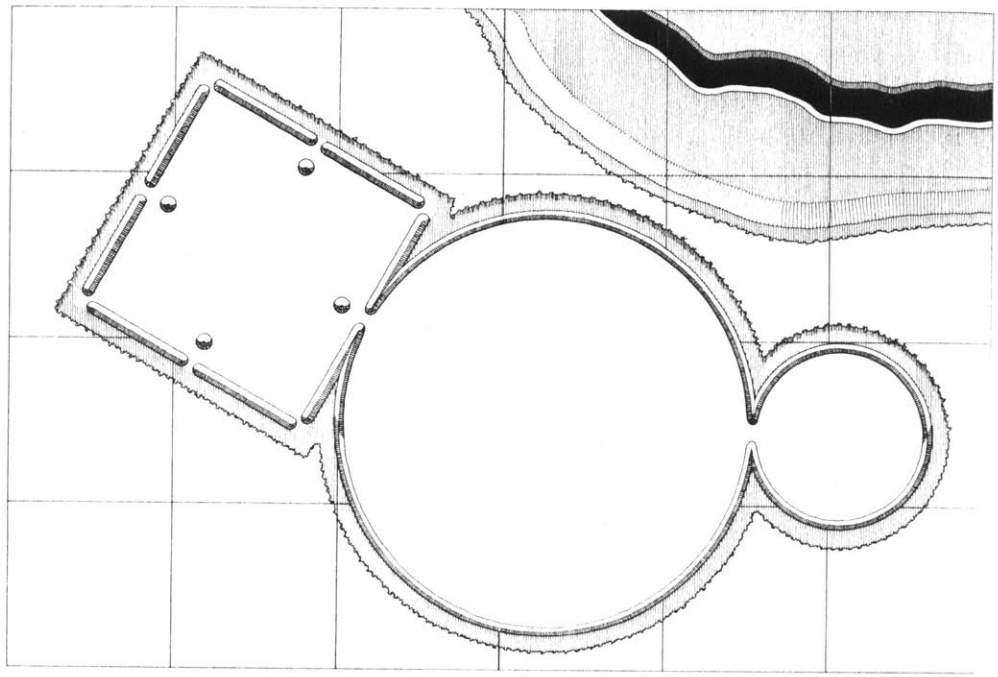
In Van Eyck's pavillion, what would otherwise be an open field distribution of various sized (semi) circles becomes a directional one parallel to the straight walls. Half circles create partial containments along the access, one 3/4 circle gets almost "free" (but still fixed by a diameter demarcation). The solid pedestals are complete circles, three are located directly in the access while the other two have the walls as a diameter demarcation.

The railing in Bofill's housing project adjacent to the silo inhabitation (visible in the background) builds a similar directional attitude as an extension to the row of silos. Note the slight displacement between the semicircle in the railing and the circle in the wall of the building which creates a different sort of exchange, both containments facing the same direction.

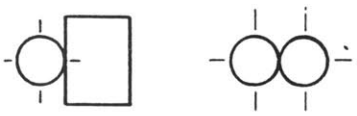
Benisch's R & D facility shows another case of directional diameter demarcation, this one at building size. Semicircular privacies (bathrooms) and vertical access punctuate alternate circles setting up a larger size by the distances between them.



G. Behnisch, R & D facility for Leybold-Heraeus, Alzenau, Germany , 1987

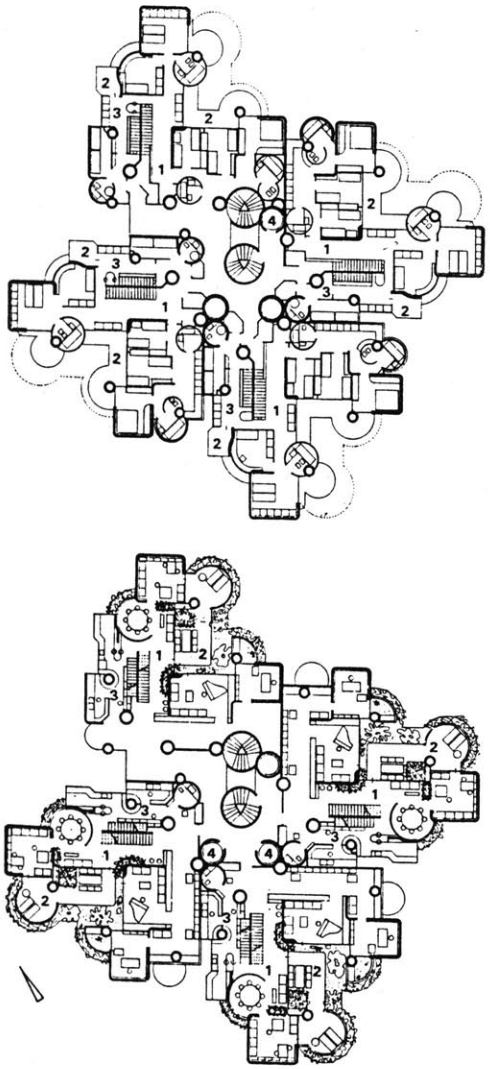


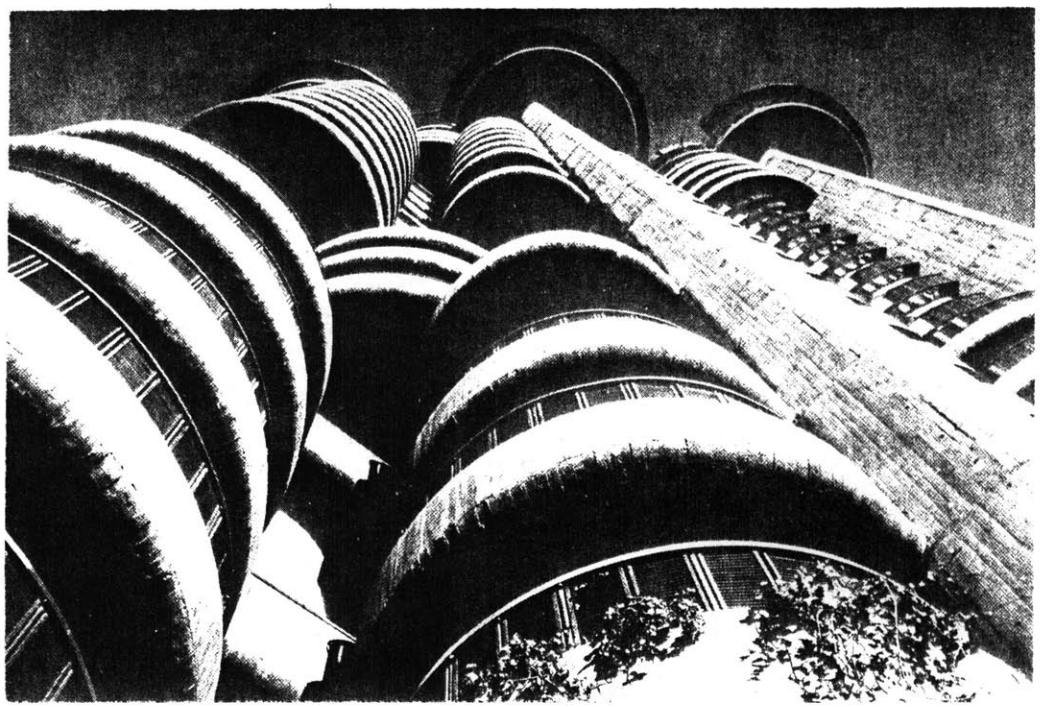
Hopewell earthwork, "Old Chillicothe", Frankfort, Ohio 500 B.C.-200 A.D.



Tangencies from circle to circle and from circle to square in the earthwork and sculpture pictured retain the complete shapes making exchanges at the edge very minimally.

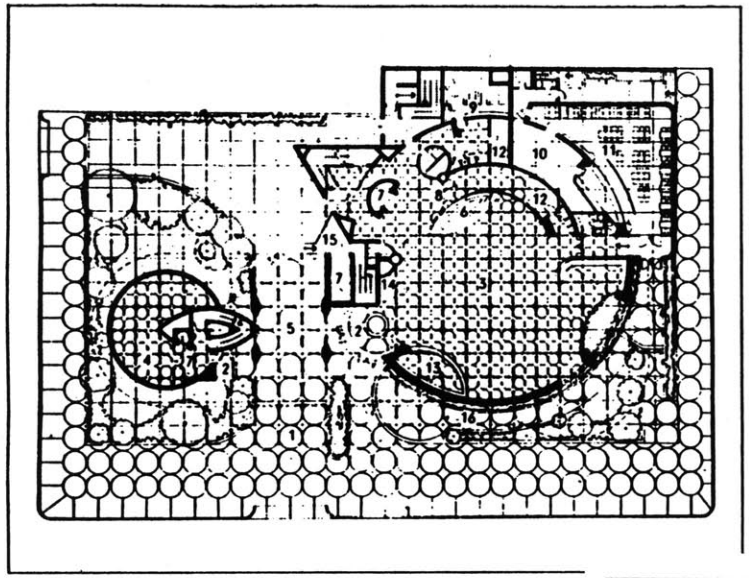
D Smith, "7 hours", 1961



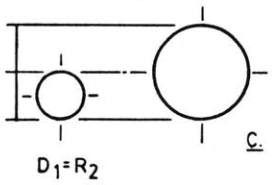


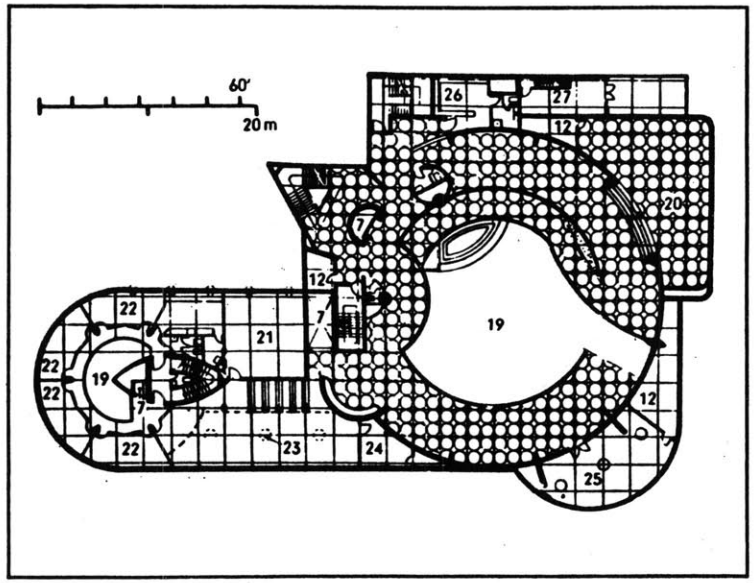
F. J. Saenz de Oiza, Torres Blancas, Madrid, Spain, 1961-68

A different case of near tangent circle and square appears in the plan of Torres Blancas. Partial building of square and circle creates a spatial exchange between the territories of the forms. Completion of the circles around the perimeter would result in several tangent circle to square relationships, yet the selective "removal" of material leaves very few awkward sharp corners found in more closed tangencies.



Ground level



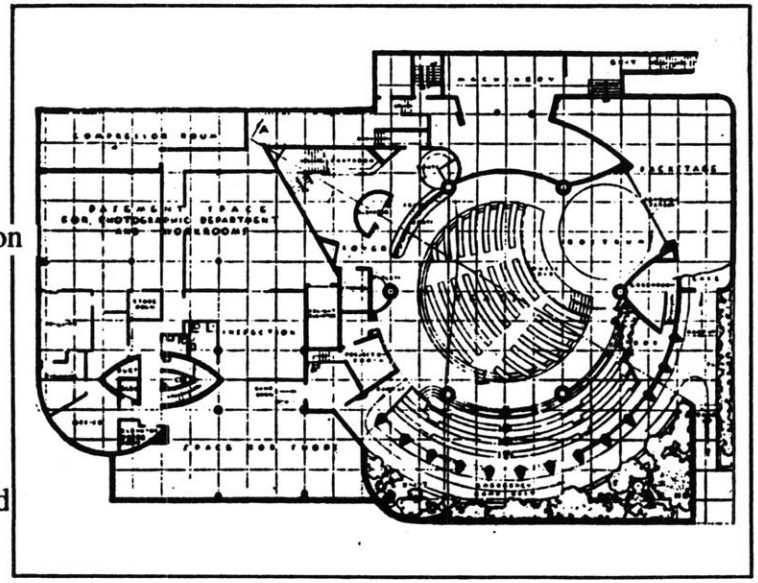


First floor

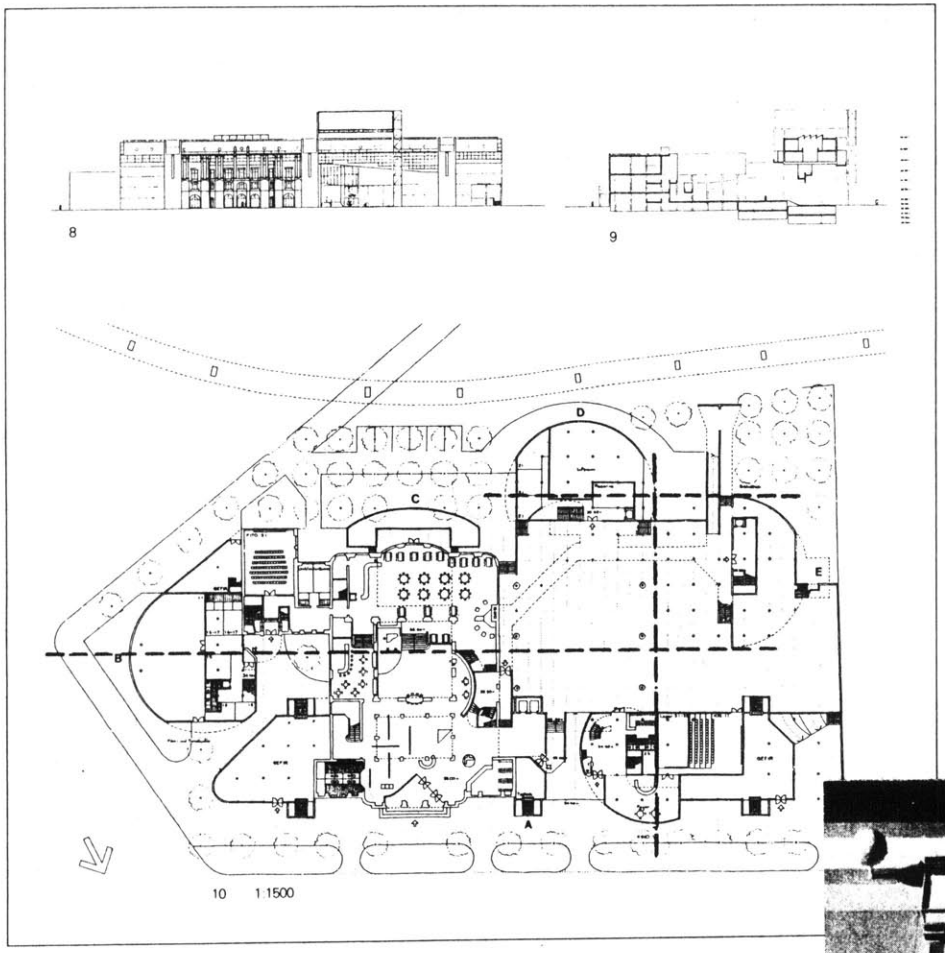
F. L. Wright, Guggenhein Museum, New York City, 1959

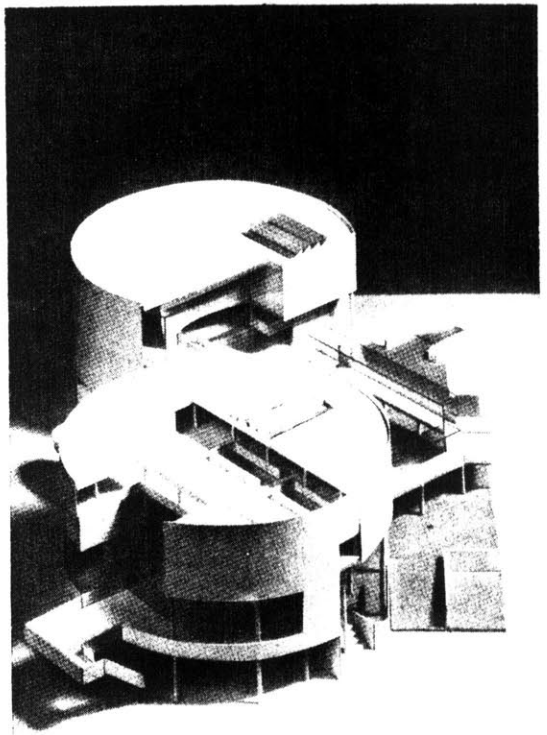
The circles in the Guggenhein set up a tangent-tangent and tangent-center attitude by virtue of the larger circle having twice the diameter dimension of the smaller. The tangent-tangent reinforces the direction of the street access while the more "habitable" tangent-center relation occurs within the body of the building.

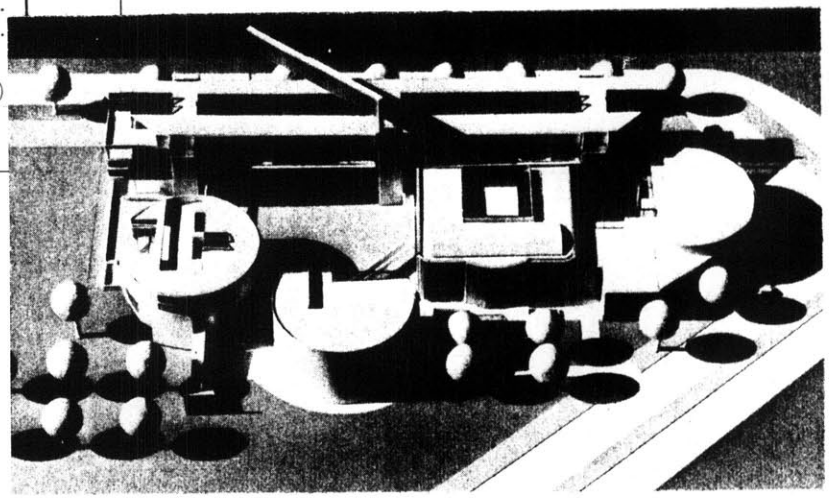
Extension of the tangents in Hertzberger's proposal hits the center of another in each of the larger circles as noted on the plan. The subtractive action from the individual cylinders, however, is less rigid in its center and diameter relationships, (i.e. very few half-circles are formed).



