PERSPECTA 25

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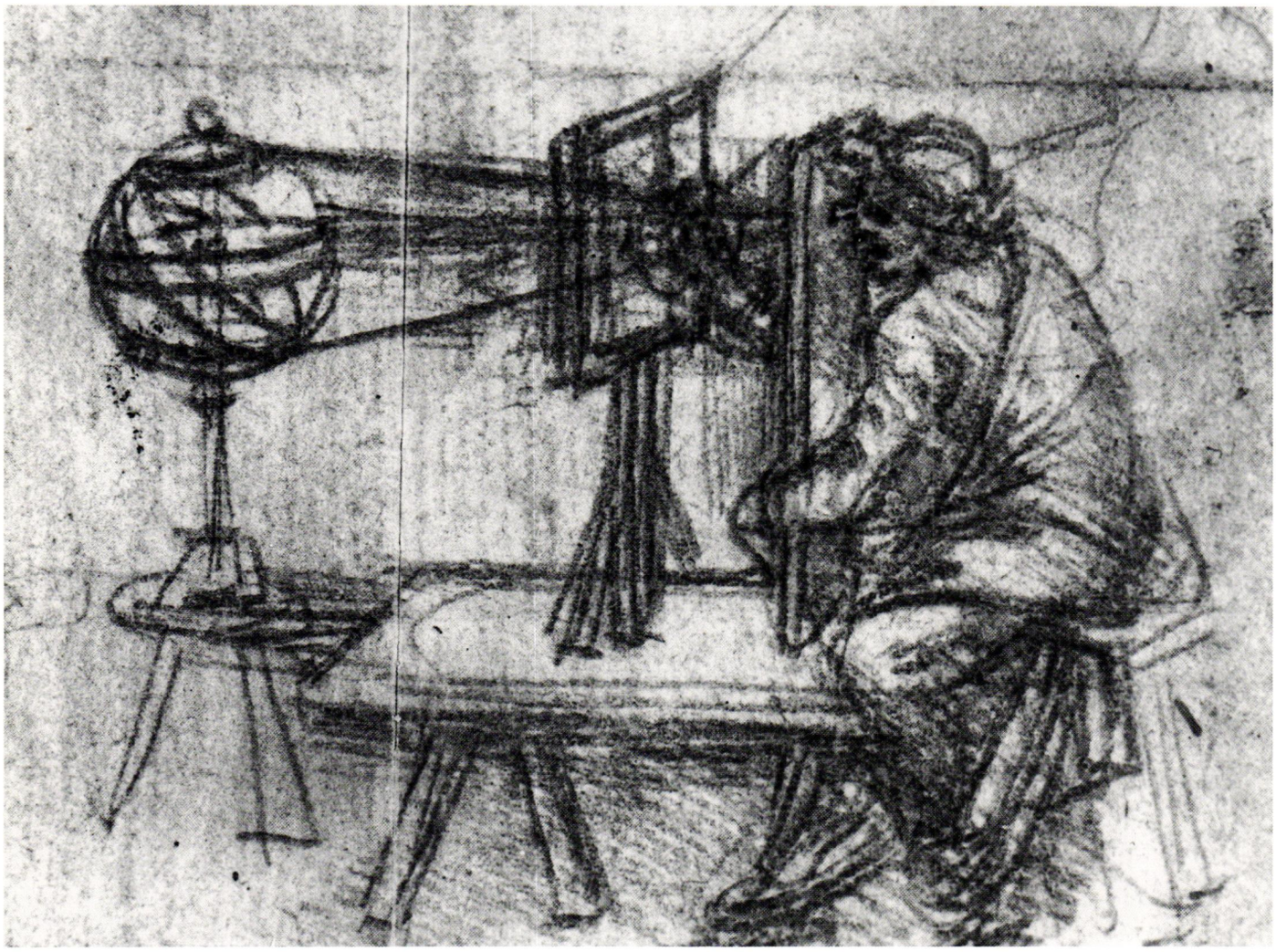
. . . While painting a landscape
or a still life,
he would conscientiously persevere
in front of the object,
but approach it
only by very complicated detours.
Beginning with the darkest tones,
he would cover their depth
with a layer of color
that led a little beyond them,
and keep going,
expanding outward from color to color,
until gradually he reached
another, contrasting pictorial element,
where, beginning at a new center,
he would proceed in a similar way.
I think there was a conflict,
a mutual struggle
between the two procedures of,
first, looking
and confidently receiving,
and then of appropriating
and making personal use
of what has been received;
that the two,
perhaps as a result of becoming conscious,
would immediately start opposing each other,
talking out loud, as it were,
and go on perpetually interrupting
and contradicting each other. . . .

Rainer Maria Rilke,
"Paris, October 9, 1907,"
Letters on Cézanne.



Leonardo da Vinci, perspectograph

The Image of the Spherical Earth

David Woodward

The realization that the physical world is a finite spherical object spinning in space is a cornerstone of how humans view their environment. As an icon, the globe represents the essence of holistic existence; it informs an understanding of our context at the macroscopic scale. But how have people come to know their world as spherical? What use is this knowledge, and what does such a realization imply? The purpose of this essay is to discuss the constraints – physical, conceptual, technical, and psychological – that have shaped and determined this knowledge, and to offer examples of how imagination and invention have confronted the problems of forming an image of the whole earth.

Kenneth Boulding begins his book *The Image* with the vivid picture of the author looking out of his window to the visible world outside.[1] He immediately extends the picture to not only what he can see but also to what he knows but cannot see: that if he goes far enough he will come back to where he is now. He has an image of the round world in the solar system, in the galaxy. He is located in space. Such a knowledge has not always been that easy. Plato's description of the view of the earth now seems incredibly modern:

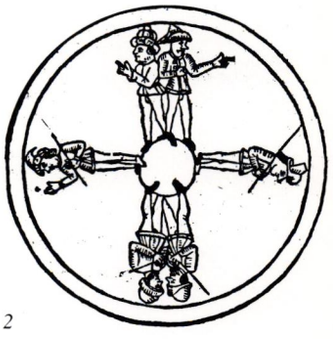
First of all the true earth, if one views it from above, is said to look like those twelve-piece leather balls, variegated, a patchwork of colors, of which our colors here are, as it were, samples that painters use. There the whole earth is of such colors, indeed of colors far brighter still and purer than these: one portion is purple, marvelous for its beauty, another is golden, and all that is white is whiter than chalk or snow; and the earth is composed of the other colors likewise, indeed of colors more numerous and beautiful than any we have seen. Even its very hollows, full as they are of water and air, give an appearance of color, gleaming among the variety of the other colors, so that its general appearance is of one continuous multi-colored surface.[2]

This description is all the more remarkable when we remember the excitement in the 1960s over seeing images of recognizable coastlines of the world from space, be they of the British Isles, Italy, or Florida.The cartographers had got it right. Each photograph from space was made special by our own previous familiarity with these shapes, built up over countless (many probably unconscious) encounters with maps and atlases produced long before satellite imagery had made such views possible. The most obvious constraint in understanding the earth as a sphere is a physical one: the globe – or even relatively small parts of it – is too big to see the whole thing at once. Our horizons are limited to the flat circle around us. Before the circumnavigation of the earth, by ship or spacecraft, the notion of its sphericity was left to the imagination, a grand hypothesis as yet unproven. Yet for centuries before the circumnavigation, the evidence of the earth's sphericity had become so overwhelming that the form was certain. During the Christian Middle Ages, we have evidence in every century from the fifth to the fifteenth that the earth was viewed as being spherical. These allusions included vivid demonstrations of this understanding, such as that of Gautier de Metz, who said that "a man could go around the world as a fly makes a tour of an apple."[3] (2)

1. Kenneth Boulding, *The Image* (Ann Arbor: University of Michigan Press, 1956).

2. Plato, *Phaedo* 110b-d. Translation adapted from David Gallop (Oxford: Clarendon Press, 1975).

3. David Woodward, "Medieval *Mappaemundi*," in *The History of Cartography: Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean*, edited by J. B. Harley and David Woodward (Chicago: University of Chicago Press, 1987), p. 321.



2

The world view of the classical Greeks lent logical support to the idea of the finite spherical earth, as did the affirmations of the Church Fathers and medieval scholars, but the empirical verification had not yet been made. The achievement of Ferdinand Magellan - or rather, of those of his crew that survived the voyage – in the first documented circumnavigation of the world in 1522 is thus of crucial importance. It provided dramatic evidence of the finiteness of the earth, evidence perhaps not to be duplicated until the twentieth century, when the first images of the earth from space were received. The *visual* confirmation of the already well-known fact was exciting. It was a difference between knowledge based on hearsay and understanding based on observation. As Boulding states: "I have never been to Australia. In my image of the world, however, it exists with 100% certainty. If I sailed to the place where the map makers tell me it is and found nothing there but ocean I would be the most surprised man in the world."[4] But on seeing Australia for the first time, there must have been a sense of personal discovery: the theory was confirmed by observation.

At the global scale, it was the view of the whole earth in one sweep of the eye from the window of the spacecraft on the lunar mission that really captured and verified the imagination. This view was the ultimate holistic picture of the finite world: "The tiny globe would continue to turn, serenely ignoring its subdivisions, presenting a unified facade that would cry out for unified understanding, for homogeneous treatment."[5] The distant view of the earth had been anticipated beforehand. C. S. Lewis's description of Cicero's *Dream of Scipio* speaks of such a perspective of the earth and its accompanying sense of humility: "Scipio now noticed that the stars were globes which easily outstripped the earth in size. Indeed the earth now appeared so small in comparison that the Roman Empire, which was hardly more than a point on that tiny surface, excited his contempt."[6] The seventeenth-century poet Abraham Cowley had similar sentiments about a later empire:

I leave Mortality *and things below;*
And Lo! I mount, and Lo!
How small the biggest Parts of Earth's *proud* Tittle *show!*

Where shall I find the noble Brittish *Land?*
Lo, I at last a Northern Spec *espie,*
Which in the Sea *dost lie,*
And seems a Grain *o'th'* Sand![7]

The frustration of not being able to see the whole earth all at once underpins Lewis Carroll's idea of life on a planet of manageable size:

But a scientific friend of mine, who has made several balloon voyages, assures me he has visited a planet so small that he could walk right round it in twenty minutes! There had been a great battle, just before his visit, which had ended rather oddly: the vanquished army ran away at full speed, and in a very few minutes found themselves face-to-face with the victorious army, who were marching home again, and were so frightened at finding themselves between two armies, that they surrendered at once! [8]

It is not only the sheer size of the earth in relation to that of human beings that creates a problem in understanding. The enormous complexity of life and landscape on the earth's surface requires us to construct an analogous world that we can visualize. As Root-Bernstein writes, "this ability to imagine new realities is correlated with what are traditionally thought to be non-scientific skills – skills such as playing, modeling, abstracting, idealizing, harmonizing, analogizing, pattern forming, approximating, extrapolating, and imagining the yet unseen. . . ."[9]

An obvious way of abstracting and reducing the earth to manageable proportions is by mapping it. The most straightforward way of showing that the earth is finite and spherical is to superimpose a spherical coordinate system on it. Although the imposition of such a geometry on the seamless earth might appear to be quite unnatural – we would indeed have been surprised if the astronauts had reported seeing lines of longitude and latitude on the earth – there

4. Boulding, *The Image*, p. 66.

5. Michael Collins, *Carrying the Fire: An Astronaut's Journeys* (New York: Farrar, Straus Giroux, 1974), p. 470. For an excellent recent illustrated anthology of impressions of the earth from space, see *The Home Planet*, edited by Kevin W. Kelley (Reading, Mass.: Addison-Wesley, 1988).

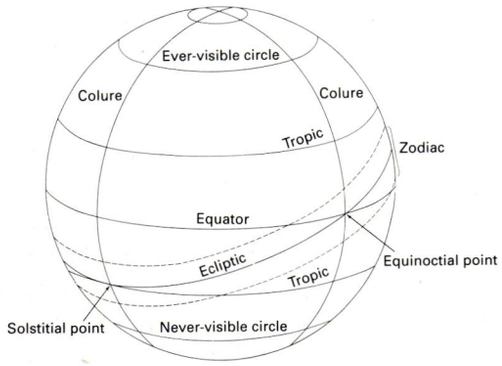
6. C. S. Lewis, *The Discarded Image: An Introduction to Medieval and Renaissance Literature* (Cambridge: Cambridge University Press, 1964), p. 66.

7. Abraham Cowley, "The Extasie," in *The Anchor Anthology of Seventeenth-Century Verse*, vol. 2 (New York: Doubleday, 1969), p. 609.

8. Lewis Carroll, *Sylvie and Bruno Concluded*, vol. 2 (London: Macmillan and Co., 1893), p. 170.

9. Robert Scott Root-Bernstein, "Visual Thinking: The Art of Imagining Reality," *Transactions of the American Philosophical Society* 75, no. 6 (1985): p. 66.

is a sense in which the global graticule as it has evolved is entirely natural.[10] The idea derived from astronomy. The celestial pole is a pivot point around which the regular movement of the heavens is taking place relative to the earth. The "turning heavens" is such a powerful metaphor that we sometimes have to remind ourselves that it is we who are turning. In the northern hemisphere, the pole star is a convenient – if not exact – point to represent this pivot. If you wish to plot star positions, it makes logical sense to draw equally spaced radiating lines and equally spaced concentric circles with their centers at the pole. On the celestial globes and armillary spheres of the classical period (3) certain key astronomical circles provided the framework to mapping the earth itself: the celestial poles, the celestial equator, the tropics, the ecliptic, and the colures.[11]



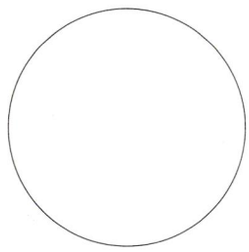
3

The transfer of these circles from the globe of the heavens to the globe of the earth emerges as a natural scheme for plotting places with parallels and meridians, a scheme which – although abstract in its notions – had powerful repercussions. The North and South Poles take on particular importance as goals for exploration because of their special situation. It is hard to convince people that the Equator and the Prime Meridian do not exist when nautical celebrations such as "Crossing the Line" have become established or when one can stand astride a brass line at Greenwich with one foot in each hemisphere. It is difficult for us to escape the significance of being halfway between the North Pole and Equator when we are sitting in Doc Grant's restaurant in Rangeley, Maine:

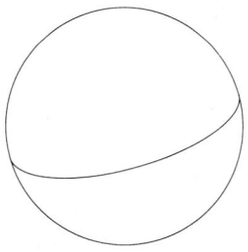
The parallel divides the dining room; paintings of tan lovelies in grass skirts line the walls of the southern half, and smiling Eskimos pull fish from holes in the ice on the northern wallpaper. . . . Tonight, I sat eating my dinner alternately facing the tropics and glancing around at the frozen wastes, and thinking fondly of such arbitrary divisions – lines on a map that can give distinction to an ordinary dining room, an ordinary open-face hot turkey sandwich.[12]

The abstract has thus become a powerful metaphor. The graticule of parallels and meridians has become an everyday icon. A few lines tell it all: if a circle can be transformed into a sphere with one line, a featureless sphere can be transformed into an icon of the earth with the addition of a few more lines. (4a,b,c) John Donne – whose constant allusion to maps and graticules deserves much more attention – put it more elegantly:

On a round ball
A workeman that hath copies by, can lay
An Europe, Afrique, and an Asiä,
And quickly make that, which was nothing, All.[13]



4a



4b



4c

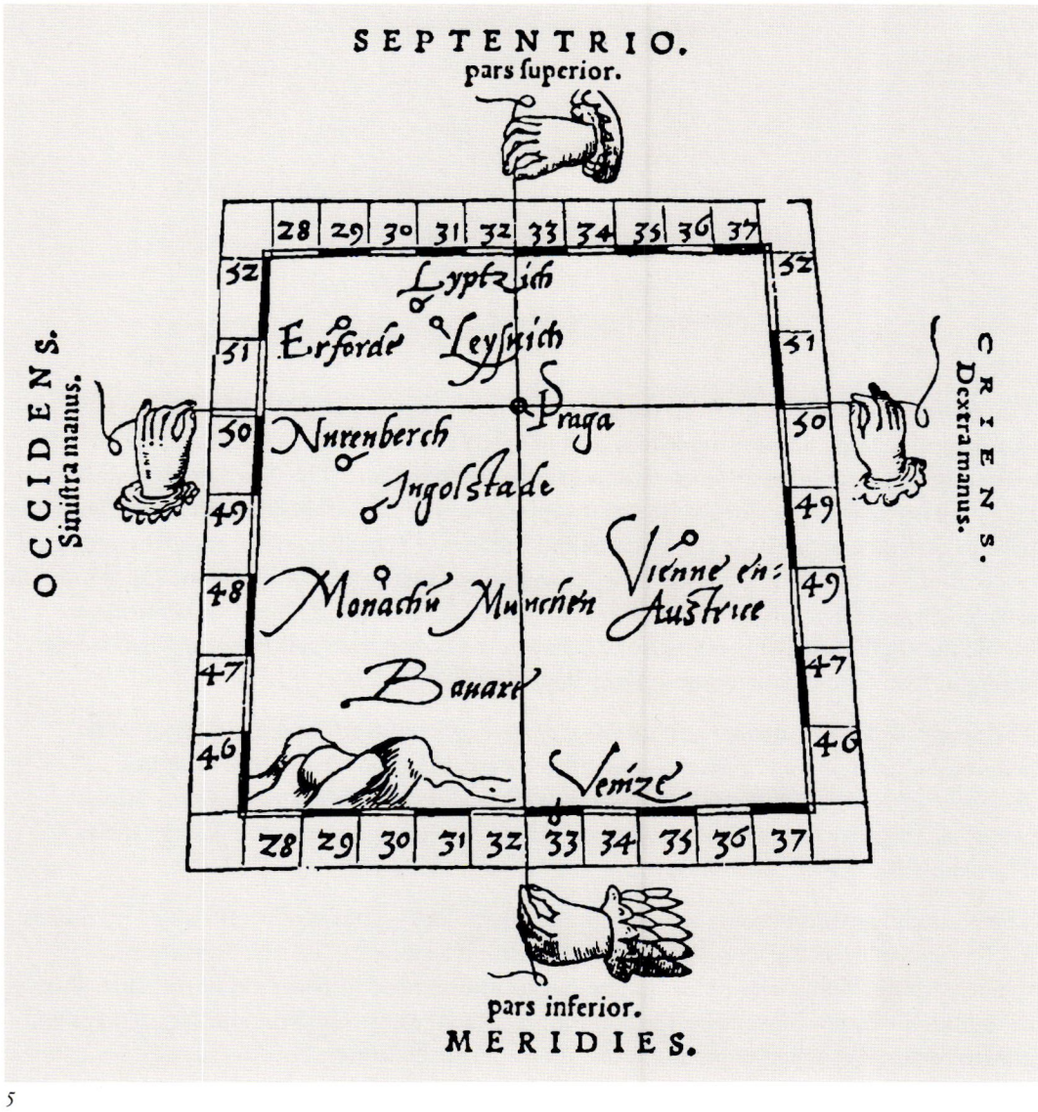
10. A graticule is an imaginary network of meridians and parallels on the surface of the earth or other celestial body. The term was introduced by General J. T. Walker around 1875. See Helen M. Wallis and Arthur H. Robinson, *Cartographical Innovations: An International Handbook of Mapping Terms to 1900* (Tring, UK: Map Collector Publications in association with the International Cartographic Association, 1987), pp. 172-74.

11. It is important to understand the relationship between ecliptic and equatorial coordinates in this period. The conversion from one to the other and the explanation of how to make a celestial globe was described in Ptolemy's *Almagest*. See O. A. W. Dilke et. al., "The Culmination of Greek Cartography in Ptolemy," in Harley and Woodward, eds., *The History of Cartography*, pp. 181-82.

12. "Notes and Comment," *The New Yorker*, 23 September 1985, p. 27. (I owe this reference to Yi-Fu Tuan.)

13. John Donne, "A Valediction of Weeping," in *The Complete English Poems of John Donne*, edited by C. A. Patrides (London: Dent, 1985), p. 85.

Although the Western world seems to have embraced the idea of a systematic global graticule in which every place could be plotted with its own unique pair of coordinates, epitomized by Peter Apian's famous diagram (5), there seems to have been strikingly little interest on the part of East Asian civilizations to draw grids and graticules on their world maps. When the Jesuits brought Western world maps to the Chinese court at the end of the sixteenth century, the maps were politely received and promptly ignored.[14] The network of lines of longitude and latitude seems not to have been incorporated into Chinese cartography until the complete westernization of their world map in the nineteenth century, despite its routine use in China for celestial maps.



5

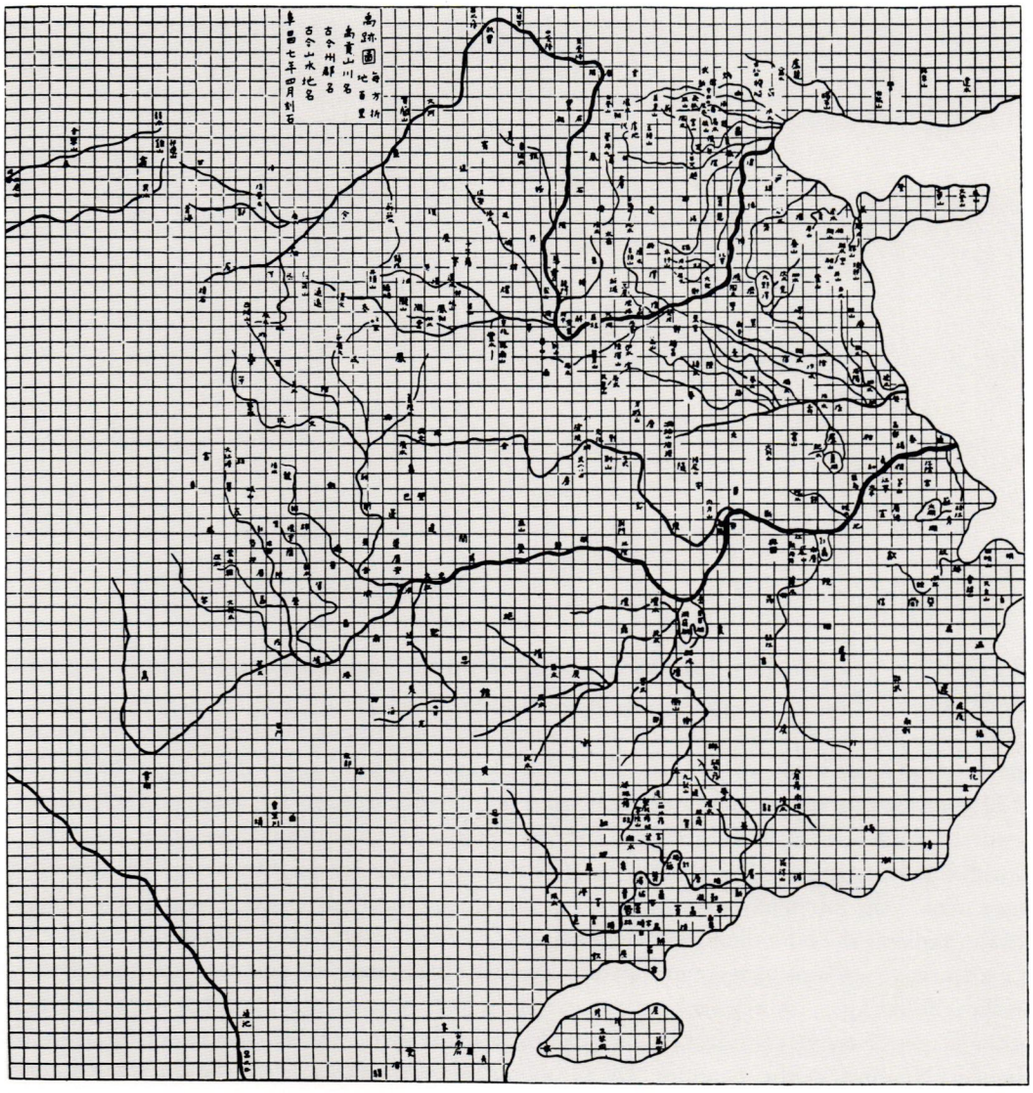
Why did the transfer of the idea not take place? It was certainly not due to any lack of desire for geometrical order on the part of Chinese civilization; such order is very clearly manifested in the rigid grid layout of Chinese cities.[15] It was likewise not due to a lack of respect for the cardinal directions; there is a rich tradition of imbuing these directions with cosmic significance and of using the cardinal points to give even simple directions in everyday life in China. The use of grids on maps of much larger areas, such as on the famous stone *yu ji tu* of the Song dynasty from 1137 (6), but on many others as well, also demonstrates that order and regularity in cartographic representation was often thought to be desirable. But on closer inspection the grids on these maps have very specific uses. They do not have an origin and the lines are not numbered – as they are in a plane coordinate system – and there is no precise geodetic function. The lines do not correspond to parallels and meridians. The purpose of the

14. Helen Wallis, "The Influence of Father Ricci on Far Eastern Cartography," *Imago Mundi* 19 (1965): pp. 38-45, esp. p. 43.

15. Paul Wheatley, *The Pivot of the Four Quarters: A Preliminary Enquiry into the Origins and Character of the Ancient Chinese City* (Chicago: Aldine, 1971).

Chinese grid was to measure off distances on the map; the sides of the squares represented 100 *li*, where one *li* is equal to about 0.5 km. The grid was imposed on the map; it was not used to make it. Although Zhang Heng, a second-century A. D. Chinese astronomer, was said to "cast a net around heaven and earth" and calculate on the basis of it, there was never any documented intention in Chinese cartography of extending the local grid to cover the finite world.[16] It was a local expression of social order, albeit on a wider scale than the town plans. Since that social order was concerned exclusively with the Middle Kingdom, there was hardly any need to extend it.

16. Fan Ye, *Hou Han shu*, vol. 7 (Beijing: Zhonghua shuju, 1965), p. 1898n.



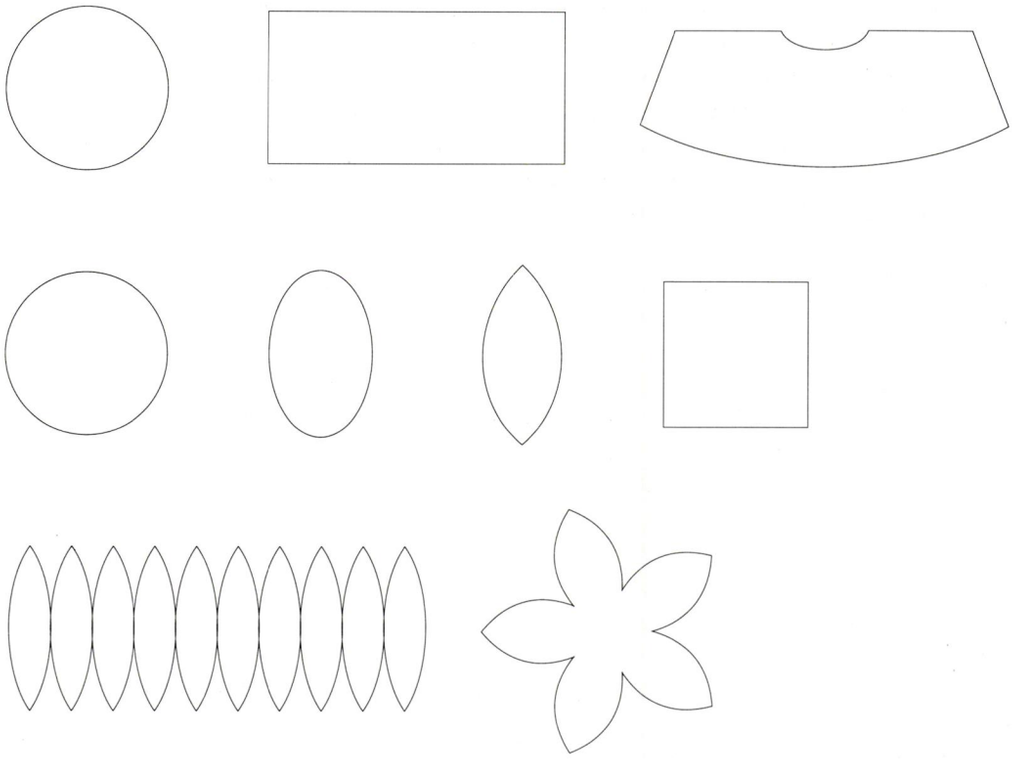
6

The desire to understand the world's shape requires it to be drawn or modeled. But there have been severe representational constraints in providing images of the spherical earth. The first is the intractable cartographic problem of representing a three-dimensional sphere on a two-dimensional, flat piece of paper. Early attempts to reconcile the two included the use of a frame to represent the limits of knowledge about the world. There have been several ways in which the outer boundaries of the map space have been prescribed. The apparently simple idea of putting a rectangular line around a map is a relatively modern custom. Its purpose in modern terms is to make a statement about the consistency and completeness of that which is within the bounding line and to separate the map space from the surrounding space. If one feature is shown within this frame, there is the implicit suggestion that – space permitting – all like features will also be represented within that space.

7a. Classical:
Disk
The oikoumene
Chlamys

7b. Medieval:
Disk
Oval
Mandorla
Square

7c. Renaissance:
Globe gores
Butterfly projection



One solution was to make a distinction – constantly made explicit in Greek writing – between the inhabited world (or the *oikoumene*) and the global world (or the *gēs*). From what we can glean from the descriptions of later Greek writers such as Hipparchus and Strabo, the frame of the ancient Greek maps was modified over the course of Greek history, from the circular disk of Homer's works, depicted on the shield of Achilles, to the rectangular maps on the *pinaki* – wooden tablets – that were supposed to reflect better the true proportions of the *inhabited* world, that is, roughly half of the northern hemisphere.[17] Ptolemy's instructions for constructing a map of the inhabited world started with drawing a rectangle twice as long as it was broad. Strabo explains the bounding frame in terms of a *chlamys*, a Macedonian cloak. (7a) In this, we see a tentative attempt to account for the curvature of the southernmost bounding parallel.[18] In the Middle Ages, the circular and rectangular frames of maps persisted, but were joined by other shapes of sacred significance, such as the oval (the form of which partly derived from the shape of Noah's ark), the mandorla (the symbol of the Christian aura) or the square (a literal interpretation of the Biblical reference to the four corners of the earth).[19] (7b) In these *mappaemundi*, the frame enhanced the center and the relationship between the two was often rigidly predetermined; the information was fitted in wherever space was available and the scale varied in proportion to the cartographer's familiarity with the regions depicted.

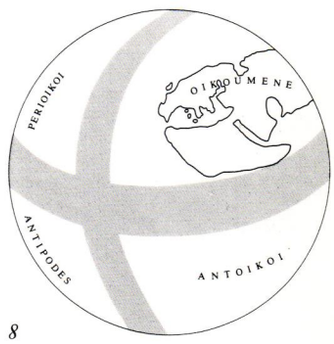
The obvious way of representing the spherical earth was to make a model of it in the form of a globe. But not only have very few terrestrial globes survived (the oldest that exists is Martin Behaim's globe of 1492) but there are very few allusions to them. This makes Strabo's report of the making of a globe at least ten feet in diameter by the Stoic philosopher Crates of Mallos (150 B.C.), apparently to illustrate his interpretation of the wanderings of Ulysses, all the more interesting. Reconstructions of the globe show four land masses, two in the northern hemisphere and two in the southern. (8) This arrangement reflected the Greek concept of a symmetrical world separated by bands of ocean, the inhabited world balanced by the antipodes.

17. Christian Jacob, "Inscrire la Terre Habitée sur une Tablette: Réflexions sur la Fonction des Cartes Géographiques en Grèce Ancienne," *Cahiers de Philologie* 14, Série apparat critique (Lille: Presses Universitaires de Lille, 1988).

18. J. B. Harley and David Woodward, from materials supplied by Germaine Aujac, "The Growth of an Empirical Cartography in Hellenistic Greece," in Harley and Woodward, eds., *The History of Cartography*, p. 156.

19. Hugh of St. Victor gives a clear account of the layout of a *mappaemundi* in the shape of Noah's ark and explains the symbolism of the various components of the maps. See Woodward, "Medieval *Mappaemundi*," p. 335.

From the Christian Middle Ages, we have direct literary allusions to the idea that the earth was viewed as spherical, but no allusions to the making of a globe before the fifteenth century. Why is this? While it is one thing to recognize different levels in the demonstration or understanding of this knowledge, it is yet another to recognize that its importance has varied considerably through time and from culture to culture. What seems to be emerging about the Middle Ages is not that the shape or finiteness of the earth was accurately known, but rather whether it was an issue at all. There is certainly evidence from ballads – which presumably reached the unlettered classes more effectively than the treatises of Sacrobosco and Robert Grosseteste – that if the question of the shape of the earth was raised at all in the common mind, it was simpler to write it off as flat.[20] To the scholars who knew it was a sphere, and cared enough to write about it as such, the construction of a globe might have been an unnecessary elaboration. It is also possible that such an artifact would have intensified the fear of its onlookers. A globe forces you to come to terms with where you are and with what is in the rest of the world. The controversy over whether the supposed inhabitants of the antipodes were worthy of salvation was unsettling enough to read in books; its graphic manifestation was probably too explicit.



8

China is usually described as the cradle of many technological achievements associated with cartography – such as the invention of the magnetic compass, the invention of paper and printing, and the advanced state of land surveying. But allusions to the making of a terrestrial globe before the one by Jamal al-Din, brought from Persia to Beijing in 1276, are completely lacking.[21] The closest reference to a terrestrial globe, a small representation of the earth in the middle of an armillary sphere of the heavens, is ambiguous because its shape is not described. In any case, the importance of such representations would have more to do with the depiction of the relationship between earth and heaven rather than the representation of the earth's sphericity itself.[22]

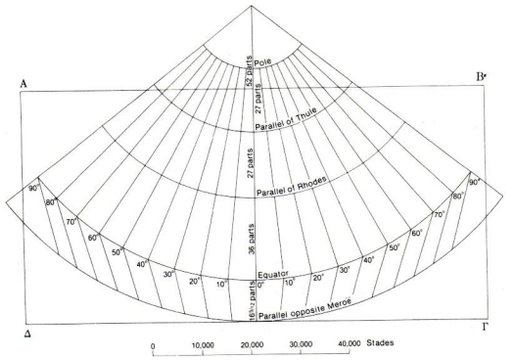
A more sophisticated solution lay in the formalization of map projections of the whole sphere, which did not take place until the Renaissance. Ptolemy had already illustrated how to transform systematically the spherical surface of part of the sphere (the inhabited world) to the plane surface of the map by the second century A.D., and this knowledge eventually found its way into early fifteenth-century Western Europe.[23] But he limited himself to the projection of the *oikoumene*, not the *gēs*. His three projections deal with a world 180° wide. His first and second projections (9a,b) are similar in that they are intended to form frame-works into which the observed coordinates of places may be fitted. They differ only in that

20. Jill Tattersall, "Sphere or Disc? Allusions to the Shape of the Earth in Some Twelfth-Century and Thirteenth-Century Vernacular French Works," *Modern Language Review* 76 (1981): pp. 31-46.

21. Joseph Needham, *Science and Civilisation in China*, vol. 3 (Cambridge: Cambridge University Press, 1954), pp. 555-56.

22. Joseph Needham, Wang Ling, and Derek J. De Solla Price, *Heavenly Clockwork: The Great Astronomical Clocks of Medieval China* (Cambridge: Cambridge University Press, 1986), pp. 98-99.

23. Dilke et. al., "Culmination of Greek Cartography," pp. 185-89.

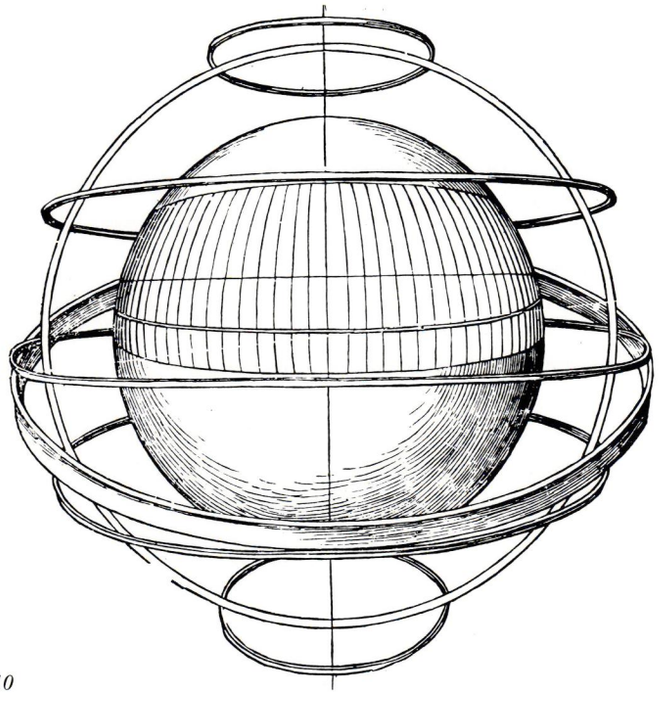


9a



9b

the meridians of the second are curved to improve the representation of the earth over the straight meridians of the first. The purpose of the third projection (10), however, is to show the position of the inhabited world in relation to the rest of the world from a point in space. It is thus rather different in concept. In it we see the earth drawn from space.[24] But it was left to Renaissance mathematicians and geographers to extend the concept to the representation of the whole globe on flat paper, for which more exotic bounding shapes – often resembling a cartographic "hall of mirrors" – were necessary. They included the globe gores of Martin Waldseemüller and the various forms of "butterfly" projections (7c) concocted in the sixteenth century to solve the problem of "flattening out the orange peel once removed from the orange" and to minimize distortion.



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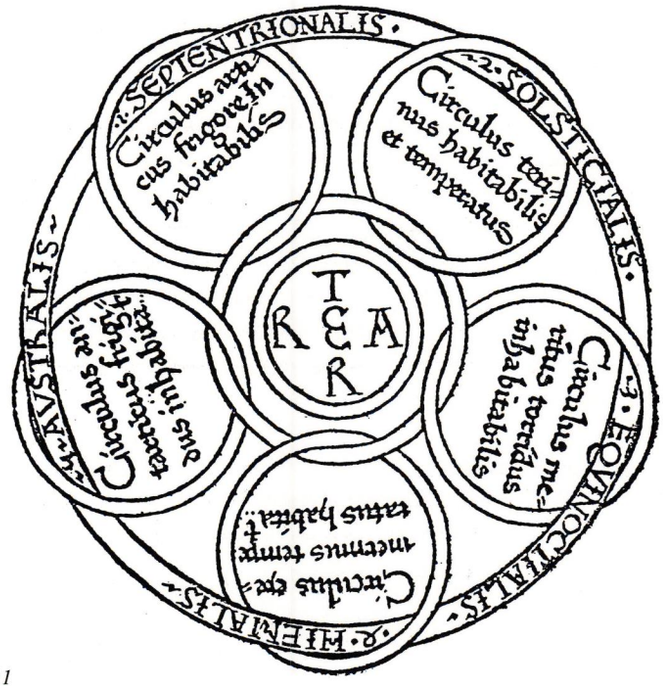

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24. Samuel Y. Edgerton, Jr., *The Renaissance Rediscovery of Linear Perspective* (New York: Harper and Row, 1976).

25. Woodward, "Medieval *Mappaemundi*," p. 321.

Such a conceptual breakthrough needed a clear understanding of how to project geometrically a three-dimensional object onto a two-dimensional surface, a skill that is not manifest in Western artistic representation until the fifteenth century, when the principles of two-point linear perspective were investigated. Before that time, the representation of the sphere was fraught with misunderstandings. For example, in his seventh-century encyclopedia, Isidore of Seville dramatically misinterpreted the ancient Greek idea of the five latitudinal climatic zones that had frequently been represented "end on" as straight parallel lines. He interpreted them strictly as circles by linking them together cheek-by-jowl *in plano*.[25] (11) The mental shift necessary to understand that a straight line or ellipse could simply be the side-view or oblique representation of a circle did not come easily. Likewise, the willingness to accept apparently severely distorted pictures of the earth in various projections involves a tacit understanding that it is not a deformation that is taking place but merely a transformation.

Underlying these physical and technical constraints to our constructing a believable image of the finite earth has been the psychological dimension. Efforts to understand and therefore abstract and simplify the world have been driven by the paramount human desire for geometric perfection. Marjorie Nicholson has written convincingly about the symbolic power

of perfection that the circle and sphere represented in scientific and literary thought since the Renaissance. She describes the crisis that ensued when observations revealed that the earth was not a perfect sphere and that the sun, moon, and stars did not rotate around it in perfect circles.[26] She quotes John Donne's painful realization:

But keepes the earth her round proportion still?
Does not a Tenarif, or higher Hill
Rise so high like a Rocke, that one might thinke
The floating Moone would shipwracke there, and sink?
. . . .
Then solidnes, and roundnes have no place.
Are these but warts, and pock-holes in the face
Of th'earth? Thinke so: but yet confesse, in this
The worlds proportion disfigured is. . . .[27]

The earth was no longer smooth – like Gautier de Metz's apple – but pock-marked, like an orange. Two centuries later, precise geodetic measurements were achieved by two concurrent expeditions to measure portions of the meridian arc in Ecuador and Lapland; they confirmed Newton's postulate that the earth was flattened at the poles. It was both disturbing and amusing for many people to learn that the earth was neither smooth *nor* spherical, but it was perhaps an equal shock to some people in the twentieth century to learn that not only was the earth flattened but it was hopelessly asymmetrical as well. Aristotle's vision of a geometrically perfect earth was crumbling. Indeed, our expectations of what other heavenly bodies should look like was also shattered when the pictures of Saturn's misshapen moon Hyperion reached us. So obvious was the distortion of Hyperion that it triggered secret thoughts that such heavenly bodies – even apparently minor ones – had no business being demonstrably non-spherical.[28]

The desire for order in our environment is perhaps most wistfully (and arrogantly) shown in Thomas Burnet's *Sacred Theory of the Earth* (1726), in which he expresses disgust at the random patterns of the heavens:

If the principal End of them [the stars] had been our Pleasure or Conveniency, they would have been put in some better Order in respect of the Earth. They lie carelessly scatter'd, as if they had been sown in the Heaven, like Seed, by handfuls; and not by a Skilful Hand neither.

What a beautiful hemisphere they would have made, if they had been plac'd in Rank and Order; if they had all been dispos'd into regular Figures, and the little ones set with due regard to the greater, then all finishd, and made up into one fair Piece of that great Composition, according to the Rules of Art and Symmetry; what a surprizing Beauty this would have been to the Inhabitants of the Earth? What a lovely Roof to our little World? This indeed might have given one some Temptation to have thought that they had been made all for us.[29]

If it were impractical to consider reordering the stars in neat rows, the possibility of ordering the earth's surface was more realistic. Imposing a grid on the earth was a possible means not only of ordering it but also of controlling it. By the second century A.D., Ptolemy had written two manuals – the *Almagest* and the *Geography* – to explain the use of the grid on the celestial and terrestrial orbs respectively. The idea did not die in the Middle Ages, as has commonly been supposed. Although Ptolemy's cartographic principles for celestial or terrestrial maps were unavailable to the Latin West until the translation of the *Almagest* in the twelfth century and the *Geography* in the fifteenth, the concept of making maps by systematically plotting places with coordinates was practiced by Islamic geographers. The best early example is that of the tenth-century scholar Sunrāb who, in his introduction to his version of al-Khwarizmi's tables, explains how to draw a map of the world; in his map features were to be inserted in positions indicated by threads stretched north and south as meridians and east and west as parallels.[30] In the Christian West, even in the thirteenth century, Roger Bacon had been contemplating such a plan to plot places on a world map using their

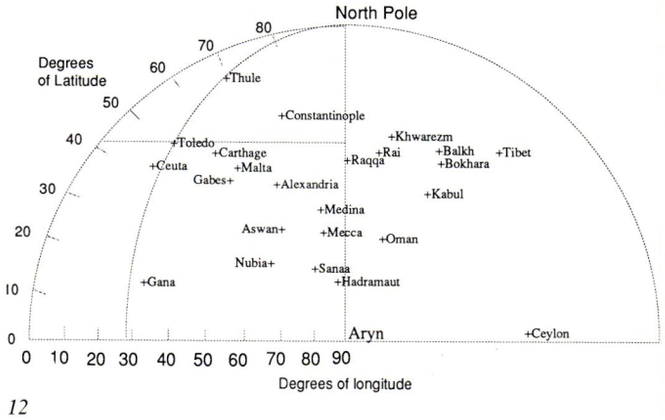
26. Marjorie Hope Nicholson, *The Breaking of the Circle: Studies in the Effect of the "New Science" upon Seventeenth-Century Poetry*, revised edition (New York: Columbia University Press, 1960).

27. John Donne, "An Anatomy of the World: The First Anniversary," in Patrides, ed., *The Complete English Poems of John Donne*, p. 338.

28. Hyperion's shape which measures 255 x 162 x 137 miles cannot be described by a simple diameter.

29. Thomas Burnet, *Sacred Theory of the Earth*, 6th edition (London: 1726), pp. 436-37.

30. Gerald Tibbetts, "Terrestrial Cartography in Islam," in *The History of Cartography: Cartography in the Traditional Asian Societies*, edited by J. B. Harley and David Woodward (Chicago: University of Chicago Press, forthcoming).



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longitude and latitude. (12) This procedure was important in its geometrical ordering of abstract space, but it also suited Bacon's *political* motives: he was proposing a systematic inventory of places of strategic importance to those in authority (his patron Pope Clement IV in particular). As Roger Bacon explained:

And this knowledge of places in the world is very necessary to the domain of the faithful, and for the conversion of unbelievers and for opposing unbelievers and the Antichrist and others. . . . For the most vigorous men, sometimes through their ignorance of the places in the world, destroyed themselves and the business interests of Christians because they traveled through places too hot in the hot seasons or too cold in the cold seasons. [31]

Bacon also stressed that this global cartographic inventory would require enormous resources:

The longitudes and latitudes of cities and regions have not yet been verified among the Latins; nor will they ever be verified except by an apostolic or imperial power or through the aid of some great king who will furnish the means to philosophers. [32]

Bacon's thirteenth-century writings thus seem to represent the beginnings of an emergence from the concept of heterogeneous space reflected by the medieval world maps, which accorded great importance to the maps' center and gave diminishing significance to anything placed toward the edges. Bacon's thinking, about mapping the world as a whole, moved towards the more abstract notion that space can everywhere be accorded the same importance. It allowed the idea that a framework of expansion and control could be superimposed on the finite world as a means to systematic domination.

There is perhaps no better laboratory to observe the power of this geometrical view of the world than in the transition period between the Middle Ages and the Renaissance. The development of systematic coordinate systems at that time may have created one of the mindsets necessary for the great age of geographic discoveries, when the frame of the medieval world map was literally broken.[33] The most familiar example concerns the cartographic conceptions of Christopher Columbus before the 1492 voyage. We must be cautious about overemphasizing the extent to which he made careful comparisons of maps and observations in order to project his enterprise of the Indies. Although he was intensely interested in the mathematical and graphic aspects of map making, he was also to state that "reason, mathematics, and *mappaemundi* were of no use to me in the execution of the enterprise of the Indies."[34] He does not however say that maps were of no use to him in the *planning* of the enterprise – and there seems to be substantial evidence that they were. On 25 June 1474, a Florentine physician and astronomer, Paolo Toscanelli, sent a letter to Fernam Martins, Canon of Lisbon, who had the ear of King Afonso V. Toscanelli clearly made a duplicate of this letter, because a later undated copy came into Columbus's hands.[35] In the letter Toscanelli describes his map:

And although I know from my own knowledge that the world can be shown as it is in the form of a sphere, I have determined . . . to show the same route by a chart similar to those which are made for navigation. . . . The straight lines which are shown lengthwise on the said chart show the distance from west to east; the others which are across show the distance from north to south. . . .[36]

31. Roger Bacon, *Opus Maius*, vol. 1, translated by Robert Belle Burke (Philadelphia: University of Pennsylvania Press, 1928), pp. 320-21.

32. Bacon, *Opus Maius*, p. 320.

33. The Andrea Bianco world map of 1436 literally breaches its circular border in East Asia. See Woodward, "Medieval *Mappaemundi*," p. 317.

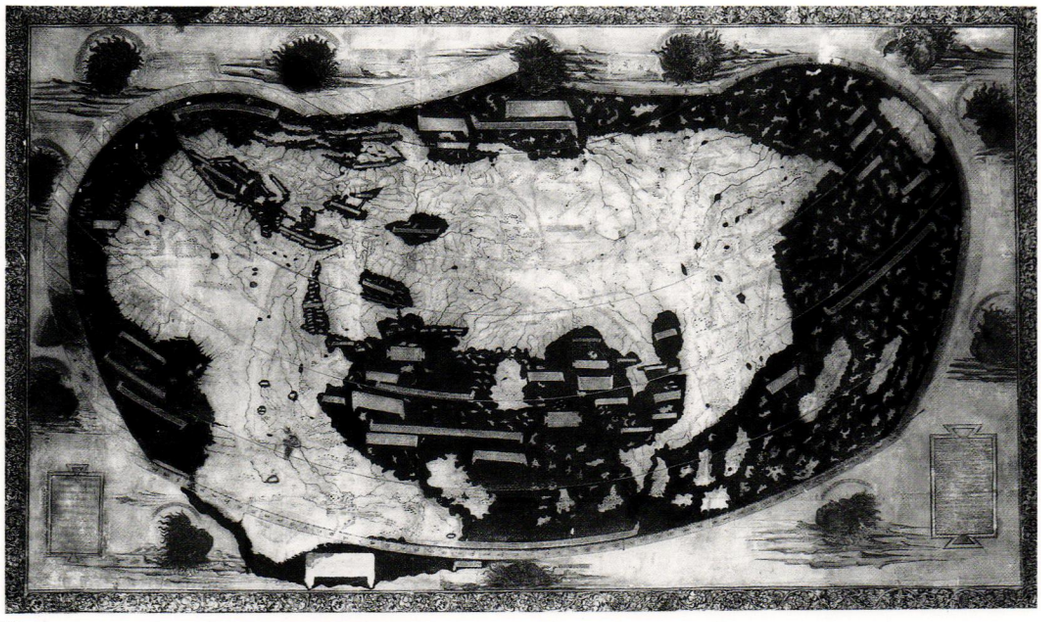
34. Pauline Moffitt Watts, "Prophecy and Discovery: On the Spiritual Origins of Christopher Columbus's 'Enterprise of the Indies,'" *American Historical Review* 90 (1985): pp. 73-102, esp. p. 96.

35. From Columbus's copy of Cardinal Piccolomini's *Historia Rerum Ubique Gestarum*, now in the Biblioteca Colombina, Seville.

36. From Columbus's copy of Cardinal Piccolomini's *Historia Rerum Ubique Gestarum*.

Toscanelli is describing parallels and meridians. It is not clear whether the meridians cross the parallels at an angle or perpendicularly, though it would have been simpler to draw them perpendicularly. In any case, Toscanelli describes a grid – twenty-six spaces of two hundred and fifty leagues each – with which to measure the distance between Lisbon to Quinsay near the city of Cathay.

Perhaps more dramatic evidence of the exaggerated width of Asia and the separation between China and Japan is shown by the globe associated with Martin Behaim.[37] Here the globemaker was forced to deal directly with the remaining width of the Western Ocean, which on the globe was reduced to 78° of longitude between Gomera in the Canaries and the east coast of Cipangu (Japan). This representation of the size of the Western Ocean, together



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with the date of the globe (it was made after Behaim's return to Nuremberg in 1490), have led to the speculation that Columbus may have seen the globe and been directly influenced by it. It is more likely, however, that he saw the sources that Behaim used, rather than the globe itself.[38] These sources – two-dimensional maps – are thought to have been similar to the world maps by Henricus Martellus, a German cartographer working in Florence in the 1480s. The large manuscript map he made in 1489 (13) is the most dramatic example of the reduction of size of the Western Ocean.[39] The map is graduated in longitude from 5° West (355° East) to 270° East, omitting 85° of the earth's circuit in the Pacific, and therefore implies that 90° exist between the Canary Islands and Cipangu.

The common denominator of these maps – or versions of them – that were available to Columbus or his contemporaries is that they derived part of their value from bearing a graticule, drawn or implied. With a spherical earth 360° of longitude in extent, calculations could thus be made about the width of the Western Ocean. But the comforting mathematical precision offered by the graticule was only one aspect of its power. By its abstracted simplicity, it also homogenized space and offered to the explorer and his patron an iconic framework for exploitation.

By assigning a pair of unique abstract coordinates to each point, the system also implies that all points are of equal significance. This was quite different from the kind of center-enhancing space that we see in the *mappaemundi* or in transformations that emphasize or exaggerate a local area at the expense of distant areas. It is true that there are some magic positions, and the importance of the Equator and the poles in this regard has already been

37. G. R. Crone, "Martin Behaim, Navigator and Cosmographer: Figment of Imagination or Historical Personage?" *Congresso Internacional de Historia dos Descobrimentos: Actas*, vol. 1 (Lisbon: 1961), pp. 117-33.

38. Crone, "Martin Behaim," p. 121.

39. Alexander O. Vietor, "A Pre-Columbian Map of the World, circa 1489," *Imago Mundi* 17 (1963): pp. 95-96.

discussed. They represent natural extremes in the world which gain importance because of their position in the abstract graticule. But the physical places to which the points refer are of no more importance than anywhere else on the earth. And if what exists at 90° West and 45° North is theoretically of the same importance as what exists at 0° and 45° North, what implications does this have for the inhabitant of one place viewing another? Certainly, if there are any motivations of an exploratory nature, be they based on curiosity, religious fervor, or monetary greed, there is every reason to expect that the resources at the unknown places are potentially as great as at the homeland. The global graticule provides a framework of domination. It enables an imperial court to manage its empire, a church to display the extent of its missionaries, or a space agency to track its satellites. The map pins are in themselves almost a metaphor for control.

There is a good reason why the rectangular Mercator projection of the world (14) is still used on the wall of the strategic planning room, despite its immense distortion of the area of the higher latitudes. It is not only that the temperate latitudes appear larger in relationship to other parts of the earth, but it is also because the map looks like a rectangular grid. When Arno Peters proposed replacing it with Gall's projection (which he called Peters' Projection) (15), it is significant that his proposed replacement was also grid-like.[40] The rectangular grid is somehow a Western metaphor; the more abstract the geometry, the more powerful the image. The coordinates become targets of opportunity or destruction, divorced from the reality beneath.



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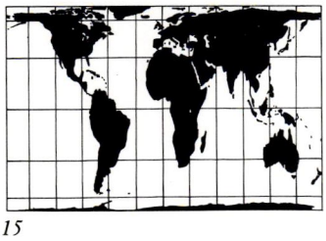

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The corollary of the statement that points in a grid refer to places of the same importance is that they also refer to places of equal unimportance. By mapping territories in this way, we *re-describe* the people who inhabit them.[41] Mapping has been an indispensable ingredient of Western colonial policy, although its precise rationale has rarely been articulated. Napoleon's *Description de l'Egypte* was a *re-description* in that its highly systematic maps formed in themselves a statement of control of the local inhabitants.[42] In the late nineteenth century, the apparently benign efforts of colonial mapping in Africa by the various European survey offices appear on closer inspection to be a highly subtle manner of making *de facto* statements of ownership. Maps thus become far more than reflections of a culture; they become active agents of change that carry the ideological imprint of their makers.[43]

When we study these graphic attempts to represent the finite sphere, we see that there is a general trend towards abstraction and separation of geometry from geography. The extremes of this abstraction can be seen when the graticule of the world becomes so much a part of the everyday graphic vocabulary that the icon becomes a stereotype removed from reality. It becomes a symbol in its own right. A comparison may serve to illustrate the point. In the fifteenth century, a genre of Buddhist world map in Korea known as the *Chonha-do* (16) developed; it had didactic functions rather similar to those of the medieval world map.[44] This map – which has a long and tenacious tradition as the opening map in small atlases treasured in the archives of the Yangban scholars – consisted of a representation of the Middle Kingdom with a concentric land mass ringing it and set within a circular frame. Around the edge of the map are scattered islands representing the rest of the world. The maps continued to be copied in their traditional form until the nineteenth century, when an unusual modification was made. A Western azimuthal global graticule, bearing no relation to the geographical information underneath, was often overlaid. This combination of the non-metric cosmographical world map and a graticule to lend it precision reflects a merging of two cultures in the most amazingly incongruous manner.

There are examples on our own doorstep and in our own century of the graphic power of the global graticule: the United States Defense Mapping Agency has recently distributed a map of the world (17) to educate the public about its role and image. In the DMA map, the global graticule, as in the *Chonha-do*, bears little relation to the (admittedly garbled) geographical information it represents. The meaning of this ephemeral document is difficult to fathom;

40. Arno Peters, *The New Cartography* (New York: Friendship Press, 1983).

41. This term is used here as by Richard Rorty in the Hilldale Lecture, "Private Irony and Liberal Hope," University of Wisconsin-Madison, May 1988.

42. Anne Godlewska, "The Napoleonic Survey of Egypt: A Masterpiece of Cartographic Compilation and Early Nineteenth-Century Fieldwork," *Cartographica* 25, Monograph 38-39 (Toronto: University of Toronto Press, Spring and Summer 1988).

43. J. B. Harley, "Maps, Knowledge, and Power," in *The Iconography of Landscape: Essays on the Symbolic Representation, Design, and Use of Past Environments*, edited by Denis Cosgrove and Stephen Daniels (Cambridge: Cambridge University Press, 1988), pp. 277-312.

44. Shannon McCune, "The *Chonha do*: A Korean World Map," paper presented at the Twelfth International Conference on the History of Cartography, Paris, September 1987.



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perhaps we should not try too hard, we are dealing with public relations. But we must assume that the message is not intended to be that the most powerful military mapping organization in the world does not know the position of the Equator. The message is iconic: the graticule is there to show it is the world; the map is there to show the approximate locations of DMA offices. The relationship between the two is *irrelevant*. The lines become Lewis Carroll's "merely conventional signs":

"What's the good of Mercator's North Poles and Equators
Tropics, Zones, and Meridian Lines?"
So the Bellman would cry: and the crew would reply
"They are merely conventional signs! . . ."[45]

The semantic distinction between the map and the territory has often been expounded.[46] The map is *not* the territory; the graticule is *not* the world. When parallels and meridians become "merely conventional signs," we need to understand not only their abstract nature but also their rhetorical power. Curiously, the representations are thus not mere shadows of reality, poor substitutes for or trivializations of the physical world they represent, but are agents of human thought and action, worthy of study on their own terms.



45. Lewis Carroll, *The Hunting of the Snark: An Agony, in Eight Fits* (London: Macmillan, 1876), pp. 15-16.

46. Alfred Korzybski, *Science and Sanity*, 4th edition (Lakeville, Conn.: International Non-Aristotelian Library Publishing Company, 1958), p. 750. The theme has been taken up by S. I. Hayakawa, *Language in Thought and Action*, 3rd edition (New York: Harcourt Brace Jovanovich, 1972), pp. 27-30.

The Culture of Description

Manuel de Solà-Morales

Is it possible to draw a country? What would be the architectural expression of a territory? And how would one draw that image?

It has been well-known since the beginning of history that the tracing of maps is a mythic act which is only superficially testimonial. The Assyrian and Pharaonic maps and the medieval maritime charts have great documentary value but they are more than merely informational guides, outlining the location of lands and seas. They are in fact authentic ideological creations, acts of possession and knowledge. Indeed, it was probably during the Renaissance that cartography reached its most highly theoretical moment, when plans of continents and cities more than just described reality, they defined it and were capable of inventing and proposing the universe in the very act of reproducing it.

This creative component of description constitutes the great political and theoretical power of the cartographic image. Through the power of definition, history is created. There is an entire social history written in the layout of routes, in the points of crossing and interchange, in the plowing of farmland, in the construction of canals or the irrigation of cultivated land and in the shape of property ownership. It is written in the placement of industries, in the growth of cities and the occupation of their surroundings, and in the often violent and contradictory impacts of great infrastructures. Each territory is a unique mix of all these components and only through a description of these components can one begin to synthesize an alternative.

The *Laboratorio de Urbanismo de Barcelona* (Laboratory of Urban Planning of Barcelona or LUB) has contributed to this vision by producing, within its academic sphere, a group of plans of fragments of Catalonia's urban territory.[1] The plans were created by synthesizing and manipulating materials from a variety of sources. These plans, due to their scale (1:10,000) and detail, offer an image of Catalonia which is a little known expression of the territorial structure of the region. This inventorial vision and encyclopedic compilation creates a cartographic image of Catalonia that hopes to provide an understanding of the territorial composition of each settlement; such an image can become a basis for proposal. It becomes apparent that to construct an image of Catalonia in this sense is the opposite of making mechanical maps.

1. The atlas is shown in its entirety in *Quaderns Extra* 1 and 2 (1981) and selected maps are found in an article entitled, "A Cartography for the Catalan Territory," in *Lotus international* 23 (1979): p. 10.

LUB's maps seek to go beyond the conventional thematic reduction of aerial photographed maps. The analyses made from such mechanical maps often result in a simplistic vision which leads to misguided urban interventions. The scope of LUB's project, on the other hand, is to deal with maps but with the new objective of converting a map into a plan, a proposal. These plans bring together the detailed description of urban spaces, of public areas and monuments, and their connection with territorial routes, with principal geographic elements, with cities' outer boundaries, with the boundaries of neighboring towns and peripheral areas, and with the cadastral forms of agriculture. The joint description of all these territorial forms provides an enormously rich, suggestive and synthetic vision which is almost impossible to obtain with conventional information. To improve description is already to propose. The morphological description of the territory for this project was an alternative route of territorial proposal for Catalonia.

How is the problem of drawing and representation addressed in these plans?

The problem of drawing is bound to the problem of the knowledge of the territory's physical structure; in the project for Catalonia the elements which were the object of attention in the analysis of the territory were at the same time the object of the effort of drawing and representation. Care was taken not to determine a priori a common code or criteria to be used in the drawings. The problems of the drawing of each map were connected to the problems of each territory's own identity and structure. In this way, the drawings bring together the diverse analyses of various territorial structures. Certain elements are emphasized by meticulous drawing, by the density of lines or a hierarchy of line weights, or by allowing the lines to become compact and fill in an area. At other times the drawing will refer to the image of an element rather than to its literal reality, or sometimes, an element will be represented in a conventional manner depending on the criteria set by the drawing's ground rules. As different drawing criteria were developed there were those which tended towards *homogeneity*, in comparison to those which produced situations of *contrast*. Certain homogeneous plans, for example, employed lines and points exclusively, and by presenting them all with equal intensity avoided creating a hierarchy among the represented elements.

Such different approaches to the relationship between the map and the territory's morphological configuration provide distinct ways to understand a plan of an area. Some plans take a more wholistic view and attempt to offer a *synthetic* representation characterized by a general image of what a region is. In this case, emphasis is placed on those structural elements or systems that provide an immediate reading. Other plans are more concerned with the elaboration of a response for each of the precise elements which have to be represented. In these plans each component searches autonomously for its own expression, its own possible reading, and in doing so a contrast is achieved between each element. The image presented is not that precise, it is rather a group of structures that express themselves in their complexity and lack a clear hierarchical relationship. The resulting image is primarily *analytical*, and attempts to offer a detailed description in two dimensions of a very complex reality.

The project by LUB to create an atlas of Catalonia was characterized by a certain super-realist desire; a desire to glean a new interpretation and critical vision of the territory by way of the selection of and the assigning of precise value to the parts and elements that make up the territory's compound reality. To draw is to select, to select is to interpret and to interpret is to propose.

The method of descriptive calligraphy used for LUB's atlas, which draws from the eighteenth-century tradition of the French topographers (from Cassini to Buchet in Catalonia), transforms the plan into an illusion of reality – but faithful representation is the method, not the purpose. What is proposed within each theme (such as the representation of agriculture, urban forms, public works, geomorphology or cadastral property) and within each plan (as an image containing their mutual relations) is shaped by the descriptive force of elements which are recognizable by their exact form and dimension. But because these elements are placed in different contexts, they are in a sense re-invented. The plan remains above all an affirmation of a vision of the concrete, of the physical detail of construction and of the territory; the plan presents an extremely material, physiocratic vision. Today, the city's or territory's most important representation is one that embodies detailed precision; this "fiction" might effectively be its proposal.

The English military plans of the eighteenth century were primarily concerned with the country/city distinction, with the precise definition of walled enclosures as strategic elements and juridical limits. Open territories were usually the neutral base of operations, almost without real structure. On the other hand, French topographic maps which emphasized extensive description of the territory created an entire cartographic tradition in which the protagonists were roads, and topographic and hydrographic morphology. In contrast, architects, throughout the latter third of the nineteenth century, influenced by the mannerisms of baroque and neoclassic figurativeness, offered a solid and perimetrical representation of urban development, as an image of alignment and facade and as a continuous object of geometric decomposition. Only later on, in the present century does the graphic symbolism of specialization by zone and the decomposition of plans correspond to the vision of functional space – perhaps in the same way that space is treated by Braque, Léger (and in Gris at times) or by the Supremacists. Finally, the modern city demonstrates the contradiction of its disorder and the vitality of its conflicts. Univocal interpretations are no longer acceptable. Once again, a new form of enlightened description is necessary, one that can recover the name and the shape of things and perhaps allow for new elements of cultural synthesis.

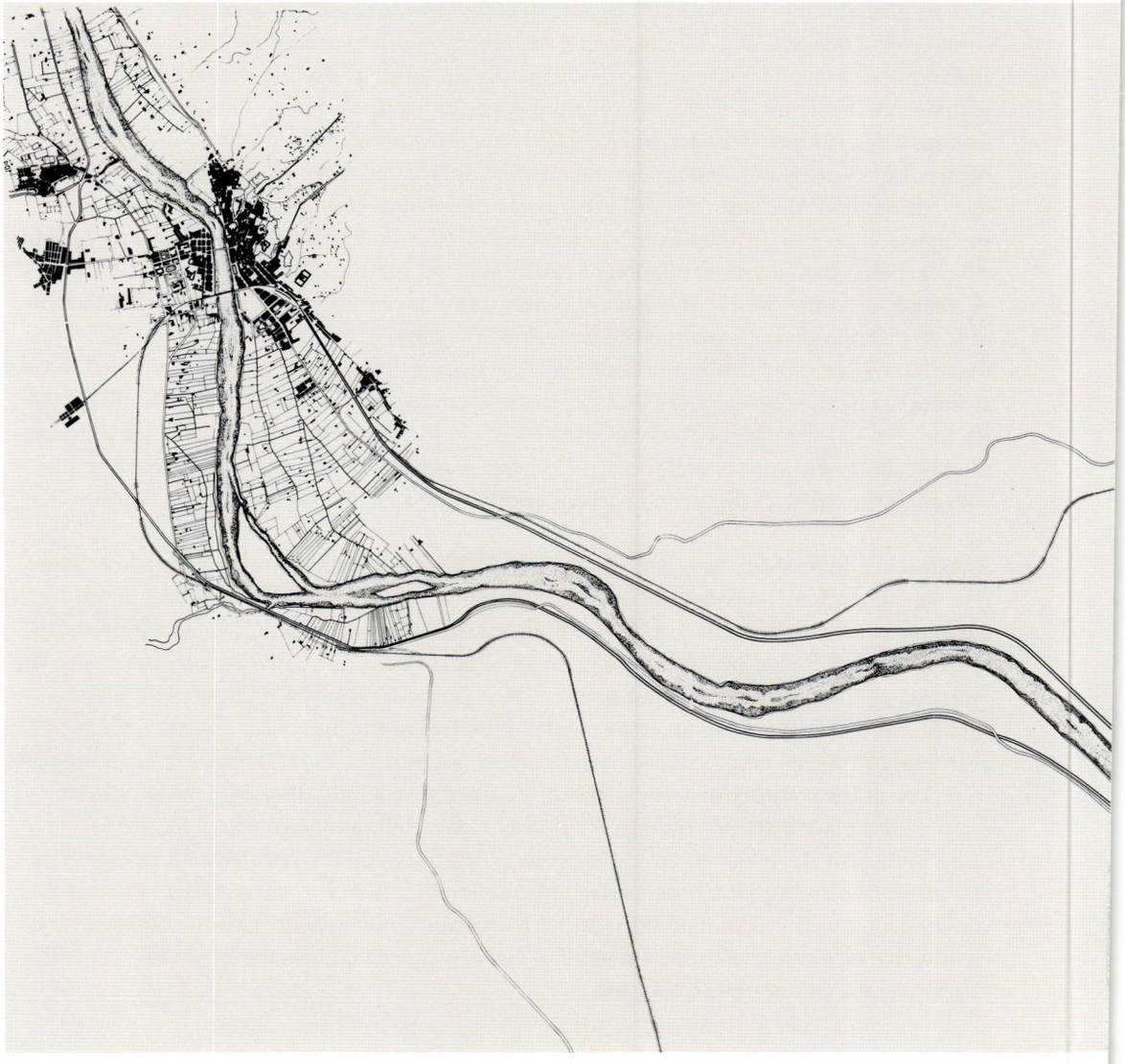
An approach to proposal based on simplistic causal explanations as working guidelines must give way to the need to recapture the descriptive moment. The strength of description, a literary knowledge, replaces causal simplifications, explanatory models and diagrammatic representations. The description of a territory should be obsessive, in order to emphasize the synthetic content of conceptual proposals. These proposals, like the architectural project, should make suggestions about and remodel the forms of the historical, not so much in an attempt to recuperate them as in an attempt to support them. Descriptive calligraphy seeks to represent the territory in a way that is more than just literal; rather, it seeks to represent the territory in a way that is literary. As an alternative method of analysis, descriptive calligraphy provides a way to avoid the project's arbitrary and eclectic nature. Here analysis and projection are simultaneous. Narration and description occur at the scale of the territory allowing for an architecture of ideas, rather than one of mimeticism. This method achieves an effective separation from the ambiguous analysis/project continuum by means of a literary territory and a conceptual architecture.

BAIX EBRE-MONTSIA

This map describes the territory around the Ebre River near its mouth. Emphasis is placed on the river – a determining element in the construction of the zone – and on the urban centers, while the surrounding non-urban areas are mapped in an elementary fashion. The river supplies water for a system of canals which defines two bands of irrigated land at both sides of the river. By following the outline of the roads and the form of the river one can read the relief of the area: a generally flat terrain that promotes agricultural use. The urban nuclei stand out in this drawing, inviting comparisons between their formation, position and character.

The city of Tortosa, to the left of the plan, is the only city with an original Arab nucleus. Tortosa is located at the historic confluence of the major roads and the railroad as they cross the great river. The path of the train became related, historically and physically, to the nineteenth-century orthogonal network, and this system of rectangular grids still constitutes the city's center. More recently Tortosa has grown over to the other side of the river, but has only initiated the formation of disperse suburbs.

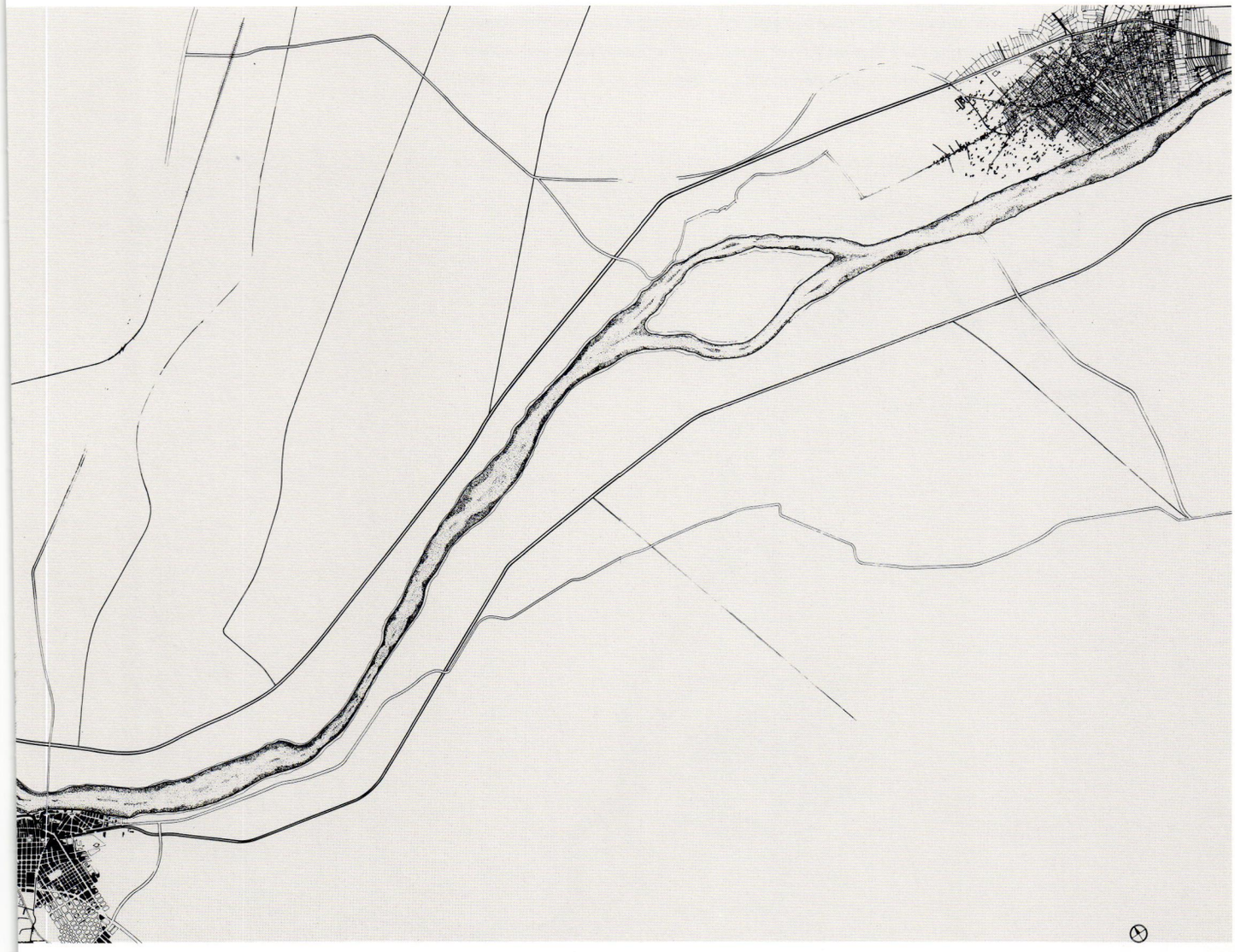
Amposta, the center city on the map, has the most momentum of the three. It developed much more recently than Tortosa and supports itself simply on the road that goes to Tortosa. Nevertheless, Amposta has endowed itself with a powerful network which is directed towards the interior, that is, away from the river, a network which has been and continues to be a framework capable of ordering the city's growth. In Amposta this growth is of an industrial nature, as opposed to the old commercial and service center in Tortosa, and the city of agricultural roots, La Cava. The drawing of Amposta's urban extension, together with the idea of its continual occupa-



tion, helps to explain the expansive direction of this city's structure.

Lastly, in La Cava the detailed drawing of the parceling system, which is at the same time the parceling of irrigated land and of housing, explains the linear form of this rural town. The parceling system describes La Cava's very origin: it grew from the compaction of very long and narrow parcels. The roads contained between the river and the canal have respected the structure of irrigation maintaining this primitive infrastructure. The character and limit of La Cava are described by the irrigation canal at the upper edge of the town, the river below, and the irrigated land between.

The map offers no more than an approximation of these towns but it succeeds at providing a synthetic image of the territory as a whole through the relative description of the towns and their surroundings.



CONGOST DE CAPPELLADES

Detail from map of L'Anoia: this image is approximately one-sixteenth of the original map.

This fragment presents a long narrow hillock in which the great protagonist of the visual landscape, the orography, acts as the background for the territory's form. The form of a slope or incline is expressed in a conventional code in areas of the plan where relief emphasizes the reason for a built form – for example, where a castle sits on a summit, where a roadway is located for panoramic views, or where a cliff forms the border of the city. The aim of this plan is to express the mountains' valley as a complex canal where a number of major artificial constructions (e.g., railroad tracks and roadways) accumulate and are resolved. On one side of the river, off by itself, the railroad is drawn in a geometric form. The drawing notes the projects, such as bridges, which have been placed to pass over washes – these washes read almost like threads in the drawing. On the other side, one can distinguish two plans: that of the riverbank, where stippling evokes agricultural use, only intervened by white areas at the large industrial warehouses, and that of the interior plain, which reads like a puzzle of irregular pieces signaling the extensive cultivation of the area. A fringe zone of varying width develops between the river valley and the plain where towns of diverse sizes, connections and natural characteristics have evolved. This drawing provides a way to learn about each of these towns. It allows one to compare how the presence of relief influenced development in some cases, while in others, the relief instead combined with more powerful and abstract geometric layouts.

In spite of being a literal plan and rigorously faithful in its observations (it represents houses, roads, factories, suburbs, cultivated land, etc.), this is a homogeneous map in the method in which it is drawn. In this way, the drawing invites a detailed reading with neither interruptions nor contrasts before one reads the plan as a whole.



MARESEME

Detail from map of El Mareseme: this image is approximately one-sixth of the original map.

This representation of Mareseme grows from the use of an austere graphic language that presents a powerful interpretation of the territory. The topography, the cultivated land, the forests, in fact, almost everything becomes background in this plan. Only the coastline is expressed as a necessary reference. The systems of occupation of the site are represented as a band of towns along the coastline hung with smaller interior towns. One reads the division of the province, of an interior zone (with villages at higher elevations with dry land and mountains) and a coastal strip (with villages at lower elevations with irrigated land).

The challenge presented in this plan is in understanding this territory as a musical "staff." This "staff" provides the structure upon which the development of the entire area is based. The divisions of the land are represented with varying intensity of delineation: sometimes the streets of towns are depicted as isolated events, and other times these streets are converted, almost seamlessly, into access roads to the proprietal, exploitational or residential developments in the agricultural plain. The map describes the interweaving of street and path, and of urban parceling and irrigation parceling. The compactness which characterizes this territory's landscape grows from a symbiosis of modest settlements and an intense agricultural land use.

The appeal of the plan results as much from this non-conventional transcription as from the depiction of certain existing territorial elements now seen without distraction. For example, one notes the alignment of peripheral areas, the parceling of land in the urban centers, the rural access roads to various constructions, the demarcation roads between different properties, and the irrigation ditches and small courses of water which mark the land.

This vision, as an abstract and synthetic statement faithful dimensionally to real space, becomes very useful in distinguishing those interventions whose type, form and scale are appropriate to the existing order from those which are foreign to that order.