Basement plan

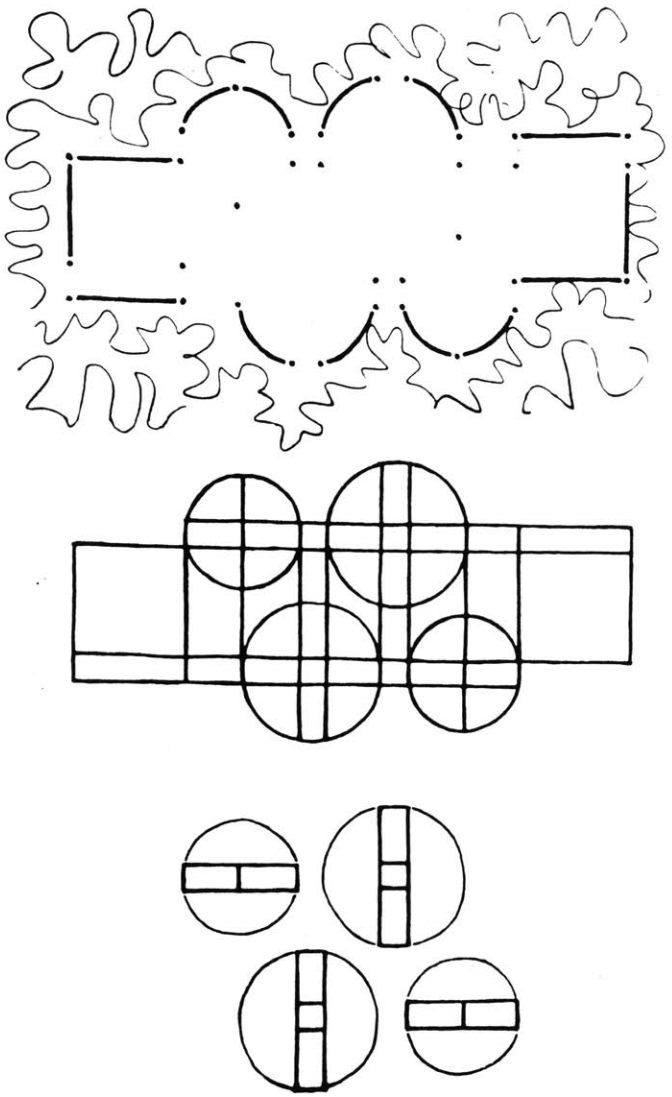




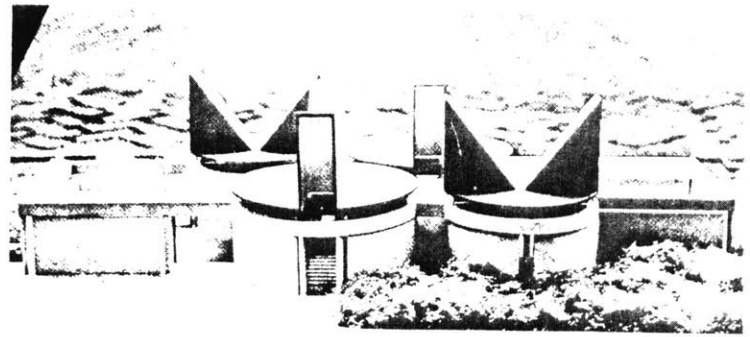


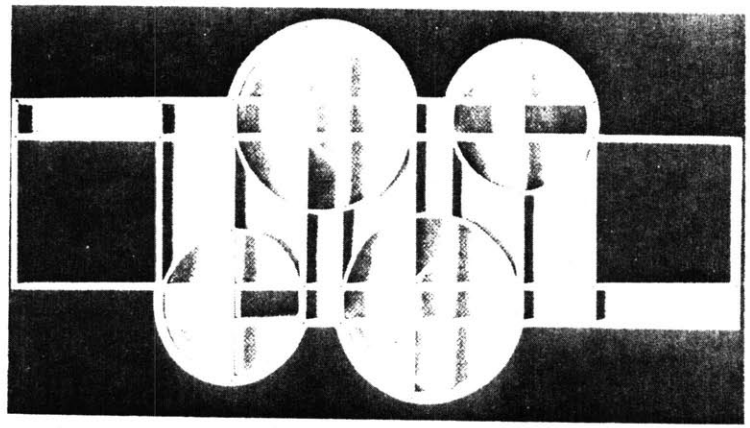
H. Hertzberger, Film Academy & Museum competition,

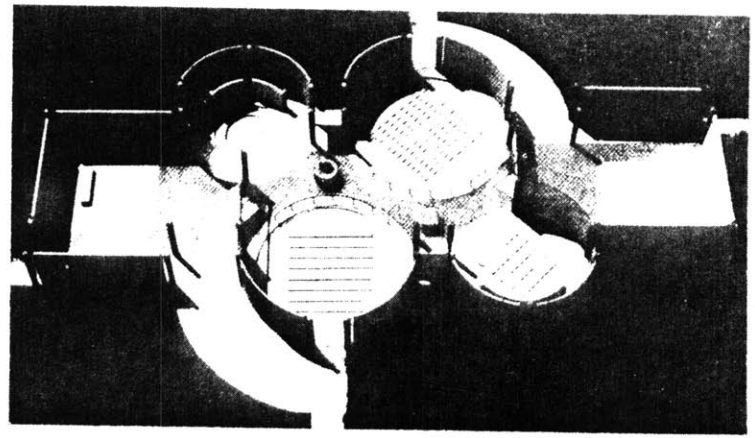
1984-85

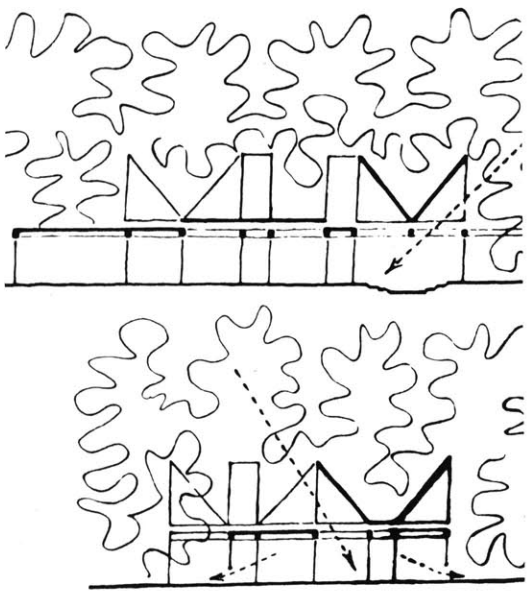


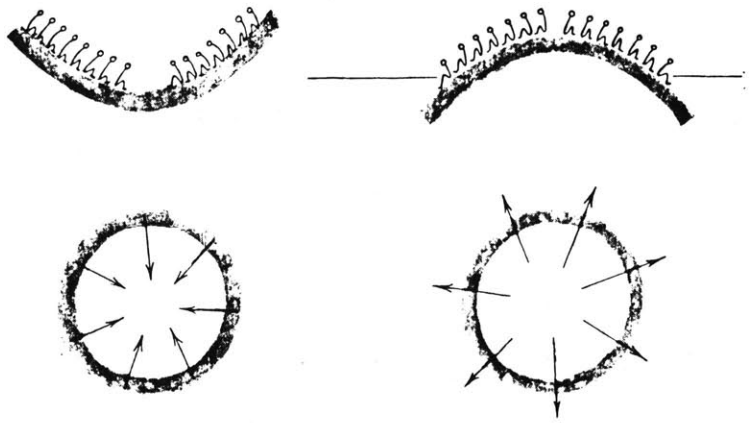
A. Van Eyck, "Wheels of Heaven", church, Holland, 1964.











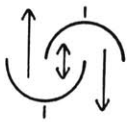
I was thinking about such twin-phenomena as inside-outside; open-closed; many-few; alone-together; individual-collective, when the following twin-image came to my mind. It helped.

People seated concentrically in a hollow, gazing inwards towards the centre; and people seated concentrically on a hill, gazing outwards towards the horizon.

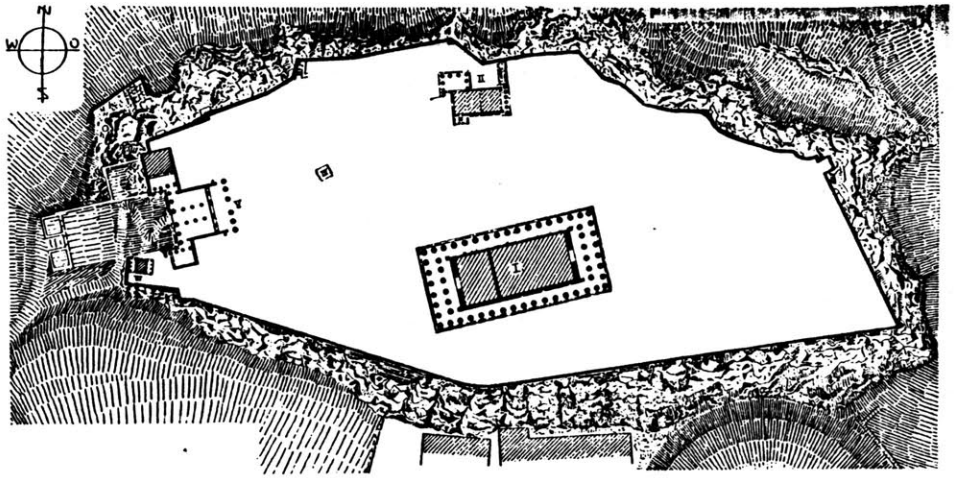
Two kinds of centrality? Two ways of being together — or alone?

The images are ambivalent — though the hill reveals what the hollow may conceal: that man is both centre-bound and horizon-bound. Both hill and hollow, horizon and centre, are shared by all seated concentrically either way; both link and both lure (the horizon and the shifting centre, the centre and the shifting horizon).

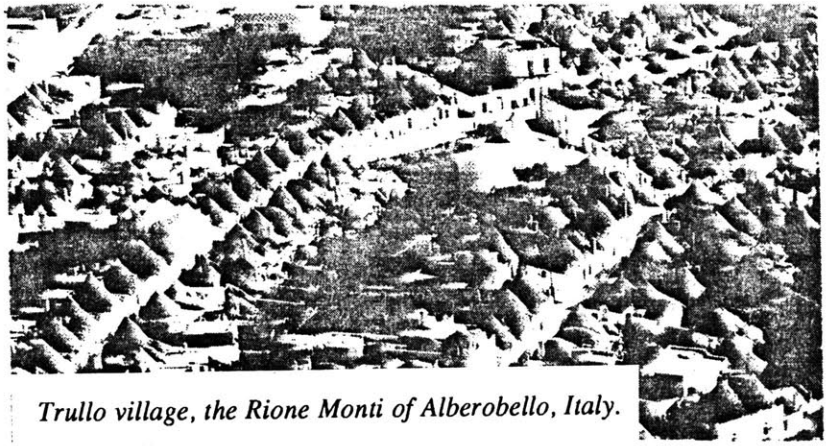
A. Van Eyck



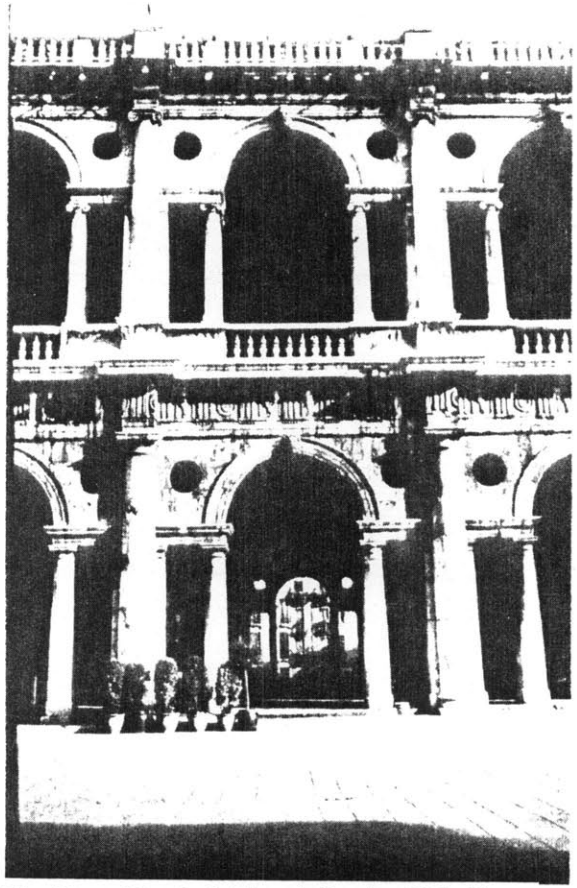
Van Eyck's church shows a similar tangent-center relation as in Hertzberger's Film Academy but the center is recognized as a band of access dimension rather than a theoretical demarcation to the center. The circles are displaced from each other by this same dimension; half circles are built with wall and column location.



Athens : The Acropolis in the time of Pericles

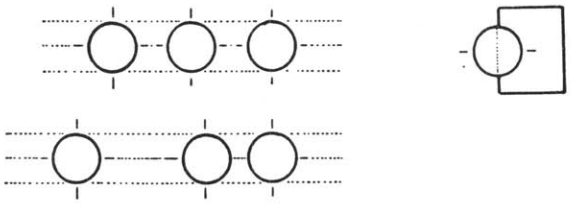


Trullo village, the Rione Monti of Alberobello, Italy.

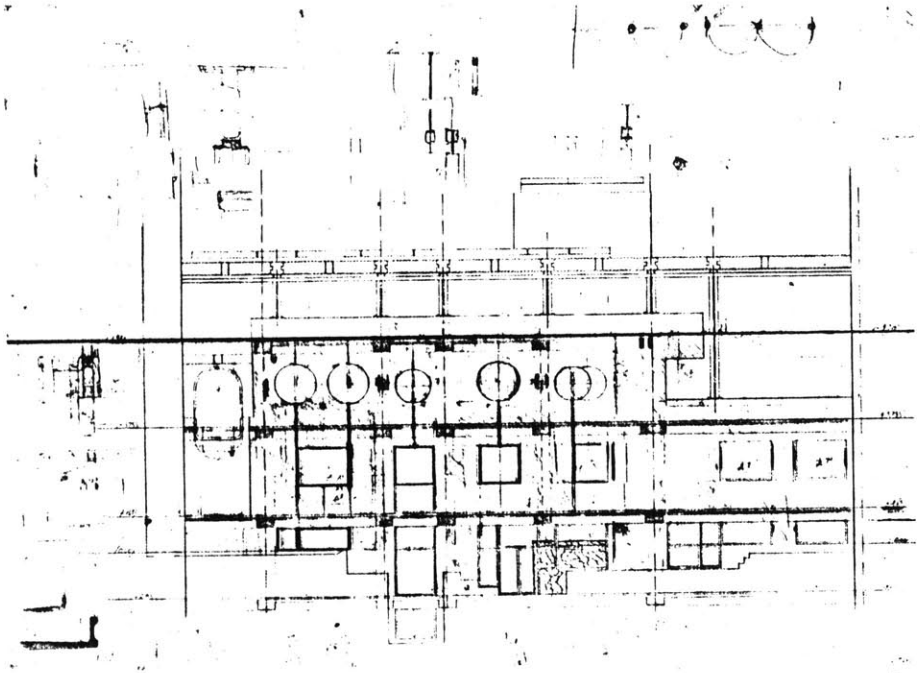


The Rione Monti of Alberabello, "trulli " village

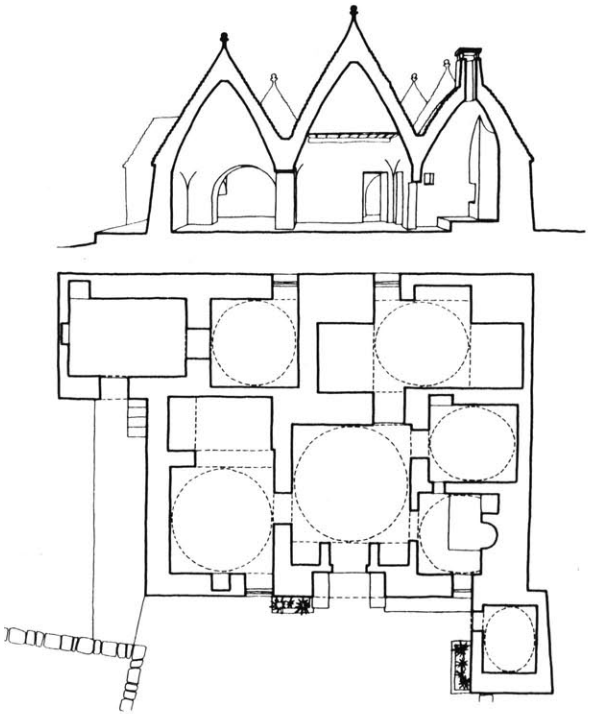
Palladio



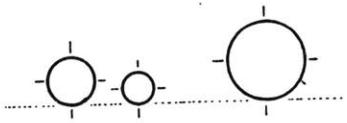
The columns of the Parthenon demonstrate the simplest form of equi-distant dimension registration. The cone shape "trulli" roofs make packed rows of registered circles. Palladio's circular openings create an alternating dimension registration while the springline of the semicircular arches reinforces their diameters.

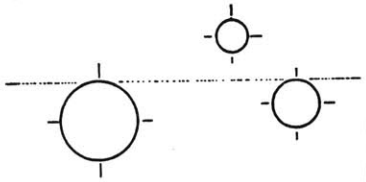


C. Scarpa, Banca Populare di Verona, 1973



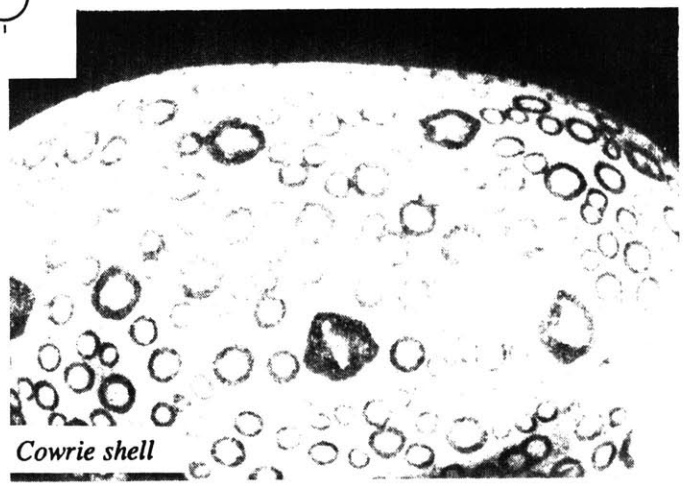
Farm house, Trullo construction.



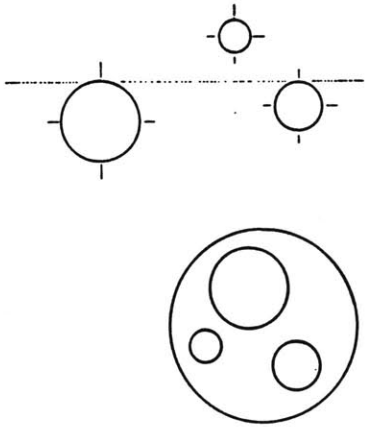


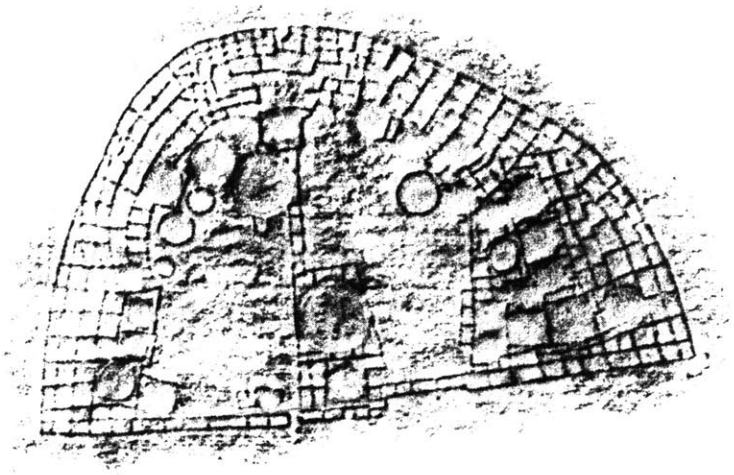
The Bank de Popolo shows an edge registration of different sized circles in the openings. Note the slot of light that comes down to orthogonal openings.

The open field distribution of the "trulli" pictured on this page resembles that of the shell surface. The "trulli", however, interact on a one to one basis with a superimposed orthogonal system.