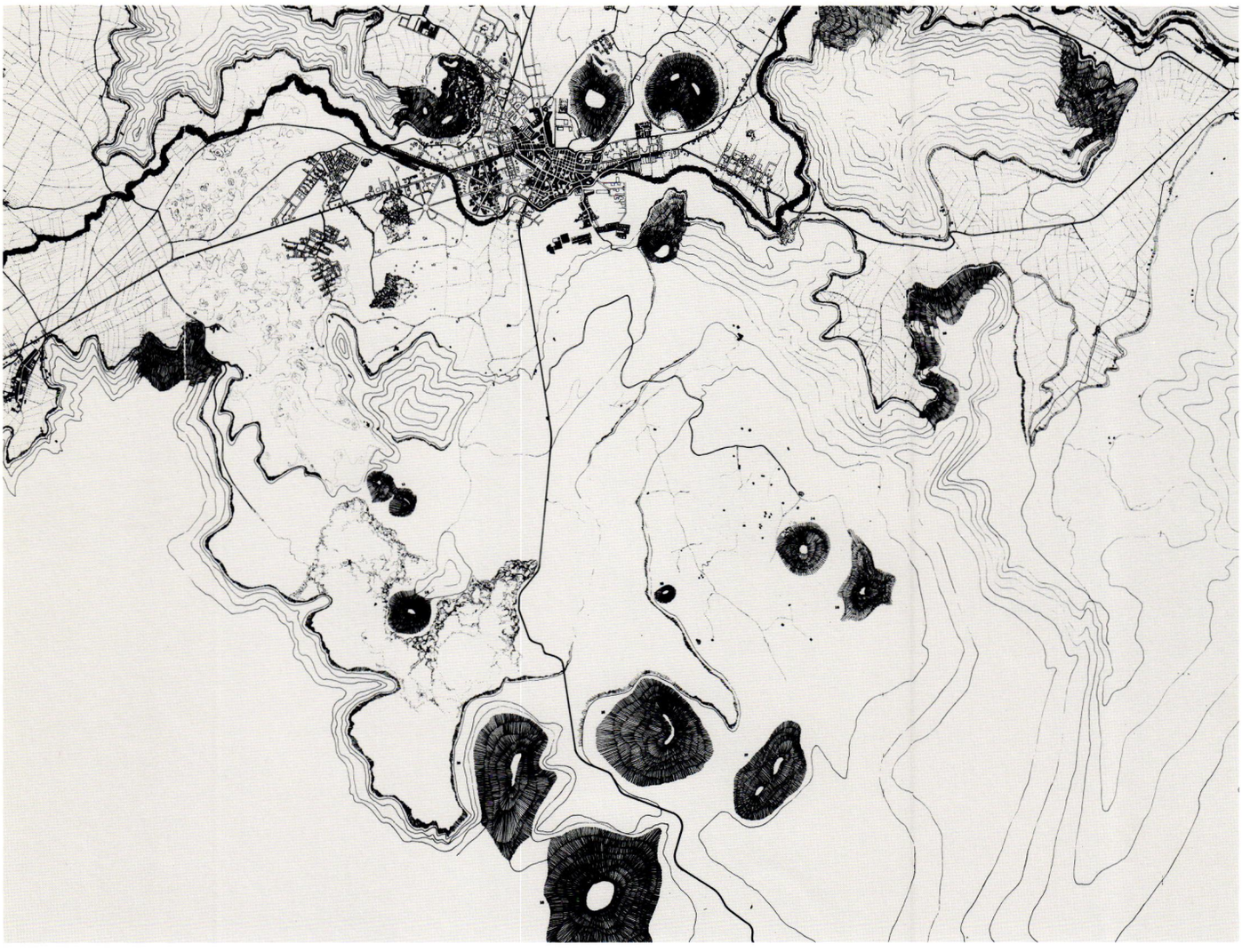
The distinction between natural and built form, which is one of the more common readings for many territories, is here perhaps less relevant. There are not powerful natural profiles, instead, in this landscape it is the artificial order and rhythm of the territory which constitutes its true relief.



OLOT

Detail from map of La Garrotxa: image on the left is approximately one-half of the original map, whereas image on the right is approximately one-sixteenth.

The drawing of the city of Olot, sited in a mountainous territory pock-marked with volcanos and cut by large forests and luxuriant riverbanks, results from the use of diverse graphic strategies that attempt to give form



and presence to each piece of the landscape. Thanks to a phenomenological description of the city's parts and to the blank areas that appear in the drawing, that is, the zones not drawn which mark the discontinuity between parts, the city's decomposition into pieces is emphasized. This decomposition is a reflection of the variety of materials which makes up the city. Such variety barely exists in other larger or more compact cities.

The map reflects a powerful reality, and includes the representation of parcels, of buildings and of grids. One can distinguish the monuments, the great porticoed plazas, parts of the seventeenth-century founding city, the suburbs built along roads, the walkway-roadways, the large city outlines and the layout of the radial city-garden. The relief of the area plays an important role in defining the identity of the city's great forms, that is, its overall disposition. These forms grow from the presence of the relief's elements (the volcanos, slopes, riverbanks and forests) in the middle of the city and their interface with the city's artificial territory. Reading the plan as a whole, one can see that the elements of this relief, due to their repetition and their various combinations, are the pieces which give a natural unity to the entire valley.

Observing the valley in which the city of Olot is embedded, it is apparent that the natural elements which characterize the city are very much present in the rural landscape as well. The river always has the same character, the form of its course and its riverbanks is continuous, while the volcanos remain object-like. One can see that the limit of the cultivated land with respect to the thickly forested areas results in a landscape of deep valleys, of hidden places, of closed vistas, and of small singular spaces. By analogy one can observe these characteristics in the internal disposition of the city of Olot.



The Relief of the City

Josep Parcerisa

What role does relief play in our image of the city?

Suppose that we choose a city of which we have both a visual and planimetric image and, with half-closed eyes, attempt to trace some of its characteristic features. We then draw another city, attempting to make it recognizable and distinct from the previous one. Successively we could accumulate sketches that would allow a person viewing them to immediately identify the place from the essential characteristics shown in our drawings. But of what would these drawings be, that is, which elements are in fact vital to the identity of a place?

It is well-known that cities, understood as plastic objects, are among the most difficult entities to represent. Perhaps this is why a picture, a story or a film is so much more evocative than a planimetric representation of a city, even though the plan is considered the city's most objective expression. One solution to this proposed exercise would consist of choosing specific buildings or the aura of certain places to characterize the city. We would refer to a city by searching in specific key elements for a total, all encompassing image. In this way, we might evoke a fragmentary though powerful figure of the city.

If we address this exercise, accepting the challenge of observing the city from a bird's-eye view, we would concentrate on the planimetric outline of human settlement in its most brilliant form, recognizing the city by way of its artificial constructions. But this sketch would be unintelligible without incorporating those geographic elements that testify to the presence of relief in the city. It becomes evident that the city is produced within a natural relief while at the same time producing its own particular relief, the latter being a certain transformation of the former.

This condition/property of the city is multi-faceted. Orography is in and of itself a fundamental aspect of relief, creating fronts and backs, and sunlit and shaded slopes. Relief's importance is even more apparent when geography is strongly in evidence, forming valleys, ravines, hills, promontories and natural amphitheaters. Relief builds riverbanks and coasts, headlands and terraces, washes and cliffs. Beaches, dikes, rivers, lakes, islands and isthmi

provide the city with different scales and particular views; similarly, forests, marshes and deltas often provide the very reason for site development and its urban uses.

These are some of the phenomena which allow for an understanding of the urban reality through the idea of land form's *profiles*. By their tangible presence, profiles offer formative conditions to the city as givens. These phenomena speak to us as the foundations of the forms they support. (The great influence of such phenomena becomes evident when we look in an atlas that does not show place names and attempt to identify cities by their shape only).

Perhaps to resolve our exercise it would help to imagine for a moment that we could reduce any familiar city to the figure on a coin. Coins can be identified by their different sizes, weights and materials, but primarily they are identified by the figures which are embossed in relief on their surface. The grooves etched on the metal surface determine the figure. They outline the profile in such a way that they constitute the very nature of the image. The relief is the material with which one constructs the image.

With this analogy in mind, we might choose to draw the city emphasizing its topographic profiles. We easily obtain a sketch to which it would only be necessary to add the most relevant infrastructures (or urban events) in order to present a characteristic image of the city. Perhaps the learned observer would object to the absence of more canonized objects that represent the city's artificial condition. Even if an observer recognized the drawing, he might consider that valuable and emblematic elements were missing for this image to truly do the city justice. Why is this so?

For many years the culture of the city has advanced by stressing the value of artificial development of the territory, incorporating its laws and examples into the heart of urban planning. The objective has been the transformation (perhaps complete) of the natural environment. Sedentary civilizations have been understood as the conquest and creation of that place which would bring about the "right atmosphere" for the development of reason. Following this

discourse, contemporary thought about the city has highlighted those historical moments in which structural techniques and interventions have given rise to humanity's most beautiful places. But recent contributions to the study of urban fabrics, of typology, and the idea of the monument and its siting have allowed a blossoming of many other images and tendencies in the material production of the city. The aim of these studies has been to uncover and give value to the order hidden behind common phenomena which had been considered up until then as simply enigmatic groupings of apparent disorder.[1] In a similar spirit, the object of this essay is to reclaim for topography the role of text of the city. This new imperative serves as a counterpoint to the many discourses that exclude relief as an essential condition of the design process; in the best of cases, these discourses suffer from a profound silence with respect to the site. Faced with so much misguided practice in urban development today, the understanding of natural profiles as the very text of the city reinstates relief as a crucial determinant in the design of cities.

The history of the construction and growth of cities is also the history of interaction with ground form; natural contours constitute the initial spatial form of the city. Relief becomes the seminal feature that is associated with an area where settlement takes place. In the making of the urban project, relief is among the few essential conditions which become associated with a settlement, its particular traits and its emblematic form. When we examine the form of cities we almost instinctively look for their outstanding features or reference points. We see how great figures or gestures formed by folds, panoramas or rivers create the context in which the master strokes of the city – avenues, neighborhoods, and gardens – are enhanced (or in some cases are undermined). Moreover, the entire order of the composition only becomes understandable, deserving of praise or criticism, at the confluence of man's interventions with these profiles.

What discipline deals with this kind of project?

Both territorial engineering and architecture participate in the transformation of space, although they go about this transformation in different ways. For engineering the territory is

1. See the pioneering work of Saverio Muratori, *Studi per una operante storia urbana di Venezia, I* (Rome: Istituto Poligrafico dello Stato, 1959). This line of thought, developed most notably in the School of Architecture of Venice in the 1960s and the early 1970s, has produced a number of studies already considered classics such as *La città di Padova*, by Carlo Aymonino, et al. (Rome: Officinà Edizioni, 1970).

understood as a context in which one struggles to place apparatuses (bridges, roads, tunnels, canals, etc.) in the landscape. In resolving a problem, the relief is considered a barrier to overcome. The success of an apparatus is measured by its ability to find favorable topographic conditions for the land's domination or exploitation. The beauty of the construction rests principally in its intrinsic reason for being. Something similar can be said for architecture. Buildings are subject to a site; but this is only one condition of architecture. Buildings must also face their own order, the sources of which must be sought out elsewhere. The good or bad fortune of the site is not inextricably linked to the worthiness of the project: the site does not pre-establish the project's value. For the architectural project, relief is an adjective, a "secondary virtue." To a great extent, the architectural project finds its value within itself, in its art. Architecture is normative and complete unto itself.

But the discipline which takes a more encompassing vision of the city and embraces the transformation of relief as its major challenge is urban planning. Here relief stops being the context in order to become the text of the discourse. This discourse engages the profile of the earth in order to imagine the form of the order yet to materialize, to search among the possible sites for the plausible sites, to make the project's site the subject of the project, and to imagine the way in which nature shall cede or reveal itself. The essential hallmarks of the artistic occupation called urban planning are the awareness of ground form and the discernment of those profiles of relief which will be incorporated into the future identity of the city.[2]

It is possible that this millenary occupation may still be confronted with new challenges. Some scholars, such as Joseph Rykwert, believe that the loss of the beautiful certainties about how the universe functions is at the very root of our inability to give form to the human environment today.[3] Certainly something fundamental has changed since the time of the construction of ancient cities (or "traditional" cities, in Guénon's sense of the word). Their history was one in which time and place were the decisive factors in their founding. It was this place and no other, a site in singular. In the observance of ritual, naming the city was tantamount to naming the site. With the *sulcus primigenius* or "first plowing" a dominion was established over a territory and was by its very nature closed and circumscribed.

2. See the works of Manuel de Solà-Morales, *L'art de ben establir* (Barcelona: Laboratorio de Urbanismo, 1983) and "Amiens: vamos entrando en materia," *UR* no. 2 (1985).

3. Joseph Rykwert, *The Idea of a Town: The Anthropology of Urban Form in Rome, Italy and the Ancient World* (Princeton: Princeton University Press, 1976).

In contrast, modern history is a chronicle of growth concerned with the relative composition of parts. The modern city distinguishes itself by overrunning the space of its founding; it is no longer an expression of the *castrum* against the *ignotum* or the "isolated fortress" against "the unknown." In addition, even the founding of settlements, since the time the Americas were colonized, is no longer a sacred cause. These cities' first iconographic representations of themselves reflect an infinite vocation, open and full of growth. This calling for growth is confirmed by later urbanistic interventions.[4] As such, modern urban planning was founded on the presupposition of the city as open and growing (if we exclude the utopian visions from the Renaissance to the socialist utopias which are associated with a closed conception of the universe). But this presupposition is not sufficient alone to establish the ground rules for giving form to the human environment.

A great tradition which stretches until the present has kept a city/territory duality alive and irresolute. Both the founding plans of Latin America and those of European cities (especially the eighteenth-century plans) are expressed in drawings displaying two codes: one geometric and abstract code, referring to the city proper within its boundaries, and another extra-ordinarily phenomenological code, portraying the agricultural features and relief of the surrounding territory.[5] In this tradition, city and territory, despite their presence together on charts and plans, were realities and representations which were not woven together but rather were contiguous entities, existing side by side, yet remaining distinct from each other. But the growing and therefore permanently inconclusive city requires other codes for its precise representation. These other codes are necessary due to the city's continual expansion and because, as a result, relief stops being a foreign context and becomes the text upon which transformations are written.

At the beginning of this century, Tony Garnier, in his famous plan for the *Cité Industrielle*, drew both city and territory in the same code. Geometry and relief here became one, so that the city, at once industrial and desirable, now incorporated the landscape as a necessary condition in the shape of urban growth. Garnier's plan inverts traditional discourse. Order is no longer a condition foreign to the land form; rather, relief becomes instrumental for composition. Almost at the same time, Eugène Henard, in his first of the "Etudes sur les transformations de Paris" essays defends an alternate layout for the extension of the Rue de Rennes, in terms of the value of the landscape, urban and natural simultaneously. He insists that progress should not destroy

4. It is significant to note the importance that is given to the square or central point in these modern cities. It is the place which gives birth to and maintains the centralized character of the city even when the seminal grid is practically unlimited. In this way, these foundings are radically distinct from ancient ones, in spite of certain appearances. In contrast to modern cities, the ancient cities are characterized by the precinct, the limit, or the form of the city walls, that which makes them into distinguishable, circumscribed units of space. In the ancient founding of cities that which describes a discreet *unity* prevails. In the modern founding of cities that which describes the *origin* prevails.

5. This tradition attempts to define a compositional order for the urban "solid" and resolve the lack of such order outside the city with a stylistic response.

the most beautiful profiles of the city. Both Garnier and Henard understood relief as a necessary condition of the modern city. They point out that along with the continuing composition of more and more parts, the city faces another intrinsic condition: the city must take into account natural profiles, incorporating them into projects as authentic elements of the composition, because those profiles are as necessary and as useful as the design itself.

Despite this awareness, the contemporary city continues to grow and develop, subjected to urban schemes which often ignore the meaning of the city's profiles; this often results in the destruction of an important aspect of the city's identity. It is as if such *erosion* were a sign of progress. Natural profiles have often been literally erased from the map when they come into conflict with problems of extension or re-structuring. This is particularly true when problems are addressed and resolved by the internal logic of systems that use criteria specific to themselves only (e.g., traffic systems, utility systems, public service systems) and without the mediation of urbanistic reasoning. The greater this process is in scale, the more abject and senseless the entire city will appear.

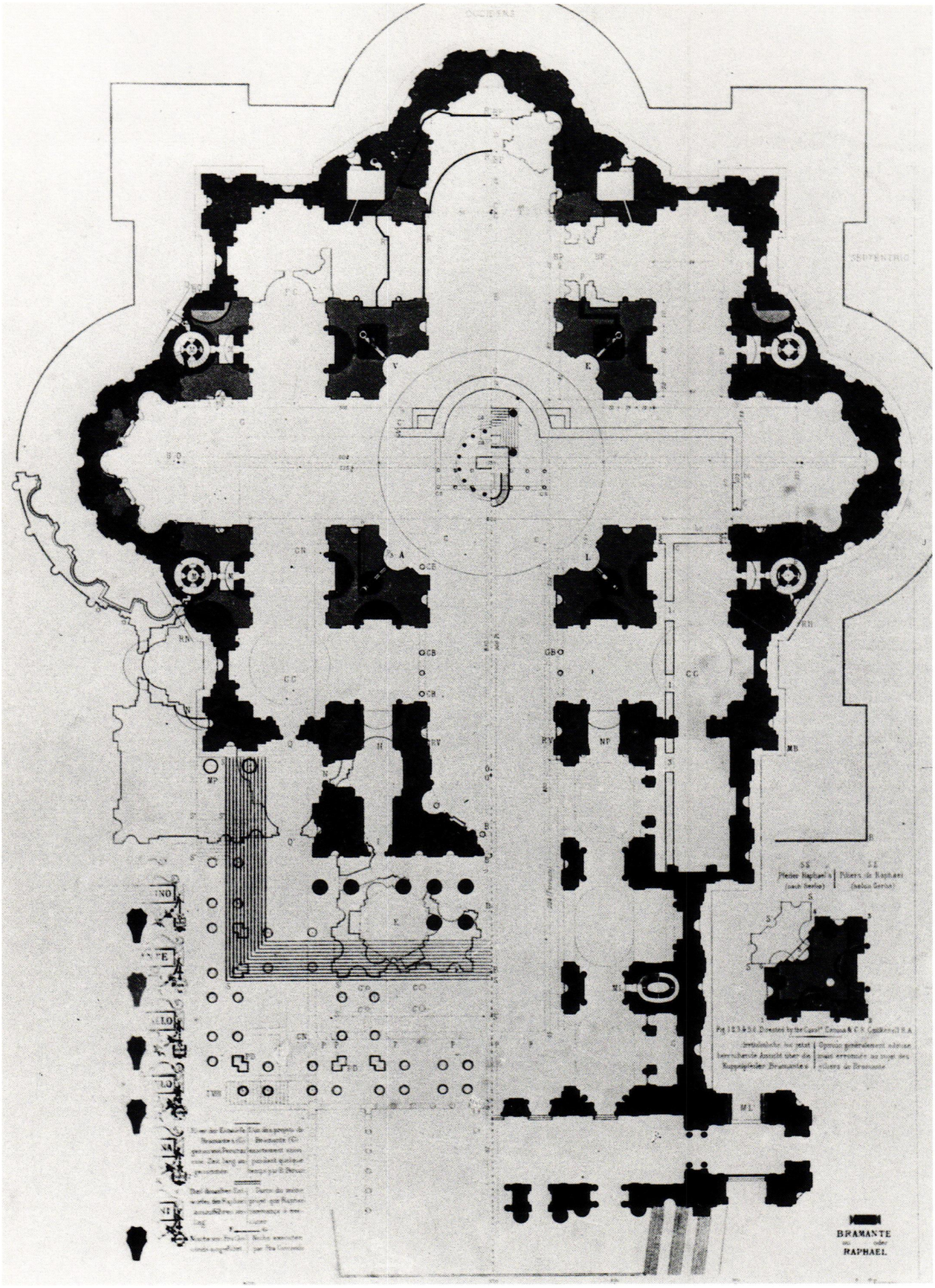
From this point of view, the marginality of outskirts with respect to the "solid" or central city can be measured not only by its land uses, lack of connection and distance from the center but also by the scarce incorporation of the ground form into their settlements. Paradoxically, only on its periphery does the city not consider itself powerful enough to compose or destroy its natural profiles. As such, these developments on the periphery of cities simply coexist with their natural profiles in a rather primitive way.[6]

We are faced with both the attempted destruction of the relief in city centers, calling for the complete transformation of the environment (which in reality merely silences nature), and the inability at the periphery of the city to confront nature, use it and enhance it. Somewhere between these two arises the effort which uses relief to make beautiful cities. These cities have sculpted an exquisite image of themselves by consciously manipulating their natural resources to their advantage.

Cities, like coins, will retain a form and identity, a *figure*, as long as they posses relief.

6. Surely this is the only similarity yet also the most surprising one which exists between such different phenomena as urban areas referred to as shantytowns or *marginales* (the *fabelas* in Rio de Janeiro, the *campamentos* in Lima, the *poblaciones* in Santiago de Chile and in the south of Europe) and suburban residential developments (from those of Los Angeles to those on city outskirts in the Scandinavian countries).

"The Culture of Description" and "The Relief of the City" were translated from the Spanish by M. Virginia Chapman with Daniel Smulian



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The History of the Site of St. Peter's Basilica, Rome

Charles B. McClendon

St. Peter's basilica in Rome, with the combined image of its dome, monumental facade, colonnaded piazza and central obelisk, is one of the most celebrated architectural ensembles in the world. And yet, there is much more to this monument than is at first apparent. The complex of St. Peter's is not the work of a single architect or even the result of a single building campaign; rather, it grew out of various circumstances and intentions that were founded on a continuous belief in the sanctity and power of the site.

In the space of a short essay, it is impossible to discuss all of the issues involved in the design and construction of this great monument. Instead, I propose a new way of approaching the subject. In order to illustrate how a series of building projects responded to the physical demands and spiritual associations of a particular place, I will trace the formation of this architectural montage in reverse chronological order by using the methods of both the archaeologist and the historian of architecture.

1. Composite drawing of successive plans for St. Peter's basilica.

2. Via della Conciliazione looking west towards St. Peter's.

3. View of St. Peter's from above the colonnade of the piazza.

4. The nave of St. Peter's looking west towards the apse.



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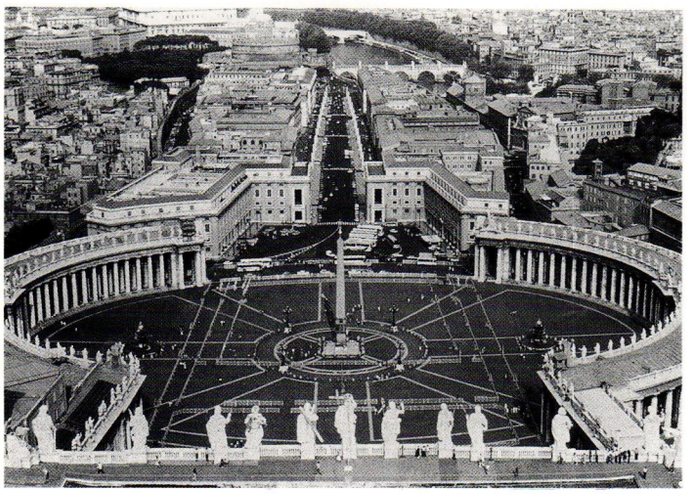

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5. View from the dome of St. Peter's looking east towards the Tiber River.

6. View from the dome of St. Peter's during construction of the Via della Conciliazione, ca. 1940.

The wealth of visual, historical, and archaeological documentation related to St. Peter's will make it possible to strip away, layer by layer, the accumulation of ages and, in so doing, reveal the continuum of history that links a series of seemingly disparate events on a common site.

Any such investigation should begin by following the thoroughfare that runs from the Tiber River to the great piazza in front of the basilica. One would assume that this magnificent approach, in line with the obelisk and the dome of St. Peter's, was the result of far-sighted planning. And yet, before 1936, the piazza of St. Peter's was not directly linked to the Tiber River or Castel Sant'Angelo or even to the city of Rome itself. It was Benito Mussolini who initiated the construction of this new boulevard as part of his grand urban scheme for "modernizing" Rome. In 1924, Mussolini outlined his plan for the city as follows:

I should like to divide the problems of Rome, the Rome of the Twentieth Century, into two categories: the problems of necessity and the problems of grandeur. One cannot confront the latter unless the first have been resolved. The problems of necessity rise from the growth of Rome, and are encompassed in this binomial: housing and communications. The problems of grandeur are of another kind: we must liberate all of ancient Rome from the mediocre construction that disfigures it, but side by side with the Rome of antiquity and Christianity we must also create the monumental Rome of the Twentieth Century. [1]

In order to fulfill this ambitious vision, Mussolini and his architects devised highways of *grandezza*, such as the Via dell'Impero that cut through the ancient Imperial Fora of Trajan and Augustus, linking the Coliseum with Piazza Venezia, and the Via del Mare, that led from the Capitoline Hill to the port city of Ostia on the Mediterranean coast. Both avenues were essentially completed by 1931 and formed the backbone of *la grande Roma* of the fascist era. Not long after, Mussolini turned his attention to the Vatican area.

The name of the modern boulevard leading to St. Peter's, the Via della Conciliazione, or Conciliar Way, refers to the treaty of reconciliation signed in 1929 by Mussolini and Pope Pius XI. The road stands as a physical expression of the new relationship between the sovereign state of Vatican City, created in 1929, and Rome, the capital of Italy, a nation that was unified only in 1870 and against the fervent opposition of the Papal See. The Via is also a chronological link between pre- and post-World War II Italy, for the project begun in 1936 was not completed until 1950. The Via della Conciliazione is therefore the creation of modern politics as well as a response to the demands of modern technology, that is, the ever-present automobile. And anyone who has visited Rome recently knows that it is one of the few relatively free-flowing thoroughfares in a city otherwise heavily congested with traffic.

1. Spiro Kostoff, *The Third Rome, 1870-1950: Traffic and Glory* (Berkeley: University Art Museum, 1973), pp. 9-10. Translated from *Scritti e discorsi di Benito Mussolini*, edited by Hoepli, vol. 6 (Milan: 1934), p. 93.



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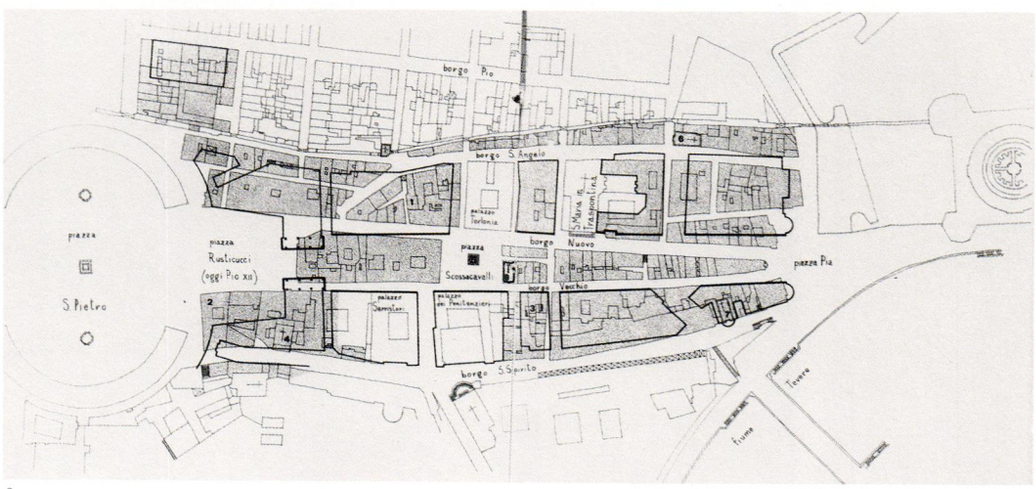

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7. *View from the dome of St. Peter's, ca. 1890.*

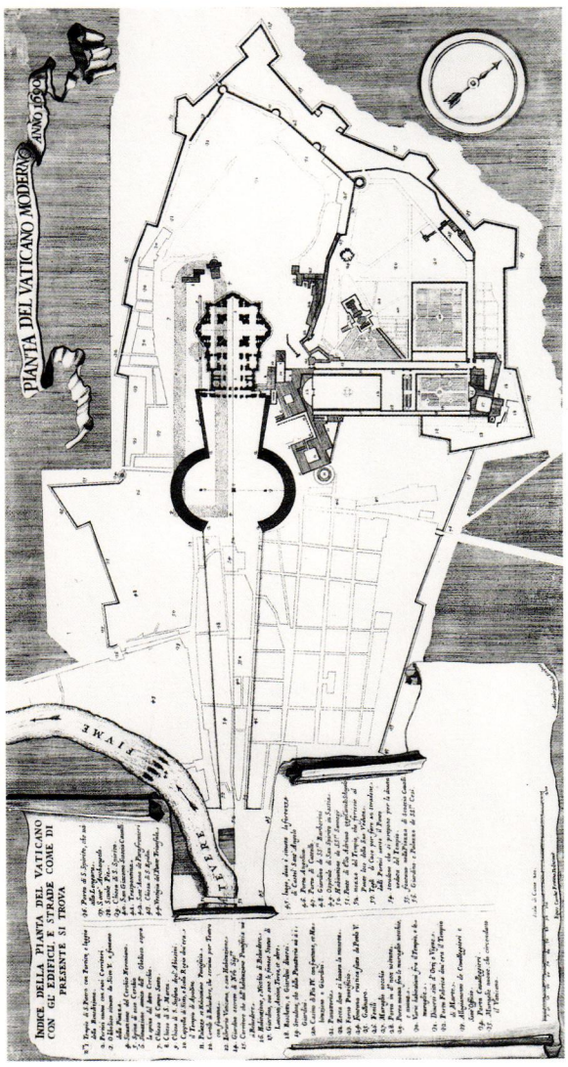
8. *Aerial view of St. Peter's and the Vatican, 1929.*

9. *Plan of Via della Conciliazione showing areas (shaded) destroyed during its construction.*

10. Carlo Fontana, "open" solution for a monumental approach to St. Peter's, 1694.

11. Cosimo Morelli, proposal for a V-shaped avenue leading to St. Peter's, 1776.

The concerns for "necessity and grandeur" inherent in the fascist scheme for the Via della Conciliazione were not new. The idea of providing a monumental approach to St. Peter's can be traced to the reign of Pope Nicholas V in the mid-fifteenth century when, with the advice of the great Renaissance theorist of architecture, Alberti, a plan was devised for three colonnaded streets to connect the basilica with Castel Sant'Angelo on the banks of the Tiber River. Like so many projects for St. Peter's, this scheme was never carried out, but the need to unite the Vatican more directly with the center of Rome remained a topic of debate for centuries. The architects of the Via della Conciliazione, Marcello Piacentini and Attilio Spaccarelli, for example, were greatly influenced by the designs of Carlo Fontana, the architect of St. Peter's at the end of the seventeenth century. In his book, *Templum Vaticanum*, published in 1694, Fontana presents two basic solutions to the problem: one that may be termed "closed" and the other "open." The simplest is the open solution, which suggests the creation of a great V-shaped avenue leading like an inverted funnel from the Tiber River to the piazza of St. Peter's. The other proposal presents a closed solution where the V-shaped avenue is interrupted by a colonnaded block which is linked by narrow corridors to the curved arms of the oval piazza. Fontana's primary motivation here seems to have been one of symmetry: the distance from his *nobile interrompimento*, as he called it, to the piazza was to be the same as the distance from the piazza to the facade of the church. He also justified this second proposal on more practical grounds:



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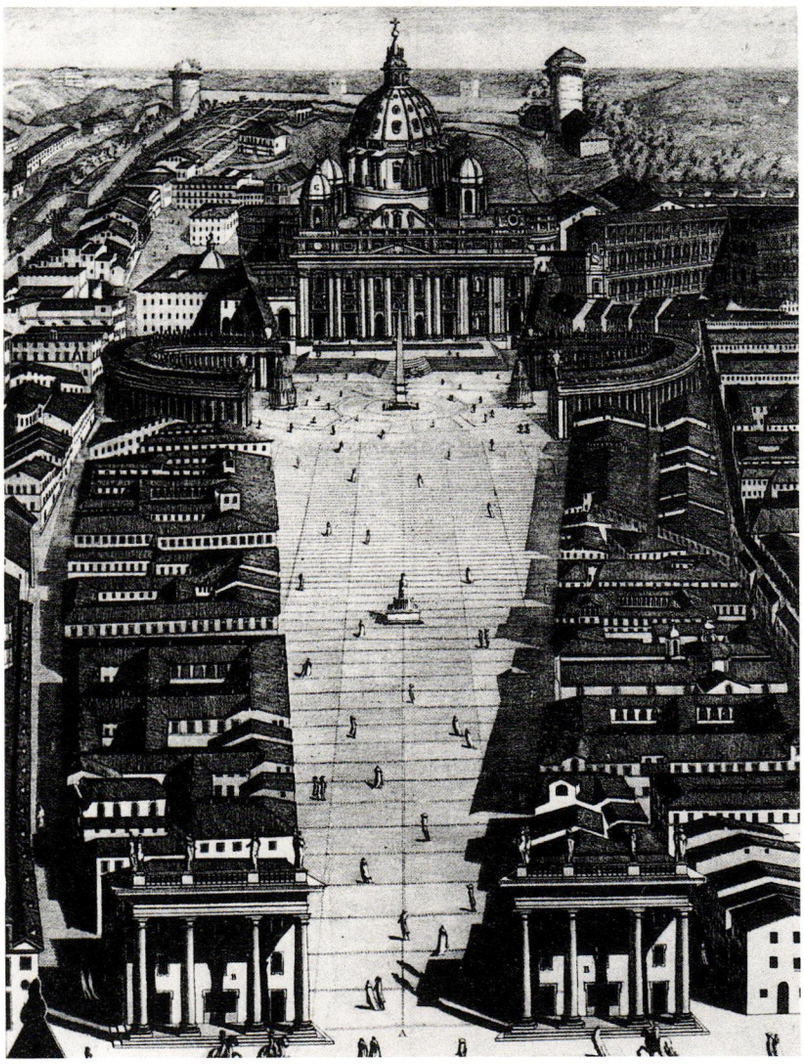

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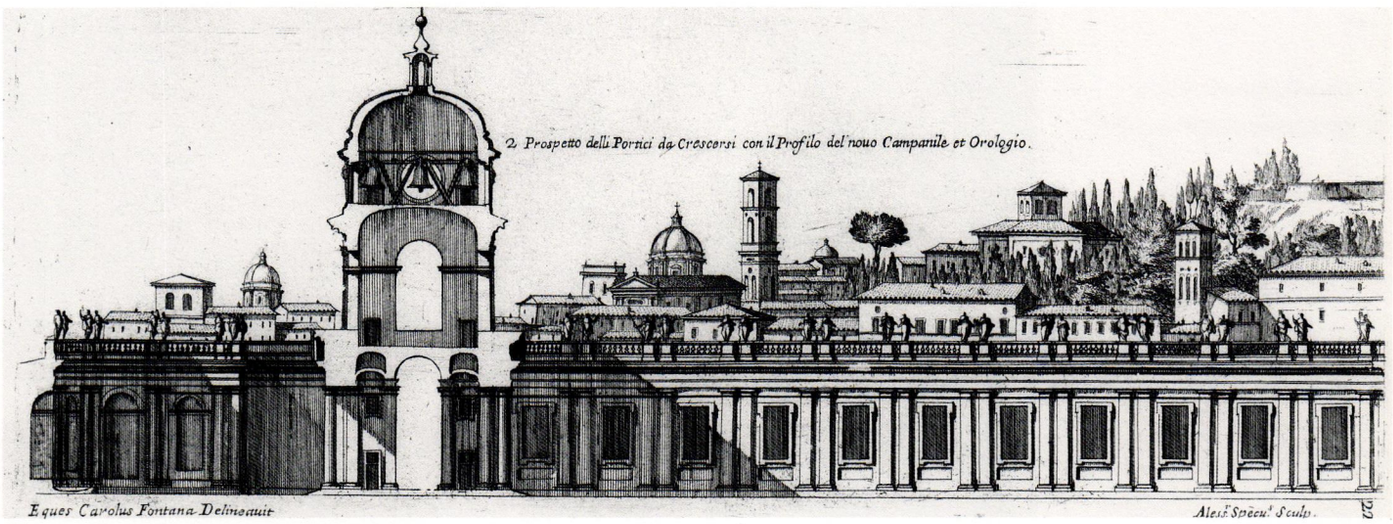
Carlo Fontana, "closed" solution for a monumental approach to St. Peter's, 1694.

12. East/west section through nobile interrompimento *showing elevation of south enclosure wall.*
13. Site plan
14. Detailed plan



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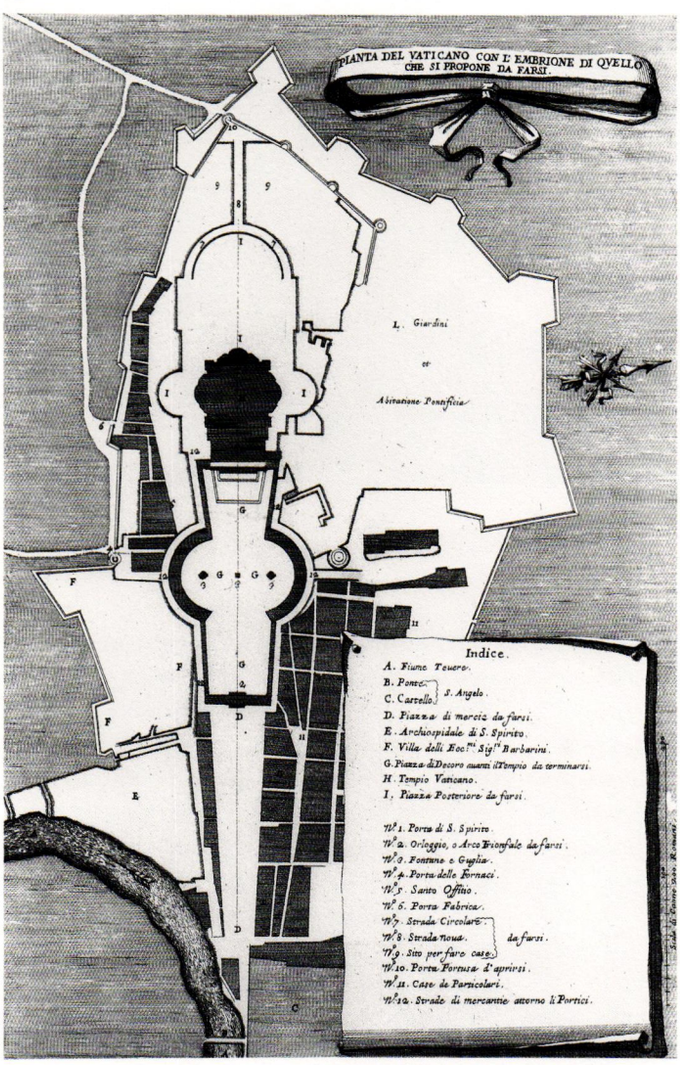

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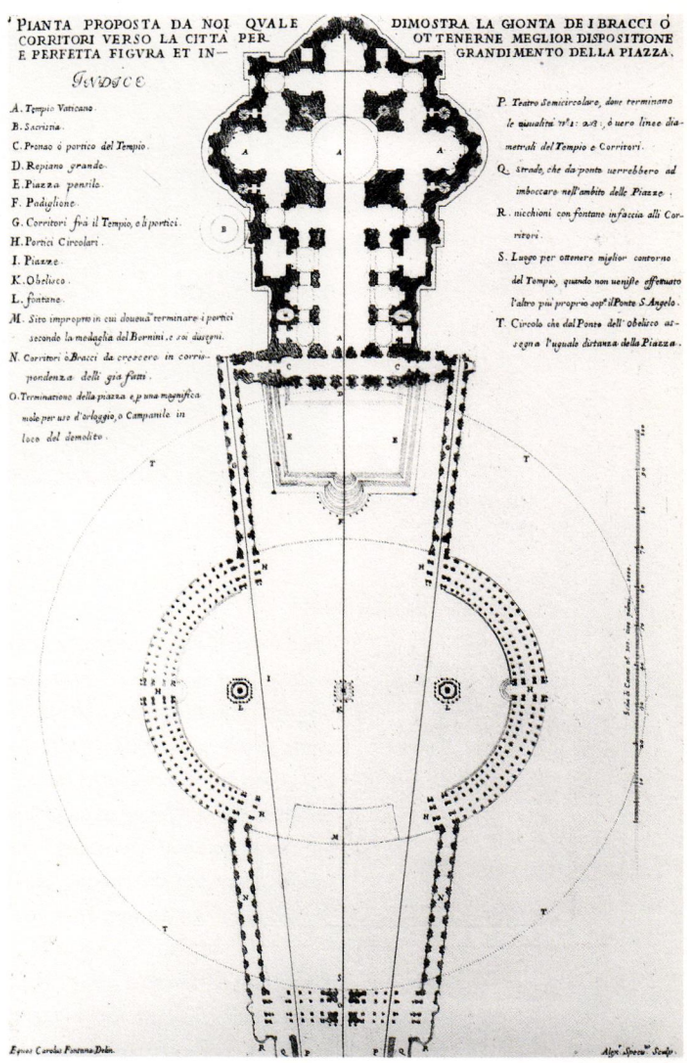

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15. The piazza of St. Peter's before the destruction of the spina *in 1936.*

16. Detail from the Nolli map of Rome, 1746.

17. Carlo Fontana, east/west section of St. Peter's basilica and piazza, 1694.

18. Giovanni Battista Piranesi, St. Peter's basilica and piazza, 1748.



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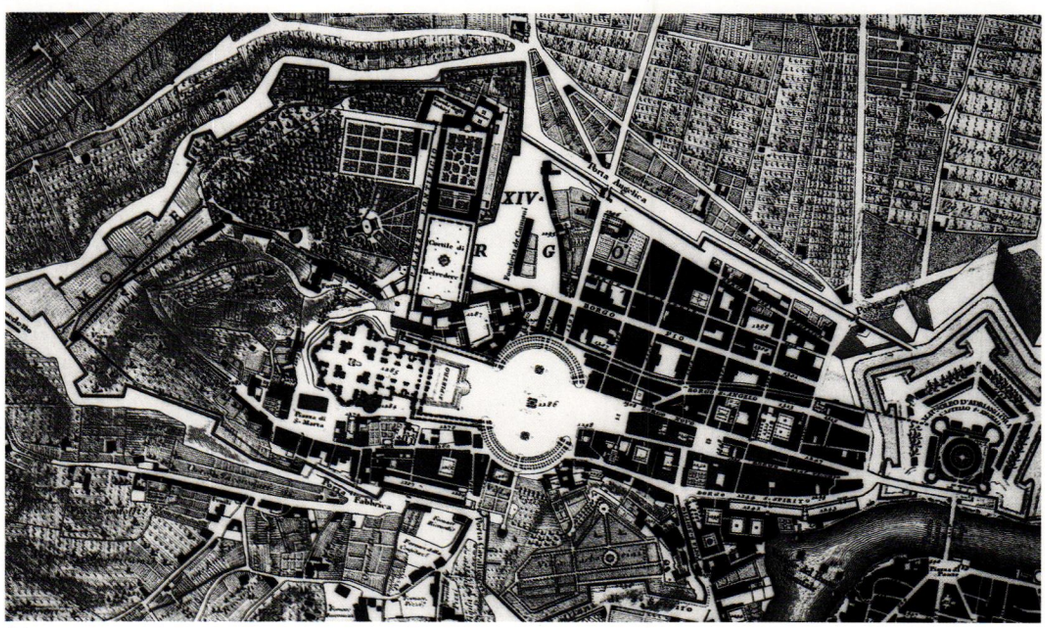

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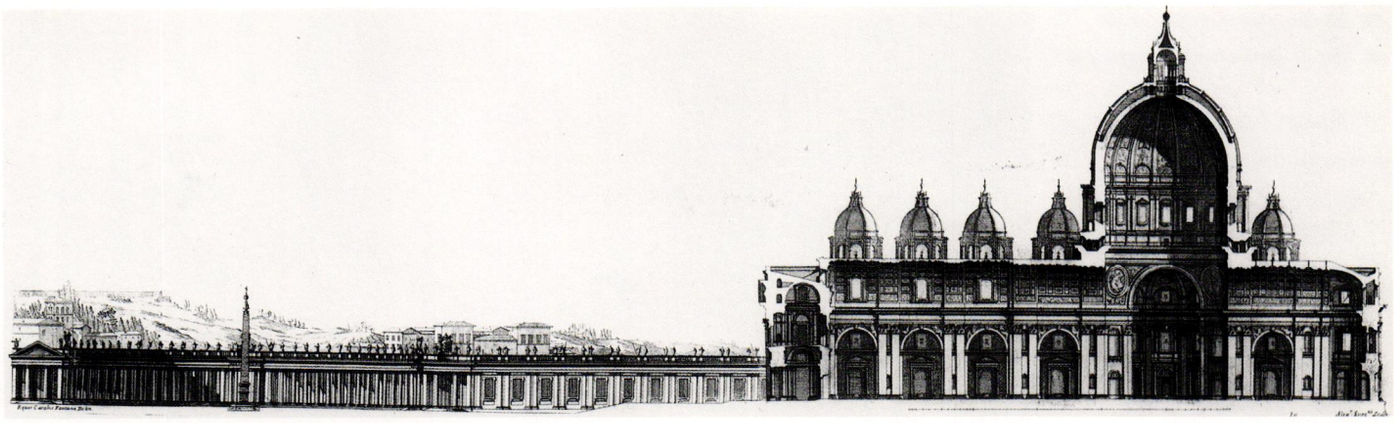
The Pontiff and his cortege of Cardinals would be able to pass in comfort through the corridors during processions without the fear of rain or the heat of the sun. And, with this single expense of constructing the proposed corridors, one eliminates the other [expense] that is annually made on the occasion of processions due to the planting of the poles and the raising of awnings, etc., which result in an ignoble sight.[2]

Between 1934 and 1938, Piacentini and Spaccarelli, following Fontana's example, also proposed alternative schemes, but as finally built, the Via della Conciliazione presents an ingenious compromise between the "open" and "closed" solutions. Like the open scheme, it provides the grand vista from the Tiber River to the dome, facade, and obelisk of St. Peter's, but in keeping with the closed scheme the great expanse of the piazza of St. Peter's is, at least partly, concealed from view by *propylaea* or wings of two facing palaces that project from the left and right into the thoroughfare immediately in front of the piazza. The irregularities in the alignment of the buildings' facades which frame the

2. Carlo Fontana, *Templum Vaticanum* (Rome: 1694), pp. 179, 243.



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boulevard are masked by two parallel rows of traffic islands bearing street lamps in the form of miniature obelisks that lead the eye to the ultimate goal of the basilica.

Before construction of the Via, early photographs and maps show that two narrow streets led in divergent paths from the Tiber River to St. Peter's basilica, forming a central triangular series of buildings known as the *spina* or spine. For any visitor to the Vatican before 1936, the vast piazza in front of St. Peter's came as a surprise, as an unexpected explosion of space. One might think that the grand oval of the piazza serves as a perfect foil for the crowded urban environment of the *spina*, and yet before the middle of the seventeenth century there was no formal piazza but only an irregular, unpaved area in front of the church. The piazza and colonnade were the creation of Gianlorenzo Bernini who between 1659 and 1667 transformed an unimpressive open lot – referred to by contemporaries as simply the *platea* or open space – into the majestic ceremonial entrance to the greatest shrine in Christendom.

19. Bernini, plan of the piazza and elevation at colonnade-corridor junction.

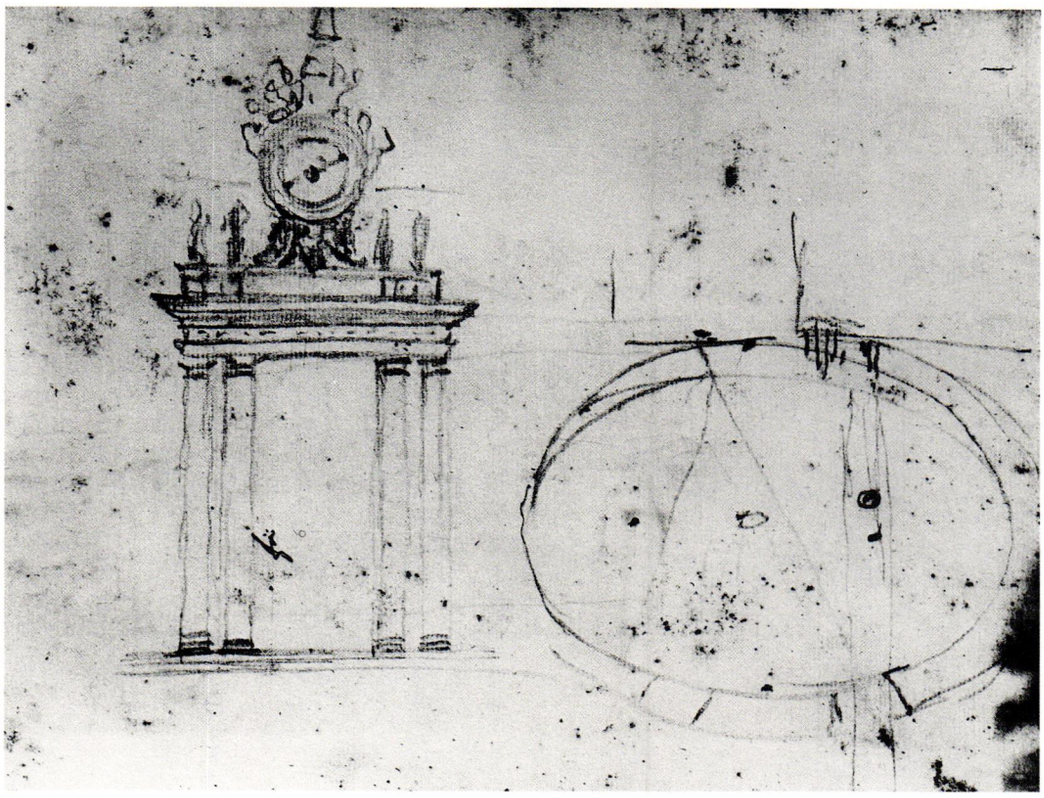
20. Bernini's workshop, preliminary drawing for the piazza, ca. 1656.

21. Anonymous drawing, caricature of Bernini's oval design for the piazza, 1659.

22. Diagram of the piazza showing relationship of obelisk and oval.

23. Detail from the Tempesta map of Rome, showing platea *before construction of Bernini's colonnade, 1593.*

24. Israel Silvestre, detail from panoramic view from the dome of St. Peter's, 1641.



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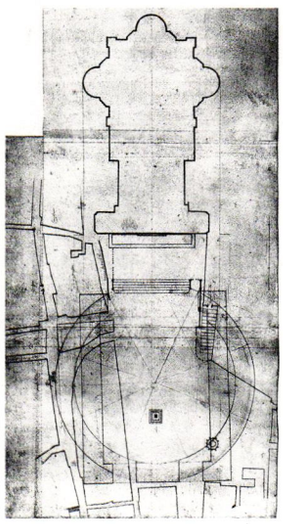

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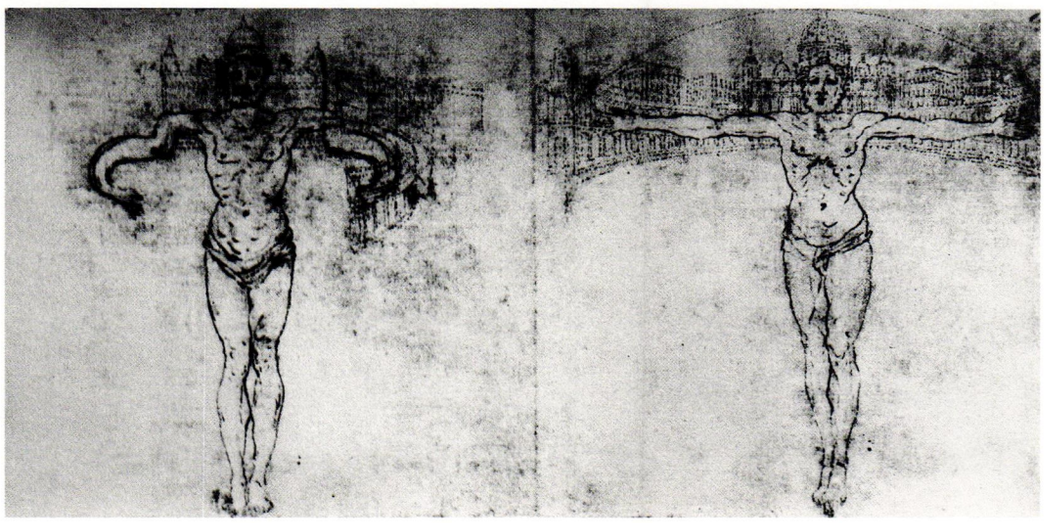

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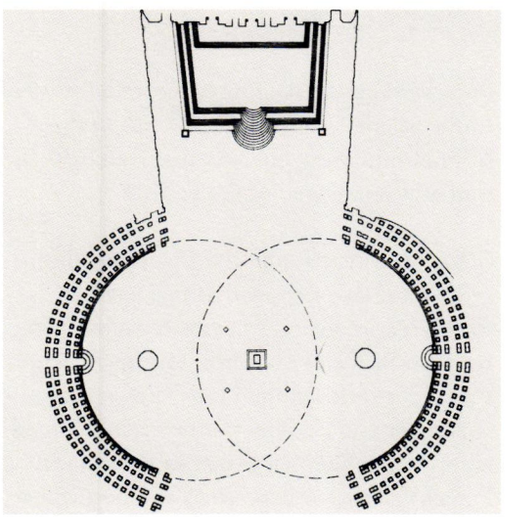

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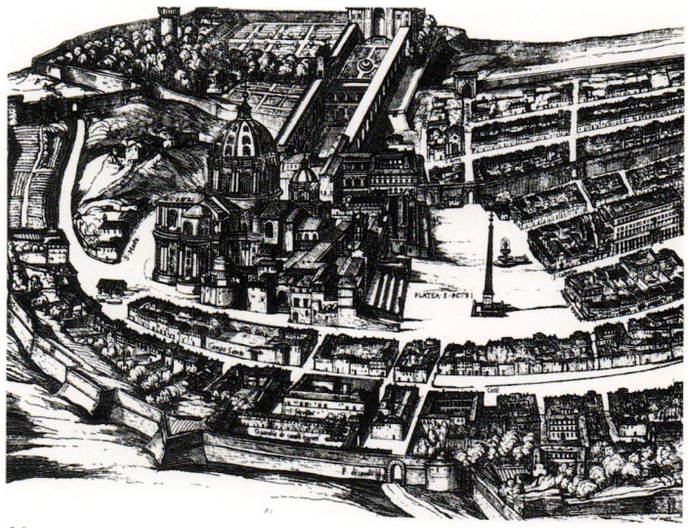
Drawings by Bernini's assistants and other drawings in his own hand make it possible to follow the creative process of the piazza's design. His workshop first proposed a rectangular piazza and then a circular one. Only then did Bernini himself, in his characteristically sketchy manner, arrive at the final, elliptical solution. Bernini found meaning in this configuration. As he explained:

Since St. Peter's is, so to speak, the Mother Church to all other churches, the portico accurately expresses her act of maternally receiving in her open arms Catholics to be confirmed in the faith, heretics to be reunited with the Church, and unbelievers to be enlightened by the true faith.[3]

From a formal point of view, the design of the piazza was determined by two intersecting circles centered about the familiar obelisk which stands in front of the facade of St. Peter's. And yet the obelisk, too, was a

3. Timothy Kitao, *Circle and Oval in the Square of Saint Peter's* (New York: New York University Press, 1974), p. 14.



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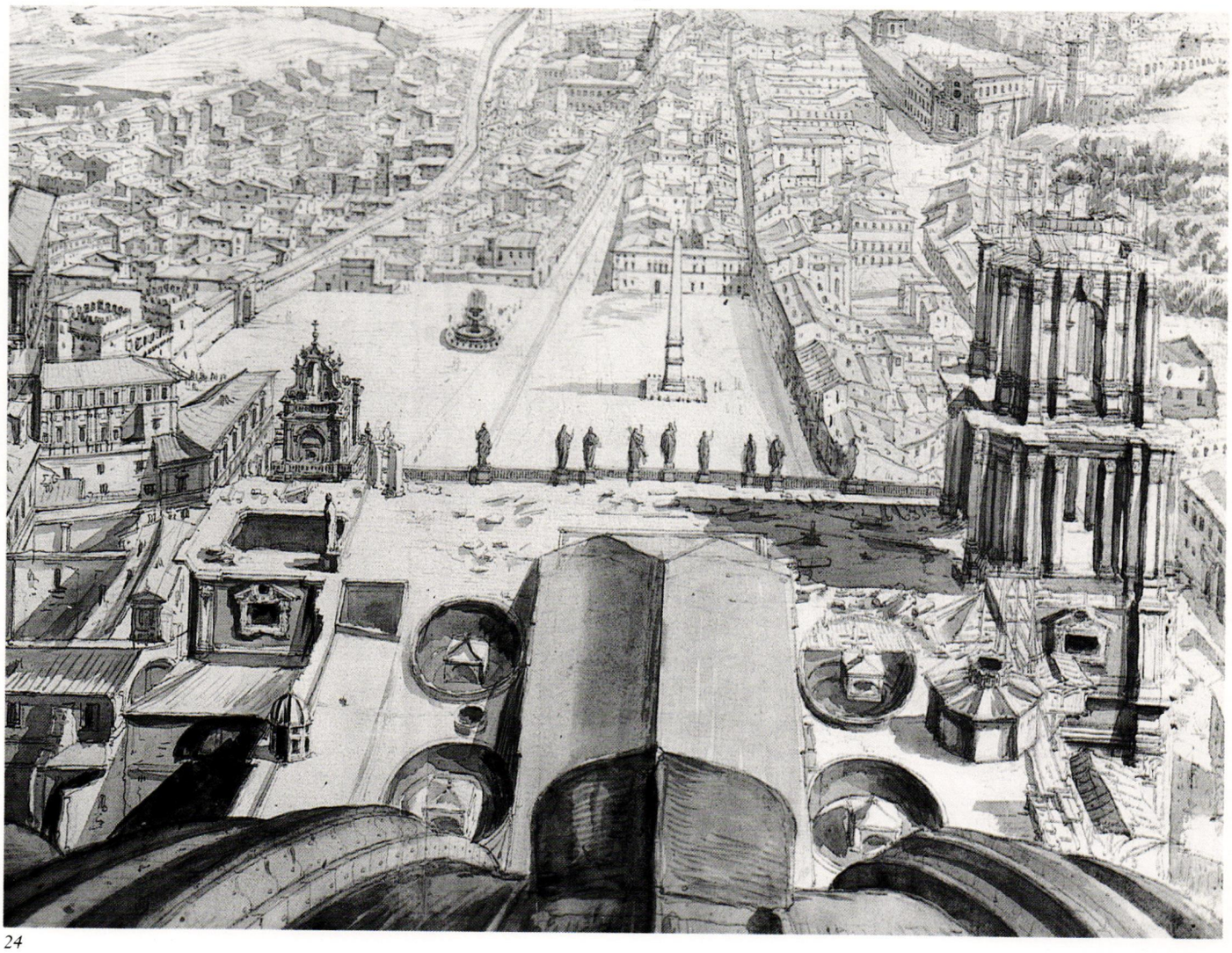

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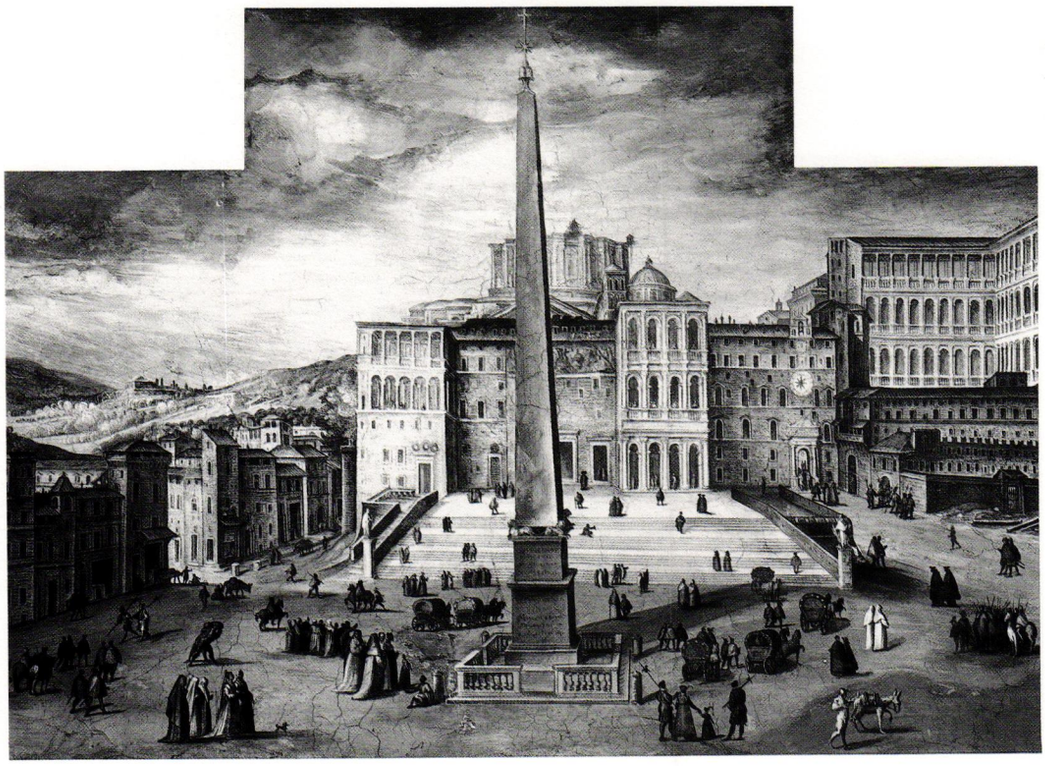

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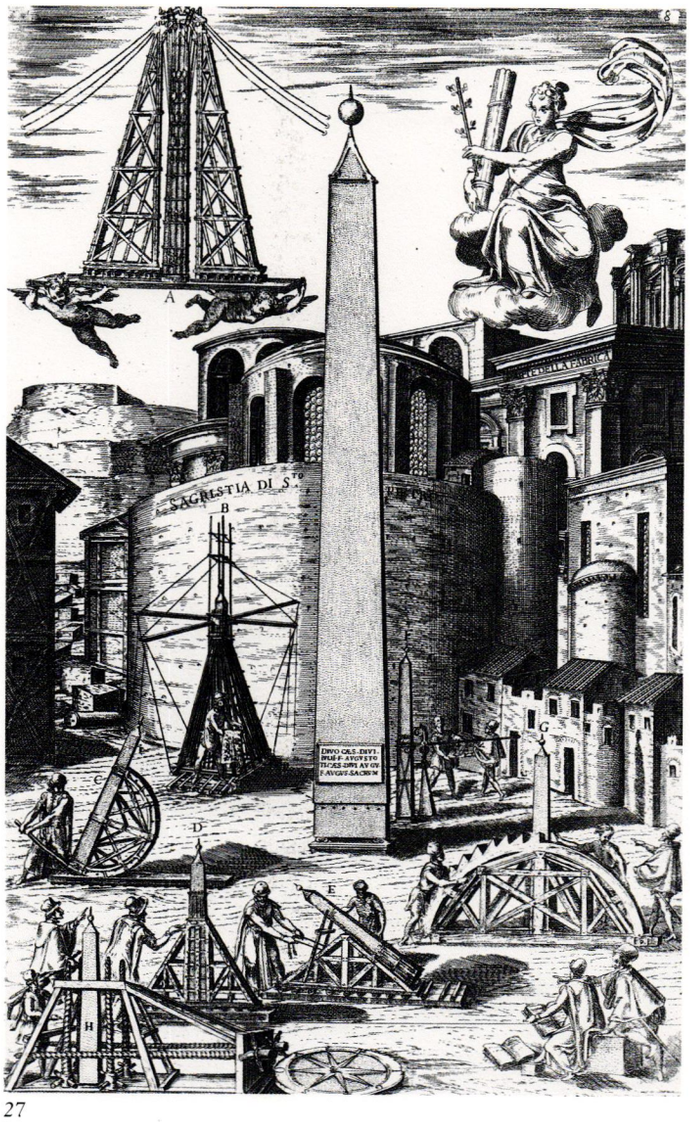
relatively recent addition to the *platea*. For centuries, the obelisk had stood not in front of the basilica but along its southern flank, in front of two ancient, cylindrical mausolea. In 1586 the obelisk was moved, at the instigation of Pope Sixtus V (1585-90) and his architect, Domenico Fontana, using an elaborate system of ropes, pulleys and rollers that may appear to us like a scene from *Gulliver's Travels* but that in its own day was hailed as the triumph of "modern technology." The obelisk was known at the time to have come from ancient Egypt and to have been brought to Rome by one of the Roman emperors. But since the Middle Ages, popular legend had it that the golden orb atop the needle contained the ashes of Julius Caesar. For Sixtus V, therefore, the obelisk in its new setting in front of St. Peter's symbolized the triumph of the Church over paganism. In the spirit of the Counter-Reformation, the Pope had the obelisk surmounted by a cross and placed on a new base with an inscription that reads: "Behold the Cross of the Lord! Flee adversaries, the Lion of Judah has conquered."

25. View of the platea *with obelisk, ca. 1588. The stairs in the center lead to the entrance of the atrium of the old church above which rises the drum of the dome of the new church.*

26. View of the platea *at the coronation of Pope Sixtus V in 1585 prior to the moving of the obelisk.*

27. Domenico Fontana, the Vatican obelisk in situ with models of various proposals for its relocation, 1589.

28. Domenico Fontana, the moving of the Vatican obelisk, 1589.



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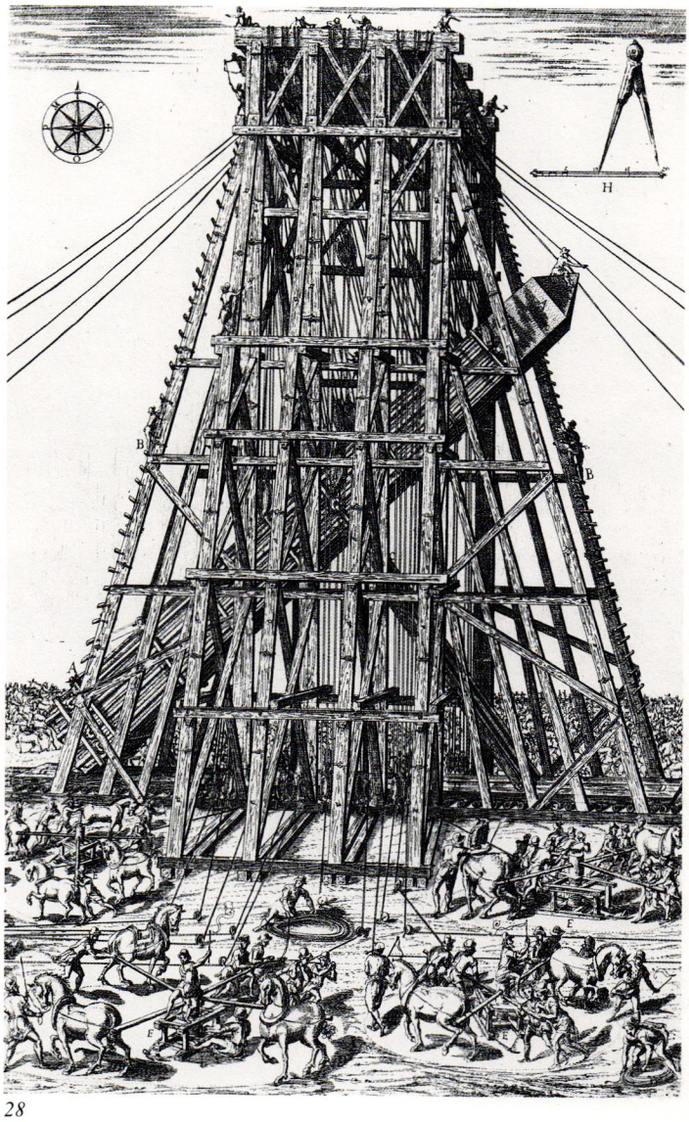

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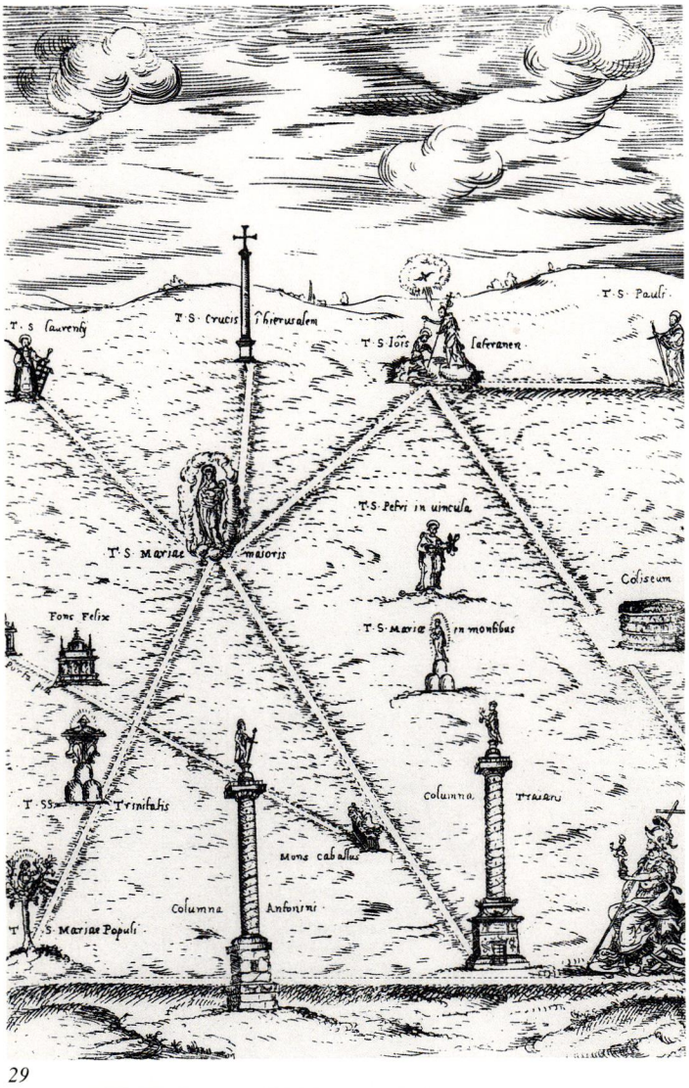

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29. Giovanni Francesco Bordino, city plan of radiating streets proposed during the pontificate of Sixtus V, 1588.

30. The Egyptian obelisk at the Piazza del Popolo erected during the pontificate of Sixtus V.

31. Detail from the Dupérac-Lafrery map of Rome, 1577.

32. Carlo Fontana, view of south flank of St. Peter's before the moving of the obelisk, 1694. On the left are the rising walls of the new basilica; in the center foreground are the obelisk and a late-antique mausoleum; in the center and right background is the silhouette of the nave, atrium, and bell tower of the old church.



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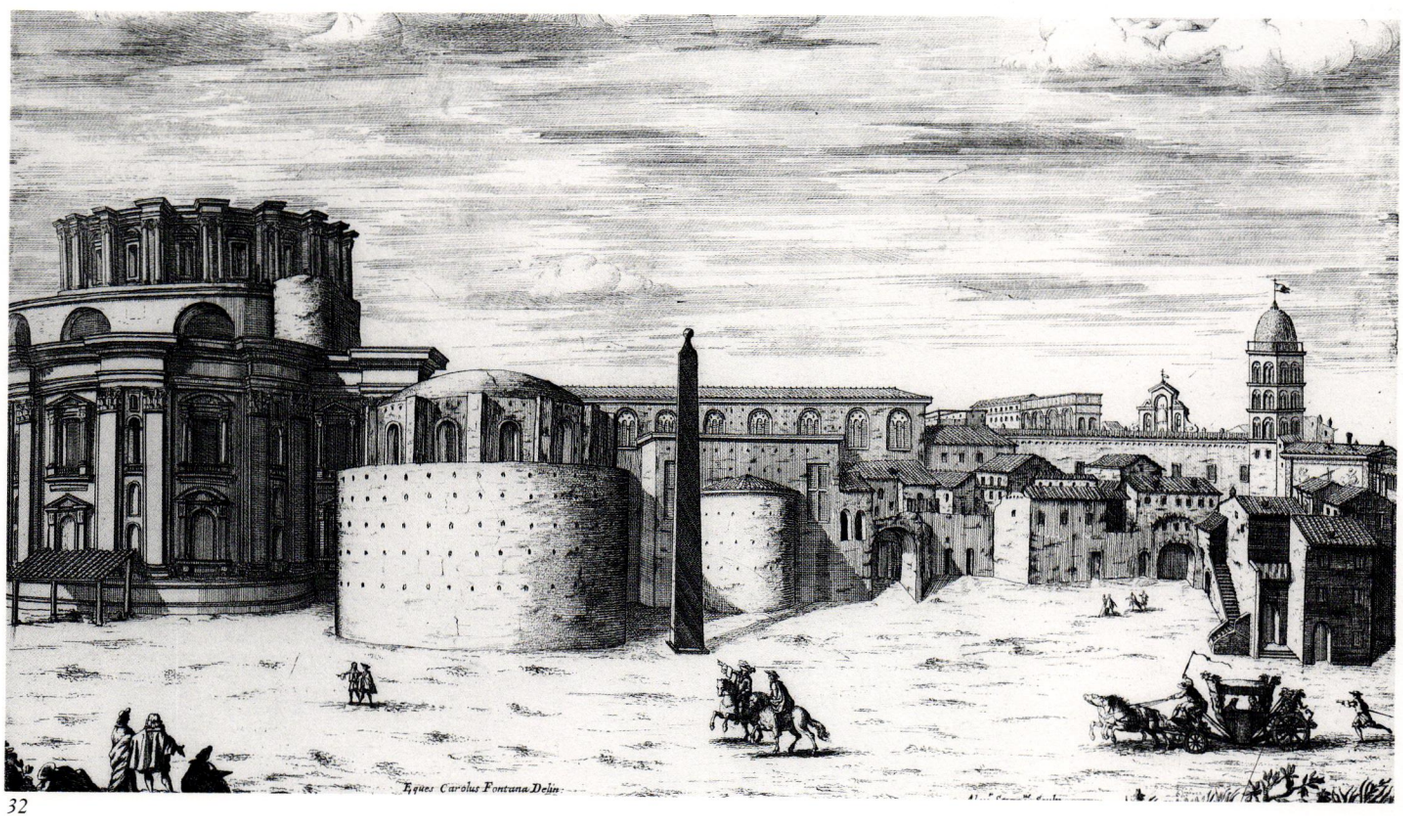
The moving of the Vatican obelisk marked the first of several such undertakings sponsored by Sixtus V during his brief pontificate. He had other obelisks erected in the Piazza del Popolo and alongside the church of S. Maria Maggiore and the new papal palace adjoining the Lateran basilica. Not only did the re-use of ancient material represent an *interpretatio christiana* of Rome's pagan past, but it formed part of an ambitious program of urban development where the obelisks were used as focal points for a new network of radiating streets. In symbolic terms, this urban scheme was described at the time as the "radiance of the star on the mountains," referring to its resemblance to a five-pointed star centered about the church of S. Maria Maggiore on the Esquiline Hill.[4] Domenico Fontana, as the papal architect, saw it from a more practical point of view, as an aid to pilgrimage: "One can by foot, by horse, or in a carriage, start from whatever place in Rome one may wish, and continue virtually in a straight line to the most famous devotions."[5] Sixtus V, on the other hand, referred to the "various and diverse perspectives . . . to charm the senses" afforded by the new avenues. Not surprisingly, once the Vatican obelisk was in place in front of St. Peter's basilica, the Pope expressed a desire to demolish the *spina* in order to create *una bella prospettiva*. But like Pope Nicholas V before him, Pope Sixtus V never saw his last wish fulfilled. For while the star-shaped pattern of streets had been laid out in a sparsely inhabited section of Rome, the construction of an avenue leading to St. Peter's required the demolition of a densely populated area, making such a project prohibitively expensive. As already noted, it was left to a modern dictator to finally carry out the plan.

4. Giovanni Bordino, *De rebus preclare gestis a Sisto V* (Rome: 1588).

5. Domenico Fontana, *Della trasportazione dell'obelisco Vaticano e delle fabriche di Nostro Signore Papa Sisto V* (Rome: 1589). Translation from Sigfried Giedion, *Space, Time and Architecture*, 5th revised edition (Cambridge, Mass.: M.I.T. Press, 1967), p. 93.



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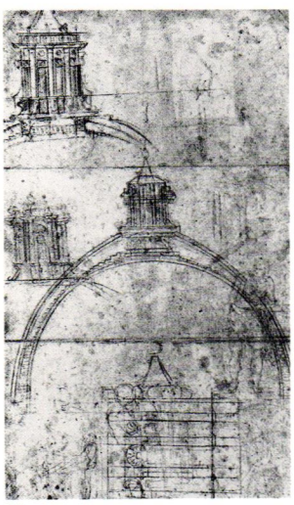
At the time of the moving of the obelisk, the great dome atop the church had yet to be completed. This dominant feature, envisioned by all architects of St. Peter's in the sixteenth century, was completed by Giacomo della Porta in 1590. Although Michelangelo is usually given credit for the design of the present dome, he in fact intended it to have a much lower profile. His hemispherical dome would have conveyed a sense of weight and compression and a far more organic relationship with the rest of the building than the attenuated structure one sees today. At the time of Michelangelo's death in 1564, however, only the raised drum provided a silhouette to the city. Fortunately, many artists living in or visiting Rome sketched the great building enterprise during this period, allowing one to follow its progress step by step, over many decades. In the 1530s, St. Peter's stood without the drum of the dome; instead, one saw only the massive piers and connecting arched vaults of the crossing rising majestically over the crumbling shell of the old church.

All the building activity discussed thus far was the result of the decision in 1506 by Pope Julius II to replace the old basilica with what he confidently felt would be a greater structure. As he explained in an edict issued in 1513, the new church "was to take the place of a building teeming with venerable memories," and that in so doing it "was to embody the greatness of the present and the future."[6] The architect in charge of this important task was Donato Bramante who had only recently arrived in Rome from Milan. Specific details of Bramante's design for St. Peter's remain the topic of considerable debate among scholars today.

6. Ludwig von Pastor, *The History of the Popes from the Close of the Middle Ages*, 3rd English edition, vol. 6 (London: J. Hodges, 1891-1953), p. 464.



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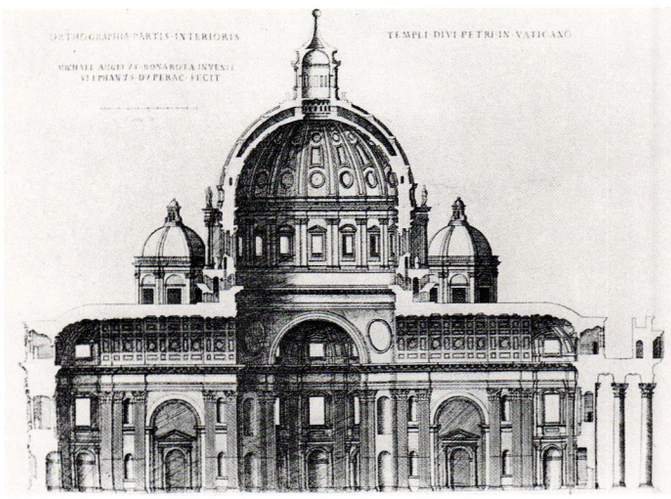

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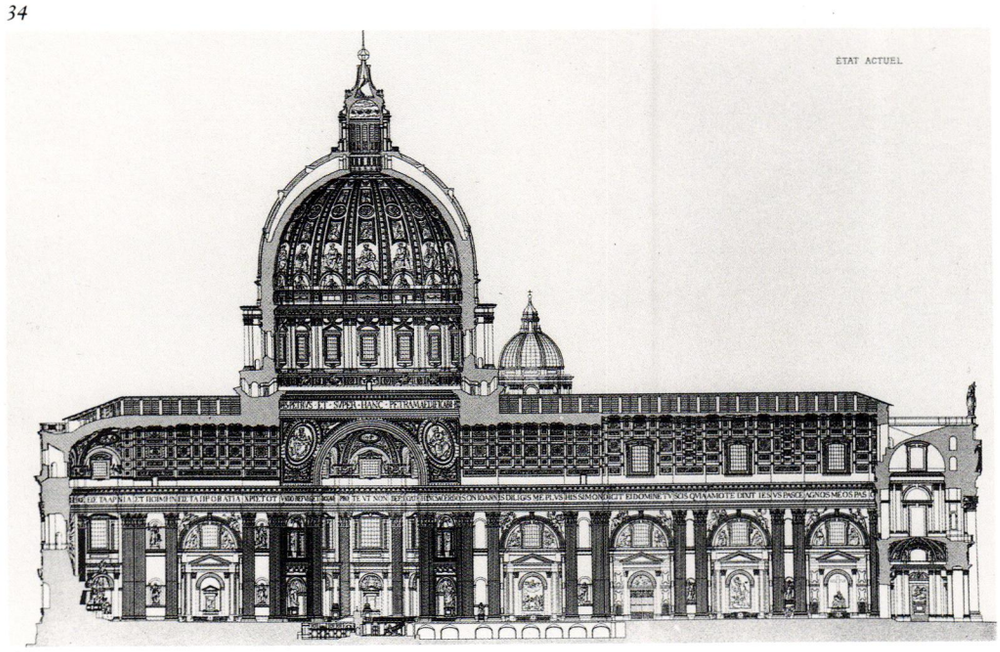
33. Michelangelo, early design for the dome of St. Peter's.