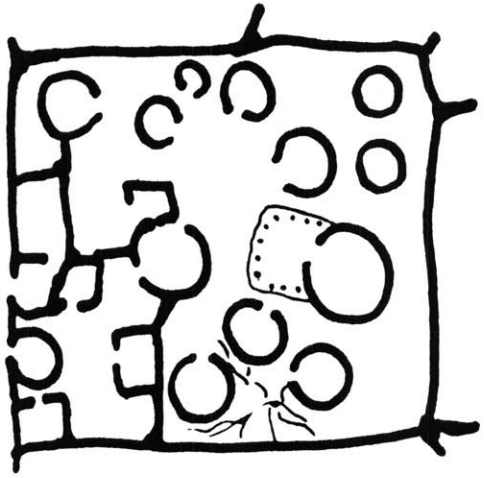
Cowrie shell

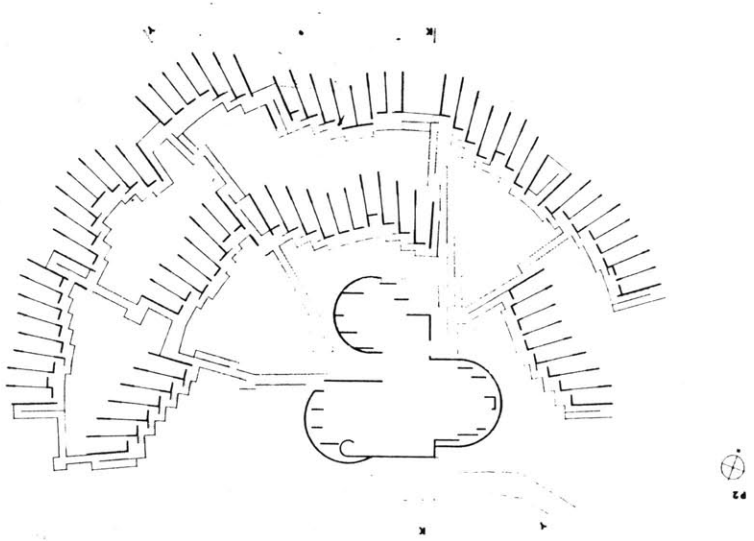




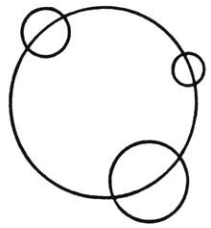
Pueblo Bonito, Chaco Indian Pueblo, American Southwest, 920-1080

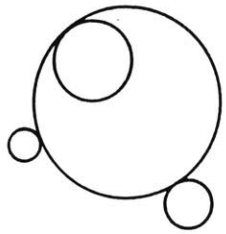
Kazaure, Dogon village, Africa

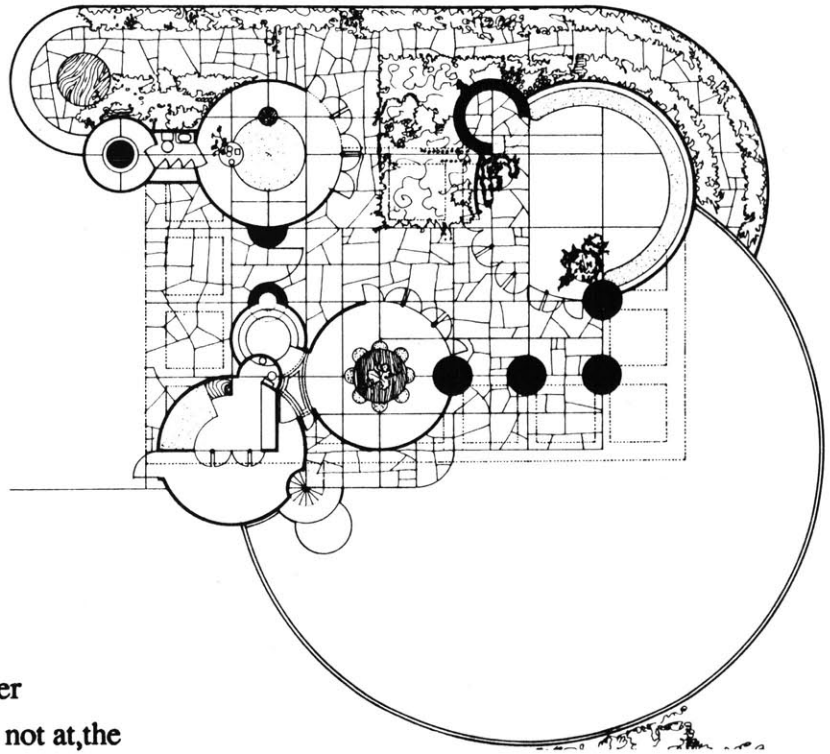




G. de Carlo, Urbino, Italy, 1960







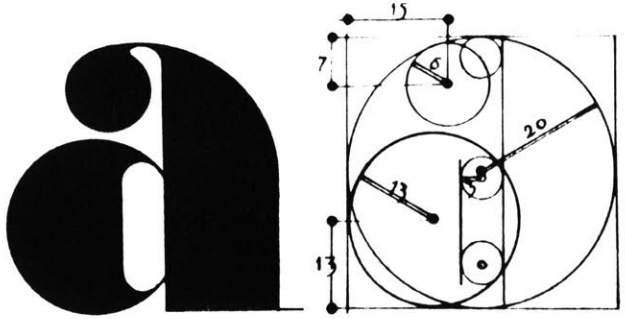
F. L. Wright, Jester House, Palos Verdes, CA, 1938

Both Pueblo Bonito and the University at Urbino show a larger semicircular form controlled by circular central space near,but not at,the center.

The Dogon village illustrates an open field distribution enclosed by a larger square.

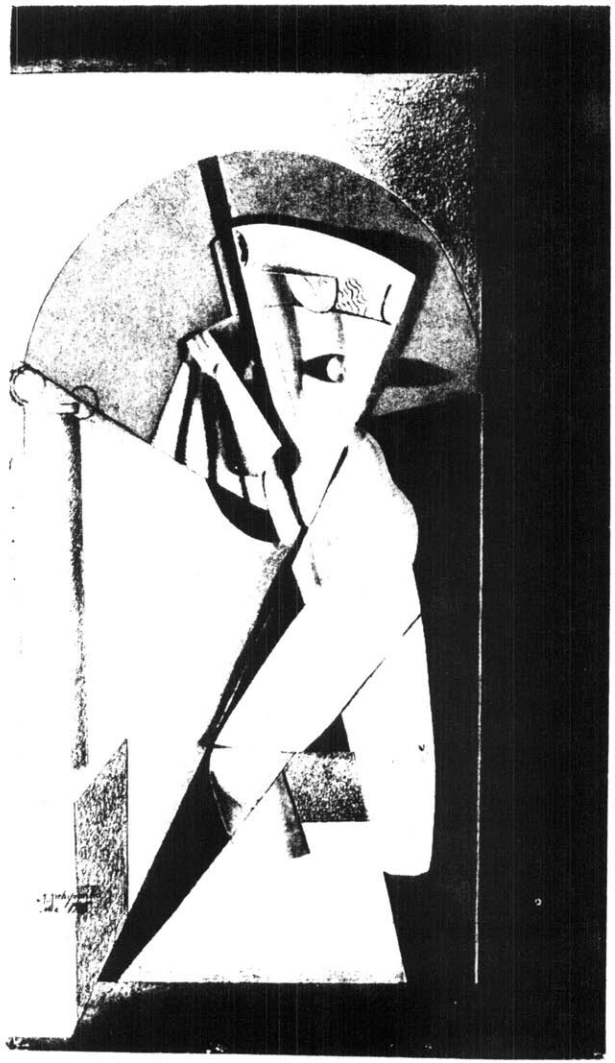
Wright's plan shows center control by the large circle as well as registration in the column structure in which reinforces the orthogonal system.

The letter "a" construct shows an internal tangent relation from smaller circles to larger ones.

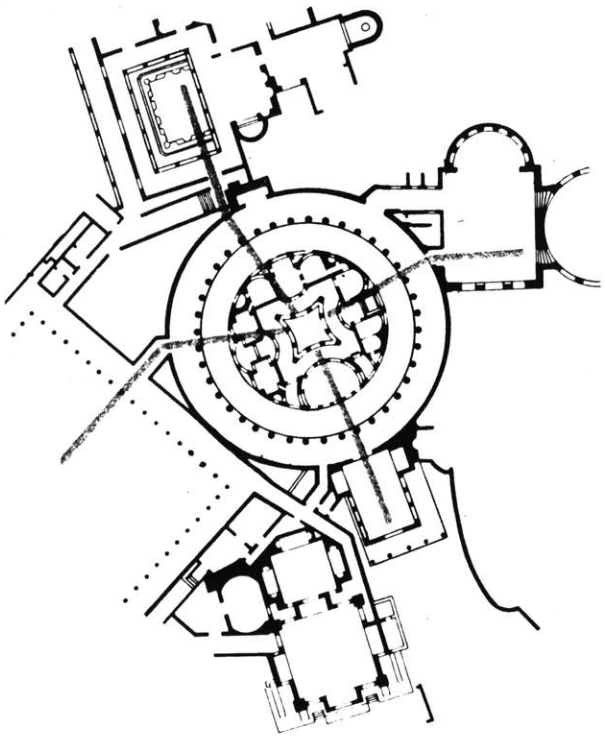


J. Schmidt, "On Lettering", course notes, Bauhaus, 1930

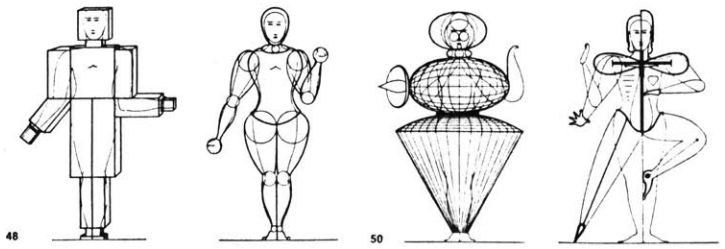
These examples show various uses of the circle as a hinging device accommodating two or more directions from the orthogonal.



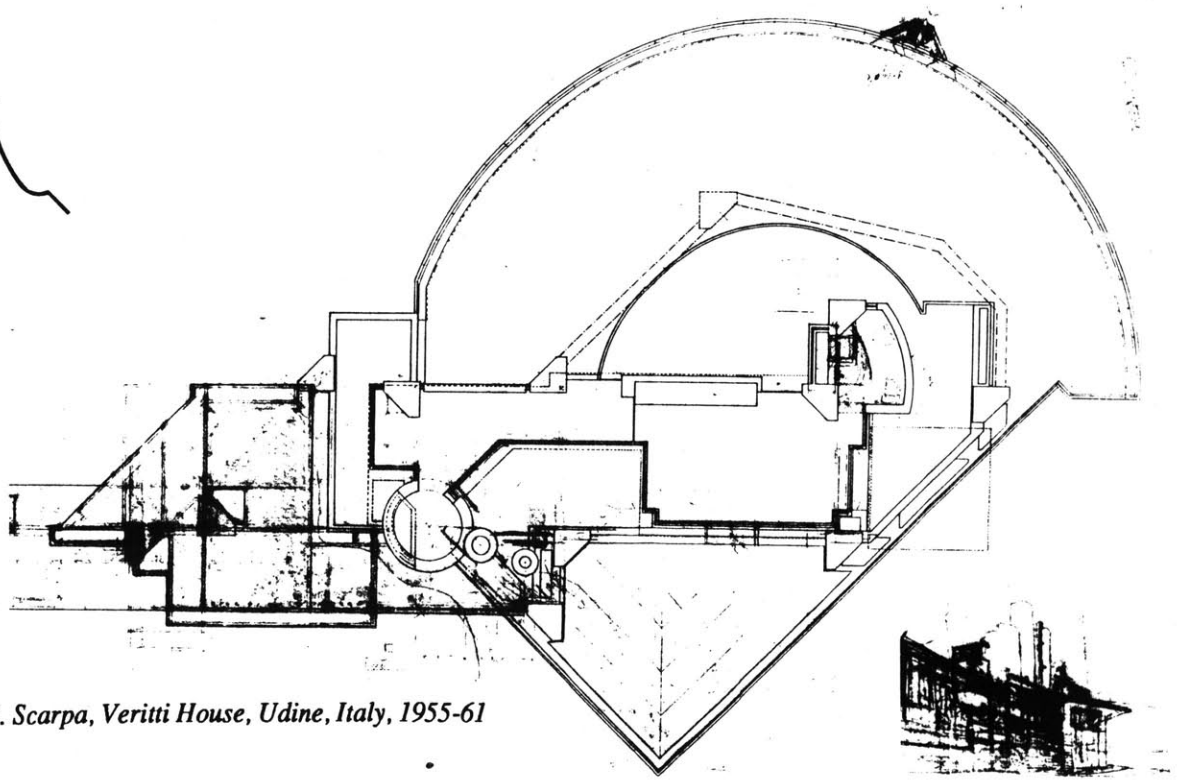
A. Archipenko, "The Bather", 1915



Hadrian's villa, Tivoli, A.D. 117-138



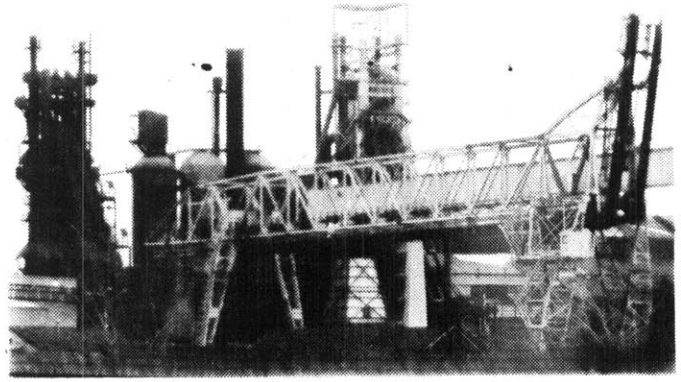
O. Schlemmer, from " Man and Artistic Figure", 1926



C. Scarpa, Veritti House, Udine, Italy, 1955-61

Urban Waterfront:

The current status of the waterfront in many American inner cities poses unique opportunities for architects and planners. Heavy industry and shipping has declined for a myriad of reasons and has left a water edge littered with industrial sized abandoned structures. High costs of city versus exurban locations, as well as the physical obsolescence of buildings and equipment to today's manufacturing and commerce needs have discouraged industry from rehabilitating these factories, warehouses, silos, etc.

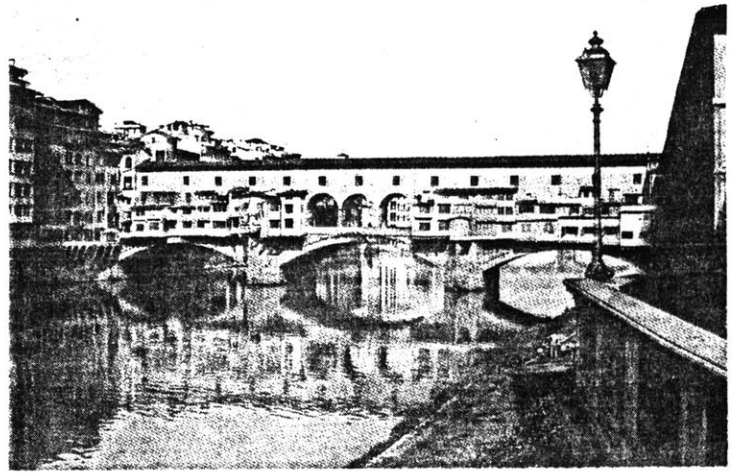


Waterfront ruin, Lake Erie

In most cases, it would seem desirable to reuse these structures in a similar fashion (a grain silo is perhaps best used as that), however, the realities of the current situation are quite different. The "revival" of urban centers has encouraged a change from heavy industry to office, commercial and, at best, high-end residential development along the water's edge. Recent projects such as South Port (Manhattan), the Lowell Fabric Mills, Monterey's Cannery Row are encouraging in their attempts at modifying the sites to new uses. But, because among their primary parameters are historic preservation, the attitude toward physically intervening and changing the site tends to be rather timid. This paper advocates these sort of rehabs not only across a broader economic and use cross-section, but also to include non-"historically significant" structures so that there can be a more aggressive approach to its transformation.

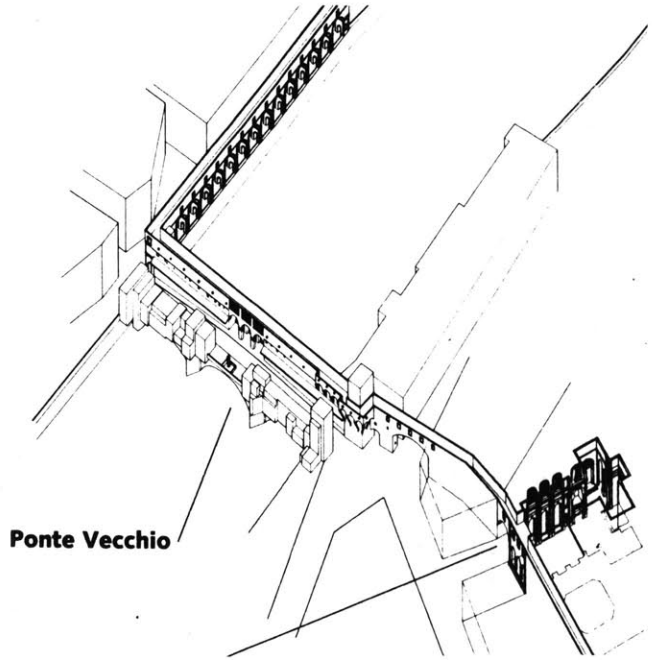
Demolition of Union station tower, Portland, OR, 1961

Driven by the relatively low cost of new materials vs. the high cost of rehabilitating the old, these structures are more often demolished and scrapped wholesale to make way for new development. Certainly some of these could provide a partial infrastructure for the new use. Though this design proposal shows an extreme stance from a labor-intensive standpoint, the basic premise is to use the existing site as a partial support for intervention while leaving a shadow of the history of the place intact.



Ponte Vecchio, Florence, Italy

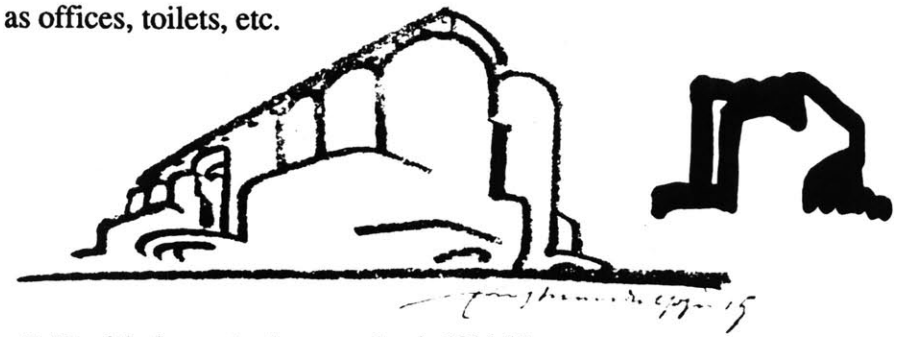
An arcade with a raised access level and roof was added to the Ponte Vecchio by the Cosimo de Medici in the 16th century as an escape corridor from the Palazzo Vechio to the Palazzo Piti. Subsequent intervention across the years have transformed the arcade with the addition of a secondary closure system outside the plane of the structure. Thus the bridge served as support for the arcade and roof which in turn, served as a partially habitable infrastructure for the infill. A range and distinction of sizes is also clear; the length of the bridge is built with three smaller spans, the arches of the arcade become building size pieces, the infill provides room to person size definitions.



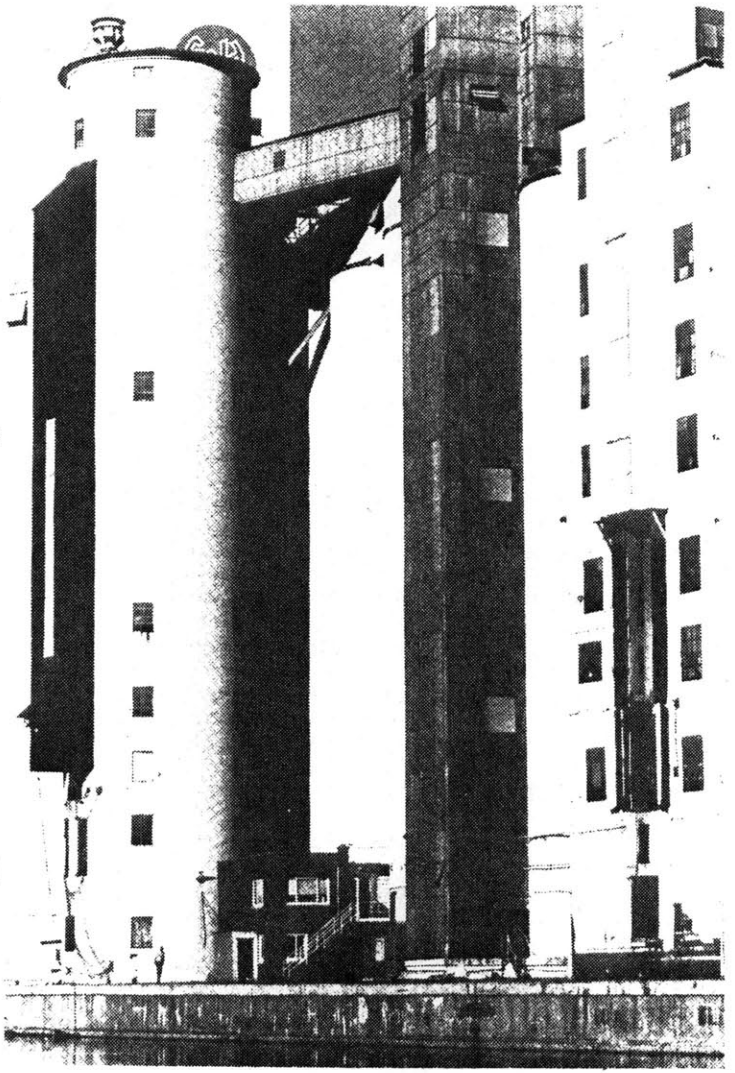
The Site

The impressive storage struictures on the Buffalo waterfront, visited and admired by the early Modrnists, Gropius, Corb, Mendelshon, once served not only the local bustling mills, but also as a transfer station for grain from ships laden with western frain to the smaller canal boats headed for the Atlantic via the Erie Canal. The opening of the St. Lawrence seaway and then the subsequent decline of the whole lake shipping industry are among the various reasons for obsolescence of the silos today. Less than 10% of the available storage capacity in Buffalo is currently in use, leaving the remaining silos abandoned in fairly close proximity to the city center. For decades these grants have stood ralatively securely due to low cost of land vs. the high cost of removing them. Recent efforts by developers and the city government to revitalize downtown and the waterfront area are modestly encouraging for development of the mill areas.