34. Etienne Dupérac, west/east section of Michelangelo's final design for St. Peter's, ca. 1569.

35. Paul Letarouilly, west/east section of St. Peter's basilica as completed after Michelangelo's death, 1882.



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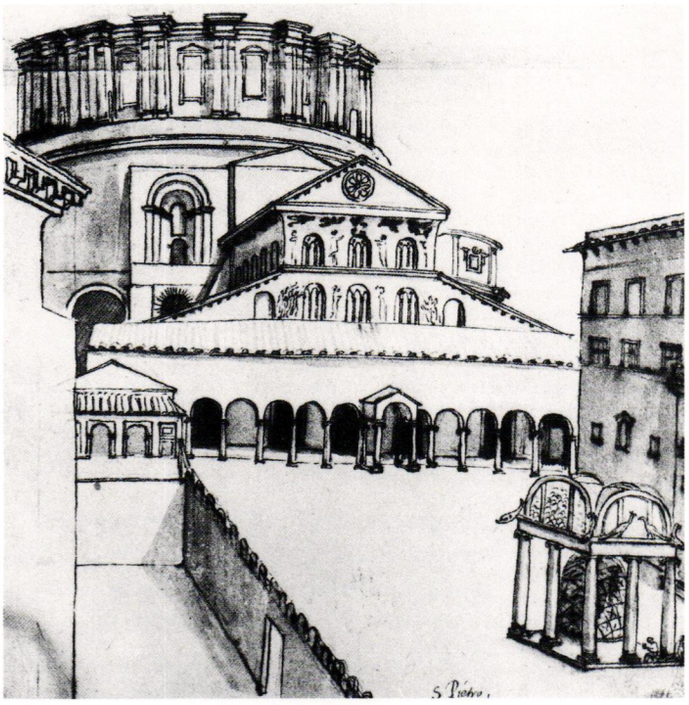

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36. G. A. Dosio, exterior view of St. Peter's, showing the atrium and the remains of the nave of the old church in front of the crossing and drum of the dome of the new Renaissance church, ca. 1565.

37. Martin van Heemskerck, exterior view looking south at the new St. Peter's under construction, ca. 1540. In the center background are the piers and arches of the crossing (below the nearest arch are the remains of the north transept arm of the old church); to the right is the exterior elevation of the choir designed by Bramante but resting on foundations laid by Bernardo Rossellino during the pontificate of Pope Nicholas V; to the left stands the remaining eastern half of the nave of the old church.

38. G. A. Dosio, interior view of the crossing of St. Peter's showing the drum of the dome under construction, ca. 1562.

39. Martin van Heemskerck, interior view of St. Peter's looking west, ca. 1535. In the left and right foreground are the remains of the walls of the nave of the old church; in the center background are the arches and crossing piers of the new church surrounding a small shrine designed by Bramante to protect the high altar and tomb during construction.



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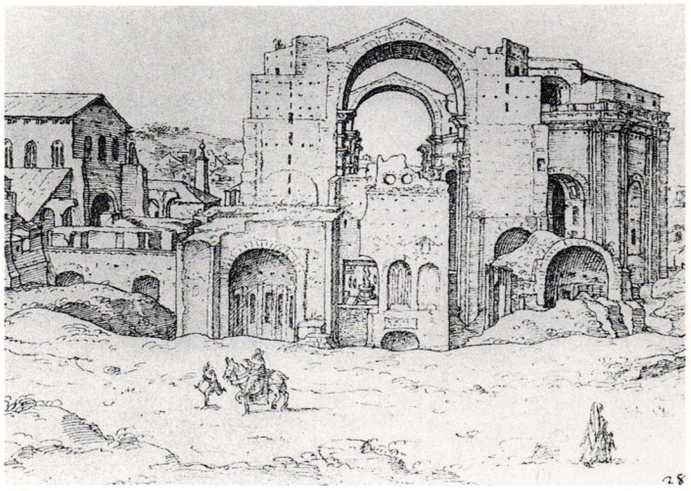

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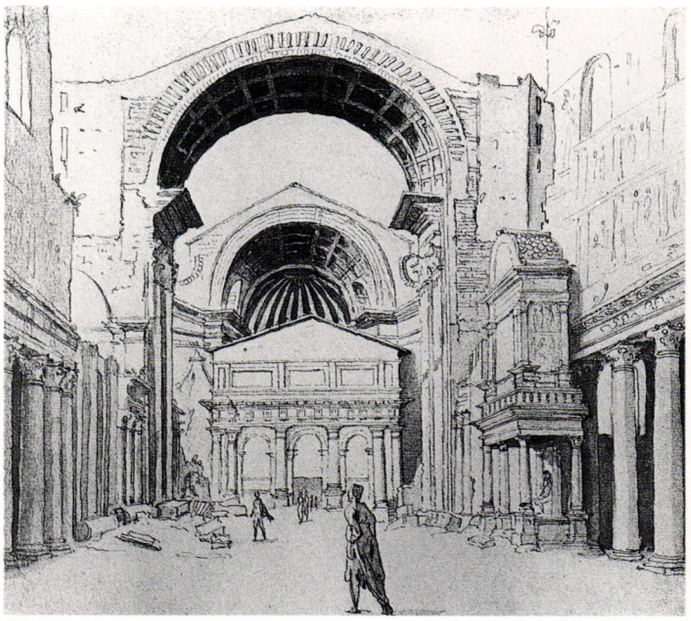

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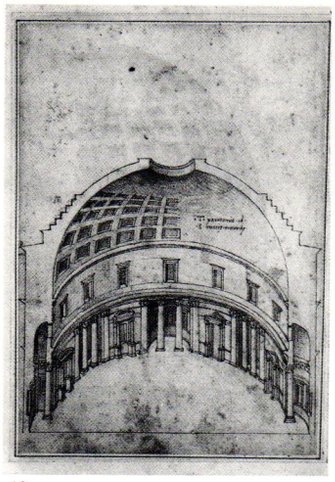

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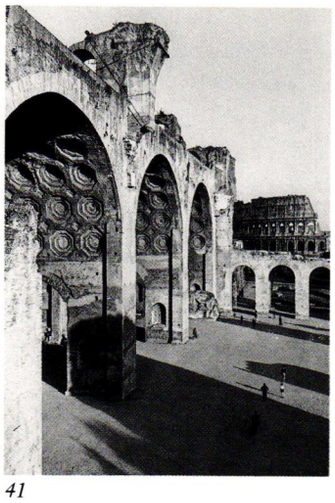

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40. Anonymous artist in the circle of Bramante, section of the Pantheon, Rome, early sixteenth century.

41. Basilica of Maxentius, Rome, built in the early fourth century A.D.

42. Commemorative medal of Bramante's design for the new St. Peter's, 1506.

43a,b. Serlio, elevation and plan of Bramante's design for the dome of the new St. Peter's, ca. 1540.

All agree, however, that a great dome was envisioned as the predominant feature of the new church from the beginning. Such a dome is represented in a famous medal, minted for the ground breaking ceremony of April 18th, 1506, and is one of the few official records of Bramante's intentions. Tradition has it that Bramante wished in this design to place the dome of the Pantheon over the vaults of the Basilica of Maxentius, believed in the sixteenth century to be the *Templum Pacis* or "Temple of Peace" in the ancient Roman Forum. Clearly the new St. Peter's was meant to rival, if not to surpass, the greatest monuments of ancient Rome both in scale and technological daring. In 1570, for example, the architect Palladio wrote, "Bramante was the first to bring back to the light of day the good and beautiful architecture that had been hidden since the time of the ancients." The boldness and beauty of Bramante's basic concept served as an inspiration for all subsequent architects of St. Peter's.

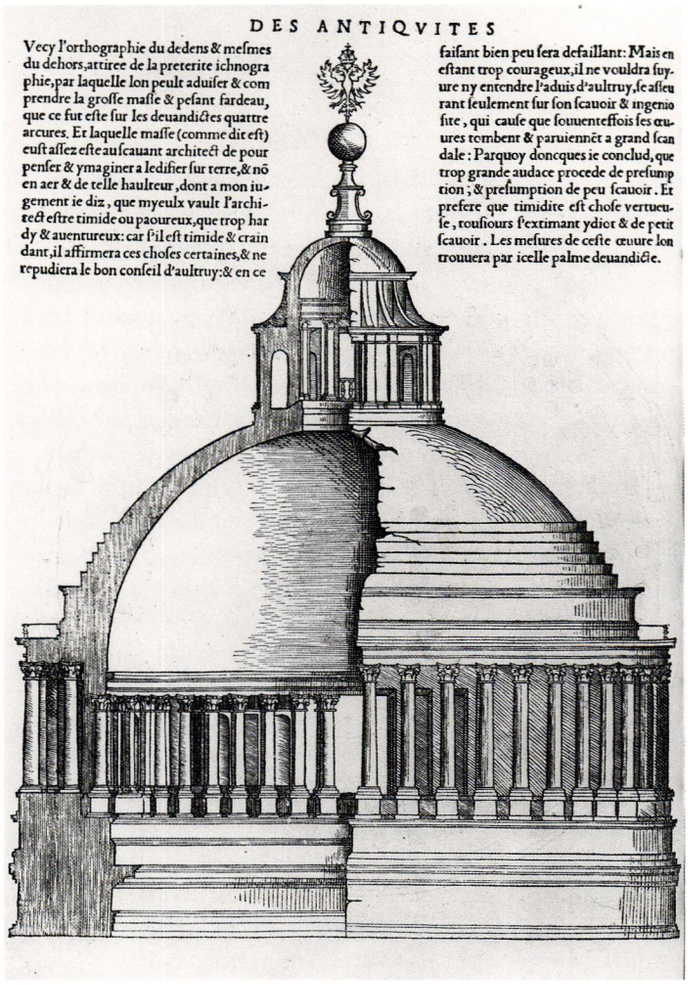
And yet the decision to demolish Old St. Peter's was one of the most audacious, and some would say outrageous, acts in the history of architecture. In fact, the decision to destroy the old church was criticized at the time. Even the famous sixteenth-century artist and historian Giorgio Vasari, who praised Bramante's "wonderful skill," did not hesitate to point out that the same architect "was so anxious for the work to progress that he destroyed in [old] St. Peter's many fine tombs of popes, paintings and mosaics, thus obliterating the memory of many portraits of great men scattered about the principal church of Christendom."[7] For this reason, contemporaries gave Bramante the nickname

Bramante ruinante or "Bramante the destroyer." It should be recognized, however, that Old St. Peter's was in a bad state of repair. Pope Julius II referred to it as "the dilapidated church," and contemporary accounts reveal that the south wall of the ancient nave was so out of plumb that a thick layer of dust had collected rendering the once vivid mural decoration virtually illegible. Already in the middle of the fifteenth century, Alberti reported to Pope Nicholas V that "I am convinced that very soon some slight shock or movement will cause it [the south wall of the nave] to fall. The rafters of the roof have dragged the north wall inwards to a corresponding degree."[8] In response Nicholas V initiated an extensive remodeling of the old church involving the strengthening of the outer walls, the construction of a monumental choir behind the venerated tomb, and the insertion of vaulting in the outer aisles and transept in what was considered to be a more modern style. He also saw the rebuilding of St. Peter's as part of a coordinated effort to restore papal authority, for, as he explained to his cardinals, "when vulgar belief founded on doctrines of learned men is continually confirmed and daily corroborated by great buildings, which are perpetual monuments and eternal testimonies seemingly made by God, it is forever conveyed to those, both present and future, who behold these admirable constructions."[9] Still, the core of St. Peter's and its basic design were to be left largely intact so that the Nicholine scheme for remodeling the basilica could be likened to a reliquary on a monumental scale. For various reasons, the project of Nicholas V was never completed in its entirety – only the foundations of the choir and transept were built in the Pope's lifetime. But its very nature serves to underscore the fact that before the reign of Pope Julius II, not only was the Apostle's tomb considered sacrosanct, but the entire building itself was seen as a holy relic of the founding of the Christian Church in Rome.

7. Giorgio Vasari, *The Lives of the Most Eminent Painters, Sculptors, and Architects*, translated by A. B. Hinds, vol. 2 (New York: E. P. Dutton, 1927), p. 189.

8. von Pastor, *The History of the Popes*, vol. 6, p. 179.

9. Carroll W. Westfall, *In This Most Perfect Paradise: Alberti, Nicholas V, and the Invention of Conscious Urban Planning in Rome, 1447-55* (University Park and London: Pennsylvania State University Press, 1974), p. 33.



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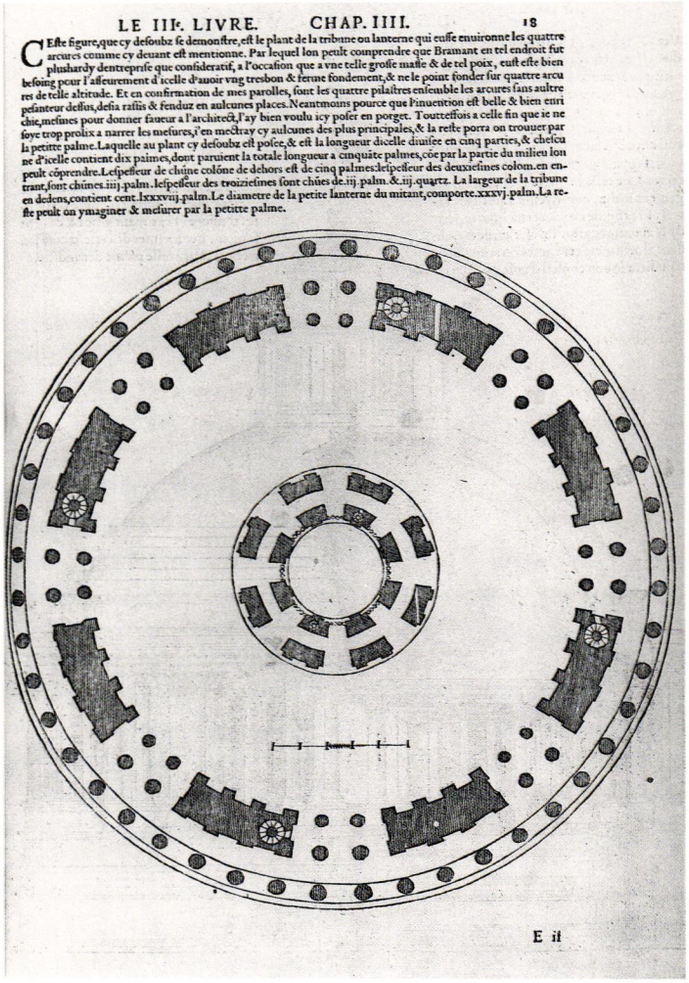

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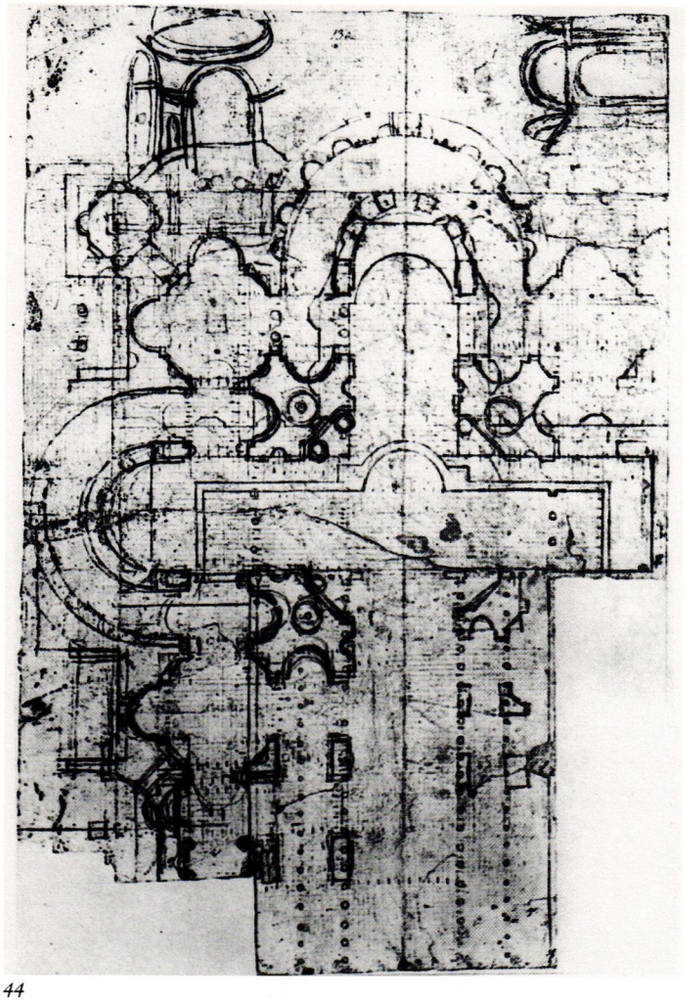

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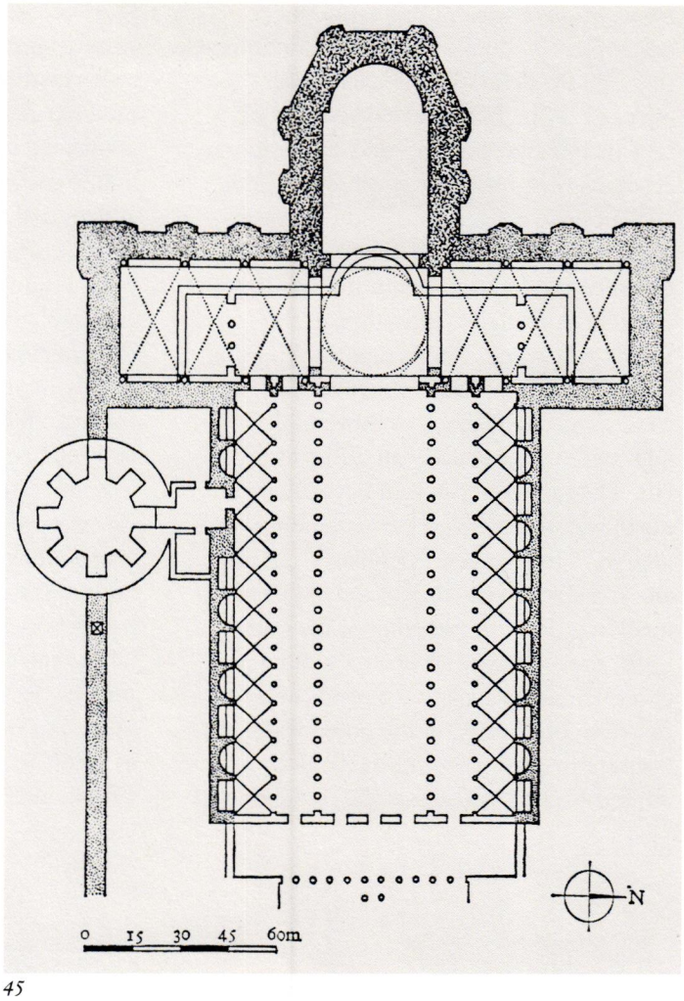

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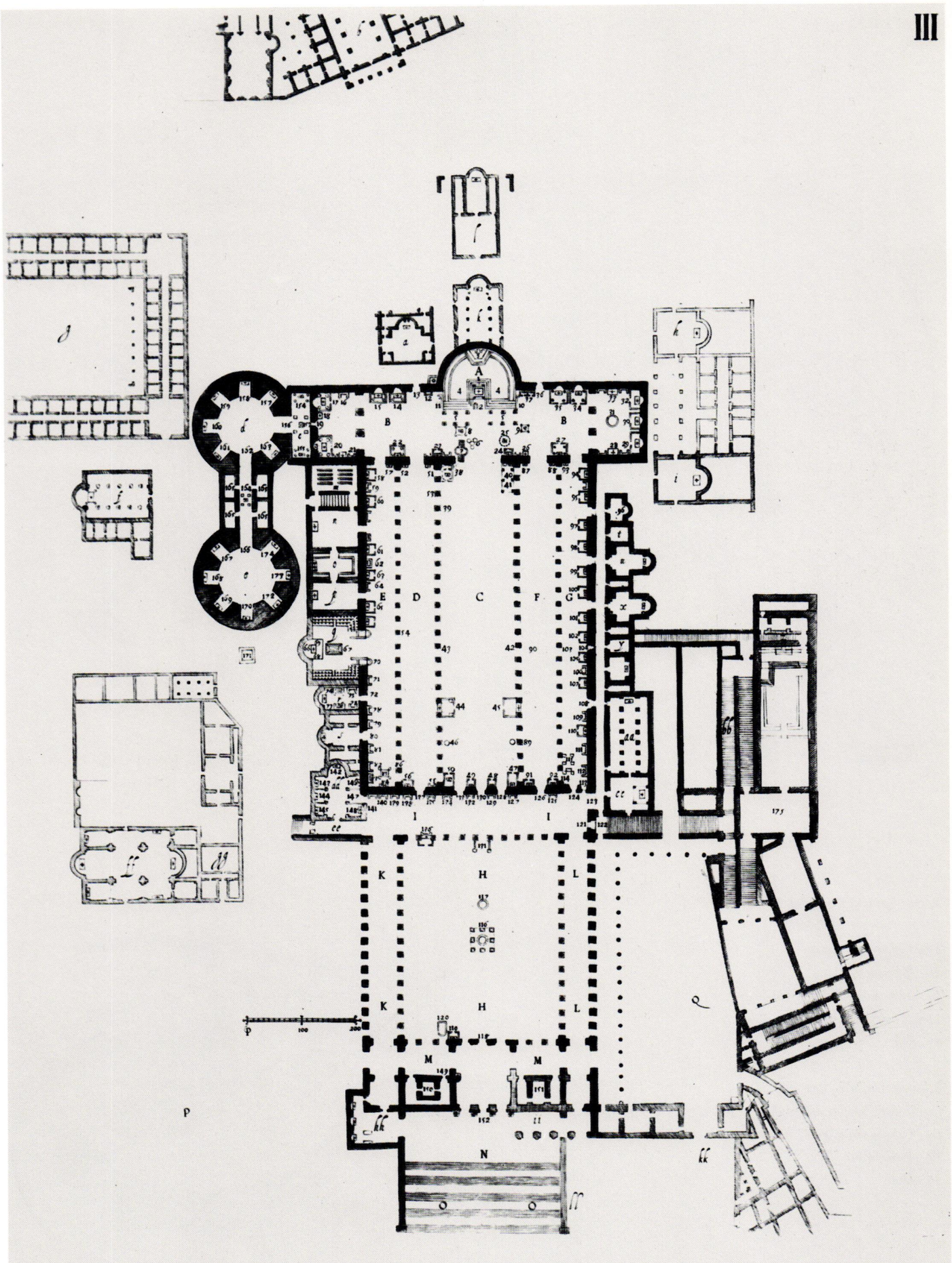
44. Bramante, plan of the Early Christian church overlaid with his design for the new church, 1505/6.

45. Reconstructed plan for the remodeling of St. Peter's by Nicholas V and his architect Bernardo Rossellino. Leon Battista Alberti may have served as an advisor.

46. G. Battista Costaguti, plan of Old St. Peter's after Tiberio Alfarano, 1684.

Before 1506, the basilica of St. Peter had stood virtually unaltered for almost 1200 years. Bramante realized that he would have to build around the old church and the high altar in order to permit continued liturgical use. As one might expect, he began by making a survey drawing of the construction site. Bramante's drawing not only records his burgeoning ideas for the new church – note especially the position of the four crossing piers – but it provides an extremely accurate plan of its Early Christian predecessor. Indeed, this is one of the earliest preserved architectural drawings to use a uniform, measured grid. In this case the grid is composed of squares, drawn free-hand, that represent 5 *palmi* each, where one *palmo* equals 22 cm, or approximately the width of a man's hand. With this information, the design of the earlier church can be reconstructed with considerable precision; the drawing reveals a relatively simple barn-like arrangement of a central nave, flanked by double aisles and terminated by a transverse hall or transept with a central apse.

Plan and elevation drawings of the Early Christian church made in the sixteenth and early seventeenth century, before it was totally destroyed (the last remains of the nave were not finally torn down until 1605-12), show that in the course of the Middle Ages and the Renaissance the interior space had become cluttered with subsidiary altars, individual tombs of the popes and other officials of the Church, and with the shrines of numerous saints. Even the outer aisle walls were pierced by numerous funerary chapels, attached to the church like barnacles to a great ship's hull. All of these embellishments had been added over centuries by individuals wishing to glorify Peter and to obtain his blessing by the proximity of their burial place, or their offering, to his tomb. During the Middle Ages, the tomb of the Prince of the Apostles had become the most important goal of pilgrimage in Western Christendom; the faithful, from kings to paupers, flocked from the farthest reaches of Europe to pray at this holy shrine.



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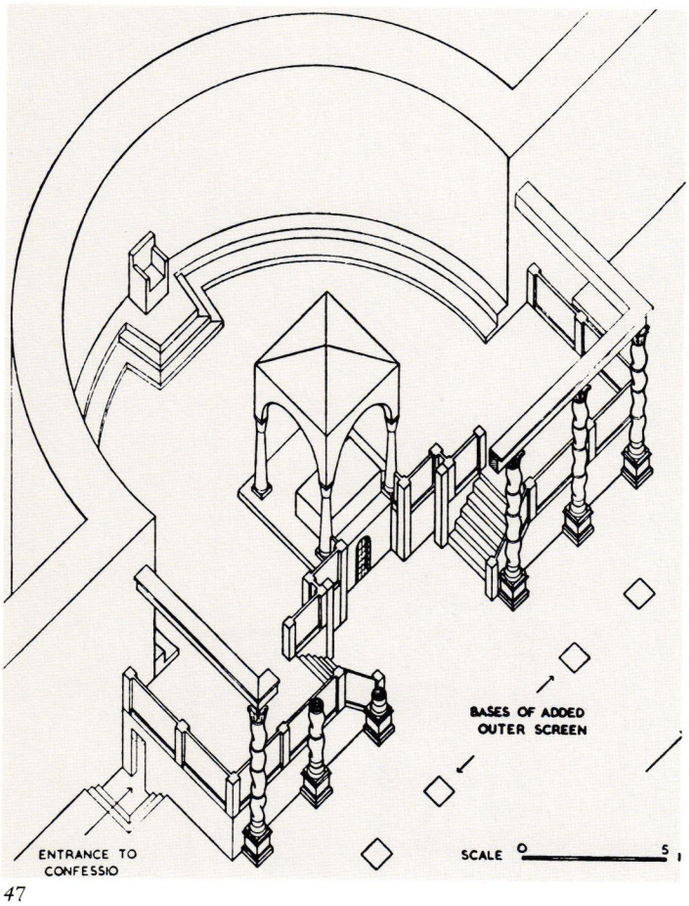

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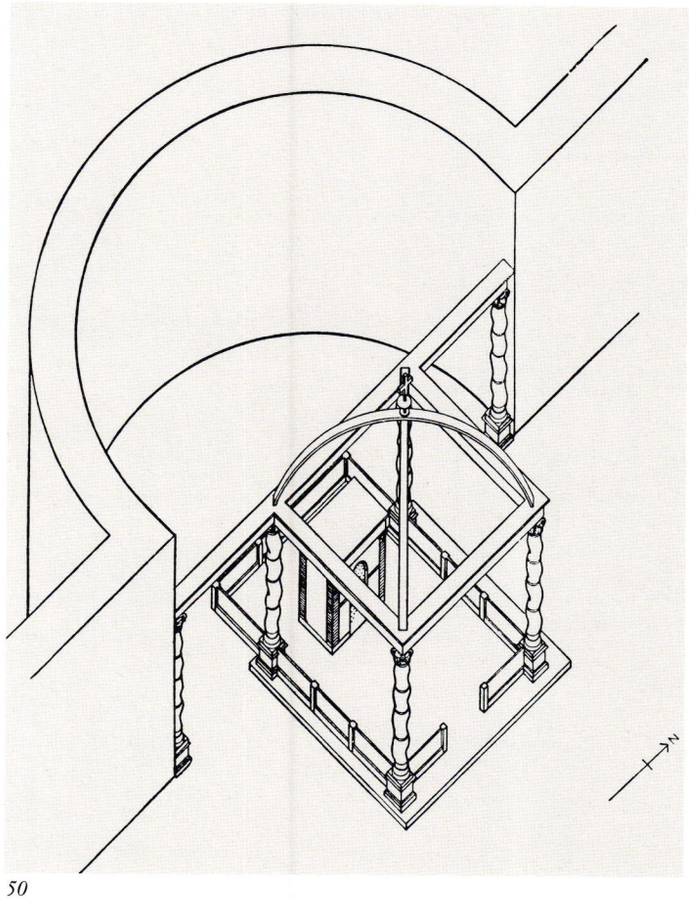

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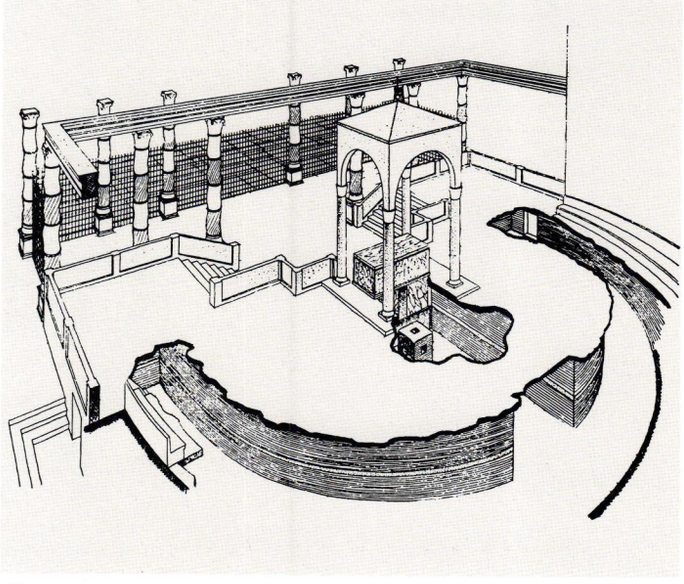
Reconstruction of the apse of
Old St. Peter's as modified by
Pope Gregory the Great.
47. Axonometric
48. Axonometric revealing the lower
level annular crypt
49. Plan

Reconstruction of the apse of
Old St. Peter's before the reign of
Pope Gregory the Great.
50. Axonometric
51. Plan



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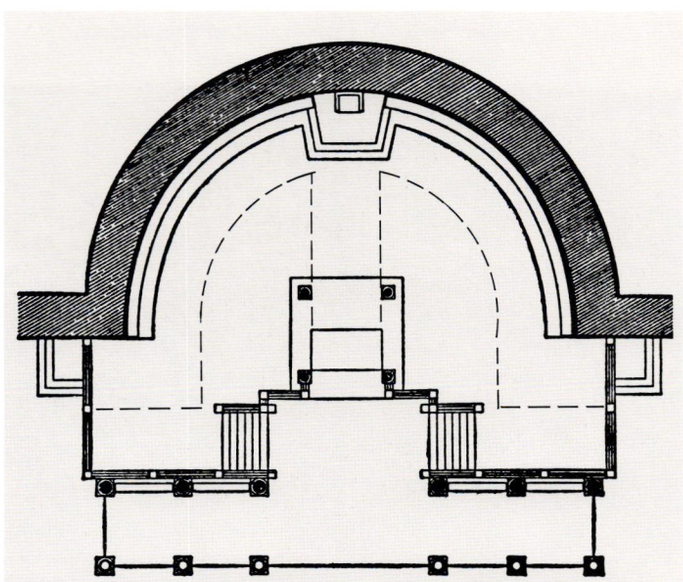
Upon reaching their goal, these pilgrims found the main altar covered by a baldacchino which stood in front of the apse on a platform that was raised some two meters above the floor of the church. As the priest or bishop performed mass at the high altar, the congregation was able to catch a glimpse of the tomb through a small window (called a *fenestella*) directly below the altar. Thus the liturgy and tomb were not only physically linked but visually unified.

This formal union of altar and relic may be credited to one of the most important popes of the Middle Ages, Gregory the Great, who reigned from 590 to 604. A contemporary account in the *Liber Pontificalis* ("Book of the Popes") states simply that "Pope Gregory arranged so that mass could be celebrated above the body of the blessed Peter."[10] And in doing so, the arrangement at St. Peter's emulated the vision of St. John as described in the book of Revelation 6.9: "I saw underneath the altar the souls of those who had been slaughtered for God's word and for the testimony they bore." Gregory the Great, as a man of his time, was a fervent believer in the cult of relics, and in a letter dated 594, he described the body of Saint Peter as "glittering with great miracles." He was acutely aware of the need for the growing number of pilgrims to be able to come in direct contact with the tomb itself. He therefore saw to it that a simple but efficient arrangement was devised so that the visitor could pass through one of two small doors to either side of the altar platform that led to a curved subterranean passageway or crypt; at the apex of the semi-circular crypt there was a straight corridor that led directly to the tomb. This annular or ring crypt, as it is called, was not part of the original Early Christian church; before the reign of Gregory the Great, anyone wishing to visit the tomb of Peter confronted a "traffic flow" problem. Before about 590, approaching the tomb had been an extremely awkward affair, as made clear by the Frankish chronicler, Gregory of Tours:

[St. Peter's] sepulchre . . . is very rarely entered. However, if one wishes to pray, the gates by which the spot is enclosed are opened, and he enters above the tomb: then he opens a little window there and puts his head inside and makes his requests according to his needs. . . . If he desires to carry away with him some blessed souvenir, he throws inside a small handkerchief [the Latin word is brandeum*] which has been carefully weighted and then, watching and fasting, he prays most fervently that the apostle may give a favorable answer to his devotions. Wonderful to say, if the man's faith prevails, the handkerchief when drawn up from the tomb is so filled with divine virtue that it weighs much more than it did before; and then he who pulled it up knows that he has obtained the favor he sought.*[11]

10. *Liber Pontificalis*, edited by L. Duchesne, vol. 1 (Paris: E. Thorin, 1886-1892), p. 312.

11. *Liber in gloria martyrum* 1.28, (Migne, *Patrologia Latina*, vol. 71, col. 728ff). The English translation comes from Peter Llewellyn, *Rome in the Dark Ages* (New York: Praeger, 1971), p. 175.



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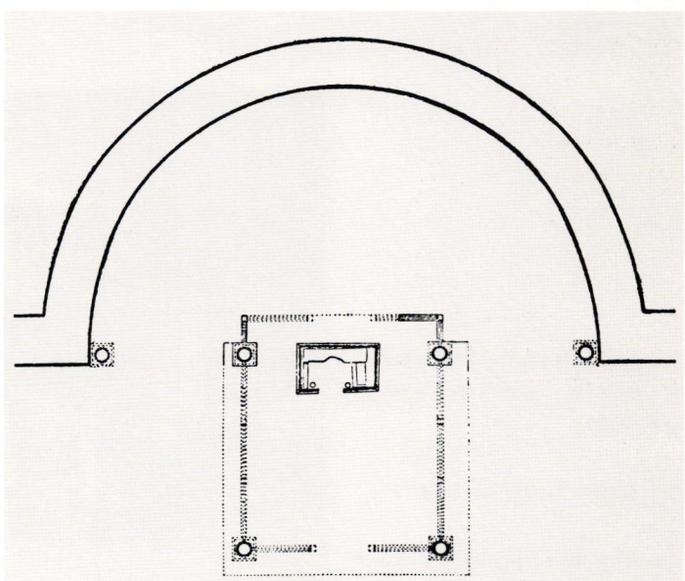

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52

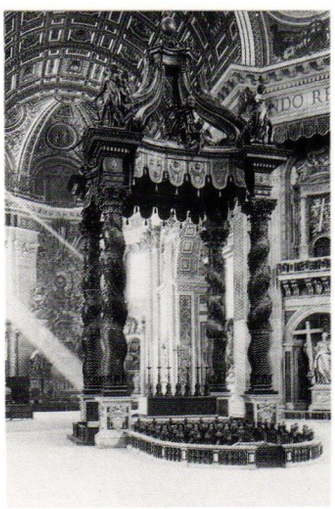
Medieval pilgrims, like tourists today, often wished to take home a memento of their travels. An ivory box, now in the Archaeological Museum in Venice, was carved around the year 400 to serve such a purpose; it was designed to contain a contact relic or piece of cloth similar to the *brandeum* mentioned by Gregory of Tours. Moreover, the box bears the image of the shrine of St. Peter before the intervention of Pope Gregory the Great; here the marker surmounting the tomb of Peter is at floor level. On the ivory relief, paired male and female figures are shown praying in the typical Early Christian manner, standing with arms outstretched and their hands open to the heavens. In the center, two smaller figures are shown before the tomb monument looking as if they are trying to open that "little window" and "stick their heads inside" in the manner described by Gregory of Tours.

Framing these figures are represented six elegant twisted columns supporting an architrave and an open canopy. Around 600, Gregory the Great set the columns in a single row in front of the crypt and altar platform, and in the early eighth century, a second row of six more spiral columns was added. These columns should appear familiar, because they served as the models for Bernini's magnificent bronze baldacchino of the seventeenth century. This relationship was not coincidental as shown by the fact that Bernini set eight of the twelve marble columns in the upper stories of the great crossing piers of the present church, while a ninth was placed in the chapel of Michelangelo's *Pietà*. Much like Sixtus V's treatment of the obelisk,

52. Spiral column from the shrine of Old St. Peter's now in the Chapel of the Pietà.

53. Bernini, baldacchino, 1624-33.

54. Ivory casket from Pola showing the shrine of Old St. Peter's , ca. 400.



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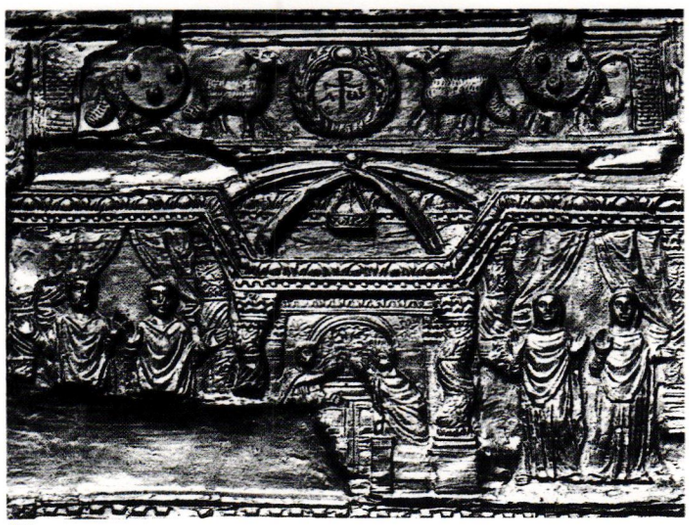

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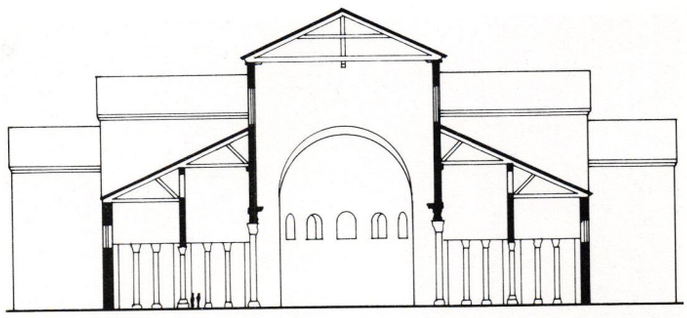
Bernini and his patron Pope Urban VIII (1623-44) consciously re-used these remnants of the earlier shrine to proclaim the ancient origins of the church of St. Peter and to promote their concept of the Counter-Reformation. The decision to re-use these Early Christian columns was also based in part upon a learned treatise on the ancient shrine which had been submitted to Urban VIII shortly before Bernini began his project. According to popular legend, the spiral columns were not only associated with the tomb of Peter, but they were believed to have come originally from the Temple of Solomon in Jerusalem.[12] Thus in the crossing of St. Peter's, as decorated in the Baroque age, the present was made to merge with the past, reverberating with references to both the Biblical and historical origins of the Roman Church.