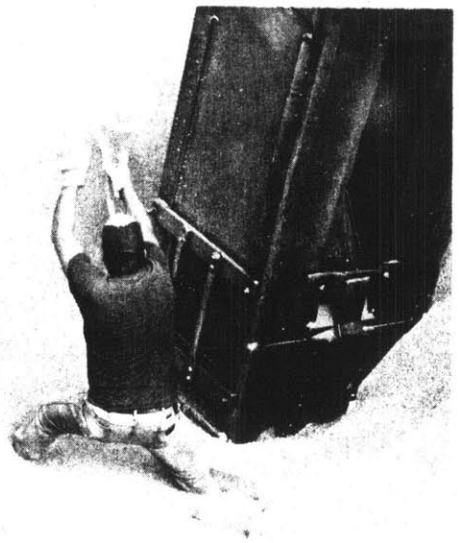
The photograph of a General Mills silo shows an early use of the silo for something other than grain, housing machinery for the marine leg as well as offices, toilets, etc.



E. Mendelsohn, grain elevators sketch, 1914-15



General Mills, Buffalo 1985



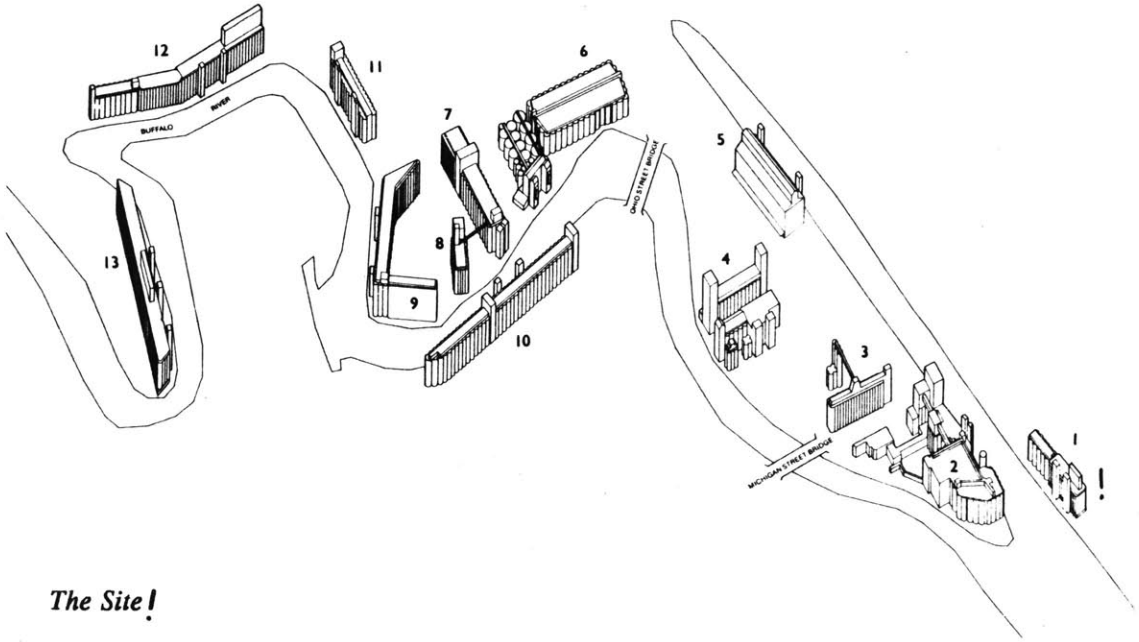
Scooper rigging power for moving to elevator marine leg, hold of steamer William A. McGonagle, Kinsman Lines, Buffal;o, New York, 1985

D. Plowden, photograph.

. It can behave almost like a solid at some times, almost like a liquid at others, and the change of state can be extremely sudden. Even in the open holds of ships, let alone in more restricted locations, these changes can look almost catastrophic. I have watched a twelve-foot cliff of red durum wheat in the hold of a Steinbrenner ship in the Buffalo River, standing at what was clearly steeper than its natural angle of repose, suddenly let go and flow like a wave around the legs of the men working in the hold. Had the flow been deeper, it could have toppled a standing man. Old hands in the trade know when to stand out from under, but I could now understand the piteous tales I used to hear about inexperienced lads being buried and suffocated under falls of grain.

R. Banham

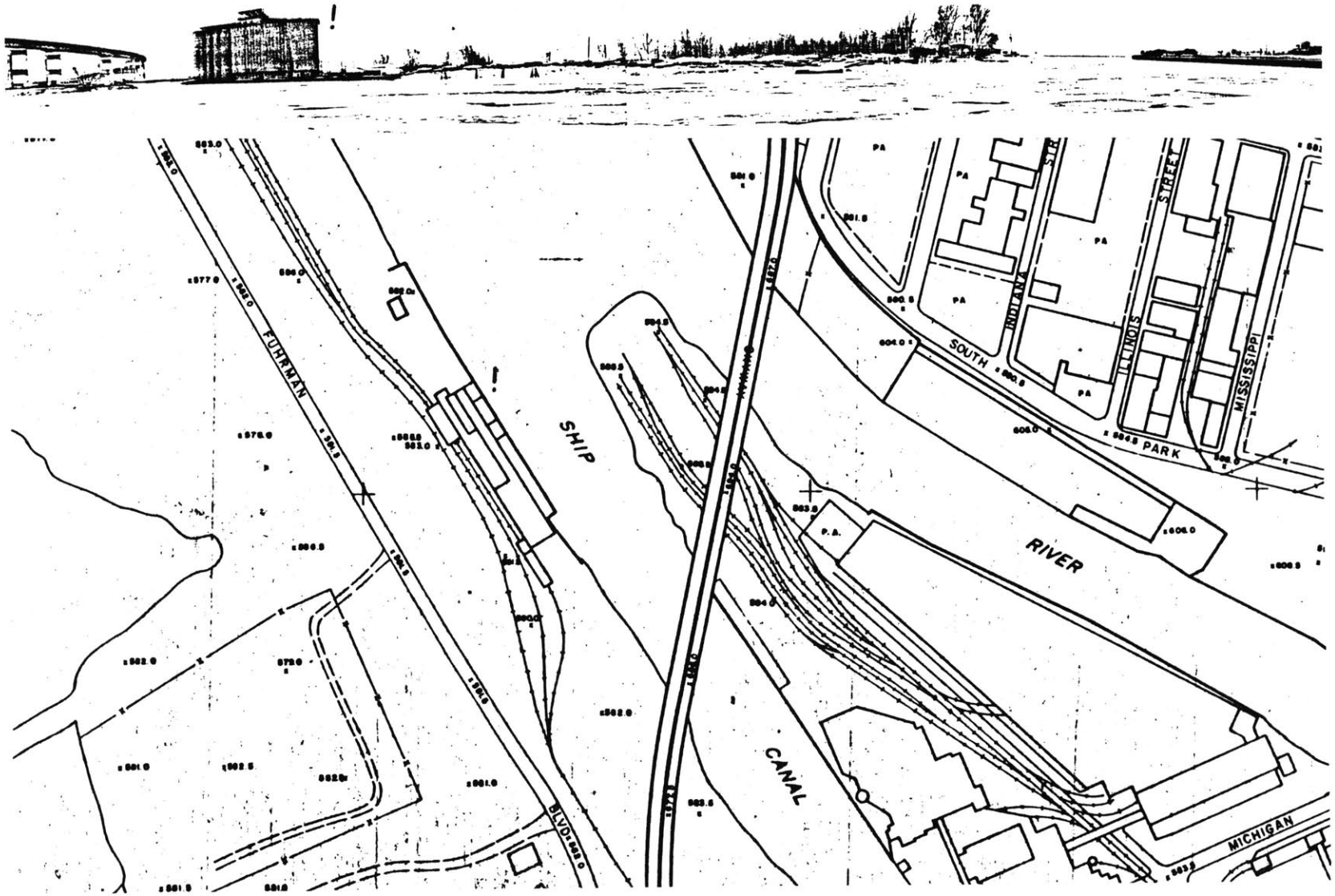
The site proposed is among the smallest of the silos as well as being closest to the city center directly accross the Buffalo River. Though a new building program, as such, was not at issue for the bulk of this exercise, the notion of a semi-public use such as a university which would include commercial, assembly, classroom, office and residential uses was used to generate sizes of spaces.



Grain elevators of the Buffalo River District. (Drawn by Cherie Wendelken and Bud Jacobs)

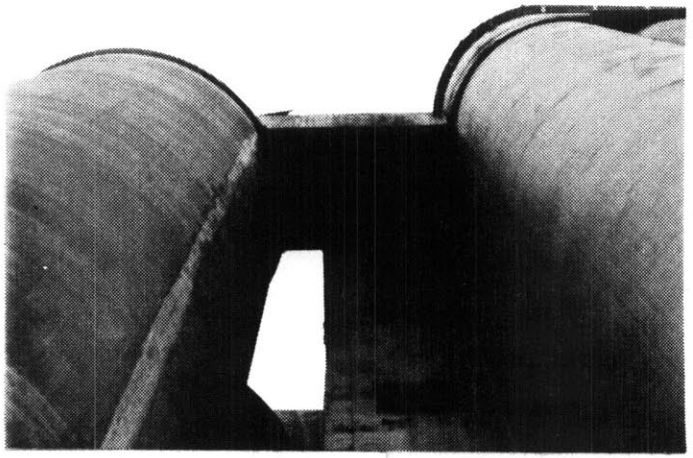
1. Connecting and Terminal
2. General Mills
3. Kellogg
4. Agway
5. Pillsbury
6. Cargill Electric
7. American
8. Perot
9. Lake and Rail
10. Standard
11. Marine A
12. Cargill Superior
13. Concrete Central

The Site!


FURNMAN
SHIP
CANAL
RIVER
SOUTH
PARK
INDIANA
ILLINOIS
MISSISSIPPI
STREET
MICHIGAN
BLVD.
P.A.

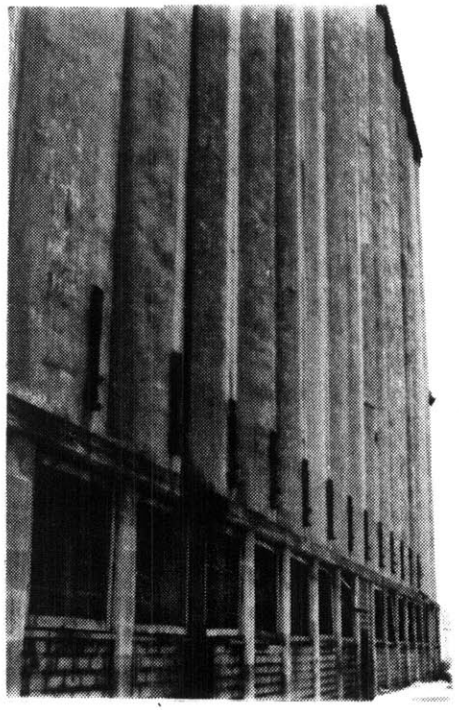
Existing Structure:

The building structure is comprised of two separate sets of silos. Ten silos in two packed rows are concrete cylinders that come down to the ground; seventy more steel containers of varying sizes bear on a concrete slab which is propped from ground level by a sea of 3' x 3' columns. The boxes are housed in a concrete box-type enclosure and are restrained laterally by a heavy steel frame. The wreckage of a single story head house runs across the top of the two buildings pieces which in turn is topped by steel hoppers and lateral conveyance mechanisms. A single concrete stair tower between their two parts of the structure provides access to the top levels.

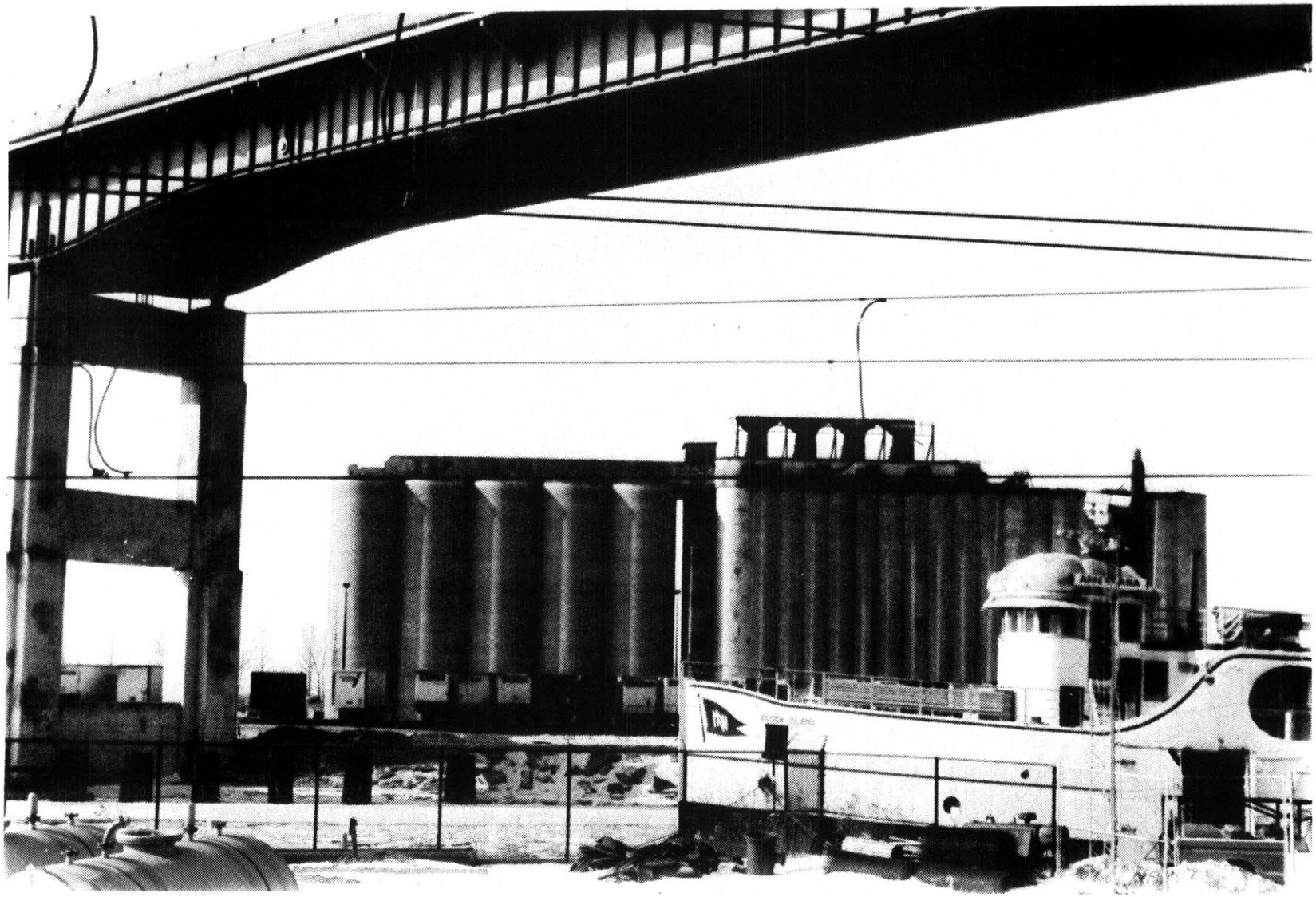


Stairwell between silo structures

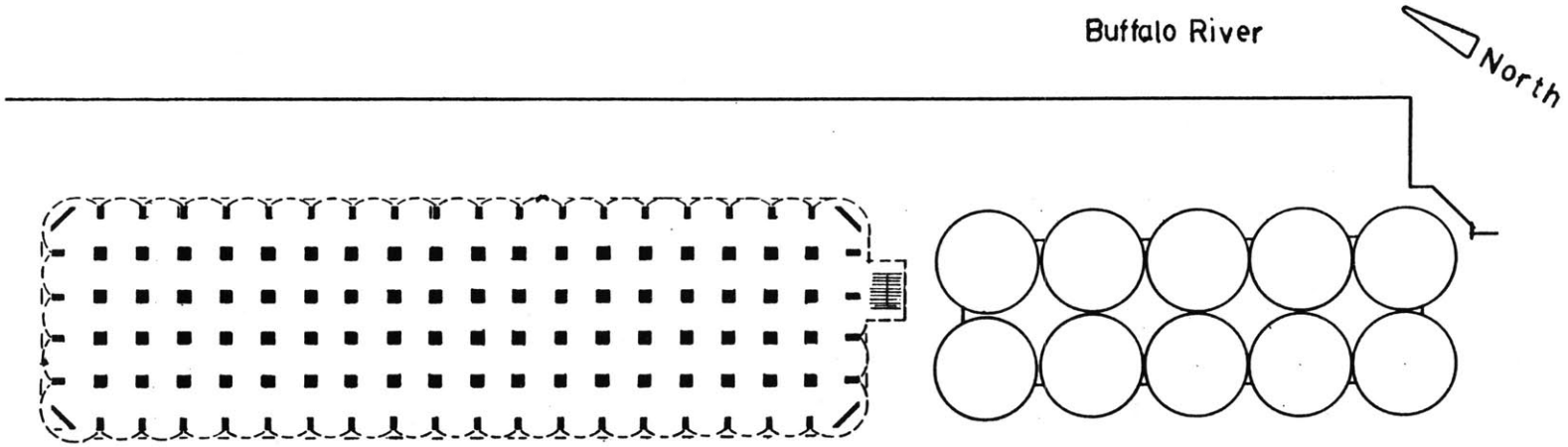
"Sea" of columns at ground level



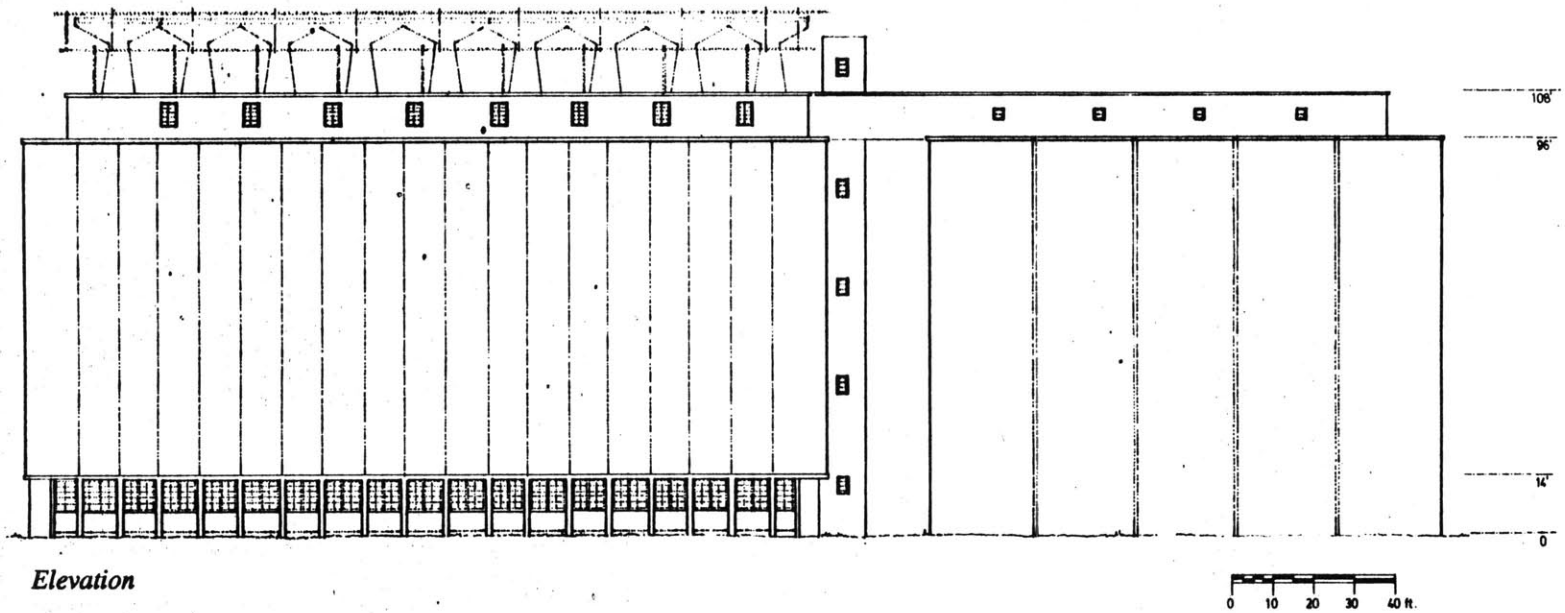
View of "box" enclosure



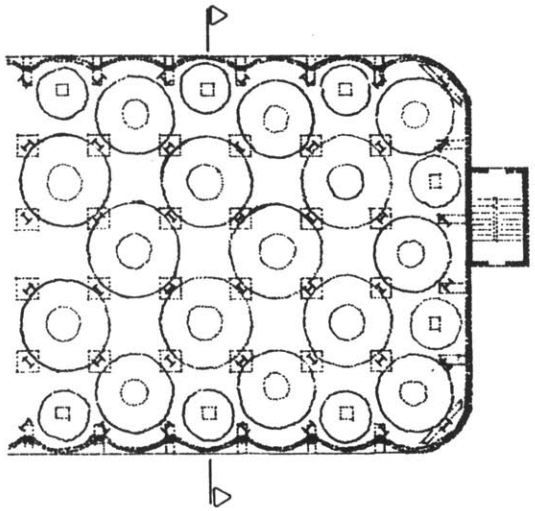
View across Buffalo River from downtown waterfront