The *Liber Pontificalis*, however, states that it was the Emperor Constantine (312-37) who "enclosed the tomb [of Peter] on all sides . . . with spiral columns brought from Greece." It was also under Constantine that the entire church was built around the year 320. To envision the Constantinian building when it was first complete one must imagine the church without the medieval additions. The unencumbered space was on a colossal scale. The nave was 300 feet long, the transept 225 feet long and the central apse some 60 feet wide. Renaissance views of the remains of the Constantinian church and the present church under construction reveal that the height of the old nave walls corresponded roughly to the cornice line of the present church, making the total height of Old St. Peter's some



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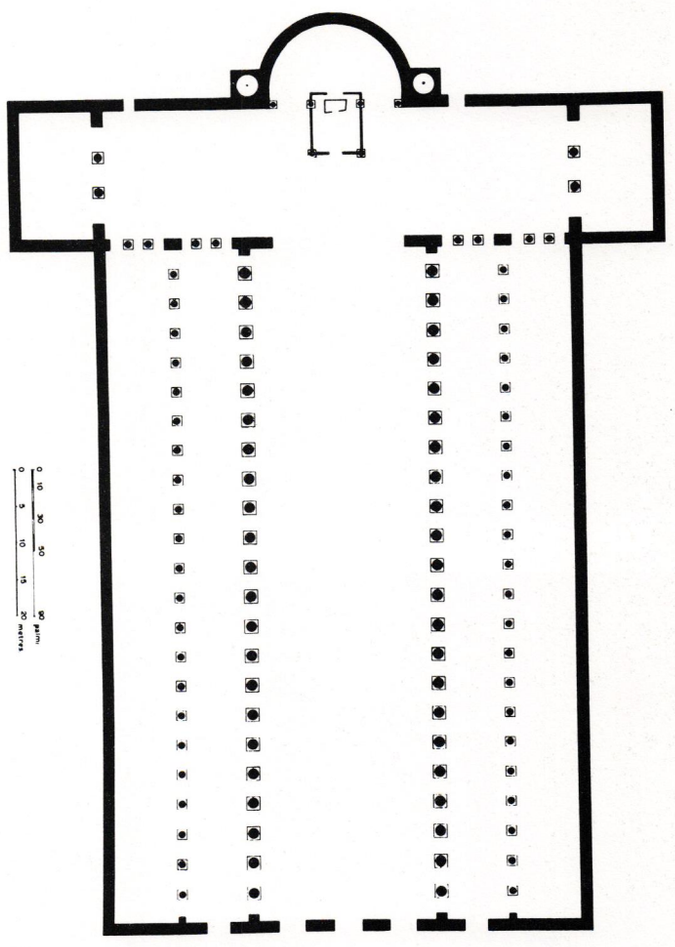

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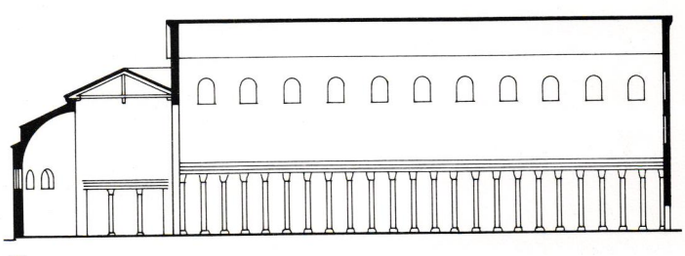
Reconstruction of Old St. Peter's ca. 400.
55. South/north section.
56. Plan.
57. West/east section.



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12. For these and other issues concerning Bernini's design for the baldacchino and the crossing of St. Peter's, see Irving Lavin, *Bernini and the Crossing of Saint Peter's* (New York: New York University Press, 1968).



58



59

Reconstruction of Old St. Peter's
ca. 400.
58. Interior view of transept looking north.
59. Interior view of nave looking west.

105 feet. In other words, the building of St. Peter's was a grandiose enterprise worthy of Constantine's imperial patronage.

There seems to have been no figural decoration in the Constantinian basilica as originally built, yet the interior was aglow with color from marble revetment and a gold mosaic in the apse. The often bland reconstructions of the interior of the Early Christian church are very misleading; a fresco representing the basilica of St. John Lateran before it was remodeled in the mid-seventeenth century gives a truer sense of the visual impression of the fourth-century interior. In this fresco, one sees that the nave colonnade was far from uniform; columns were of various sizes and colors, and the capitals were of various orders (Corinthian, Ionic, and Composite). The reasons for this amazing jumble are not fully known. Certainly, it represents a love of color and variety for their own sake. And the re-use of older material – for none of these elements was made to order for the Lateran or St. Peter's – presumably helped to speed the completion of the churches. But there also seems to have been a reverence for, and an admiration of, artifacts from the past. This attitude is reminiscent of the use of *spolia* on the Arch of Constantine dedicated in 315 where reliefs of the second-century emperors Trajan, Hadrian, and Marcus Aurelius are juxtaposed to the narrative frieze of Constantine's own day. It seems that reminders of the Golden Age of Rome were reassembled in the church and on the triumphal arch to announce the new age of Constantine.

Only an Emperor could have carried out such a lavish enterprise as the construction of St. Peter's. Before this time, Christians had no public architecture of their own. Early Christian writers of the second and third centuries were proud to proclaim that "we have no temples, we have no altars." In the great cities of the Empire, such as Rome, Christians met in apartment buildings with shops on the ground floor and private rooms above where worshippers gathered for prayer and the celebration of the Eucharist. Baptism took place wherever there was water and deceased members were laid to rest in the underground cemeteries of the catacombs situated on the outskirts of the city. Tenement

buildings and private houses served as the meeting places of the Early Christians. Without exception, these buildings remained inconspicuous from the outside and represented only the simplest adaptations of utilitarian structures for a Christian purpose.

All this changed dramatically with the conversion of Constantine to Christianity following his conquest of Rome in 312, for not only did Christianity become an officially recognized religion, free from the persecutions of the past, but it now had the Emperor as an enthusiastic building patron. His first building enterprise involved the construction of Rome's cathedral, the church now known as St. John Lateran. The completion of the Lateran basilica was quickly followed by the building of St. Peter's. And while the Lateran served as the administrative center of the Christian community in Rome and the residence

60. F. Gagliardi, reconstruction of the nave of the Lateran Basilica (erroneously arcaded), ca. 1650.



60

of the pope until the middle of the fifteenth century, St. Peter's was built to glorify the burial place of Rome's first bishop and Prince of the Apostles.

The Lateran basilica was built on the site of an urban villa owned by the Laterani family some two centuries before the reign of Constantine, which meant that it lay within a posh residential district along Rome's eastern periphery, just inside the city walls. St. Peter's, on the other hand, stood far to the west, outside the city and on the other side of the Tiber River, because of the purported location of Peter's tomb, which had been a focus of Christian veneration long before Constantine's building project began. In this way, the Lateran and St. Peter's marked the spiritual poles of Early Christian Rome.

It had always been assumed and by many fervently believed that the site of Constantine's church was determined by the location of Peter's tomb and yet the specific nature of this relationship was unknown until quite recently. In 1940, a portion of the so-called grottoes below the present church was being remodeled. An eyewitness describes the moment of discovery:

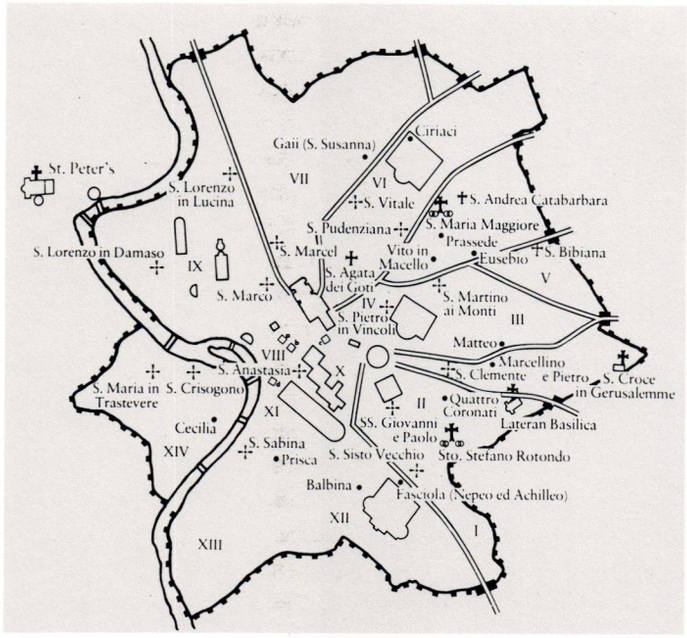
We were busy trying to provide more space for the narrow crypt of St. Peter's. I was watching the workmen who, with this purpose in mind, were breaking through a wall, behind which there appeared to be possibilities of extension. In the process a broad wall was revealed that clearly had once been higher but now ended just under the floor level of the grottoes. On closer inspections its ancient masonry was clearly recognizable. The abnormal thickness of more than two meters showed that it was part of a monumental building.[13]

According to this account, the upper portion of an ancient brick building was found *below* the floor level of the grottoes. Fortunately, archaeological excavations of the immediate area were carried out between 1940 and 1950, although work progressed very slowly during World War II. Nevertheless, the remains of an ancient Roman cemetery were unearthed with many different types of tombs ranging from elaborately decorated mausolea to unmarked graves.

In one area, investigators found the remains of a wall built with bricks bearing stamps of ca. 160 A.D. (because brick making was a state-controlled industry in the Roman Empire, bricks were commonly dated). At some later time, a crude shallow niche was hacked out of the brick wall. Framing this niche were found traces of a small shrine, consisting of two colonnettes carrying a small pediment. Scratched into the plaster that coated an adjoining wall were found the words in Latin and Greek of many Christian prayers, and one inscription in Greek which read simply: *PETR[o]S ENI* or "Peter is here."

Although various human remains were found in association with the shrine, it is not possible to demonstrate conclusively that they relate to Peter; there are, after all, limits to archaeology. Here it is more important to recognize the fact that by the year 200, at the very latest, the Christians of Rome believed this spot to be the tomb of Peter. At around that time, a Roman priest named Gaius wrote, "I can show you the trophies (*tropaia*) of the Apostles [St. Peter and St. Paul] . . . ; if you go to the Vatican or the Ostian Way [the site of the tomb of

13. Engelbert Kirschbaum, S.J., *The Tombs of St. Peter and St. Paul*, translated by John Murray, S.J. (New York: St. Martin's Press, 1959), pp. 19-20.



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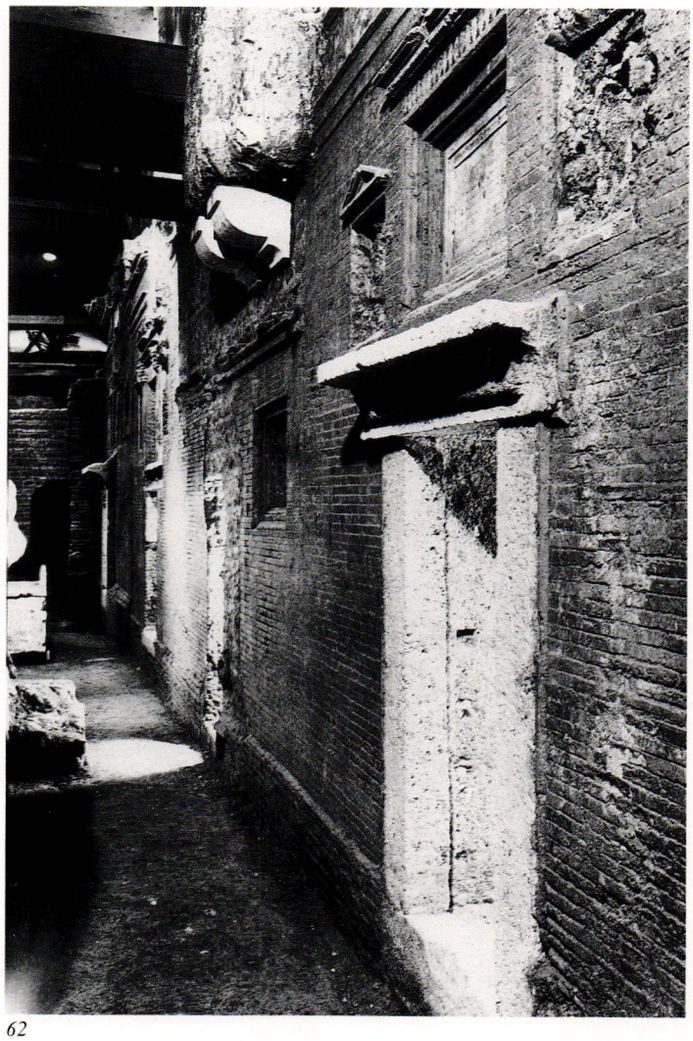

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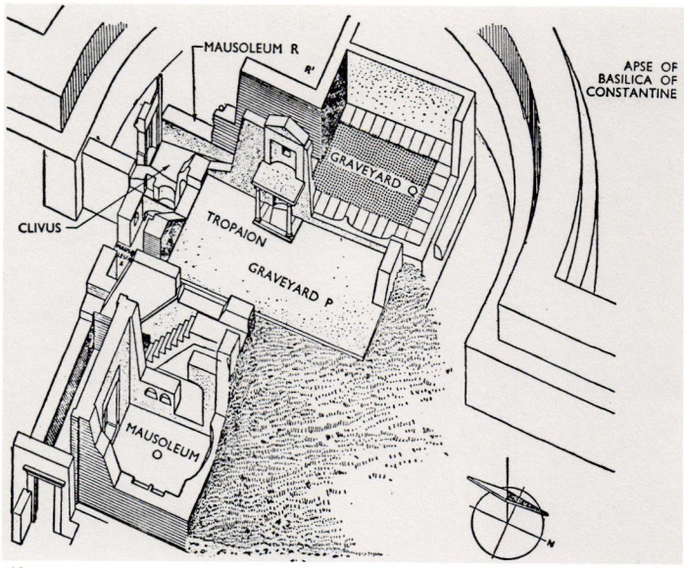

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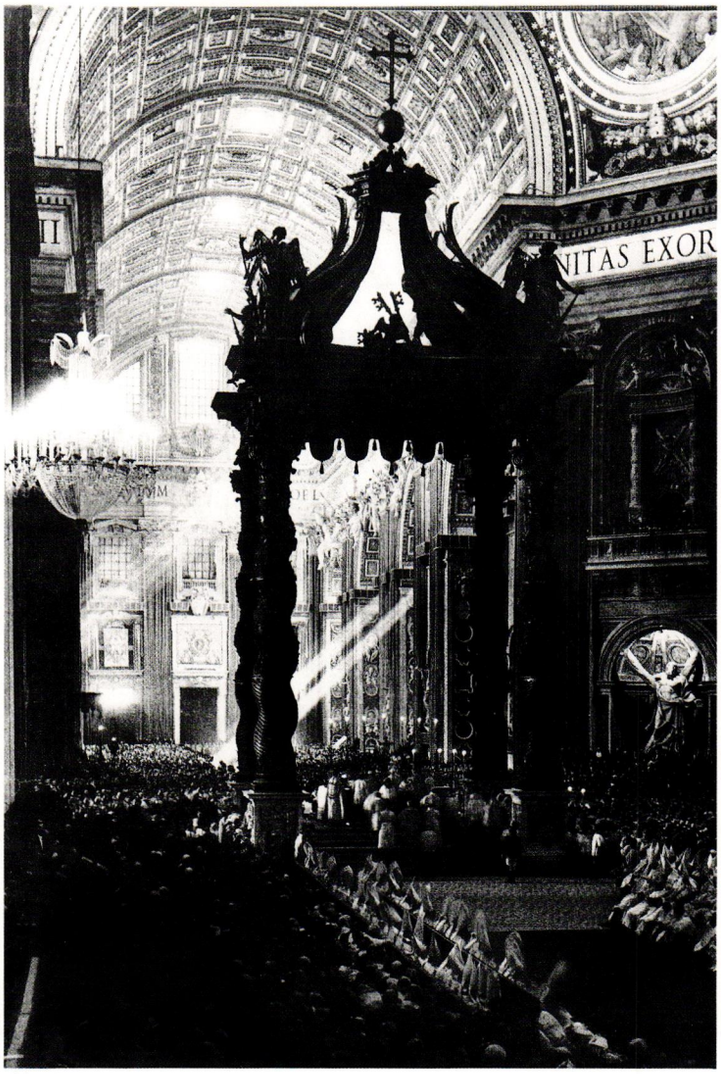
61. Map of Rome, showing location of the Lateran basilica and St. Peter's ca. 500.

62. View of the excavated cemetery below St. Peter's.

63. Reconstruction of the early Christian tomb marker of St. Peter and adjoining mausolea in relation to the foundation of the Constantinian church ca. 200.



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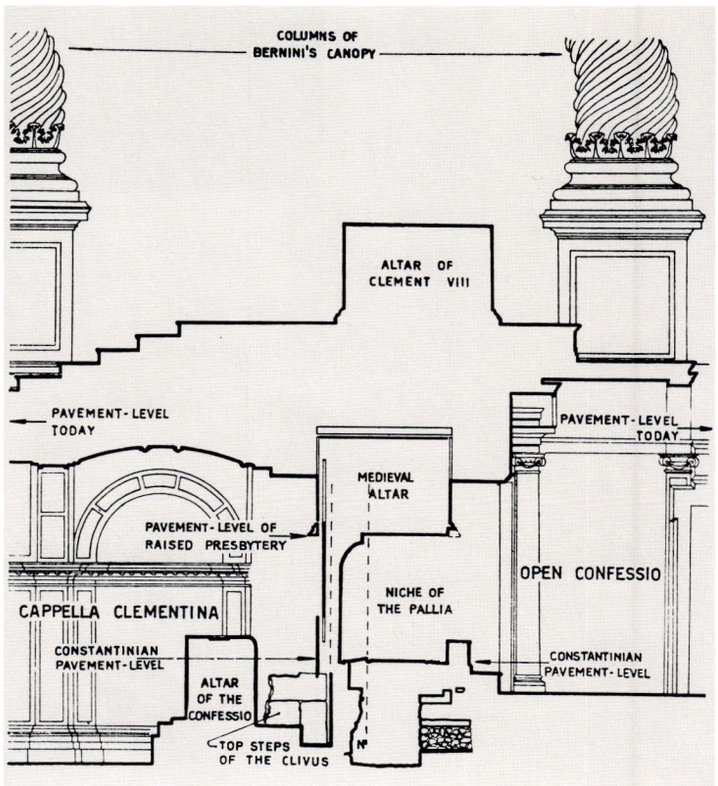
64. The high altar, baldacchino and crossing of the new St. Peter's.



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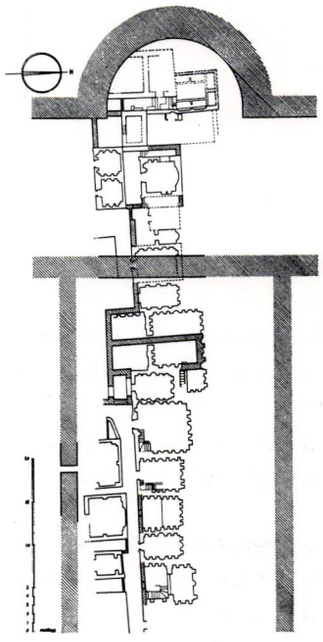
65. Section through the high altars of St. Peter's showing the relationship of the present altar to earlier altars and the ancient cemetery.

St. Paul], there you will find the trophies of those who founded this Church."[14] The modesty of the tomb shrine or trophy, as opposed to the elaborate basilica built by Constantine, reflects the dramatic change in the status of the Christian community in Rome that took place between the third and fourth centuries, when a modest religious cult was transformed into a major social and political force.

It was this modest shrine that formed the focus of the entire Constantinian complex. The tomb was framed by the apse, and the curve of the apse was derived from the radius of a circle with the shrine at its center. The plan of the church, in fact, seems to have been laid out using a module of 30 Roman feet, which is the length of the radius of the circle about the tomb; so that the dimensions of the entire church may be said to revolve literally about the tomb. It is not surprising, therefore, that the Early Christian shrine was found to lie directly below the High Altar of the present basilica of St. Peter. The one element that never changed over the entire history of the site was the position of the tomb. From the late second century onwards, memorials or altars were fitted over the tomb, one after the other. This aspect of the site illustrates more clearly than any other the relationship between the horizontal layering of centuries of building and the vertical thread of history.

The purported grave of Peter was only one of countless burials in a vast cemetery. The Apostle's tomb was originally one of the least conspicuous, wedged in between an array of elaborate mausolea, many with richly decorated interiors of painted stucco walls and rows of niches to receive the ash urns of various members of a single family. These tombs have been well preserved because Constantine dared to break the law; he confiscated this cemetery and had the tombs filled in to create a platform for his church. Such desecration of the dead was illegal, even for the emperor, but Constantine was apparently undaunted. The cemetery was situated on the southeastern slope of the Vatican Hill and so the foundations of the north side of the church were embedded in the hillside while the foundations of the south side were some 25 feet above ground. Part of the cemetery and most of Peter's tomb were thus obliterated from view; only the upper half of the modest tomb marker was allowed to protrude above the floor of the basilica at the chord of the apse. The fact that it was far from an ideal site for construction emphasizes once again the primary importance of the tomb of Peter.

14. Eusebius, *Ecclesiastical History*, vol. 2, pp. 25-27.



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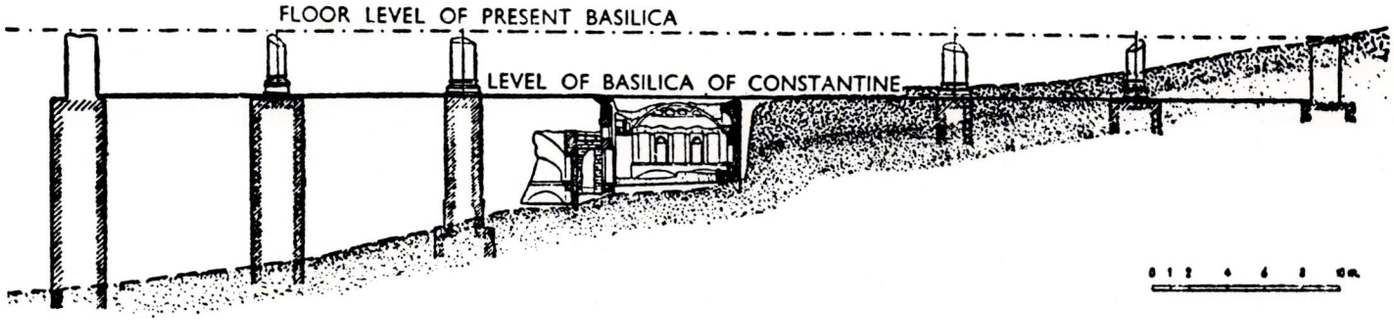
66. Plan of the excavations of the ancient Roman cemetery at the Vatican in relation to the foundation walls of the Constantinian church.

67. South/north section of the floor of St. Peter's in relationship to the ancient cemetery and slope of the Vatican Hill.



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68

According to ancient Roman law, all burials were required to be outside the city limits and so vast cemeteries ringed the outskirts of most major cities of the Empire. Rome was no exception. Tombs and mausolea lined the major arteries of the city, such as the Via Nomentana to the east, the Via Flaminia to the north, the Via Cornelia to the west in the area of St. Peter's, and the Via Appia to the south. In antiquity, a cemetery was referred to as a *necropolis*, Greek for "city of the dead." The narrow alleyways among the crowded tombs and the many mausolea with pedimental facades in clear imitation of ancient Roman houses must have provided the impression of a miniature city. As one entered and left the city of Rome, or any major city of the Roman world, reminders of human mortality were clearly apparent as the "City of the Dead" embraced the "City of the Living."

The earliest coins and inscriptions found in association with the cemetery below St. Peter's date to the middle of the first century A.D. Before that time, the major use of the area had not been for burial but for sporting events. A large elliptical stadium or circus stood just to the south of the Via Cornelia. In design, it must have been similar to the Circus Maximus. Only portions of the Vatican circus have been excavated so that the exact dimensions of the structure are not known. However in the late 1940s, in connection with the completion of the Via della Conciliazione, the main end wall (the so-called *carceri* or prisons, where animals and prisoners were kept) was discovered just outside the perimeter of the piazza of St. Peter's. According to Pliny the Elder, the Vatican circus was begun by the emperor Caligula (37-41 A.D.), but it seems to have received its monumental form under Nero (54-68 A.D.), who, according to the Roman historian Tacitus, "enclosed a track in the Vatican valley in which he could drive horses at a show away from public view."[15] It was here that Christians were executed after the great fire of 64 A.D. that ravaged much of Rome. Tacitus explains that the Christians were used as scapegoats for the disaster and their deaths were turned into sport:

They [the Christians] were dressed in the skins of wild animals and torn to pieces by dogs, or they were crucified or set fire as human torches after dark. Nero offered his Gardens for the spectacle and provided entertainment in the Circus, during which time he mingled with the crowd or stood in a chariot, dressed as a charioteer.[16]

It was in this stadium that Peter is believed by many to have met his death.

Like any Roman circus, the oval track was divided by a central island divider, called a *spina*. In the middle of the *spina* was usually an obelisk. We know from Pliny the Elder that the Vatican obelisk was set up by the emperor Caligula in 37 A.D. after having been brought to Rome by ship from Alexandria in Egypt, where it had been placed decades before in the Roman forum Iulium by the emperor Augustus.[17] Originally, the obelisk had stood not in Alexandria but in Heliopolis, the ancient center of the

15. Tacitus, *The Annals* 14.14. See also John H. Humphrey, *Roman Circuses: Arenas for Chariot Racing* (Berkeley and Los Angeles: University of California Press, 1986), pp. 545-52.

16. Tacitus, *The Annals* 15.44.

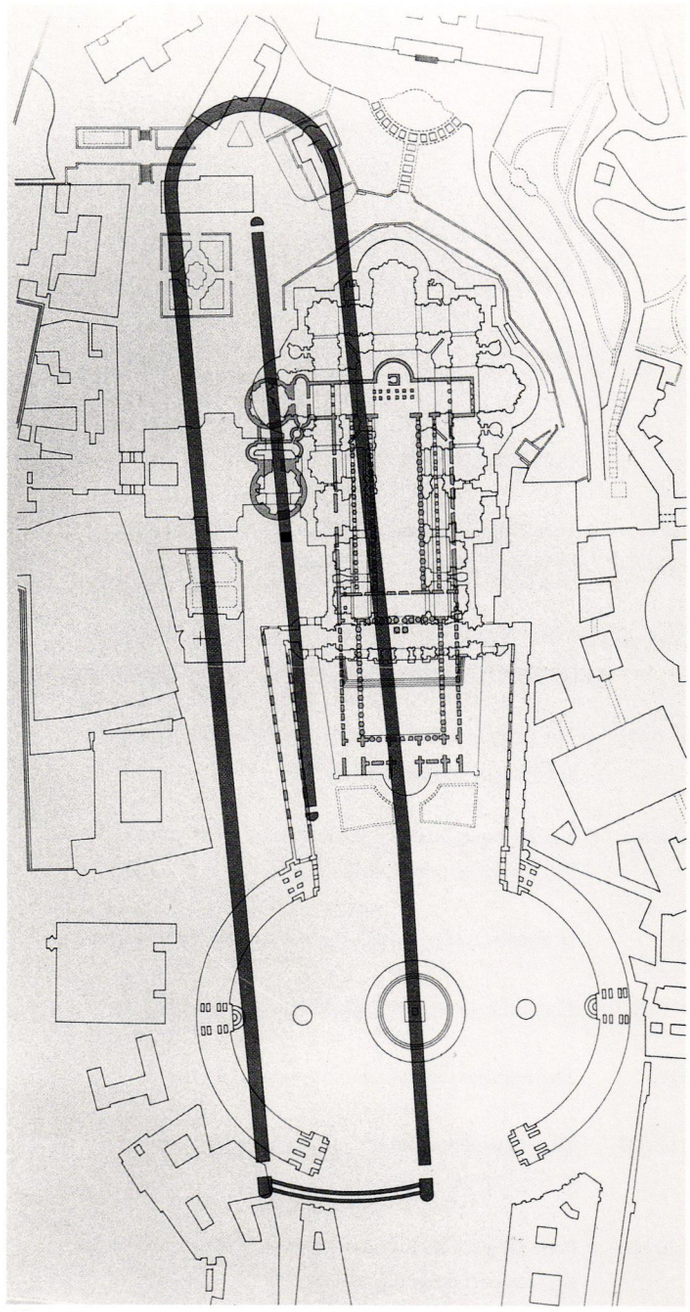
17. Pliny the Elder, *Natural History* 36.74.

18. Humphrey, *Roman Circuses*, pp. 269, 549.

Egyptian sun-cult near Cairo in the Egyptian delta. Like other obelisks at Heliopolis it was probably quarried for the pharaoh Seti I and his son Ramses II during the nineteenth dynasty (1314-1197 B.C.).[18] The Vatican obelisk, therefore, is the oldest object on the site. And it was upon the foundations of this race course divider that the obelisk stood for over fifteen hundred years until the intervention of Pope Sixtus V and Domenico Fontana in the late sixteenth century.

Before the construction of the stadium in the early first century A.D., there is little evidence of habitation on the site. Instead, one must imagine an open countryside, with only the gentle slope of one of the many hills of Rome, the *Mons Vaticanus* or Vatican Hill – the landform that would forever give the area its name.

The history of the site of St. Peter's spans two millennia, during which time the Vatican area evolved through the interrelated processes of continuity and change. From the stadium and obelisk to the ancient Roman cemetery, from the Early Christian basilica to the Renaissance church, and from the seventeenth-century piazza to the twentieth-century thoroughfare, each age, inspired by the belief in the power of the site, added another layer of meaning not only through new construction but also by incorporating, and thus transforming, artifacts of the past. It is this conscious and consistent assimilation of the past that allows the particular fascination of the site to endure.



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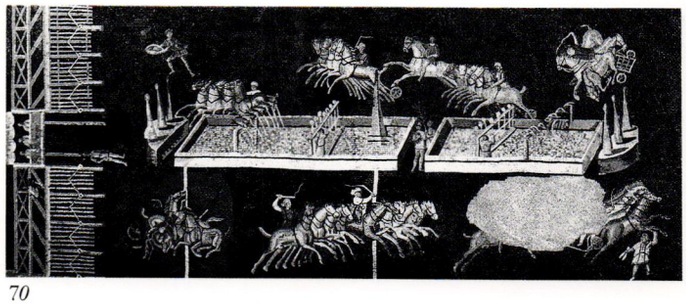

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68. View of the Via Appia, late nineteenth century.

69. Plan of the circus of Nero in relation to the successive building on the site.

70. Roman mosaic representing a chariot race in a circus, ca. third century A.D.

SELECTED CHRONOLOGY

1314-1197 B.C. An obelisk is quarried for the pharaohs Seti I and Ramses II and placed in Heliopolis, Egypt.

30-20 B.C. The emperor Augustus moves the obelisk to the Roman forum Iulium in Alexandria, Egypt.

37 A.D. The Egyptian obelisk is brought to the Vatican gardens in Rome by the emperor Caligula.

54-68 A monumental stadium is constructed on the Vatican Hill for the emperor Nero.

64 St. Peter is traditionally believed to be martyred on this date.

170-200 The shrine or *tropaion* of St. Peter is constructed.

312 The emperor Constantine converts to Christianity.

317-332 The construction of Old St. Peter's is undertaken by the emperor Constantine.

590-604 Pope Gregory the Great directs the improvements to the altar above the Apostle's tomb.

1450-55 Pope Nicholas V and his architect, Leone Battista Alberti, propose a building project for St. Peter's and the Borgo that includes the remodeling of the basilica. Only the foundations of the proposed choir are completed.

1506 Pope Julius II with his architect, Donato Bramante, initiate the demolition of the Early Christian basilica. The first stone of the new St. Peter's is laid on April 18, 1506.

1511 The four crossing piers of the new church are completed.

1546-64 Michelangelo serves as architect of St. Peter's under five consecutive popes.

1586 The obelisk is moved to the *platea* in front of St. Peter's, under the direction of Pope Sixtus V and his architect, Domenico Fontana, according to the Pope's proposed plan of Rome.

1588-93 The dome and lantern are completed by Giacomo della Porta.

1608-18 Carlo Maderno, the architect of Pope Paul V, oversees the construction of the nave and facade.

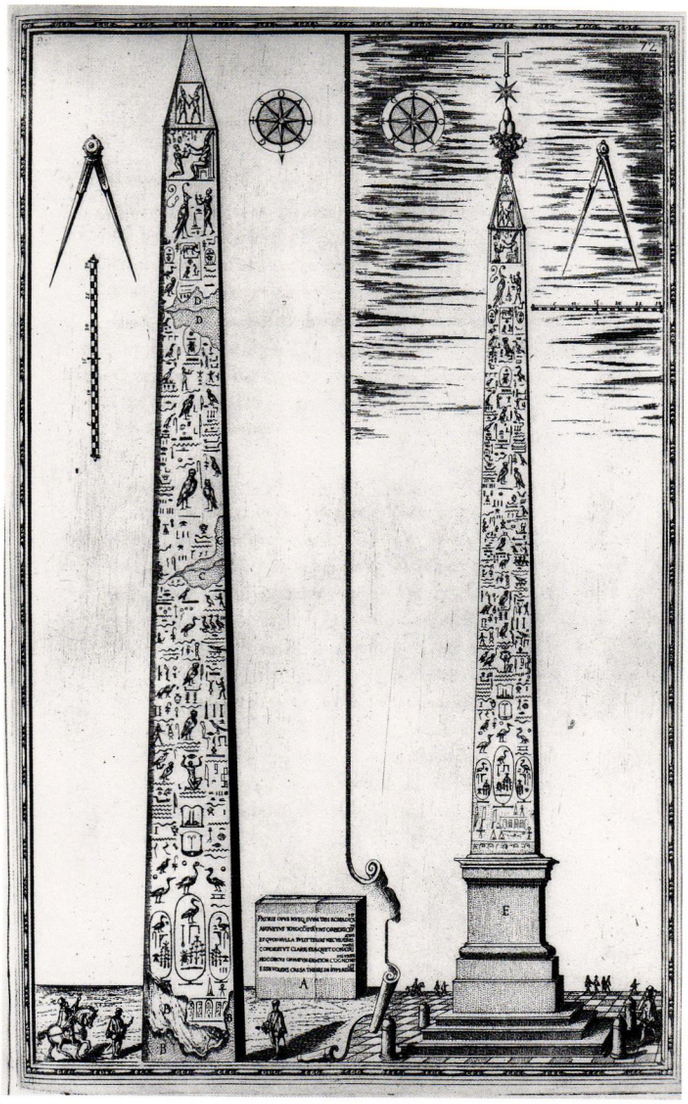
1626 The new basilica is consecrated by Pope Urban VIII.

1624-34 Gianlorenzo Bernini designs and builds the baldacchino for Pope Urban VIII.

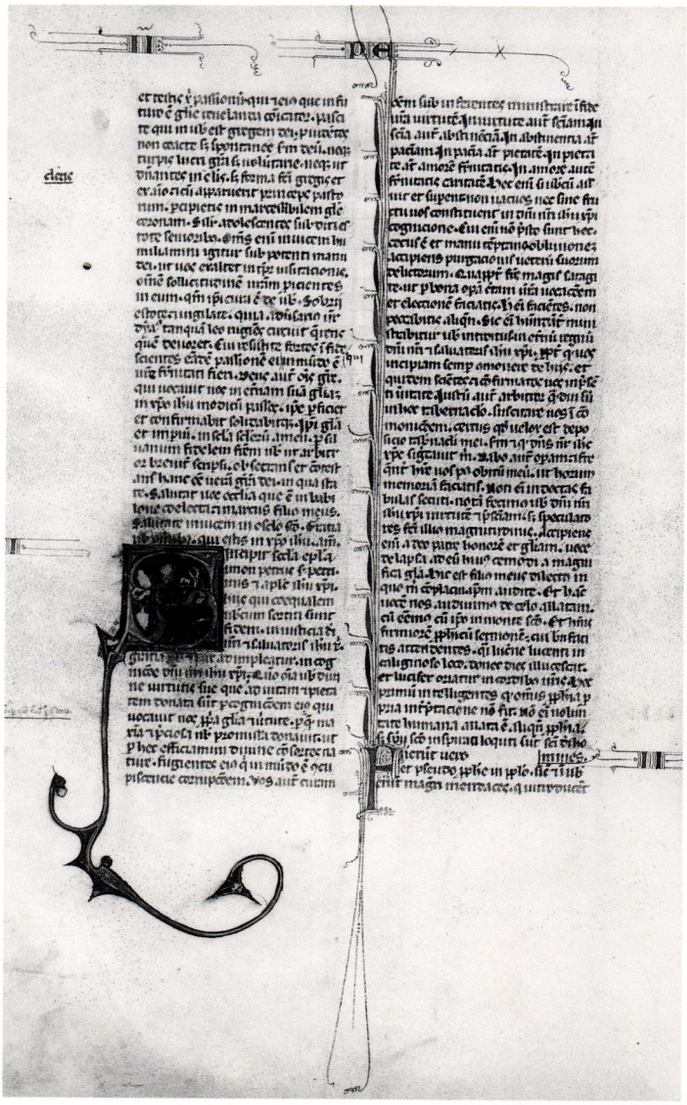
1656-67 Bernini, under Pope Alexander VII, designs and oversees the construction of the piazza of St. Peter's.

1929 Pope Pius XI and Mussolini sign a treaty of reconciliation, creating the sovereign state of Vatican City.

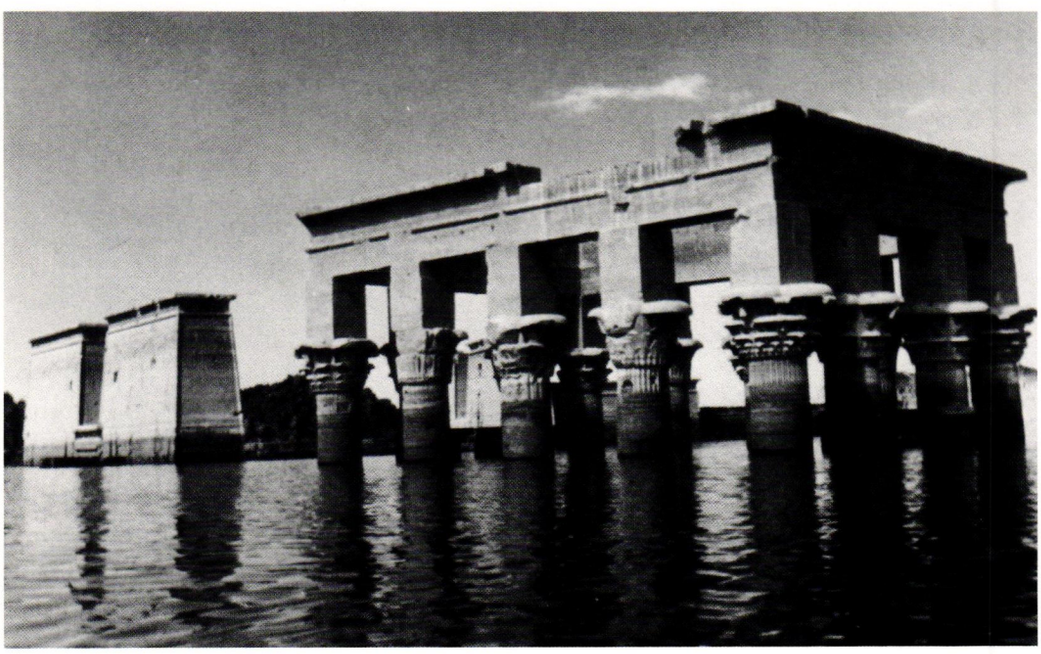
1936-50 Mussolini's architects, Marcello Piacentini and Attilio Spaccerelli, carry out the demolition of the *spina* and the construction of the Via della Conciliazione and the *propylaea*.