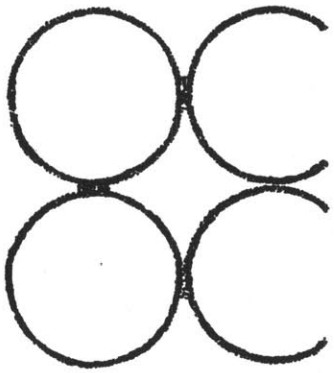
Existing ground plan

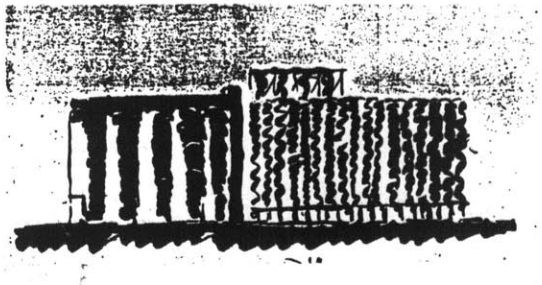


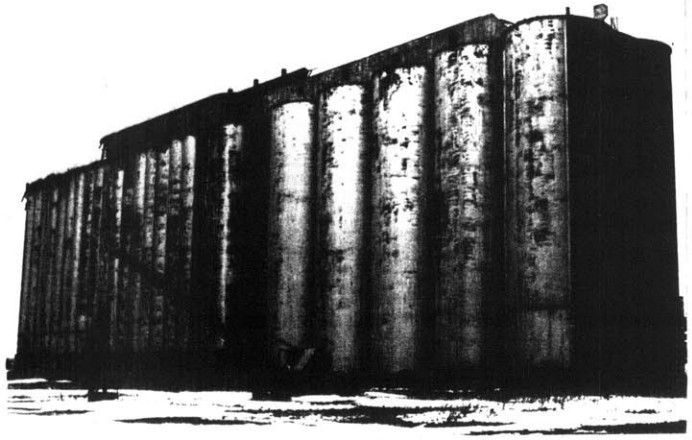
Elevation



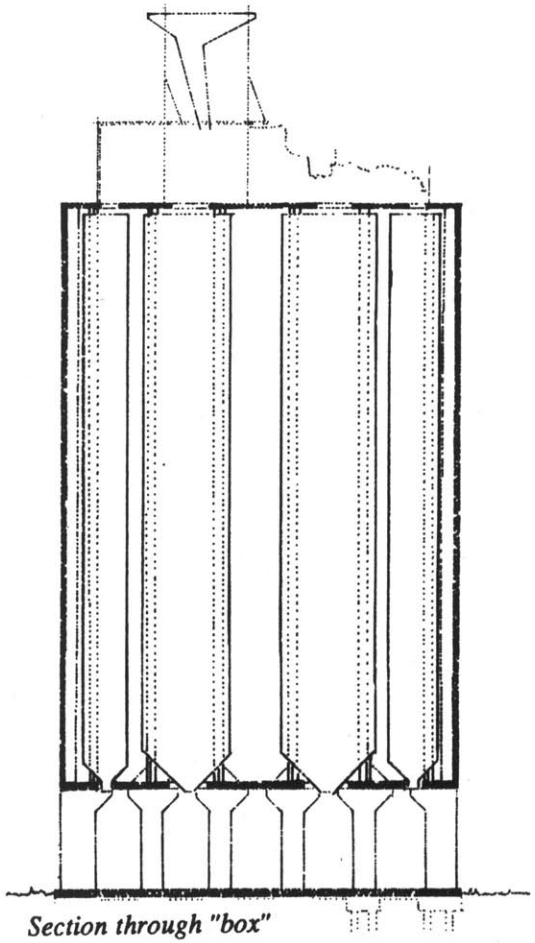
Detail plan through steel cylinders







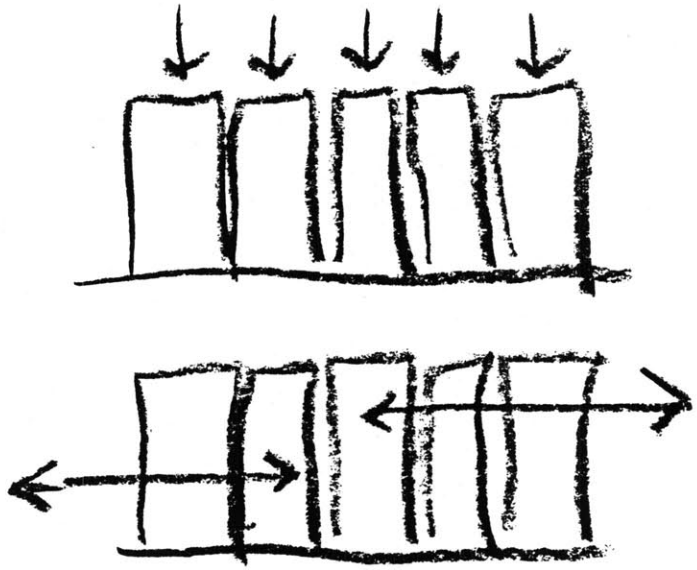
View from South



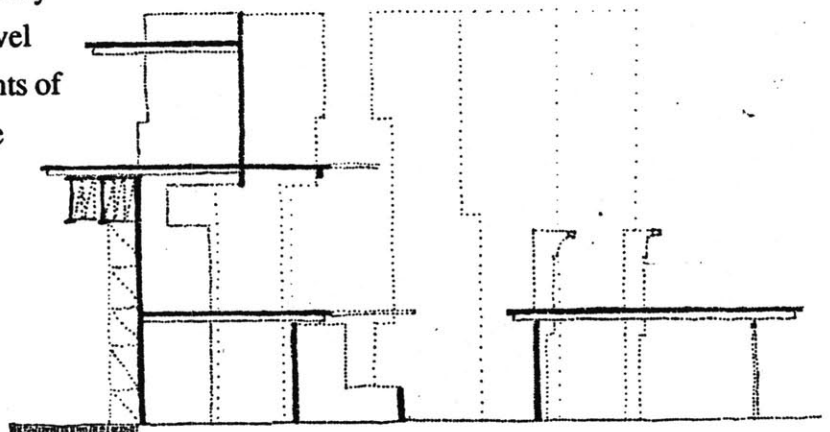
Section through "box"

Problems and Intents:

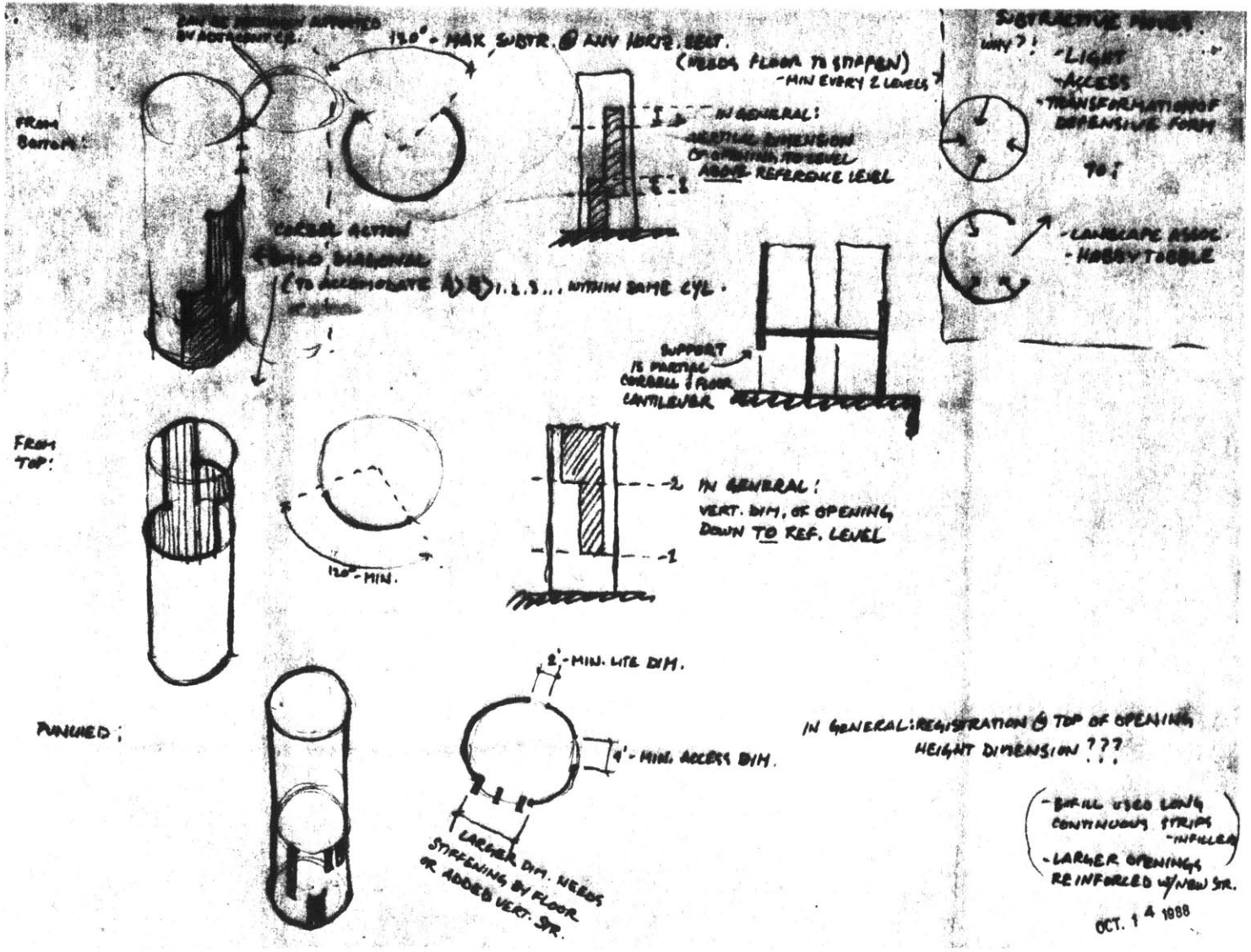
The nature of the form of the silos in the horizontal direction is too closed for reasonable human inhabitation, while in the vertical direction it is much too open. The problem addressed is the transformation of this general behavior by removing material and adding a structure such that spatial continuity can be expanded horizontally and controlled vertically. Actual material removed may reappear elsewhere on the site as ground definition. The added structure behaves as virtual hingings, displacements, and extensions of the silos, maintaining dimensional and behavioral attributes of the removed and remaining material. The structure becomes the light and the light the structure.

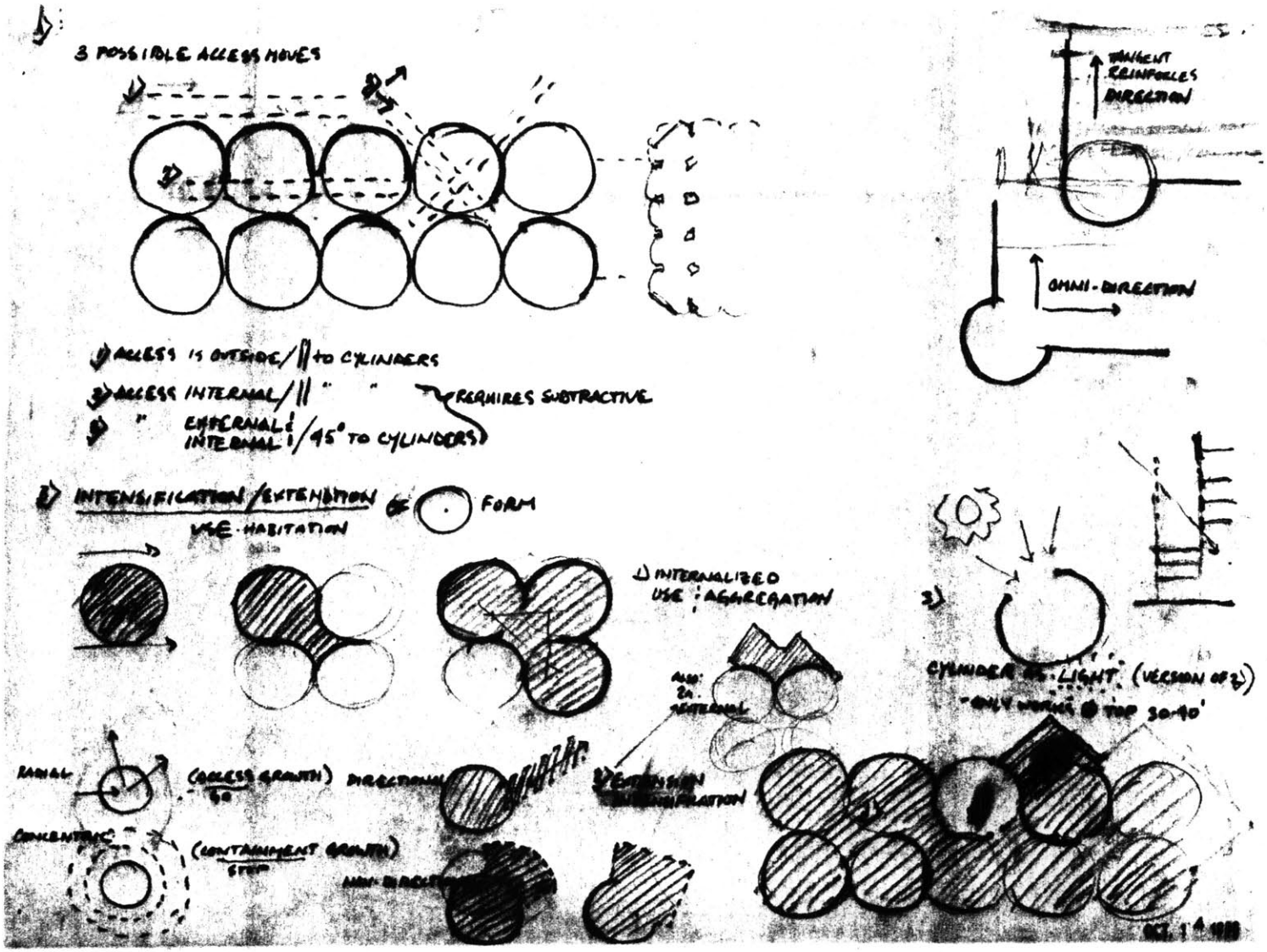


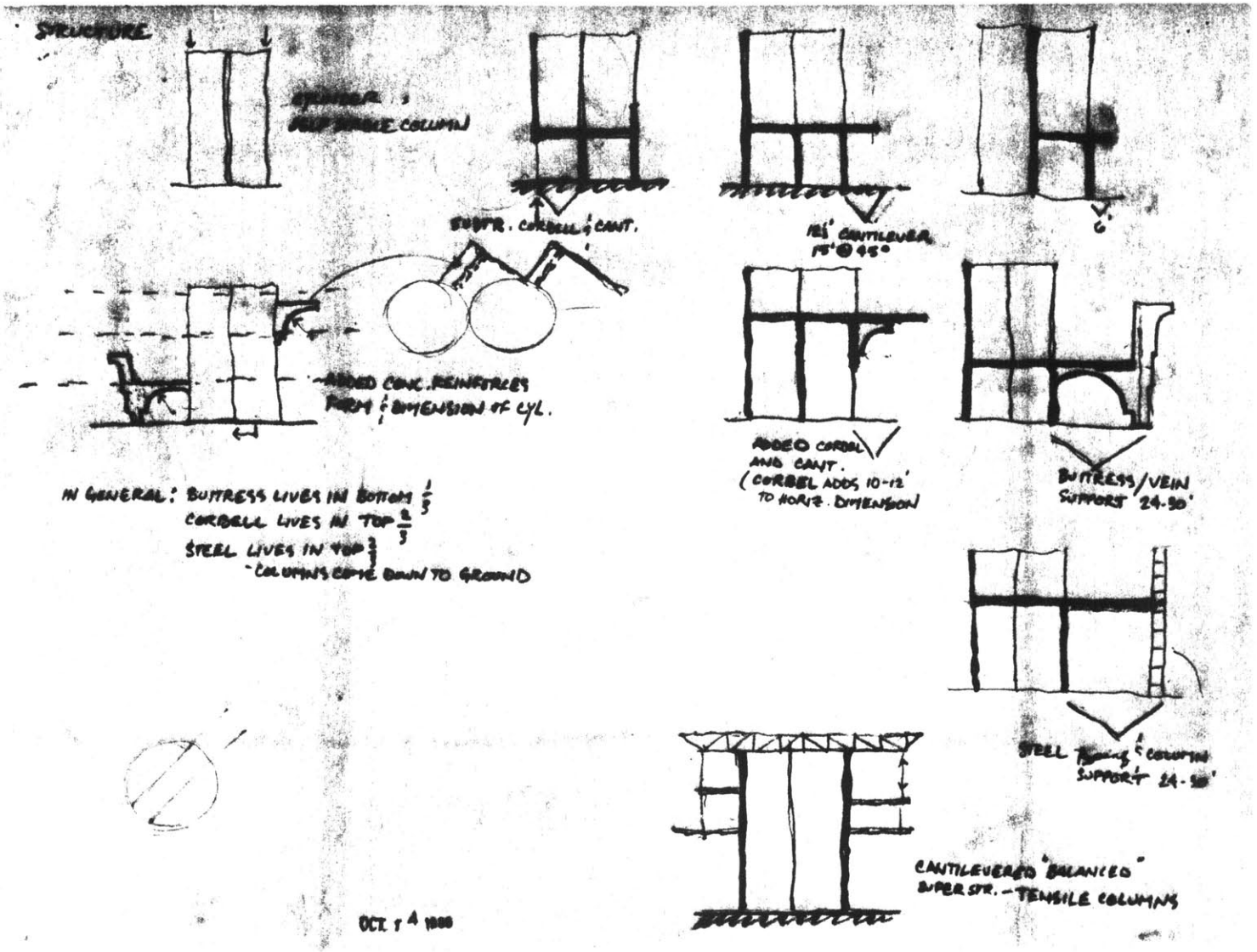
The primary structure establishes three reference levels above the ground; the intent being to keep further infill within a 2-3 story walk-up range of each level. These elevated levels are intended to provide relatively easy lateral access across the site as well as provide a "raised ground" level within an associative distance to the use spaces. Vertical components of the structure help demarcate building size pieces, as well as provide partial access-room size definitions.