71. Domenico Fontana, an Egyptian obelisk transformed by Pope Sixtus V, from Della trasportatione dell'obelisco Vaticano e delle fabriche di Nostro Signore Papa Sisto V *(Rome: 1589).*



72. The Second Letter of Peter, 12-13: Therefore I intend always to remind you of these things, though you know them and are established in the truth that you have. I think it right, as long as I am in this body, to arouse you by way of reminder, since I know that the putting off of my body will be soon, as our Lord Jesus Christ showed me. And I will see to it that after my departure you may be able at any time to recall these things.



Iris Temple, Philae, Egypt

Material Preservation and its Alternatives

David Lowenthal

Preservation has become a rampant cult. All over the world, individuals and institutions save more and more from every possible past. The resources devoted to salvaging and celebrating surviving remnants mount exponentially. Few cultures are exempt from, few individuals uninfected by, the mania for memorabilia.

Why is this so? It reflects a wider modern preoccupation with the past – the nostalgic temper that makes each new film a reprise of an older one, the search for roots that swamps the genealogical archives, the reverence lavished on oral histories, the insatiable appetite for historical romance. Disappointed expectations of progress and looming fears of decline and impending catastrophe feed all these attachments to the past. Preservation's particular focus also reflects the global diffusion of nationalism and capitalism. Both make material relics precious symbols of power and icons of identity.

Historic preservation arose in conjunction with early nineteenth-century European nationalism. Old buildings in particular and physical relics in general for the first time became valued, not merely as emblems of private property or of religious faith but as tokens of a shared identity, uniting present communities through felt continuity with an ancient past. Nation after nation legislated to safeguard material remains as crucial elements of their heritage.

Since the Second World War, ex-colonial Asia and Africa have followed Europe and America in celebrating antiquities as national icons. Under UNESCO's aegis, scores of states seek to repossess heritage lost to the West along with pre-colonial autonomy through looting, plunder, or sale. The heritage restitution crusade, the brouhaha over World Heritage sites, and infamies of the art and antiquities markets attest to the power and pervasiveness of attachments to material relics.

Preserving things also creates wealth. Modern technology and consumer manufactures turn all goods into money, all values into exchangeable commodities. Uniqueness or rarity enhances the material value of heritage items to the detriment of traditional, spiritual, or aesthetic values. Antiquities are collected and preserved less for their meaning or beauty than for their investment potential. Crowds flock to the museums less for aesthetic thrills than to take a gander at all that money hanging on the wall. And traditional societies must bid for their own heritage in Western-dominated markets.

Commodity values also reflect the materialization of memory. Oral discourse gives way to printed histories, memorial monuments, and other material evocations of the past. Collective memories get consigned to history books, museums, commemorative occasions, and preserved precincts. We create archives, mark anniversaries, protect historic localities, and save things generally because memory has been truncated.

The range of things preserved has also expanded. Our predecessors saved only grand heroic treasures; today everything – the typical as well as the unique, the neighborly and the exotic, the relics of the wicked as well as those of the good – is saved for many new motives. Among these are a *cult of the representative*, ascribing merit to things typical of their time; a *cult of the folk*, seeking reminders of unsung masses who left few artifacts and no written words; a *cult of the familiar and the recent*, as tokens of continuity against obsolescence and dislocation, that makes 1930s linoleum and 1950s toasters as collectable as Georgian tea caddies; a *cult of escape* from a soulless, monotonous, or fearsome present, a perennial nostalgia now given added edge by the placeless sameness of global goods and the grim austerities of much modern architecture; a *cult of economic gain*, that ranges from conserving energy and materials to pandering to tourism.

I do not decry material preservation. Its benefits are manifold. It endears the familiar, reaffirms purpose, validates custom, enhances identity; it guides, enriches, and diversifies life. But it also exacts costs and engenders problems. And material preservation virtually excludes other ways of valuing tradition. Before exploring some alternative modes of appreciating our legacy from the past, let us look at some of the contradictions inherent in material preservation.

CONTRADICTIONS OF MATERIAL PRESERVATION

Endurance in perpetuity is preservation's guiding aim. But nothing lasts forever, and however faithfully protected, everything always departs more and more from its original state. Indeed, for all preservation's emphasis on original substance, we identify and cherish most things for their form or genetic continuity, not for the stuff they are made of. Though erosion and accretion ceaselessly transform them, a building or pair of shoes remains that building or those shoes from the moment of their making until the building falls into rubble, the shoes into rubbish. Living things likewise keep their identity despite obvious development and physical change. "An oak, that grows from a small plant to a large tree, is still the same oak," as Hume put it, "tho' there be not one particle of matter, or figure of its parts the same."[1]

1. David Hume, *A Treatise of Human Nature* (1739), bk. 1, pt. 4, sect. 6, in *The Philosophical Works*, edited by T. H. Green and T. H. Grose, vol. 1 (Aalen: Scientia, 1964), p. 538.

Preservationists have done little to resolve the dilemma Plutarch made famous to philosophy as the "ship of Theseus." Brought into port for repairs, every old plank in Theseus's ship was replaced by new planks. Was it still the original ship? Brian Smart's variant sharpens the issue: a builder commissioned to supply two ships, an old one restored to seaworthiness and a new one made of old materials, sees a way of selling the two ships for the cost of one. In drydock A, each old board of Theseus's ship is replaced by a new one, until the entire ship is refurbished. Meanwhile, each old plank is put into a new frame at adjoining drydock B. When a fire destroys drydock B, both buyers sue for the delivery of the original ship; but which one is it? On the grounds that identity inheres in an object's continuing form, not in its fragmentary and ephemeral substances, the court ultimately awards possession to the buyer

of the surviving ship at drydock A. Each new plank in it has at once become part of the old ship, while the old plank it replaced forms part of the new ship just coming into being. Being a part of Theseus's old ship was only a temporary phase in the lifetime career of the old planks. Does the importance of the original historical treasure lie in its identity as a boat or in its being a collection of planks?[2]

Material substances may help to authenticate an object's provenance, but it is genetic properties (maker, period, history) that distinguish authentic from fake or replica objects of art and nature alike. A child values a teddy bear because they share a history of interaction; only the teddy bear he has always cuddled will satisfy him, not even a molecule-by-molecule reproduction will do.[3] The worth of what we preserve depends ultimately on the various and sometimes conflicting intentions of its creators and subsequent guardians and restorers.

Material preservation is thus at bottom an illusion. Felt historical continuity takes precedence over strict material authenticity, which is itself impossible to achieve or sustain. What matters in preservation may be continuity of form, of substance, of texture, of color, or whatever. And because material objects are continuously transformed, every stage in preservation forces choices among these many valid but irreconcilable criteria. No preservation decision is logically right, let alone permanently appropriate.[4]

Another difficulty of material preservation is the stress engendered by multiple claimants. Relics and monuments are treasured not only by the cultures that created them and the states that now possess them, but also by individuals, by other localities, and by the world as a whole. The Parthenon is precious not only to Greeks in general and Athenians in particular, but to all admirers of classical culture; Jerusalem is sacred alike to Jews, Christians, and Muslims. But a material relic can be in only one place at a time.

Competition may enhance preservation worth. But the more widely valued such objects are, the more fraught the struggle to possess them – and the more prone they are to theft and vandalism, as assaults on the Louvre's *Mona Lisa* and the National Gallery's *Virgin of the Rocks* attest. Indeed, scarcity value promotes destruction, as with Mayan temples cut up for illicit export. The avid appetite for antiquities undermines their protection in situ, in context, and in their integral wholeness.

The threat of loss to a supposed rival has, to be sure, spurred heritage consciousness into preservation action. The precursor of the French antiquities service came into being following real (though unfounded) fears lest British antiquarians transport neglected Norman monastic ruins across the Channel. The Netherlands' monuments agency was born out of scandalized reactions to a British museum's purchase of a hitherto little regarded sixteenth-century Dutch rood-screen. The felt need to forestall the transatlantic export of Tattershall Castle put teeth in the British Ancient Monuments Act of 1913.[5] But the felicitous results of rivalry are outweighed by its ill consequences: the whiplash between sudden inflation and speedy decline of interest; the mercenary nimbus or patriotic penumbra that obscures aesthetic, pedagogic, and historical values; the time and energy spent, the enduring bitterness engendered in squabbles over possession. Whatever decision is reached, there can be only one winner and there will be many losers.

2. Brian Smart, "How to Reidentify the Ship of Theseus," *Analysis* 32 (1972): pp. 145-48. See also Francis W. Dauer, "How Not to Identify the Parthenon," *Analysis* 33 (1972): pp. 63-64; Lawrence H. Davis, "Smart on Conditions of Identity," *Analysis* 33 (1972): pp. 109-10; Brian Smart, "The Ship of Theseus, the Parthenon, and Disassembled Objects," *Analysis* 33 (1973): pp. 24-27; Theodore Scaltsas, "The Ship of Theseus," *Analysis* 40 (1980): pp. 152-57; David Wiggins, *Sameness and Substance* (Oxford: Basil Blackwell, 1980), pp. 92-94; Theodore Scaltsas, "Identity, Origins, and Spatio-temporal Continuity," *Philosophy* 56 (1981): pp. 395-402; Hugh S. Chandler, "Plutarch's Clothes-pin," *Analysis* 44 (1984): pp. 55-58.

3. M. Pabst Battin, "Exact Replication in the Visual Arts," *Journal of Aesthetics and Art Criticism* 38 (1979): pp. 153-58.

4. David Lowenthal, "Art and Authenticity," in *Themes of Unity in Diversity*, Acts of the Twenty-sixth International Congress of the History of Art (University Park: Pennsylvania State Press, 1988), pp. 637-41.

5. David Lowenthal, *The Past is a Foreign Country* (Cambridge: Cambridge University Press, 1985), pp. 393-94.

Even when location is not at issue, guardianship and access may embroil rival celebrants. Stonehenge is a case in point. To preserve the monument, to pacify local landowners, and to cater to a seemlier tourist clientele, English Heritage and the National Trust, which "own" the prehistoric stones and the land they sit on, in 1985 banned the customary annual solstice visits of hippies and of Druids; the result was armed combat with many casualties. Only on one point are all parties agreed: to relieve the pressure by constructing replicas would be fruitless folly, for there can be only one meaningful Stonehenge. Fame and need may spur demand for this or that material relic, but materiality itself inexorably limits the authentic supply.[6]

Preservation costs and benefits are largely unresolved, for most of its values are matters of feeling and attachment not amenable to cost-benefit analysis. Preservation sometimes saves materials and fuel, but the more that is preserved, the greater the effort required and the sacrifice of new construction foregone. Preserved structures and milieus may defray some costs through visitor receipts, but thereby write off other economic choices and incur other social costs. In any case, only a small fraction of what is preserved pays for itself through tourism. Ultimately one cannot keep the nineteenth let alone earlier centuries without paying for it in the twentieth.[7]

The cost of preservation transcends repair and maintenance charges. Saving old things runs counter to the very spirit of modern enterprise. In Britain today many fear the cult of preservation may create a nation valued only as a relic. They are leery of becoming full-time purveyors of their past, quaint old codgers in a fairy-tale historyland. "Tourism reduces all nations to Ruritania," warns a critic. "It encourages their citizens to become hucksters and grovelers after tips."[8]

Preservation is charged not only with preventing progress but inducing moral and social decay. Gentrified villages conserve old houses only by destroying the old community. Restoration block-busting in quaint old American neighborhoods typically displaces low-income residents. It is still mainly the rich who wish to save old buildings – and get grants or tax benefits for doing so.

Others censure preservation for crippling initiative. Americans felt this burden of the past long before preservation became practice. "All towns should be made capable of purification by fire, or of decay within each half-century," wrote Hawthorne in a typical tirade against the old. "Otherwise, they become the hereditary haunts of vermin and noisomeness, besides standing apart from the possibility of . . . improvements."[9] This complaint was soon leveled against preservation, and not only by Americans. "We cannot allow our lives to become over-burdened and crushed down by the mere accumulation of the dead things of the past," said a member of Parliament in 1878.[10] A modern director of the Victoria and Albert Museum echoes the point. "Worship of the past and what it has created has been taken to an extreme unknown to any previous century. . . . Nothing is deader than dead heritage and there is too much dead heritage around. The past has swallowed us up."[11]

Preserving architecture is particularly felt to inhibit creativity, to foreclose the future. Old buildings pre-empt talent as well as space; regard for antiquity stifles innovation. "If we let the paranoid preservers manoeuvre us into keeping everything," charges an architectural

6. Christopher Chippindale, "Stoned Henge: Events and Issues at the Summer Solstice, 1985," *World Archaeology* 18 (1986): pp. 38-58.

7. David Lowenthal, "Conserving the Heritage: Anglo-American Comparisons," in *The Expanding City*, edited by John Patten (London: Academic Press, 1983), pp. 225-76.

8. Frank Johnson, "Ruritania Here We Come," *The Times* (London), 23 June 1981.

9. Nathaniel Hawthorne, *The Marble Faun*, originally published in 1859 (New York: Signet, 1961), pp. 219-20.

10. Leonard Courtney, quoted in Charles Dellheim, *The Face of the Past: Preservation of the Medieval Inheritance in Victorian England* (Cambridge: Cambridge University Press, 1982), p. 91.

11. Roy Strong, "Taking the Age Out of Heritage," *The Times* (London), 24 September 1983, p. 8.

historian, "we shall bring the normal life-process of decay and replacement to a halt, we shall straightjacket ourselves in embalmed cities of the past."[12] Had preservation so ruled in the past, structures now thought splendid or sacrosanct would never have been built. "Conservationists rob us of our cultural self-confidence," runs a typical indictment. "We can no longer create, construct, imagine something new. We have to conserve, preserve, restore."[13] These complaints may exaggerate preservation's influence, but they reflect pervasive misgivings about attachment to relics.

Preservation also segregates the past. Salvage encumbers the landscape with artifacts that no longer attest to a living antiquity but celebrate what is dead, replacing traditional stream-of-time continuity with a separable and salable past. Museums expressly aim to sequester relics so as to save and display them. But outside the museum, survivals adapted to new uses are also apt to be set apart from present-day things; their anachronisms are highlighted, their antiqueness is emphasized, the obsolescence of the original use is underscored.

Museum perspectives suffuse preservation work, for we tend to "see our historic towns as 'pictures' somehow divorced from the reality of everyday life," in a planner's words.[14] Seen from this perspective, preservation actually underscores our freedom from antiquity. Our very eagerness to save its vestiges shows how much we have overcome it. The vogue for preservation reflects the victory of the modern. Relics are enjoyed all the more because they matter so little; it is their felt remoteness, their lack of consequence for the present, that lends preserved things much of their charm.

Setting preserved things apart forecloses other ways of using them. Such remnants seldom inspire new creation; they are valued as sacred relics, not for how we might reshape them. We protect ancient structures rather than make new ones after their example. Unable to use the past creatively, we further isolate what we preserve; what we make may conform with treasured relics but seldom extends their virtues; what we save is property and artifacts rather than ideas or culture.

Is material preservation our only option? What else might secure the benefits we associate with it? Can the difficulties I have sketched be avoided or mitigated by putting less emphasis on material preservation or perhaps forswearing it altogether? Three modes of action, customary in some societies but not now common in our own, suggest alternative ways of coming to terms with a legacy.

FRAGMENTS

Saving fragments rather than wholes has obvious practical advantages. They take up less space; they are less costly to maintain. And because they are already reduced from their original state, they come to us with a presumption of change that should allow their caretakers greater latitude: fragments do not demand the same obsessive fidelity to original integrity as wholes.

Yet fragments are not less efficacious as reminders. The merest traces of the past, as Adrian Stokes has put it, "keep us in touch with our own development."[15] Indeed, their very fragmentariness helps to evoke the past. What survives is always a fragment of what existed. Even the intact entities visitors see at historic sites or in museums are in a significant sense fragments of what used to be some greater assemblage. Europeans of the Renaissance disdained fragments

12. Reyner Banham, "Preserve Us from the Paranoid Preservers," *Observer Magazine* (London), 21 October 1973, p. 15.

13. Douglas Johnson, "Not What it Used to Be," *Vole* 5 (1978): p. 43.

14. Roy Worskett, "New Buildings in Historic Areas," *Monumentum* 25 (1982): p. 150.

15. Adrian Stokes, *The Invitation in Art* (London: Tavistock, 1965), pp. 60-61.

on philosophical and aesthetic grounds as incomplete, incoherent, asymmetrical, and reminiscent of death and decay. Just as humanists reassembled the mangled body of classical learning – Thomas Traherne's "worthless shreds and Parcels" – into an "Intire piece," so they restored mutilated antique remnants to lovely wholeness. Restorers reconstituted scattered classical fragments; sculptors made facsimiles to fill in anything that was not whole, adding new heads and limbs to bring antique torsos alive.[16]

Romantic sentiment, picturesque taste, and the cachet of authenticity began to lend fragments greater prestige by the late eighteenth century. Connoisseurs of the "aesthetics of rupture" scorned modern repairs to ruined buildings and armless torsos. The Elgin Marbles exemplify the aesthetic revolution that transformed fragmentation from a defect into a virtue: as late as 1805 Lord Elgin and others took it for granted the sculptures would be restored, and sought out Canova and Flaxman to make men, horses, and centaurs whole; by 1820 it seemed right to leave the sculptures as they were. "How broken down they are, a'ant they?" Benjamin Haydon overheard one viewer of the marbles in the British Museum remark. "Yes," his companion replied, "but how *like life*."[17]

Fragments seemed lifelike because they exemplified living processes. And the taste for fragments spread to other works of art, new as well as old. Literary creations like Goethe's *Faust* were advertised as "Fragments." "Many works of the ancients become fragments," wrote Schlegel, "many works of the moderns are so at their genesis."[18] Even the tragic abbreviation of such modern lives as Byron's and Shelley's lent these "fragments" a luster of romantic mortality.

Fragments surpass wholes in joining the past dynamically with the present. Mutilated and incomplete, they impart a sense of life "from the evidence of their struggle with Time," in Malraux's phrase.[19] The decrepitude of many Christian relics underscores the miracle of their immortality. The charred and fragmented bones, the scattered remnants of wood and cloth, express the eternal power of the saints they enduringly incarnate. On the other hand fragments that are merely transient evoke the past with peculiar intensity. Seeing the unreconstructed fragments of mutilated paintings, for example, shocks the viewer into a double apprehension, of its presumed original state and of its ineluctable decay into *bricolage*.

In thus engaging the viewer's imagination, fragments activate myriad connections between what is and what was. "The fragment points backward," notes Stephen Owen of aesthetic responses in China; "it draws our attention to the empty spaces around its jagged periphery"; it recalls what it came from, forming a bond between past and present in a way a whole does not, or does only when we recognize it as a "fragment" of the world that was. Such recognition enables us imaginatively to reconstruct the past. In the ninth-century poet Li Ho's "Song of an Arrowhead from the Battlefield of Ch'ang-p'ing," a wanderer contemplates the commingled debris – "Char of lacquer, powder of bone . . . three-spined, broken wolf's fang" – left by the carnage. The encrusted lump he holds "clearly *was* something but . . . now has no form, category, or definition . . . char or ash, something that remains after burning; powder of bone, relics of death, . . . the physical survivor that recalls a shattering and a dissolution." Fragments not only reveal what is missing, ghost presences of their past, they also refer to their rediscovery. Thus the fragment implies "the history of both its deposit and its recovery." Implicating so many surrounding realms, the fragment is invested with "repleteness and intensity."[20]

16. Lowenthal, *The Past is a Foreign Country*, pp. 169-71.

17. William St. Clair, *Lord Elgin and the Marbles* (London: Oxford University Press, 1967), pp. 151-53; Benjamin Robert Haydon, *Diary*, edited by W. B. Pope, vol. 2 (Cambridge: Cambridge University Press, 1960), p. 120.

18. Friedrich Schlegel, quoted in Thomas McFarland, *Romanticism and the Forms of Ruin* (Princeton: Princeton University Press, 1981), p. 24.

19. André Malraux, *The Voices of Silence* (London: Secker & Warburg, 1954), p. 635.

20. Stephen Owen, *Remembrances: The Experience of the Past in Classical Chinese Literature* (Cambridge, Mass.: Harvard University Press, 1986), p. 66, pp. 70-73.

The function of fragments in dynastic China parallels their role in the Renaissance. Humanists regarded bringing together fragments of ancient buried texts as a laudable act of healing, recalling the heroic career of Hippolytus. Resurrected fragments became nutriments for new metamorphoses. And in restoring the fullness of the past the humanist reassembled himself as well, reconstituting out of the fragments of his own memory, his own history, an identity that combined an old consciousness with a new one. Such resurrection demanded not simply the rebirth but the replacement of the past, for "the dead must be devoured and digested before new life can ensue."[21] In organizing fragments, the present preserved and transmitted a reshaped past.

For the Chinese, fragments served to encapsulate and magnify the past; for the Renaissance, fragments served as vehicles for restoring and translating the past. Both preserved fragments not for their own sake but, the one to contemplate a wider inter-temporal world, and the other to reconstitute a world to be out of a world that was. In both cases, preservation was creative rather than passive.

PROCESSES

A focus on preserving fragments does not connote a reduced regard for preserving material substance; on the contrary, it implies a heightened respect for its now altered and attenuated form. Those who strive to preserve not materials but processes of manufacture honor the past not by saving traditional relics but by replicating them. The world's most renowned instance is the wooden Ise Shinto temple in Japan that has, over the past millennium, been dismantled every twenty years or so and then replaced by a faithful replica built exactly as before. When traditional construction materials are highly perishable, as in Japan, it makes sense to repeat rather than to perpetuate, to bow to the mortality of matter while aiming to secure immortality in the process of replication.[22] As prized transmitters of cultural heritage, the traditionally trained craftsmen who thus perpetuate the techniques and rituals of re-creation are themselves designated "Living National Treasures" by the Japanese government.

That things must be periodically destroyed as a prelude to their re-creation is implicit in this emphasis on process. Many societies thus combine preservation with creative emulation or even outright innovation. The use of *malangan* in tribal New Ireland illustrates how demolition contributes to the wellsprings of creativity and to its social functions. Traditional social interaction involves the periodic exchange and destruction of carved or woven ritual artifacts. It is not the material durability of malangan that matters, but the artifacts' family resemblances to bygone and future malangan. Only those who acquire *and then destroy them* gain the right to replicate their form in new malangan; the right is in abeyance as long as the previous object still exists. Thus museums and Western collectors who acquire malangan reduce the range of forms available for replication and hamper patterns of social interaction. Among these islanders, the material destruction of previous ritual objects is part and parcel of conserving social bonds.[23]

Destruction and preservation are, in the most profound sense, bound up in a cyclical process. A story by David Ely describes Britain after it has been destroyed in a nuclear accident. The massive effort of total restoration has had the useful corollary of reducing international tensions. Perhaps "the vaporization of Britain was logically necessary," muses an expert, "to express the dual impulse of our age – vast devastation coupled with equally vast

21. A. Bartlett Giamatti, "Hippolytus among the Exiles: The Romance of Early Humanism," in his *Exile and Change in Renaissance Literature* (New Haven: Yale University Press, 1984), pp. 12-32; Terence Cave, *The Cornucopian Text: Problems of Writing in the French Renaissance* (Oxford: Clarendon Press, 1979), pp. 37-46, pp. 69-73.

22. Bunji Kobayashi, "The Case of the Ise Grand Shinto Temple in Japan," in *Nessun futuro senza passato*, Acts of the Sixth General Assembly of the International Council on Monuments and Sites (Rome: ICOMOS, 1981), pp. 185-91.

23. Susanne Kuechler, "Absent Meaning: The Death and Resurrection of 'Objective Value,'" paper presented at symposium, Making Exhibitions of Ourselves: Limits of Objectivity in Representations of Other Cultures, British Museum, London, 13-15 March 1986.

reconstruction." Other social benefits also ensue. To "ease the population pressure and provide a harmless outlet for human energy both at the same time," he concludes, "ultimately it may become desirable to vaporize and then restore one nation every generation."[24]

Where living entities are at stake, preservation must concern process rather than substance. All organisms are mortal; little is to be gained by prolonging any life much beyond its natural span. Once it is dead, neither mummification nor taxidermy can preserve what was most valued in the living creature. Nature preservation efforts hence focus on species, on aggregates rather than individuals. As with malangan, it is the ongoing process that counts, not any substance (unless one considers a gene pool to be a substance). To some biologists even species preservation seems fruitless, since extinction is in any case the ultimate fate of most if not all species. What these scientists consider worth preserving is not species but ecosystems, which may be unique assemblages but are in no sense individual entities. And some biologists would protect neither species nor ecosystems, but only whatever biosphere conditions maintain evolutionary processes. For evolution continually replaces species and ecosystem losses with new realms of living organisms that are no less diverse and adaptable.[25]

REPRESENTATIONS

Fragments and processes offer more flexible alternatives to preserving material objects in toto. Images of the past, whether preserved in paint or print or simply as memories in the mind's eye, may serve as adequate surrogates for original material entities, and on occasion offer a heritage in many respects preferable to the "real" thing.

In China, for example, devotion to tradition in language and ideas has long gone hand in hand with recurrent destruction of physical remains. Mao's orders to demolish most of China's ancient monuments proved easy to carry out, for few historic structures had survived the incessant iconoclasm of millennia past. Revering ancestral memory and written tradition, the Chinese hold the past's purely physical traces in small regard. That most antiquities and art works were hoarded in central dynastic collections sped their periodic demolition; they succumbed to the iconoclasm of those who toppled each dynasty in turn. The relics of "ancient" vintage that Chinese sages refer to having seen rarely date back beyond a century or two. Indeed, Chinese scholars agree that old works of art must perish so that new ones can take their place. It is the memory of art objects rather than their physical persistence that suffuses Chinese consciousness and stimulates new works. However grievous their destruction may be to individual owners, it is felt to be no serious loss to the nation.

In fact, the Chinese ideal discourages material possession as a burdensome, imprisoning vice. To amass, classify, house, and protect art objects and other relics reduces creation to commodity, demeaning both object and owner. Only the loss and ultimate dissolution of those objects can rectify the psychic damage their possession has inflicted.[26]

How material possession degenerates into a lust for acquisition and into dehumanized hoarding is the lesson of Li Ch'ing-chao's "Afterword" to her dead husband's monumental study of epigraphy, written in 1132. Chao Tê-fu shared with his wife a love of antiquities – old books, rubbings of inscriptions, calligraphy. For the pleasure of acquiring some treasured item, they lived in cheerful frugality, even pawning their clothes for a painting or calligraphic work, "chewing over" old writings and antiquities in companionable contentment.

24. David Ely, "Time Out," in his *Time Out* (London: Secker & Warburg, 1968), p. 101.

25. Alan Randall, "Human Preferences, Economics, and the Preservation of Species," in *The Preservation of Species: The Value of Biological Diversity*, edited by Bryan G. Norton (Princeton: Princeton University Press, 1986), pp. 79-109; David Lowenthal, "Conserving Nature and Antiquity," in *Man, Nature and Technology: Essays on the Role of Ideological Perceptions*, edited by Eric Baark and Uno Svedin (London: Macmillan, 1988), pp. 122-34.

26. Pierre Ryckmans, *The Chinese Attitude Towards the Past*, Forty-seventh George Ernest Morrison Lecture on Ethnology (Canberra: Australian National University, 1986), pp. 2-4, pp. 7-9; Wang Gungwu, "Loving the Ancient in China," in *Who Owns the Past?*, edited by Isabel McBryde (Melbourne: Oxford University Press, 1985), pp. 175-95. See Joseph A. Reaves, "The 'Uglification' of Beijing's Past Glory," *Preservation News* (July 1987): p. 5.

As Chao Te-fu's career as a provincial official prospered, their collection grew. Items were classified, organized, put in perfect condition, to the point where they required a separate wing in the house, now so valuable they had to be kept under lock and key; to gain access to it, Li Ch'ing-chao herself had to ask her husband's permission. "From a connoisseurship of knowledge and appreciation, we have moved to an almost mercantile connoisseurship of possession"; now it was no longer what was in the work that counted, but "the work as object," in Stephen Owen's gloss on this tale. "The transformation of books and art into objects is part of a system of possession, which in controlling, organizing, ranking, regulating, and locking things away, corrupts a genuine relationship to the past, just as it corrupts the relations between human beings in the present" – for Li Ch'ing-chao now learns that she, too, is valued mainly in relation to the collection.

As Tartar invasions threaten the collection with scattering and destruction, Chao Te-fu sets up a hierarchy of worth to save as much as possible. And the collection shows its ugly face, not as knowledge and pleasure but as a mass of objects that enslave their owners. As the wife transports the more precious moiety to supposed safety, her husband reminds her of the order in which she must save things: "abandon the household goods first, then the clothes, then the books and scrolls, then the old bronzes – but carry the sacrificial vessels for the ancestral temple yourself; live or die with them; don't give *them* up." Thus, writes Owen, "she too has her place in the catalogue - along with the sacrificial vessels, the last to go," commanded by her husband "to die gloriously and willingly with her arms full of bronzes." Ironically, her own poignant account of its corrupting influence is what secures the collection's immortality in historical memory.[27]

Material preservation may engender corruption in the objects preserved as well as in their collectors. A revealing parable of the misuses of preservation is the focus of Siegfried Lenz's novel *The Heritage*. His protagonist, Zygmunt Rogalla, founds a museum to preserve and display local arts and folkways in the Masurian borderland of East Prussia. Successive invasions by German and Russian armies again and again constrain Rogalla to "remold the museum in the spirit of the new times," now weeding out artifacts of Germanic provenance to emphasize Masurian links with Slavs, now eliminating Slavonic relics to reveal Masuria's essentially Teutonic heritage. A German commander insists the collection be rearranged "to demonstrate that the Masurian has always seen himself as the advance guard of the Germanic spirit in the East"; then Russian reconquest renders once-favored Teutonic relics not only tasteless but incriminating, while the decorated butter-crock and the toothed flax-scutcher from the Vistula take on heightened significance.

At the end of the Second World War, the surviving remnant of the Masurian community flees to Schleswig. Rogalla re-establishes his museum there as a focus of Masurian identity and a reminder of the homeland. But even here German nationals and Polish visitors exert pressures that influence what is displayed and how it is attributed. Their chauvinist zeal subverts authenticity until Rogalla realizes that his relics will never be allowed to attest historical truth. In despair, he at length sets fire to the lot, so as to "bring the collected witnesses to our past into safety, a final, irrevocable safety, from which they . . . could never again be exploited for this cause or that." Originally preserved so as to bear witness to the realities of the past against the violations of the present, Rogalla's heritage collection finally succumbs to the very corruptions its retention was meant to prevent. Better no material witnesses at all, Lenz warns us, than relics that can so readily be turned into lies.[28]

27. Owen, *Remembrances*, pp. 90-92.

28. Siegfried Lenz, *The Heritage* (New York: Hill and Wang, 1981), p. 266, p. 452, p. 458.

To be sure, immaterial witnesses to the past are no less malleable. Current recall can warp memories even more easily than physical relics. But immateriality exempts them from most corruptions that possessiveness and commodity market greed engender, and spares them the pretenses that cloak material remains with a spurious validity.

Wang Xizhi wrote his archetypal calligraphic "Preface of the Orchard Pavilion" to mark a day of festival during a spring ritual in the fourth century. Instantly famous, "Orchard Pavilion" was copied again and again. The seventh-century Emperor Tang Taizong avidly collected these copies and was reputed ultimately to have acquired the original. Buried with the emperor in 649, the original "Orchard Pavilion" has not since been seen. But it has been continually copied, with new stone tablets carved from copies, then new rubbings taken from the stones; the pedigree of these copies of copies of copies is itself a complex, arcane discipline. Some five centuries later, "Orchard Pavilion" gained still greater influence through another calligrapher of genius, Mi Fu, whose own creations based on Wang's style became famous. But few "pure" exemplars even of Mi Fu by now remain.

Refracted for over a millennium only through the medium of increasingly remote emulations, Wang's original now turns out to be a probable fiction. In 1965 an archaeologist demonstrated that the form and style of "Orchard Pavilion" were much later than supposed; hence it could not have been written by Wang Xizhi. Thus "the sublime model which inspired the entire development of Chinese calligraphy," in Pierre Ryckmans' words, "may in fact never have existed."

Perhaps this is less cause for chagrin than for congratulation. The Chinese "capacity for metamorphosis and adaptation" over three and a half millennia, as Ryckmans suggests, "may well derive from the fact that this tradition never let itself be trapped into set forms, static objects and things, where it would have run the risk of paralysis and death."[29]

Another such immaterial witness is a sixteenth-century Ming poem celebrating a landscape garden, a literary form then common. The Wuyou Garden was this one's name – literally, "the garden that does not exist." The poet observes that most famous gardens of the past now survive only in literary memory, their plantings and physical traces having wholly disappeared. But should it matter that they ever actually existed? Why not dispense with the preliminary earth-bound garden and begin with the literary recollection which is, after all, their ultimate end? It is tedious to search out and care for vestiges of the original garden, now long overgrown, its trees aged and its composition obscured; it is pedantic to dwell on comparisons between what it now is, what it once was, and what at various times has been portrayed. Material reality lumbers the mind, hobbles the imaginative spirit. Freed from the prosaic constraints of physical heritage, the garden in the mind's eye is fructified by memory.[30]

In the famous old city of Soochow there are no ancient ruins. "We in the West tend to equate the antique presence with authentically ancient physical objects" observes a Sinologist. "China has no ruins comparable to the Roman Forum, or even to Angkor Wat," not because the Chinese were unable to build with hewn stone, "but because of a different attitude about how to achieve an enduring monument." Ancient cities such as Soochow became repositories of the past by embodying or suggesting associations whose value lay beyond the material realm:

29. Lothar Ledderose, *Mi Fu and the Classical Tradition of Chinese Calligraphy* (Princeton: Princeton University Press, 1979); Ryckmans, *The Chinese Attitude*, pp. 10-11.

30. Ryckmans, *The Chinese Attitude*, pp. 11-12.

"The past was a past of words, not of stones." China did not feel "its history as violated or abused when the historic monuments collapsed or burned, as long as these could be replaced or restored and their functions regained. . . . The real past of Soochow is a past of the mind; its imperishable elements are moments of human experience."

Soochow's Maple Bridge is a famous topic in Chinese literary history. But the bridge has little importance as an object. "No single poem refers . . . to its physical presence; . . . its reality to them was not the stones forming the span" but its associations realized in words. Men achieve immortality not by building imperishable stone monuments but by cultivating their capacities to express themselves in imperishable words or by the act of revering someone else's enduring thoughts.[31]

31. F. W. Mote, "A Millennium of Chinese Urban History: Form, Time, and Space Concepts in Soochow," *Rice University Studies* 59, no. 4 (1973): pp. 49-53.

32. Karl Marx, "The Eighteenth Brumaire of Louis Bonaparte" (1852), in *Selected Writings of Karl Marx*, edited by David McClellan (Oxford: Oxford University Press, 1977), p. 100.

CONCLUSION

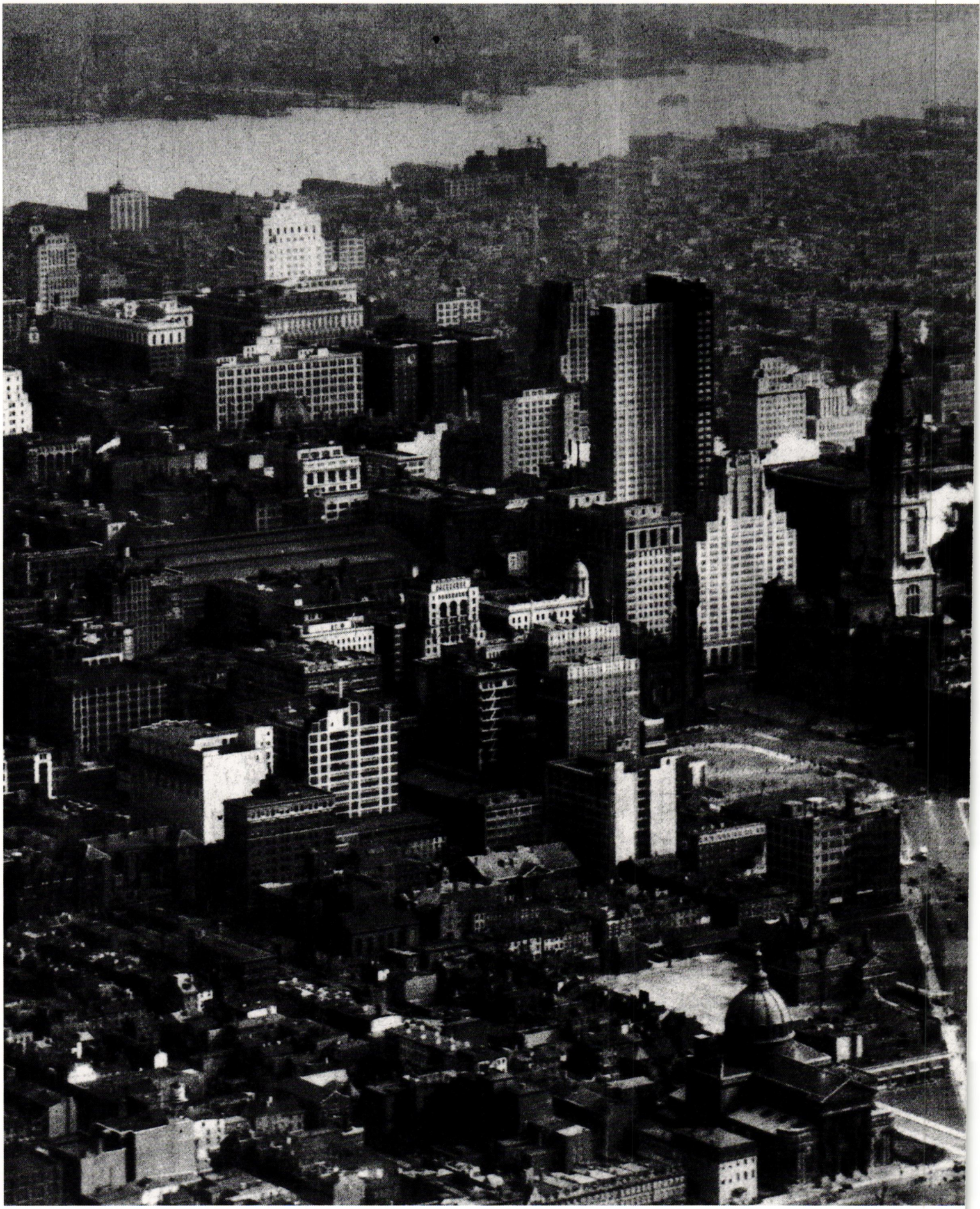
Preservation is an impulse innate to life. But our need to preserve coexists with a no less urgent need to innovate. Preservation's extension into widening realms of nature and culture threatens to upset delicate balances between saving and changing, balances crucial to individuals and to social groups alike.