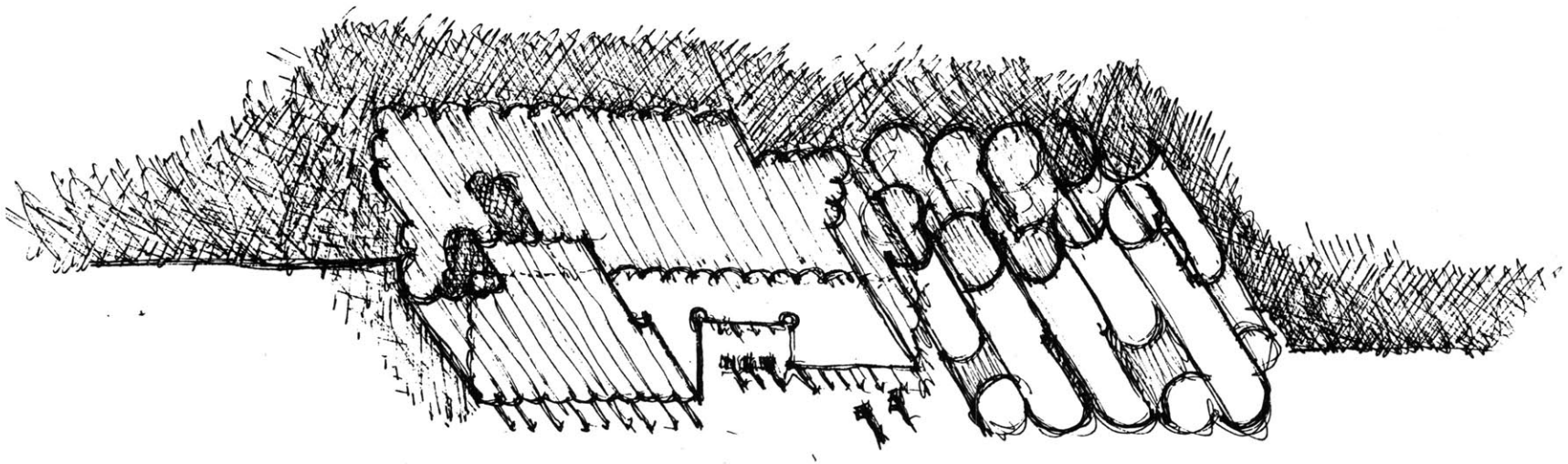


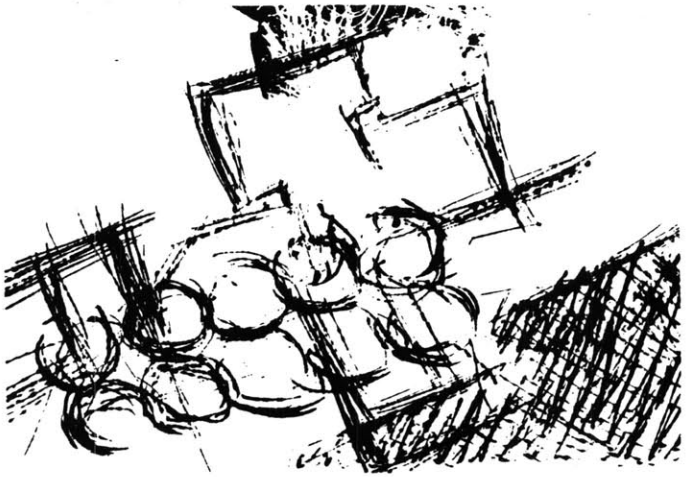
Sketch showing major reference levels


FROM BOTTOM:
FROM TOP:
PUNCHED:
IN GENERAL:
IN GENERAL: REGISTRATION @ TOP OF OPENING
HEIGHT DIMENSION ???
OCT. 14 1988

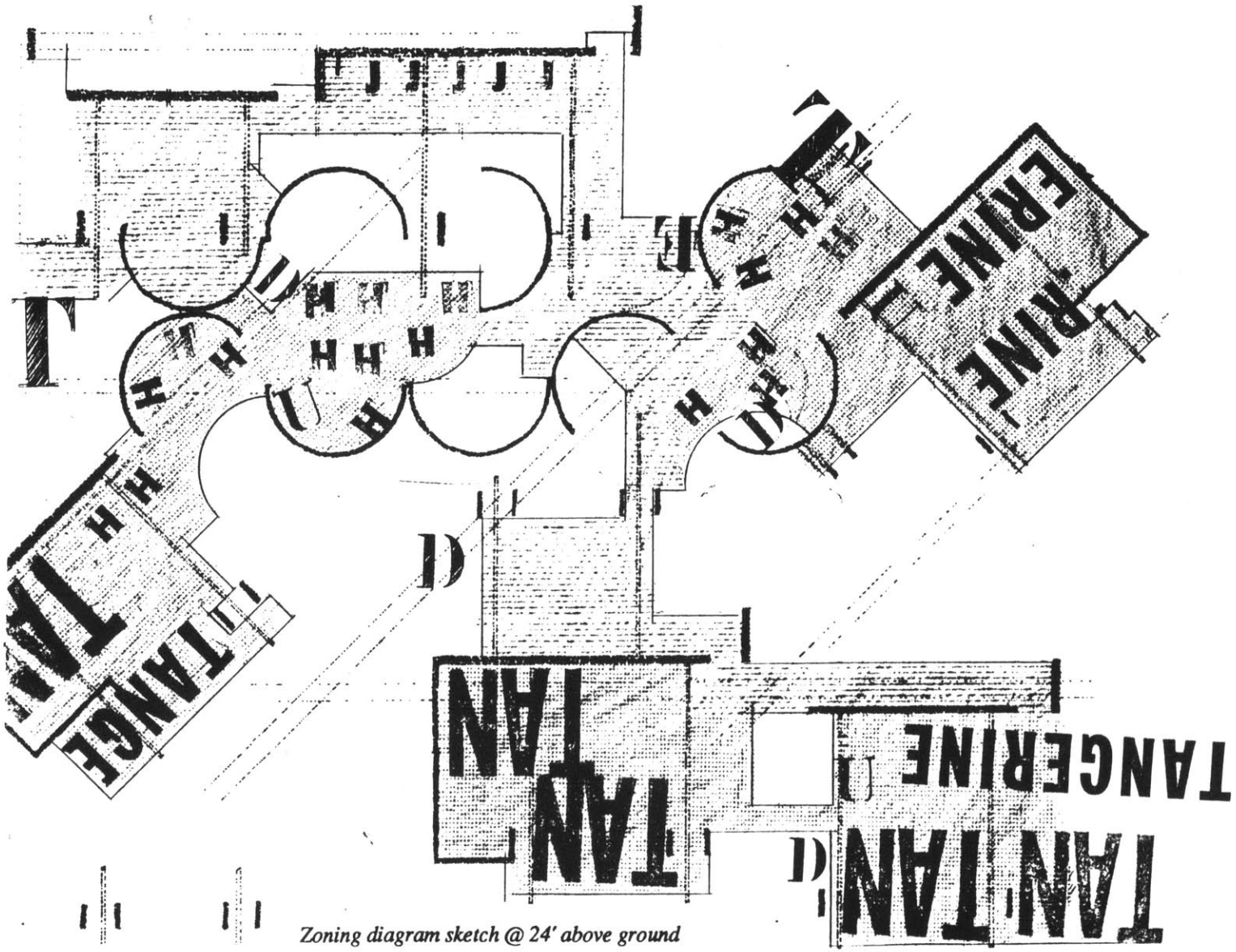

3 POSSIBLE ACCESS MOVES
1) ACCESS IS OUTSIDE/// TO CYLINDERS
2) ACCESS INTERNAL/// " "
3) " EXTERNAL/INTERNAL/45° TO CYLINDERS
REQUIRES SUBTRACTIVE
TANGENT REINFORCES DIRECTION
OMNI-DIRECTION
1) INTENSIFICATION/EXTENSION OF FORM
USE: HABITATION
2) INTERNALIZED USE: AGGREGATION
3)
RADIAL
CONCENTRIC
(ACCESS GROWTH)
(CONTAINMENT GROWTH)
DIRECTIONAL


STRUCTURE
SUPER. CORBELL & CANT.
16½' CANTILEVER
15'@45°
ADDED CONC. REINFORCES
FORM ⅓ DIMENSION OF CYL.
ADDED CORBEL
AND CANT.
(CORBEL ADDS 10-12'
TO HORIZ. DIMENSION
BUTTRESS/VEIN
SUPPORT 24-30'
IN GENERAL: BUTTRESS LIVES IN BOTTOM ⅓
CORBELL LIVES IN TOP ⅔
STEEL LIVES IN TOP ⅔
-COLUMNS COME DOWN TO GROUND
STEEL & COLUMN
SUPPORT 24-
CANTILEVERED "BALANCED"
SUPER STR. - TENSILE COLUMNS
OCT 4 1966

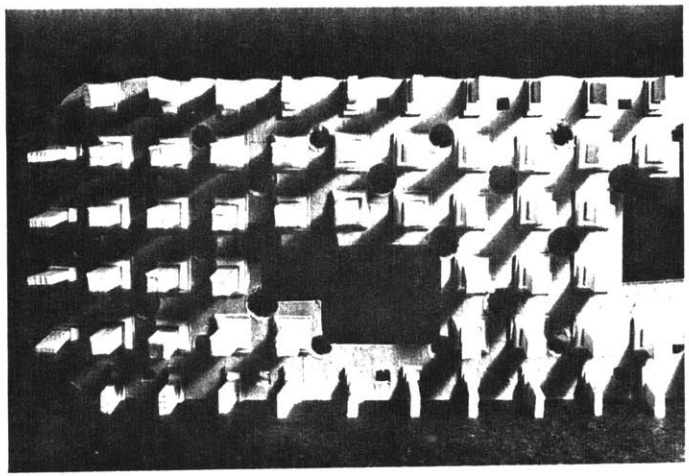


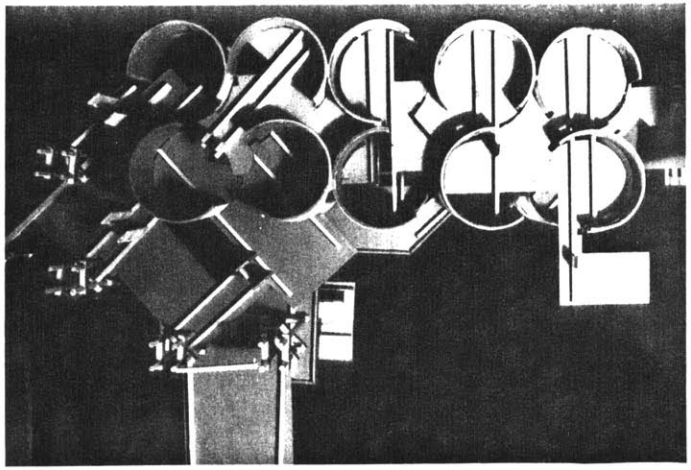


Early sketches

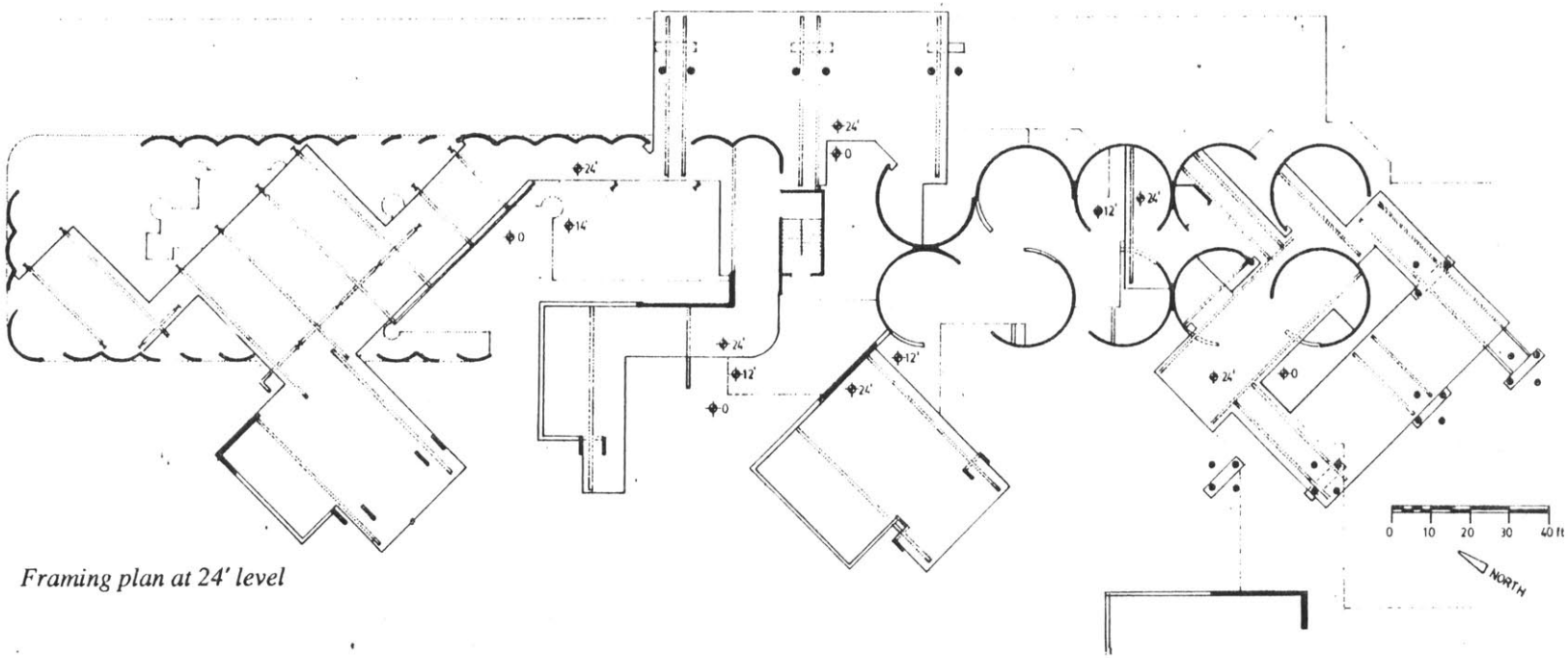


Zoning diagram sketch @ 24' above ground

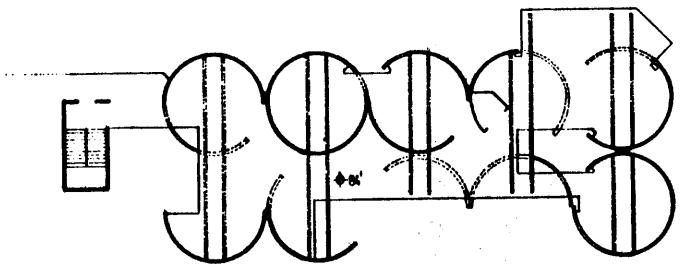




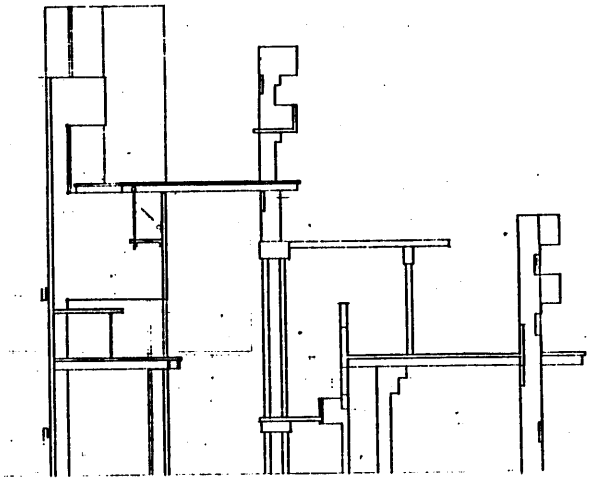
Model photos

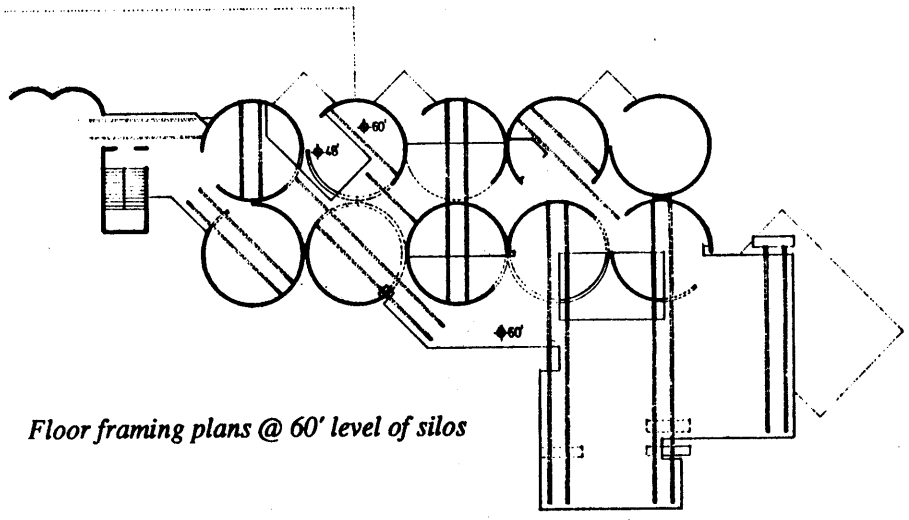


Framing plan at 24' level

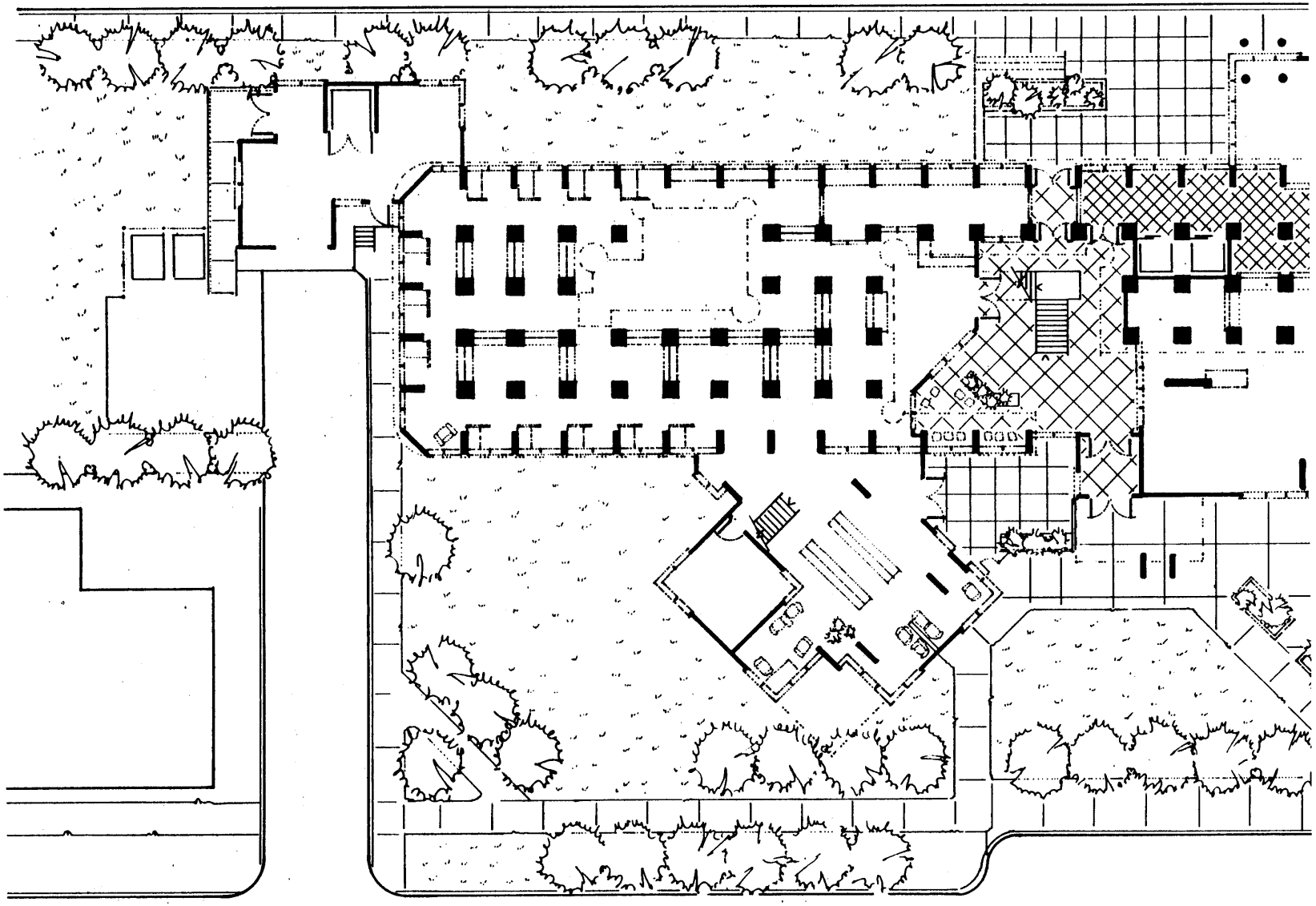


Floor framing @ 84' level

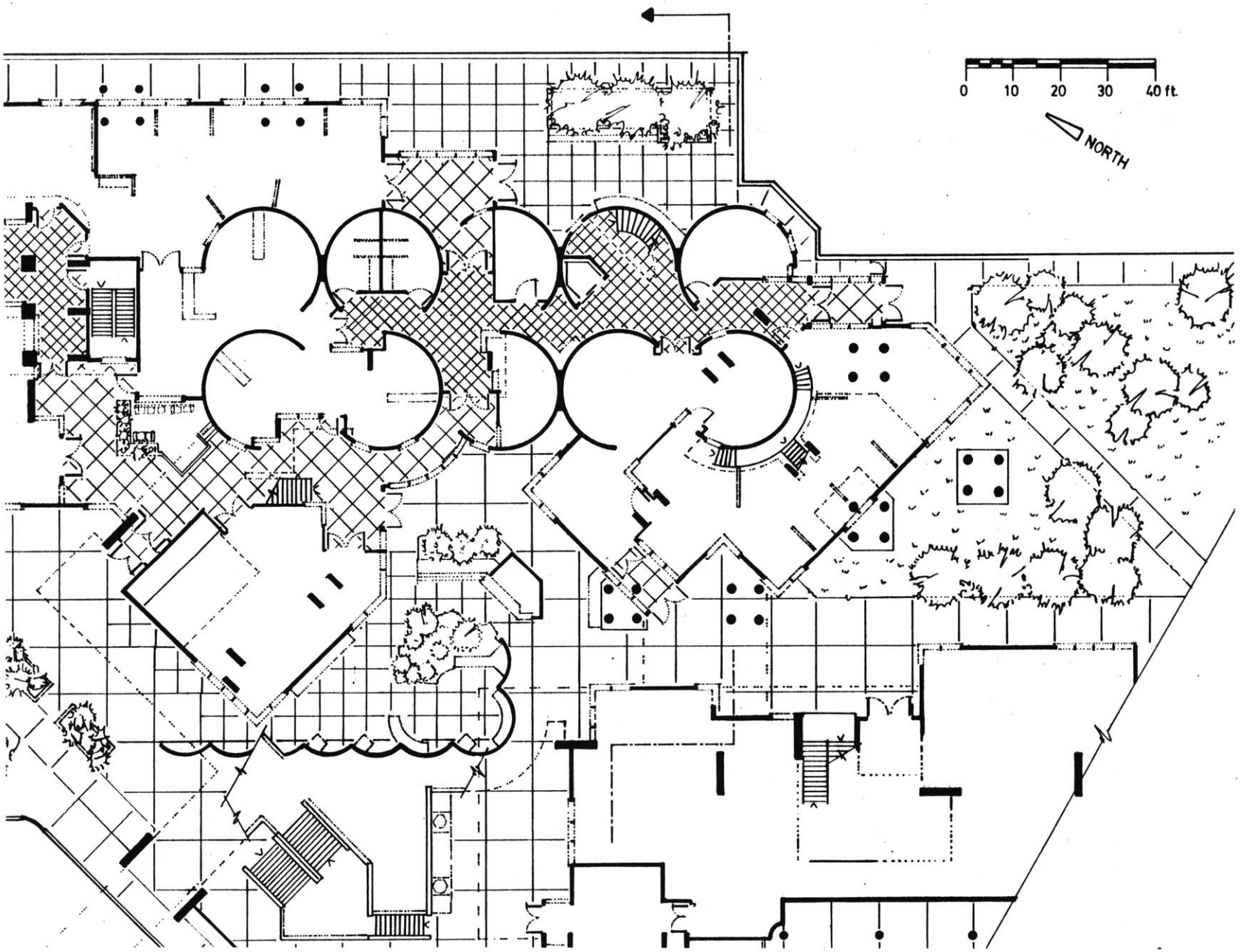


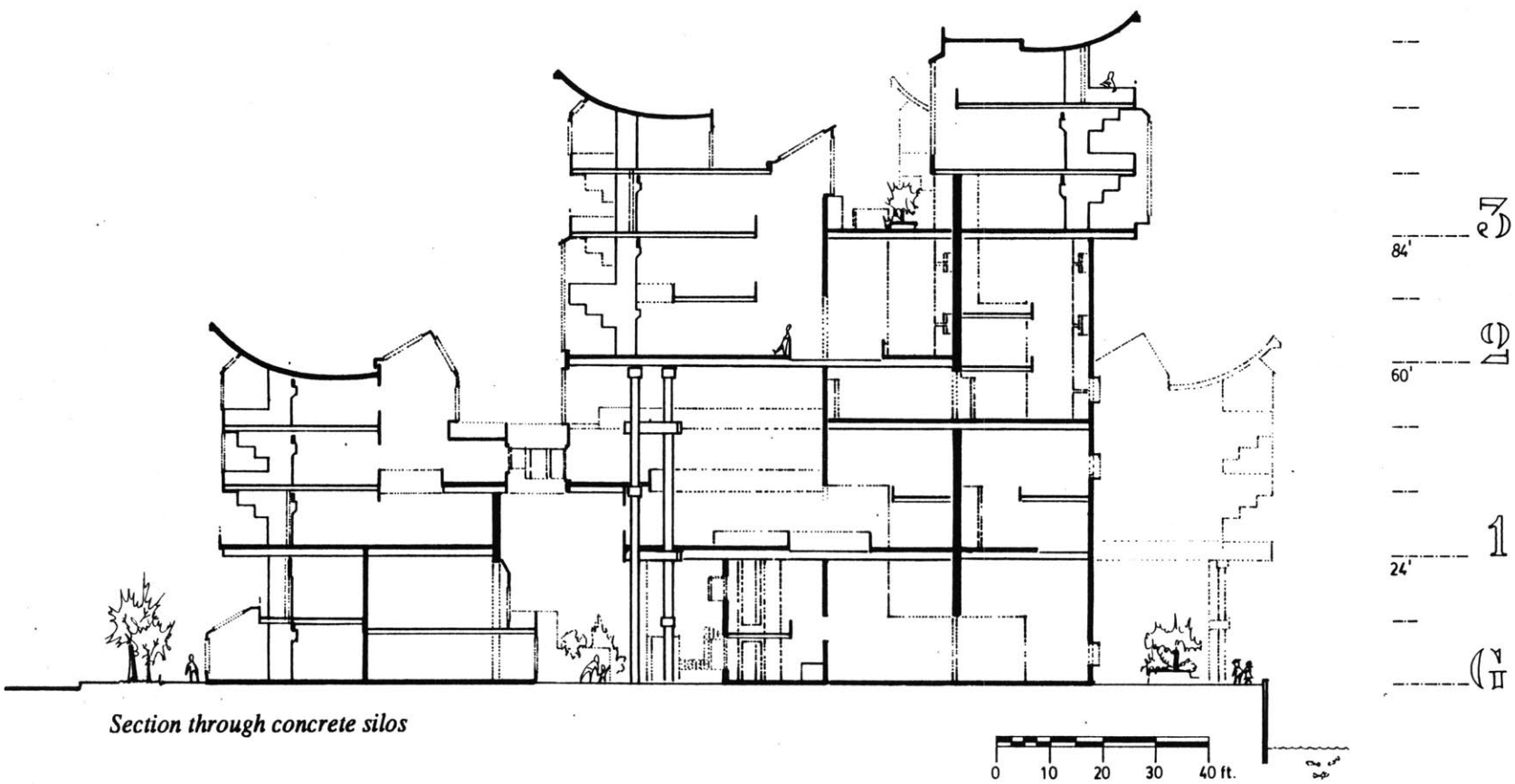


Floor framing plans @ 60' level of silos

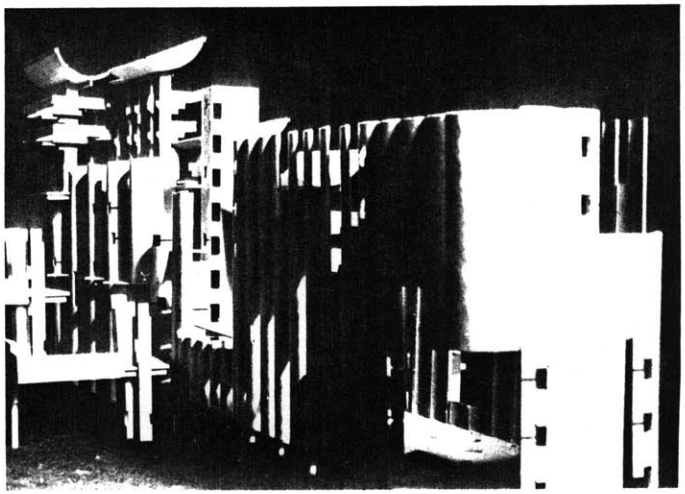


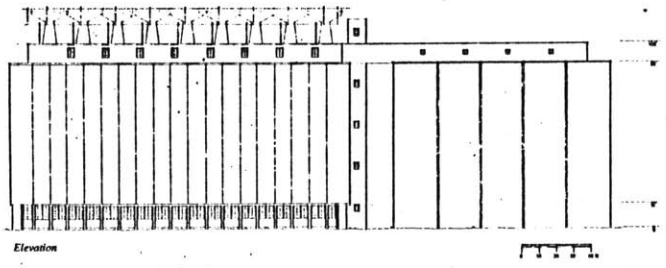
Transformed ground plan-library, studios, workshop, classroom, exhibition areas.


0 10 20 30 40 ft.
NORTH



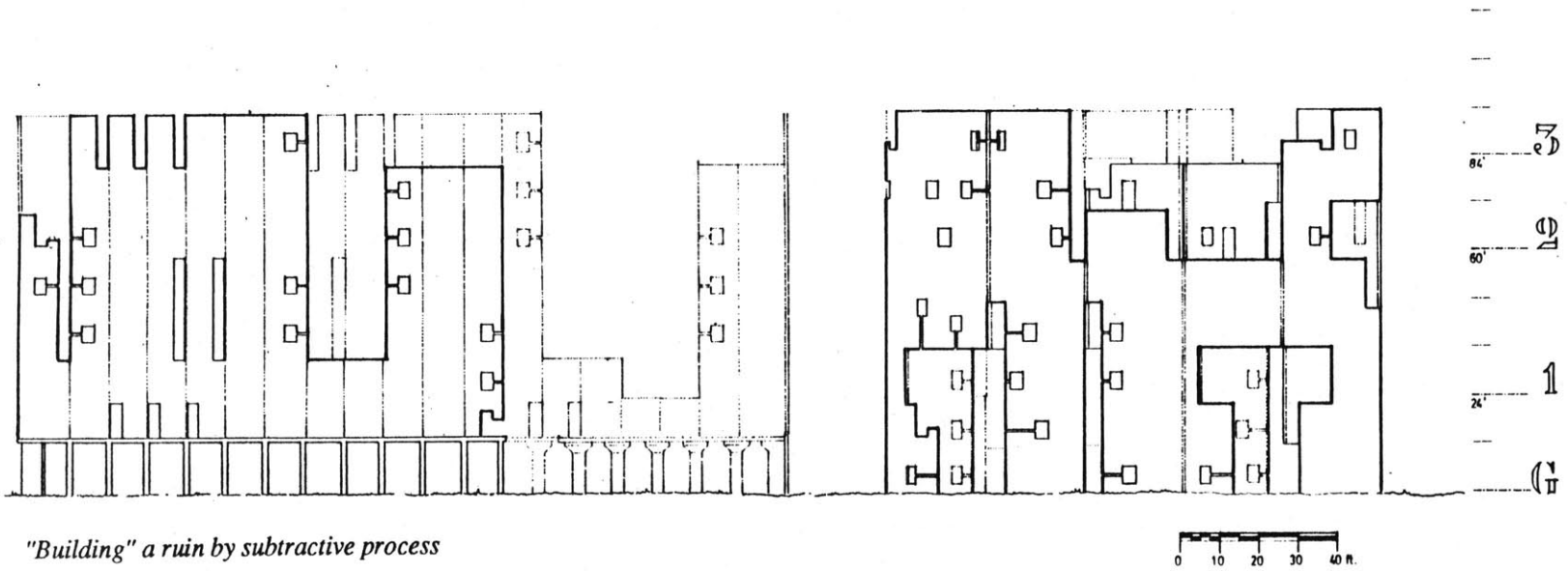
Section through concrete silos



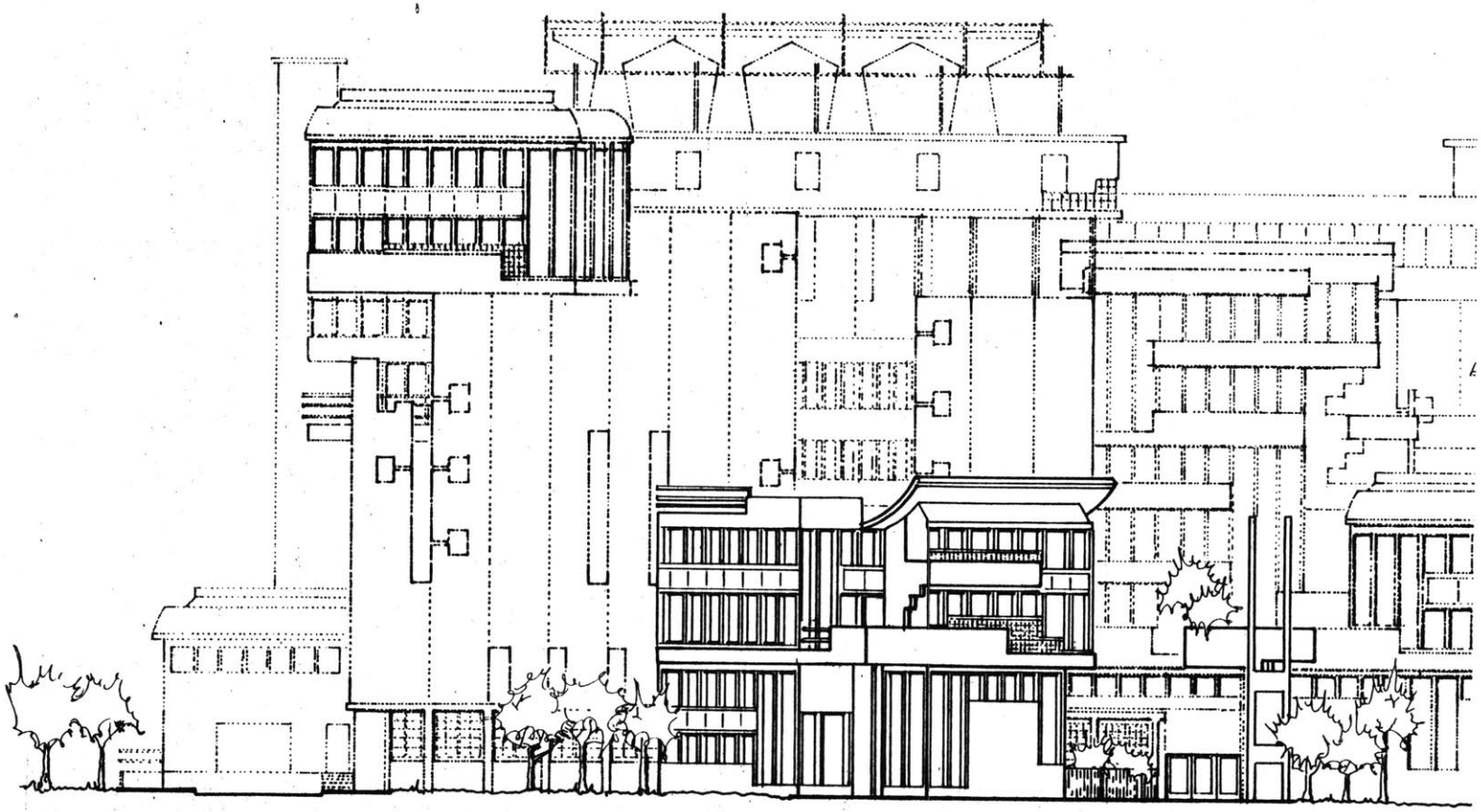


"First I make de form, und den I must (h)eat it."

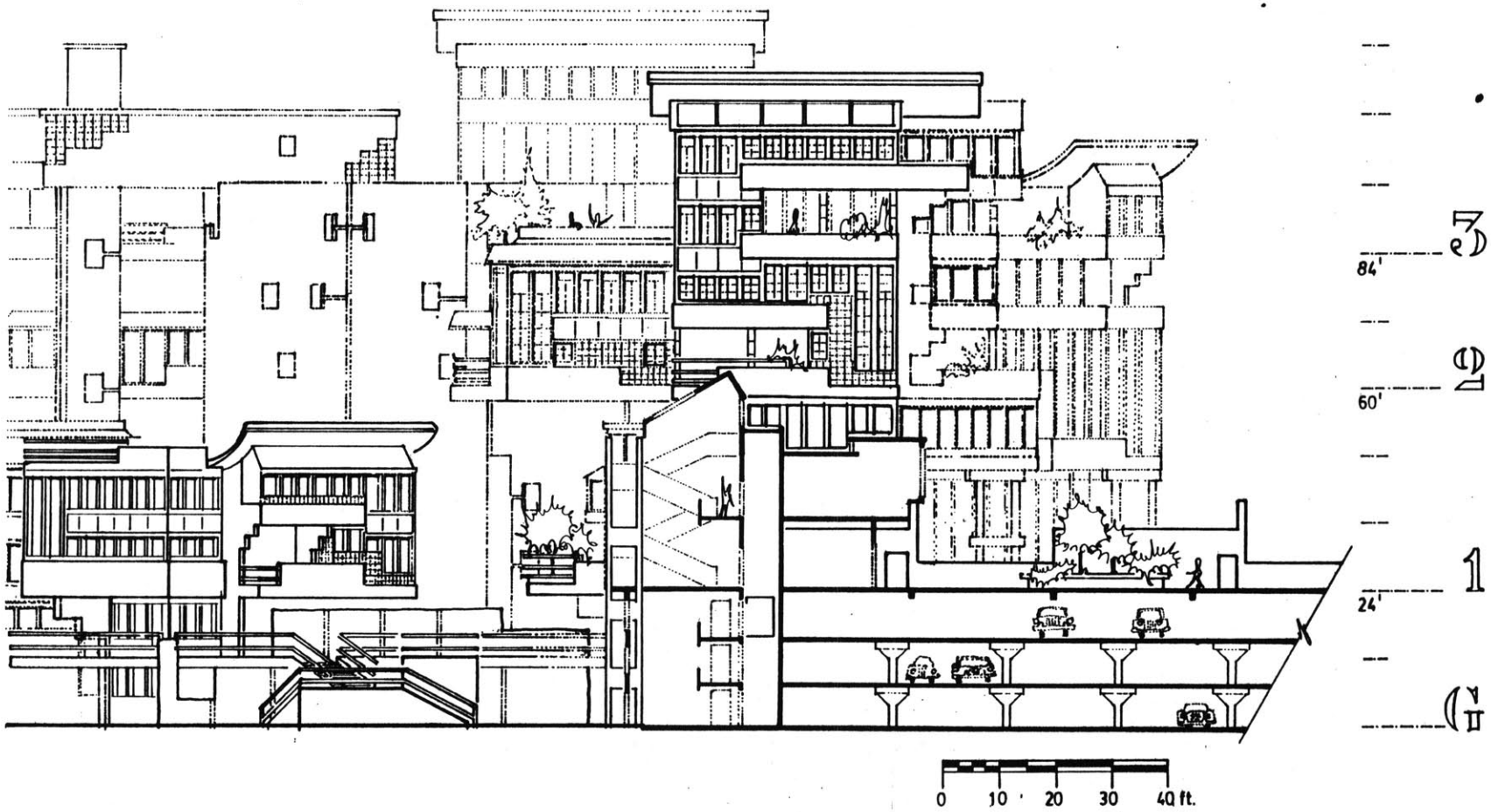
Hertzberger, notes from lecture at MIT, Fall 1987

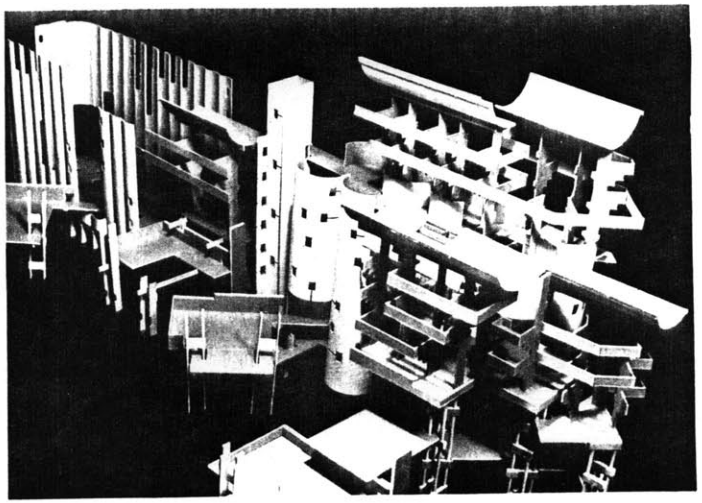


"Building" a ruin by subtractive process

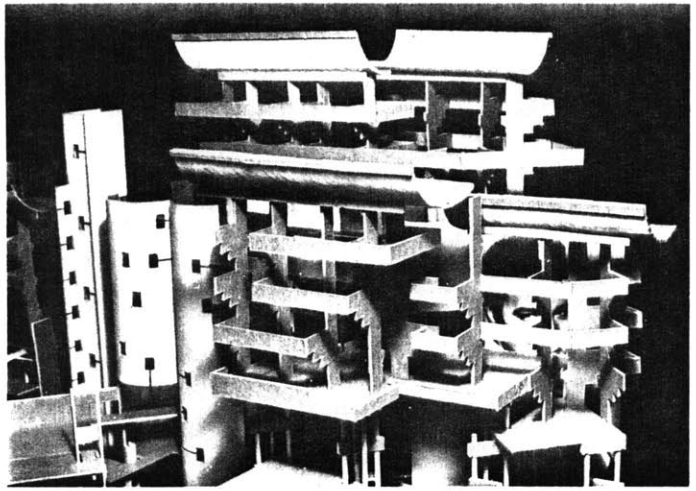


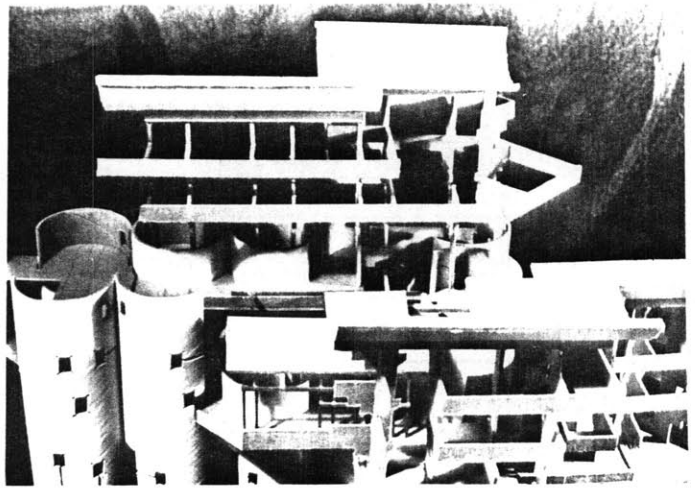
South Elevation

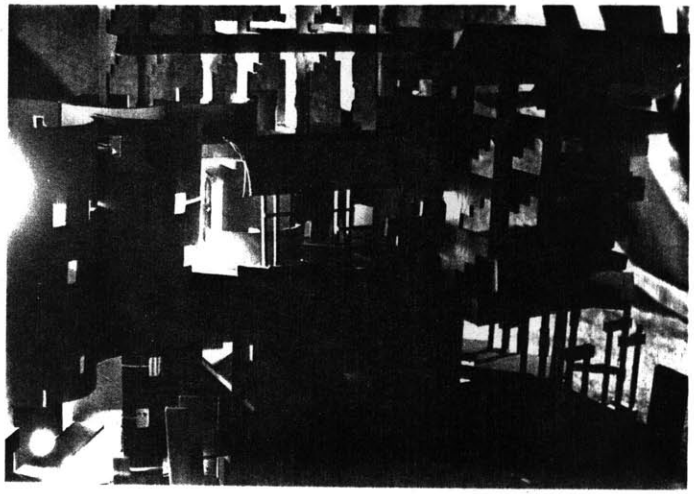

84'
60'
24'
0
10
20
30
40 ft.

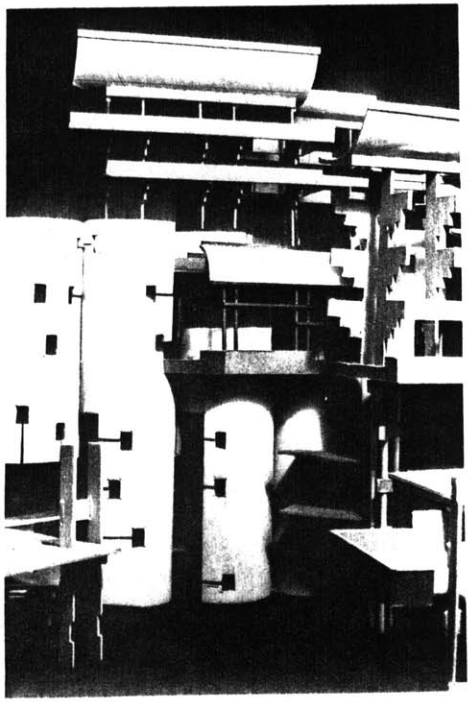


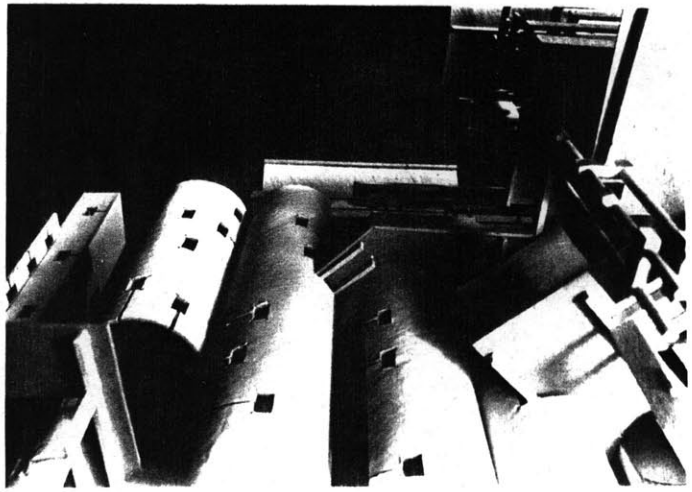
Model photos

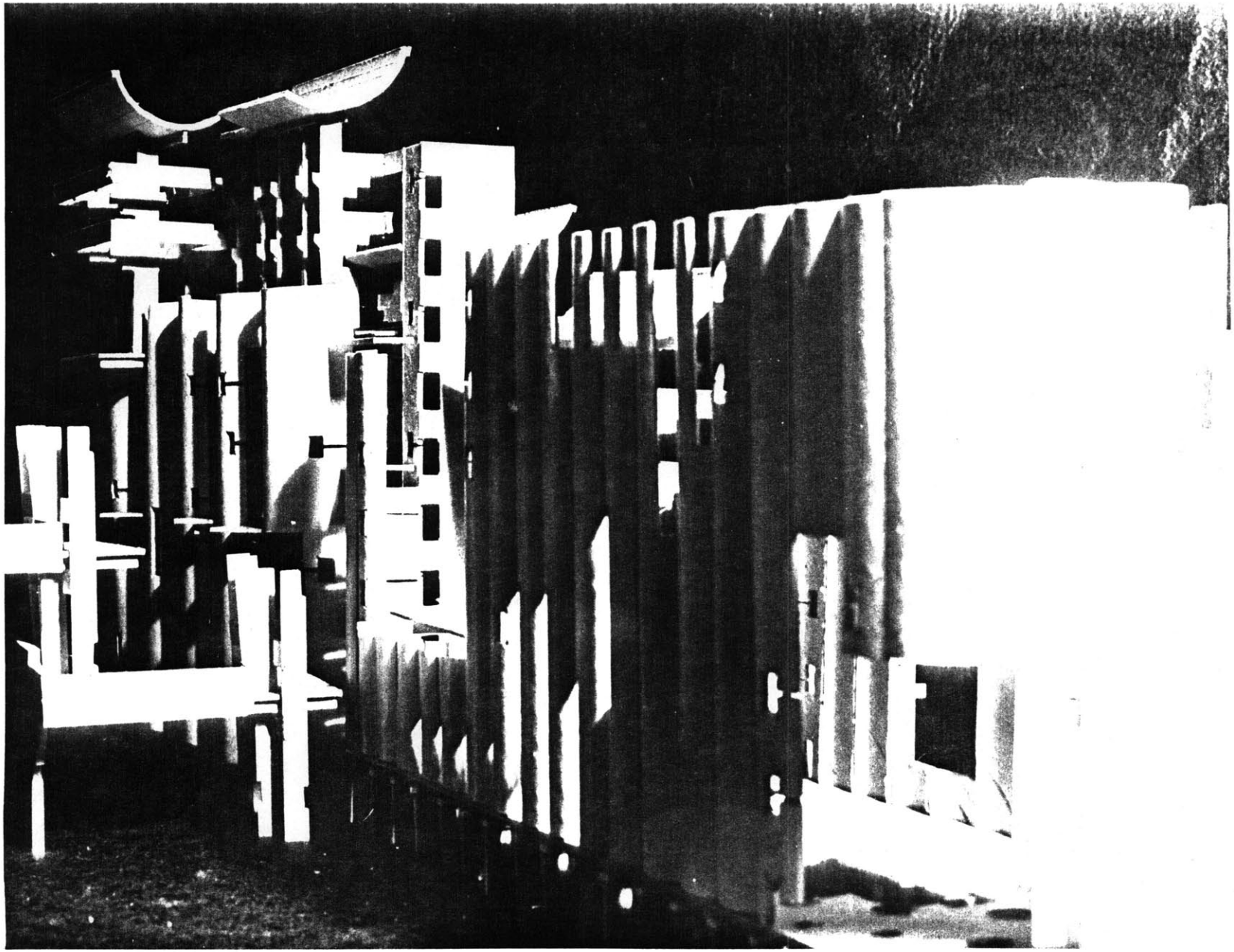


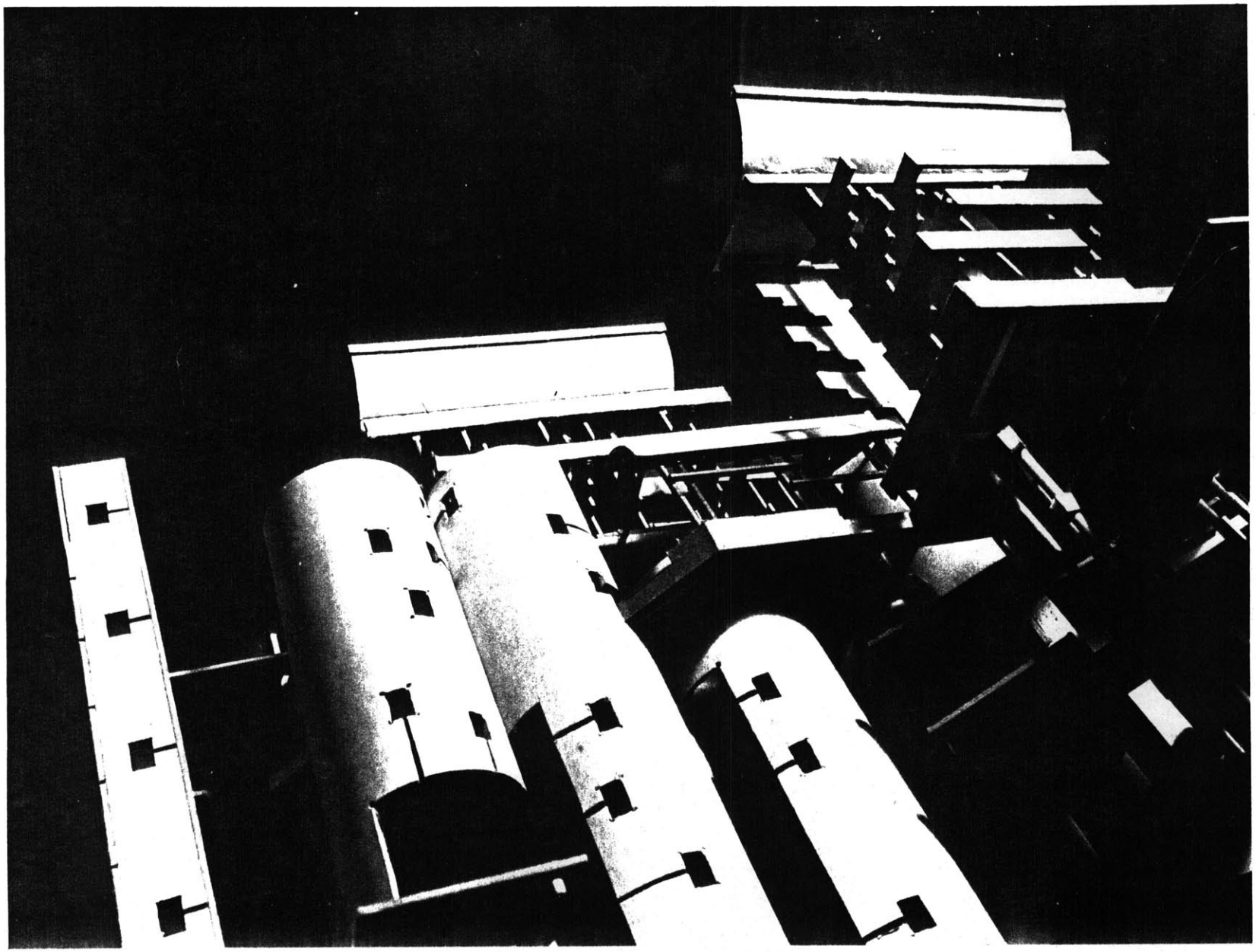


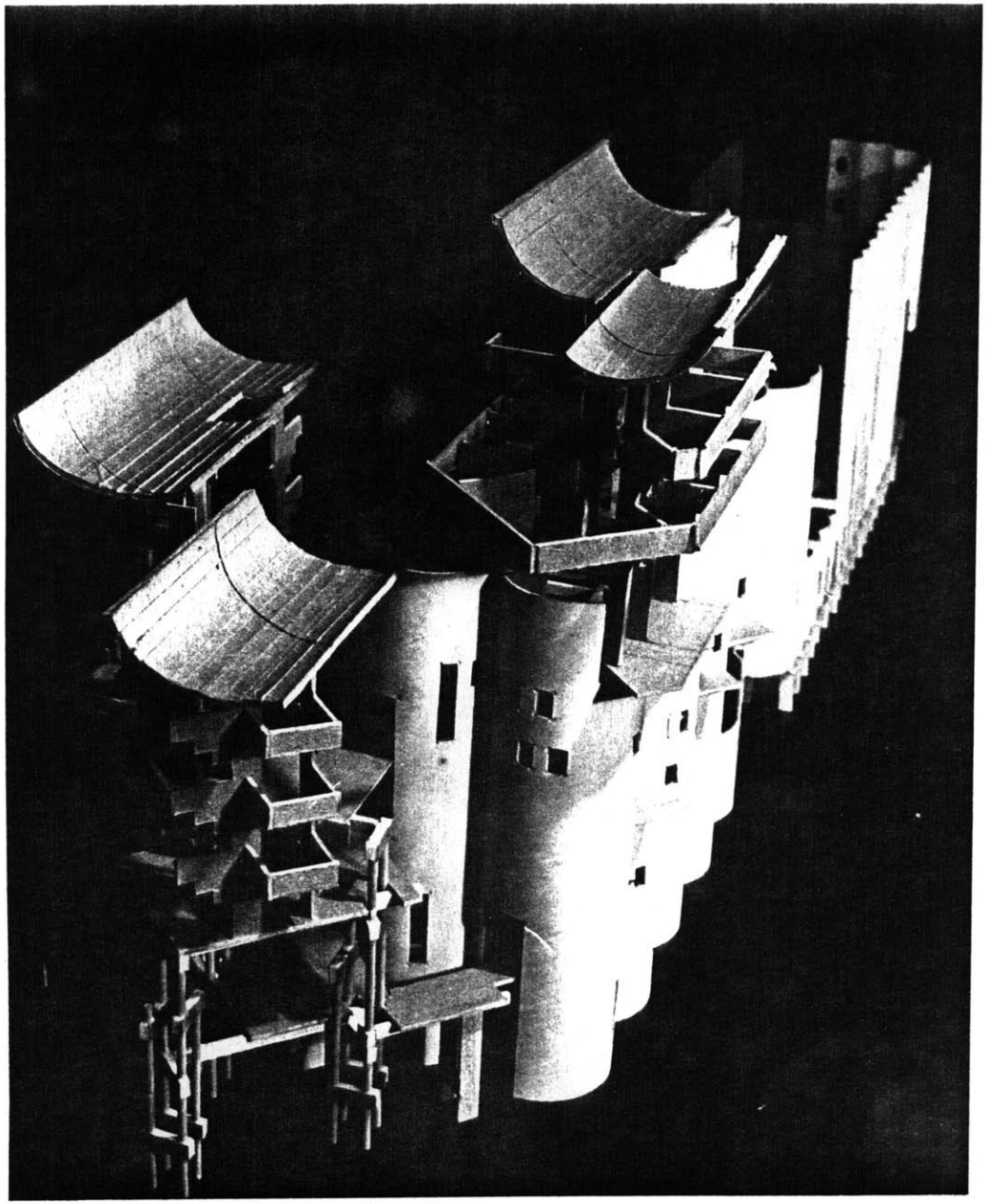


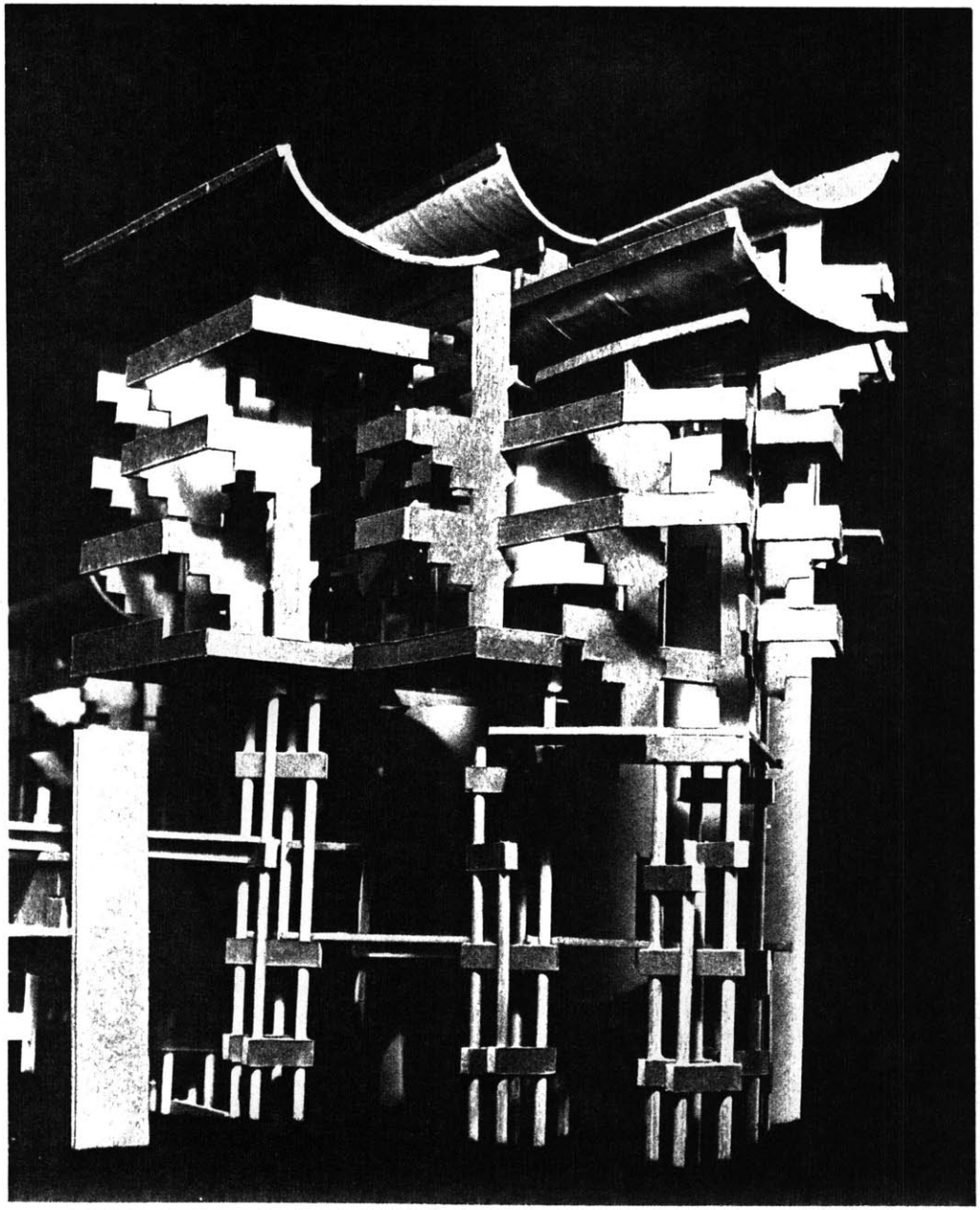












The King, "T.C.B."

THE NIPTON TROLL

He's known as the Nipton Troll. He lives scot free in three rooms, each with running water when it rains. One is a storeroom for food, water and firewood; another is a bedroom with America's deepest wardrobe; and the third is a library/reading room stocked with magazines, newspapers and books. Each room is tubular, four feet in diameter and fifty feet long. His laundry and bathroom are two miles away at a Caltrans rest area. His backyard stretches long miles through the desert between Los Angeles and Las Vegas.

"If you don't think too good, don't think too much"

-Ted Williams

"Luego, baby."

-H. McDonald

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