The alternatives to material preservation described above are not options freely open to modern Western culture. Preferring fragments to wholes, processes to material entities, written or painted or mental images to physical objects, all imply perspectives on the past, on the present, and on life in general that are quite unlike our own. They are modes of behavior that are enacted only by dint of long immersion within congruent cultural features; they are patterns that derive from habit, not from deliberate adoption. We make our past, as Marx said, but we do not make it just as we choose: we are constrained by cultural circumstance, over which we have little control.[32] So too with modes of preservation: we may study how alternative commitments operate with an eye to re-examining our own, but not with a view to seeking substitutes for them.

Culture and circumstance enforce our commitment to material preservation. Nonetheless, awareness of other cultures' different modes of defining and preserving pasts useful to them may help us to extend the forms and functions of material preservation. Re-using artifacts in ways that transcend pure museumization, on the one hand, and purely contemporary utility, on the other, offers one engaging prospect. Preservation today is normally polarized between idealized pasts that are wholly antiquarian and those that are wholly usable, to the caricaturing detriment of both extremes. Preservation advocates should realize that most preserved objects occupy places along a continuum between these extremes, in some measure subserving the interests of both immediate utility and long-term heritage.

To confine consideration of preservation only to our own narrow traditions disserves the treasures and diminishes the pleasures the past has left us to enjoy. It should be remembered that preservation is only a means to an end; when it becomes an end in itself it ceases to advance its prime functions of use, of instruction, of delight.

Whatever may be its authentic etymology, "preserve" also carries with it the meaning of "pre-serve." It is an act that preceded some aim to be served through it. Preservation is not action or epilogue; it is only prologue.





The PSFS Building

Philadelphia, Pennsylvania, 1929-1932

Howe and Lescaze, Architects
Philadelphia Saving Fund Society, Client
George A. Fuller Company, General Contractor
Purdy and Henderson, Structural Engineer
H. B. Hackett, Mechanical Engineer

The Editors

1. Philadelphia, 1932



2

2. Philadelphia, looking west.

3. The PSFS Building, looking south with Reading Terminal in the left foreground, 1932.



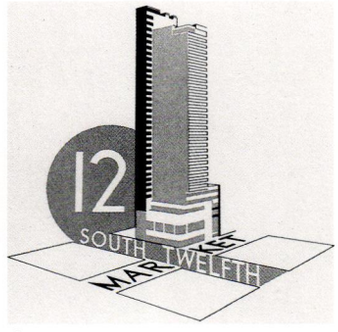
3



4



5



6

4. Map of Philadelphia, 1687.

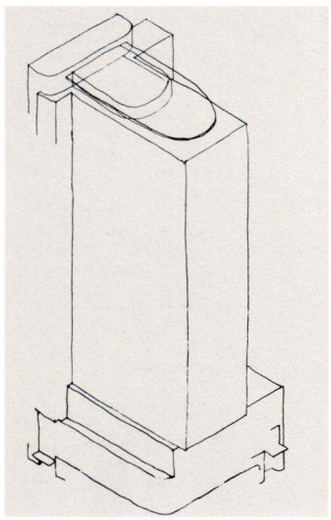
5. U.S.G.S. map of Philadelphia showing PSFS Building on the southwest corner of Market and Twelfth Streets, 1949. (North is to the top of the page.)

6. Logo from Nothing More Modern, *PSFS Building promotional brochure, 1931.*

7. Looking east down Market Street, roof sign under construction, July 1932.



7



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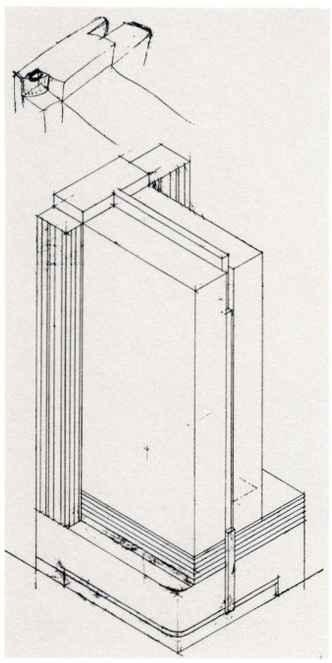

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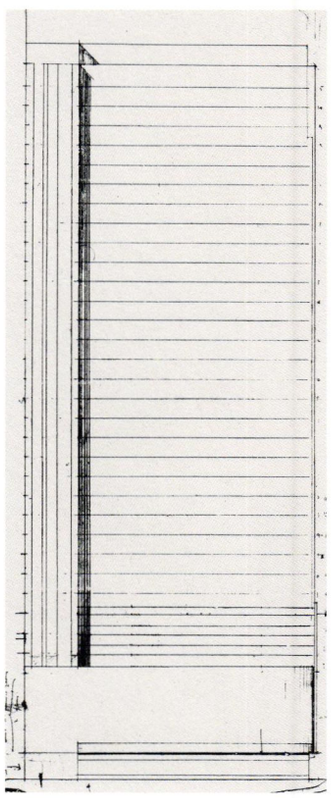

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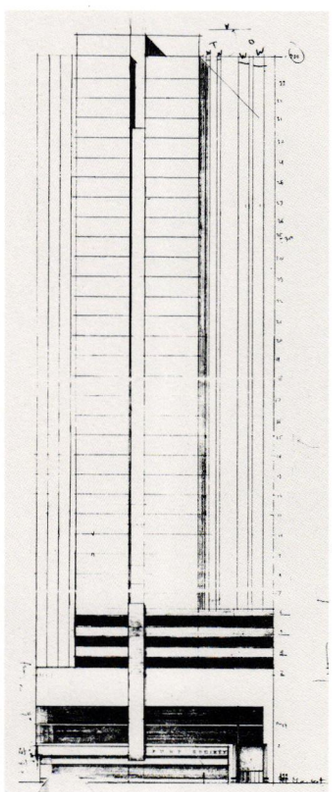


11

8. Massing study, October 1929.

9. Massing study, November 1929.

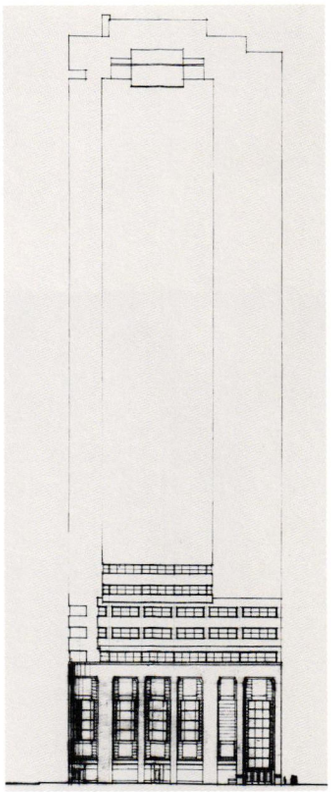
Elevation studies, November 1929.

10. East (Twelfth Street)

11. North (Market Street)



12



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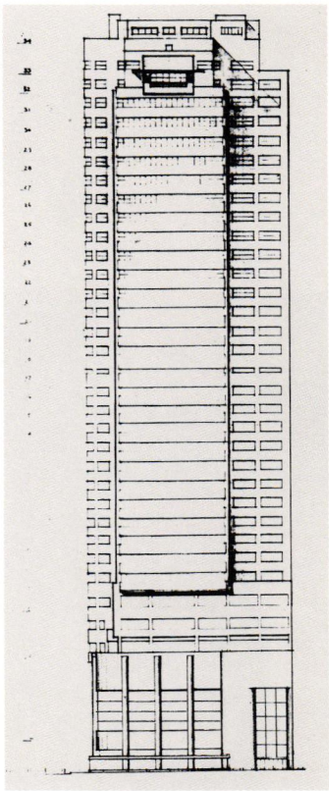

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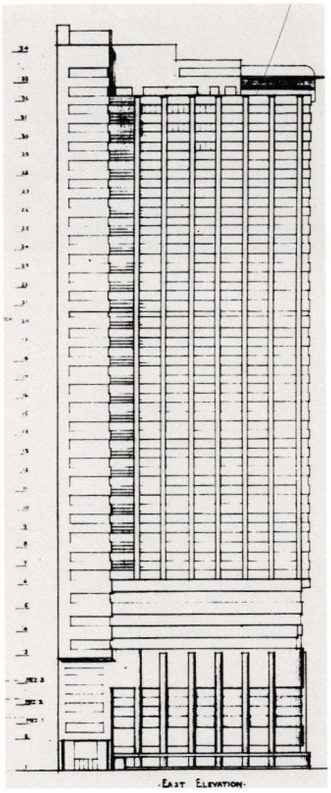

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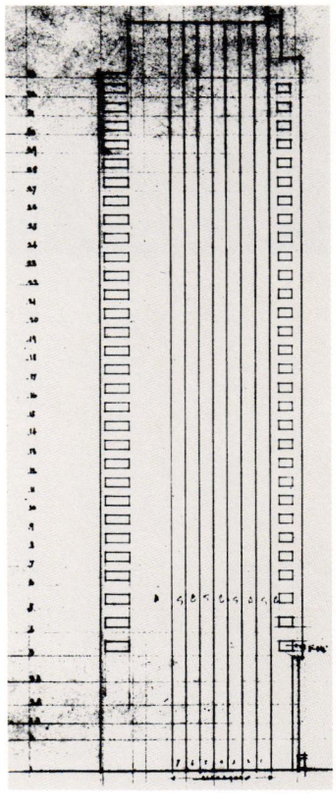


16

12. Perspective, (corresponds to images 14, 15, and 16).

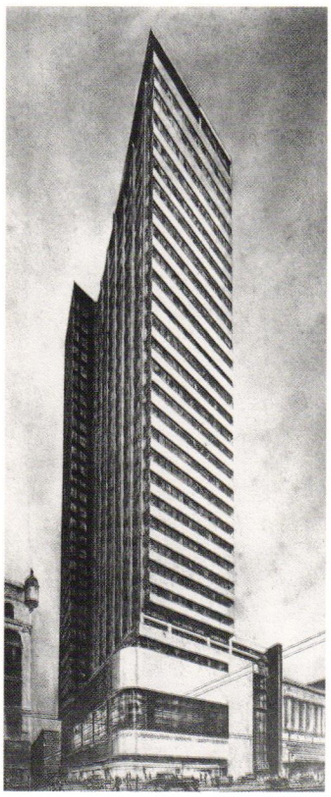
13. North elevation study, November 1930.

Elevation studies, January 1931 (?).

14. North

15. East

16. South



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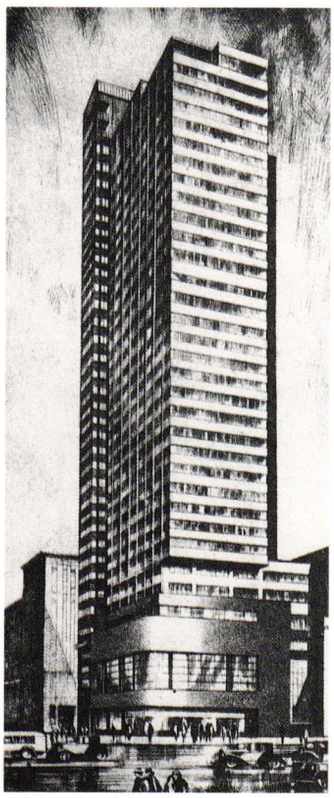

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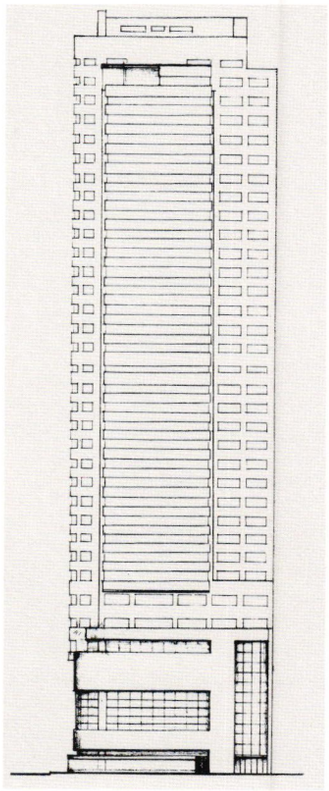


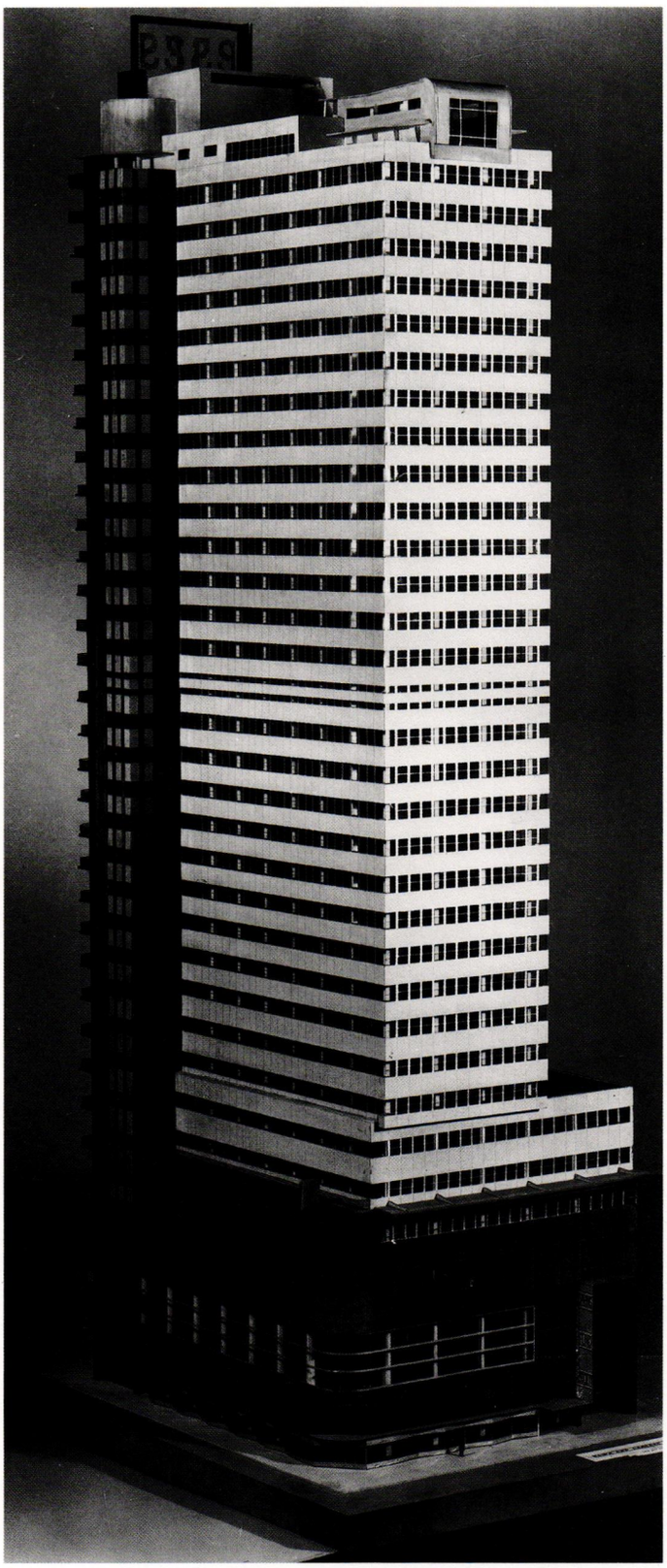
19

17, 18. *Perspectives, (correspond to image 19).*

19. *North elevation study, January 1931.*

20. *Presentation model, July 1930.*

21. *Photomontage of presentation model in site.*



20



21



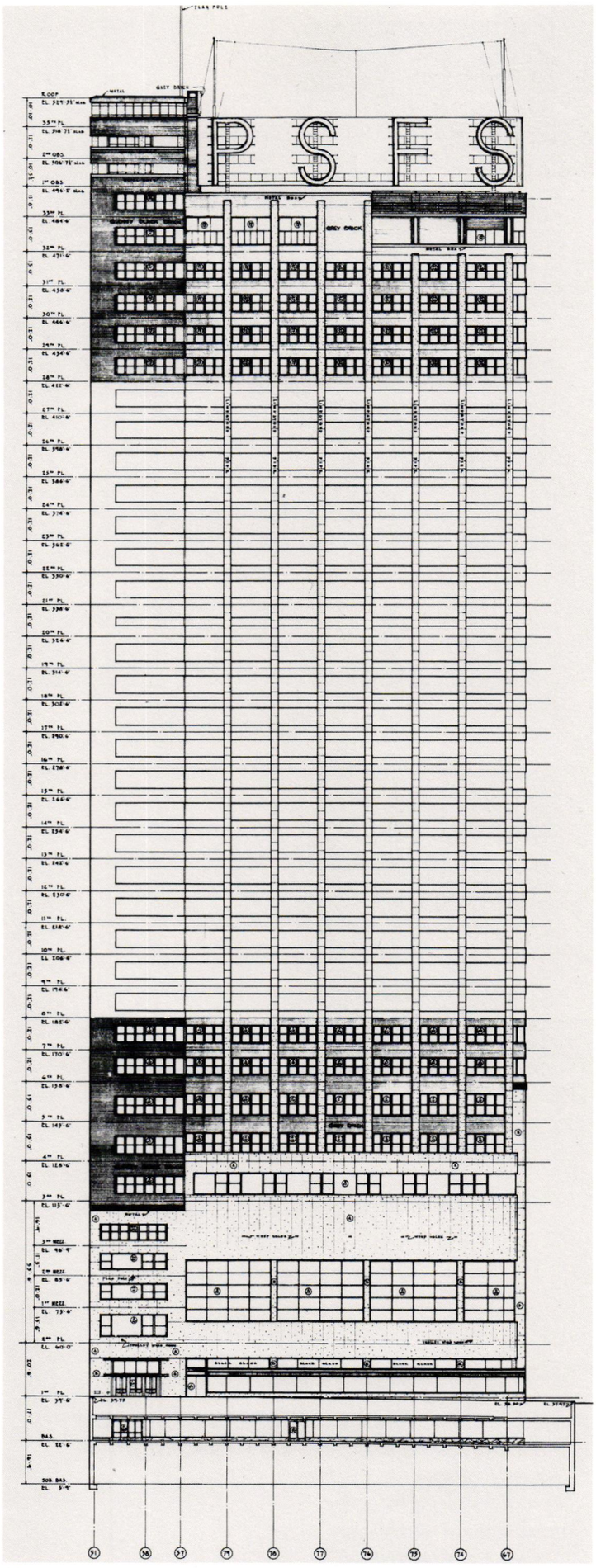
22

22. View from Reading Terminal during construction, November 1931.

Elevations, working drawing. (The total building height is 491 feet, exclusive of the radio antenna.)

23. East

24. North



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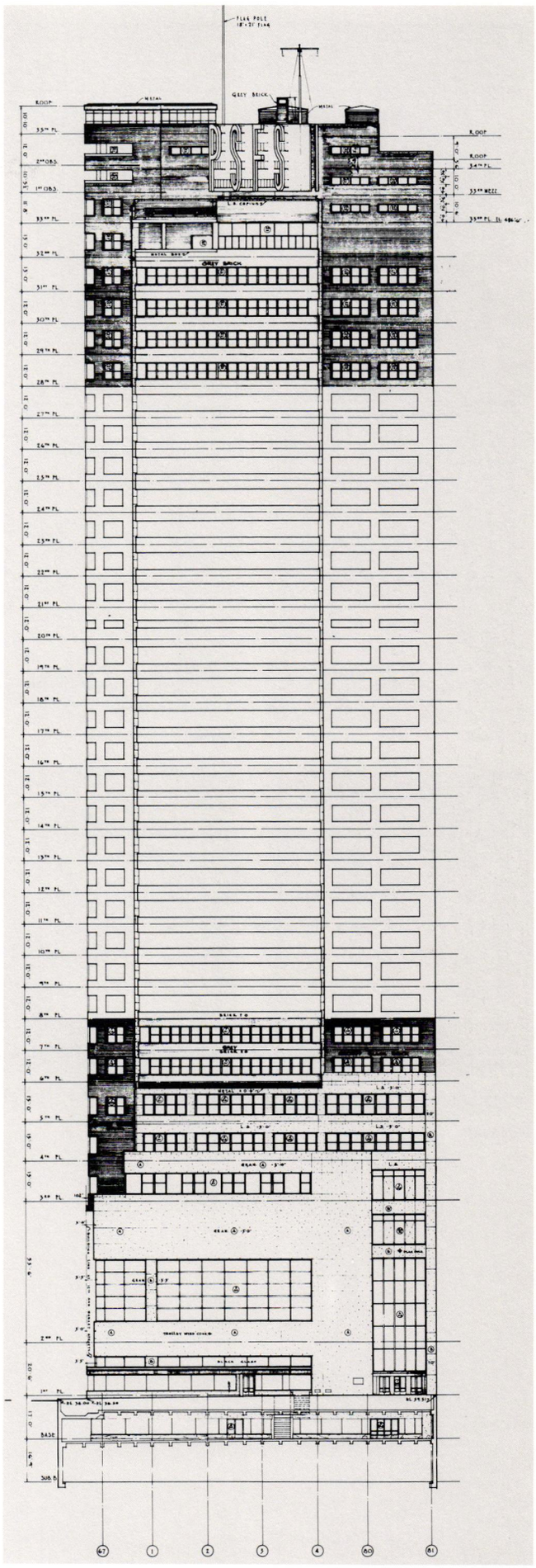

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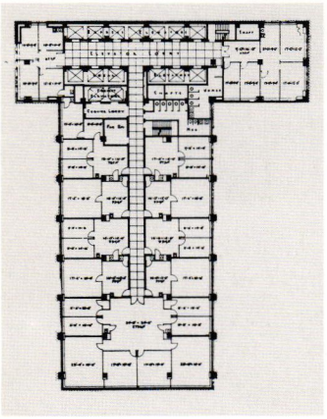
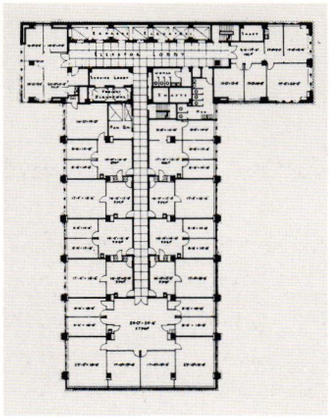
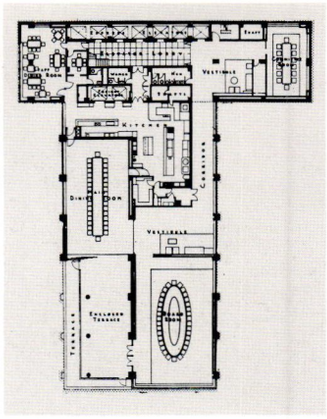


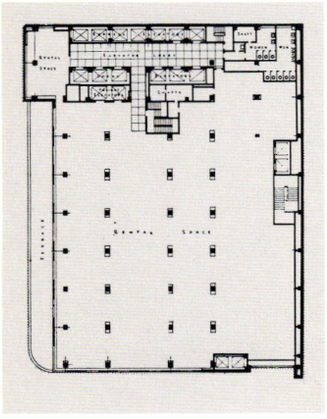
6th to 19th Floor



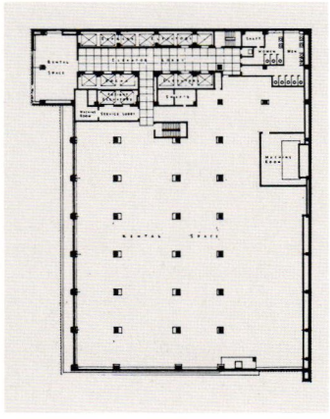
21st to 31st Floor



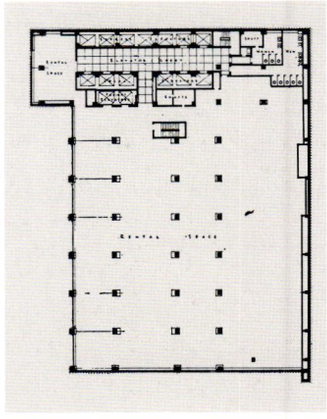
32nd Floor



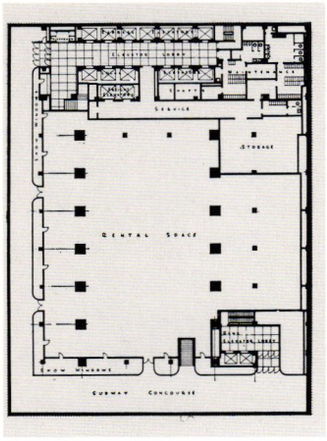
3rd Floor



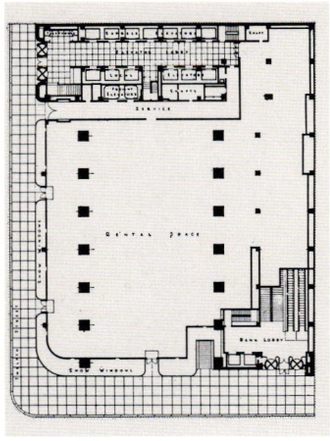
4th Floor



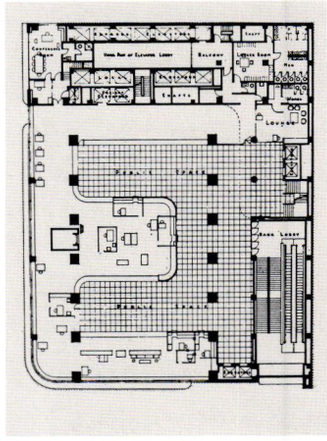
5th Floor



Basement



1st Floor



2nd Floor

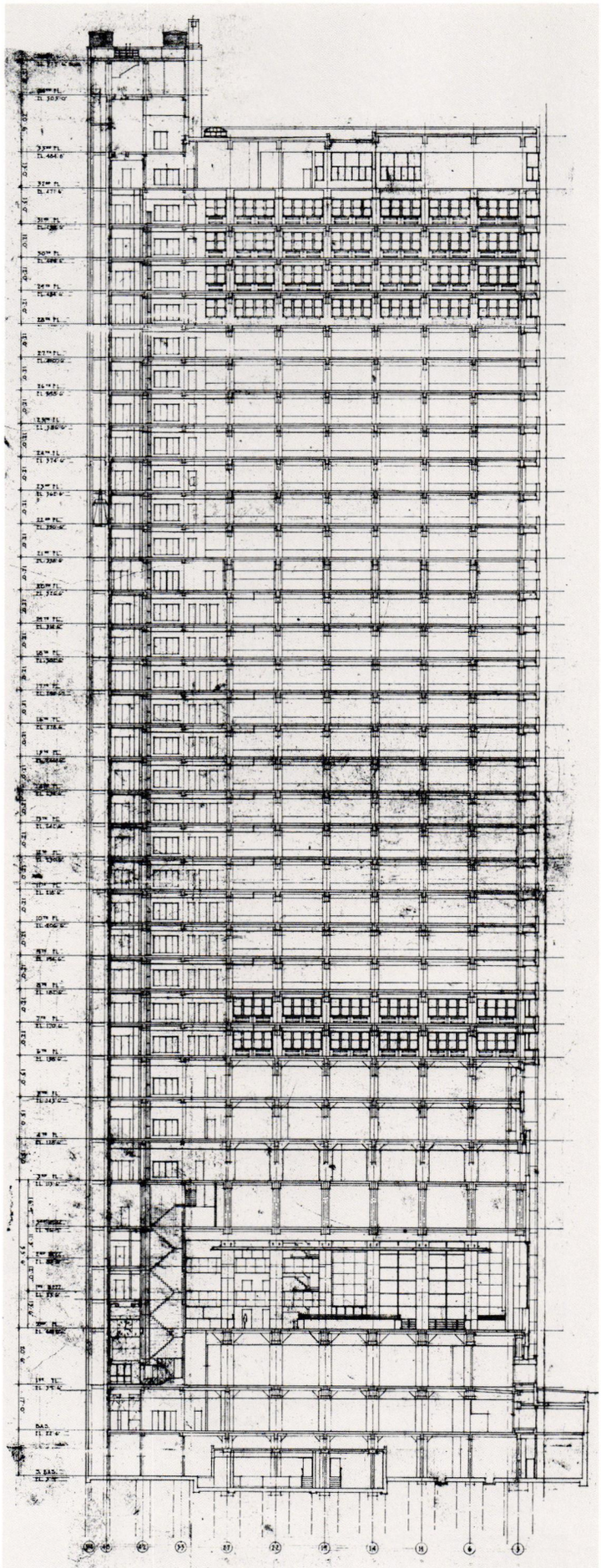
25

25. Plans, presentation drawing. The lot size is approximately 132 feet on Market Street by 164 feet on Twelfth Street. The twentieth floor contains the building mechanical equipment. (North is to the bottom of the page.)

Building sections, working drawing.

26. South/north

27. East/west



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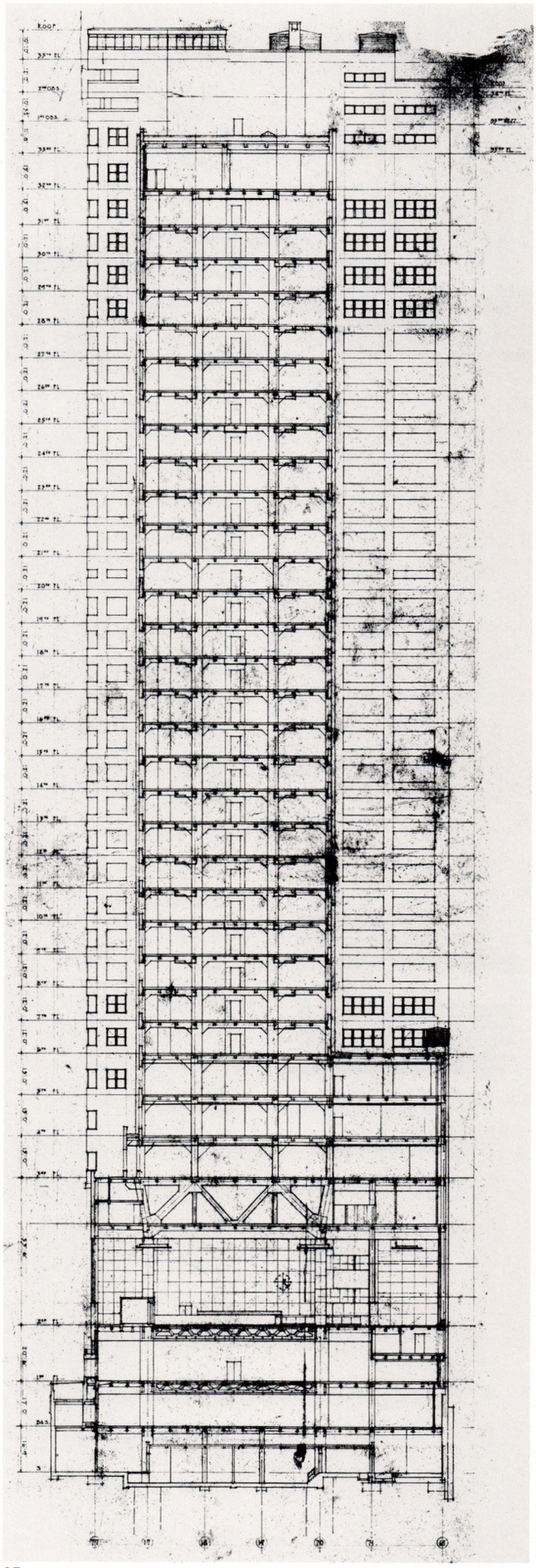

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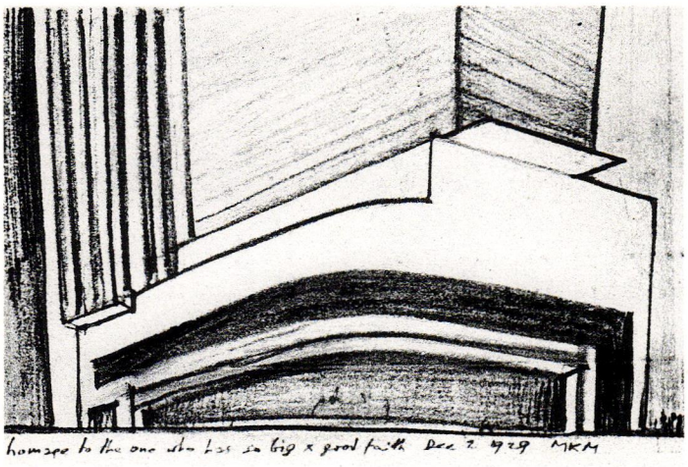

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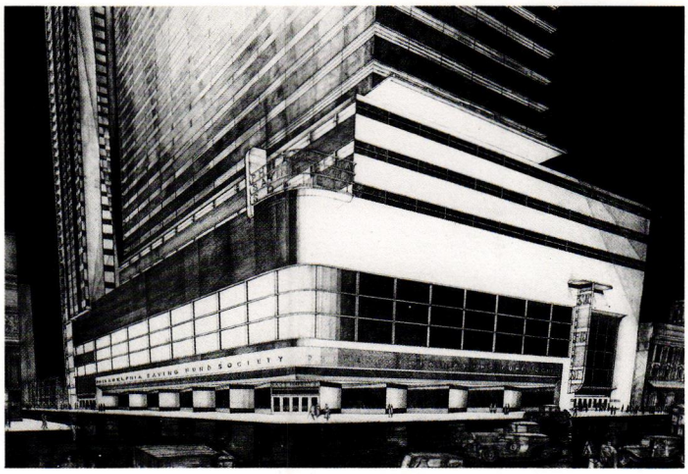

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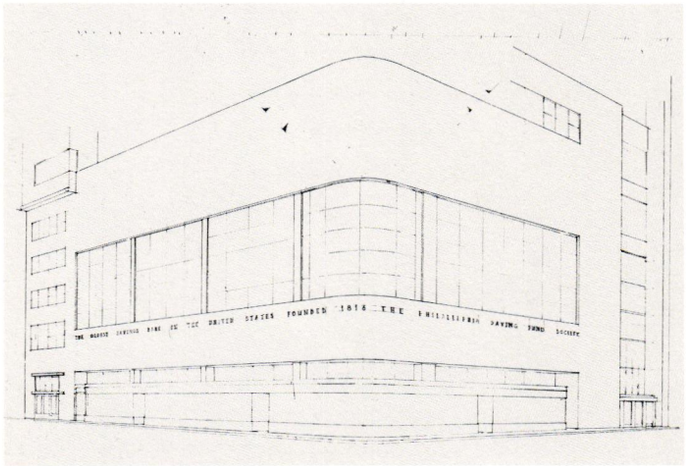

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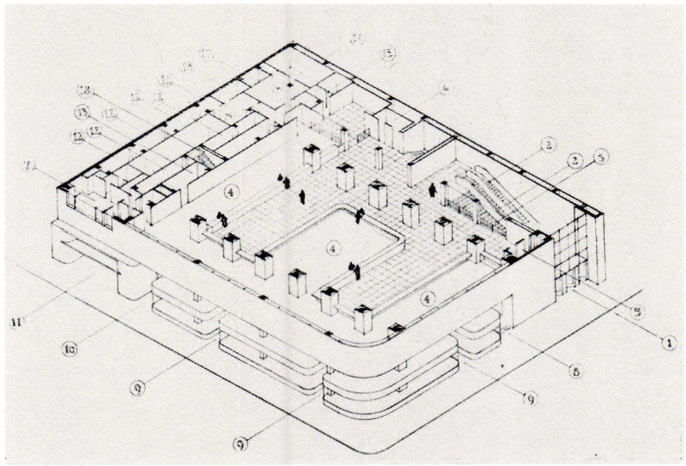

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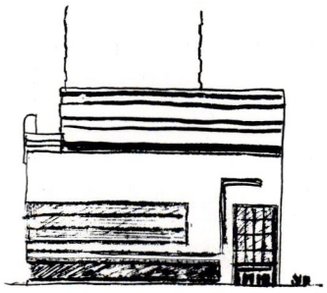


32

28. *W. Lescaze, perspective study, December 1929.*

29. *W. Lescaze, perspective study, December 1929.*

30. *Perspective study, May 1932.*

31. *Axonometric showing the bank and office tower entrances and the banking hall.*

32. *W. Lescaze, elevation study, May 1930.*

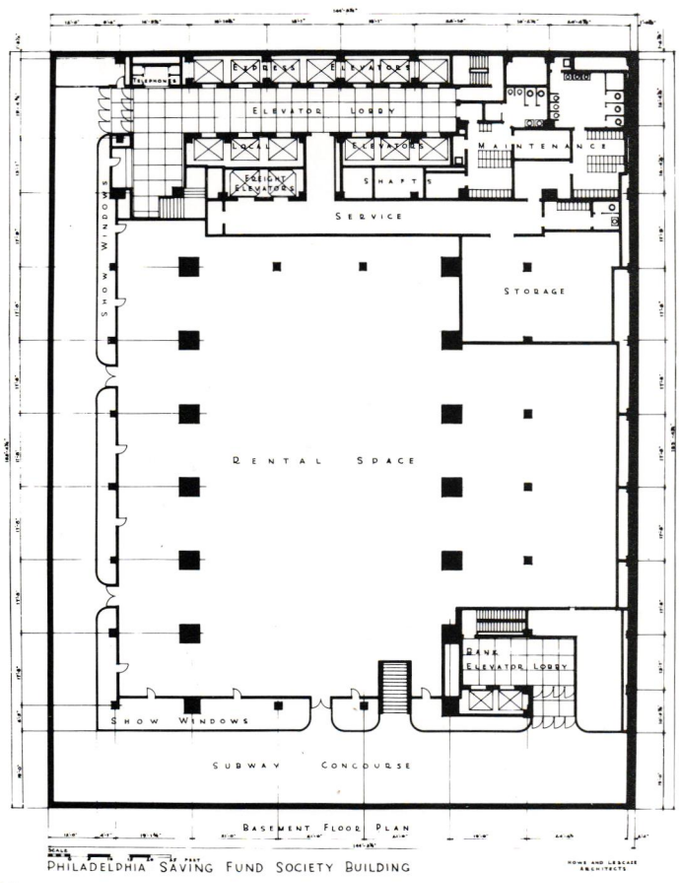
33. *Street level view, 1932.*

34. *Basement floor plan.*

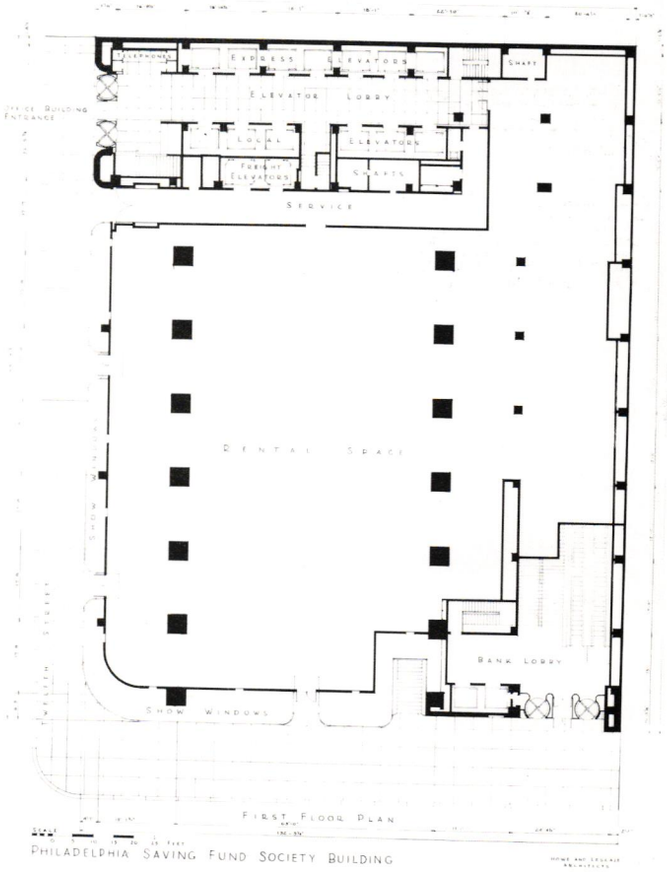
35. *First floor plan.*


Chesterfield
RENT

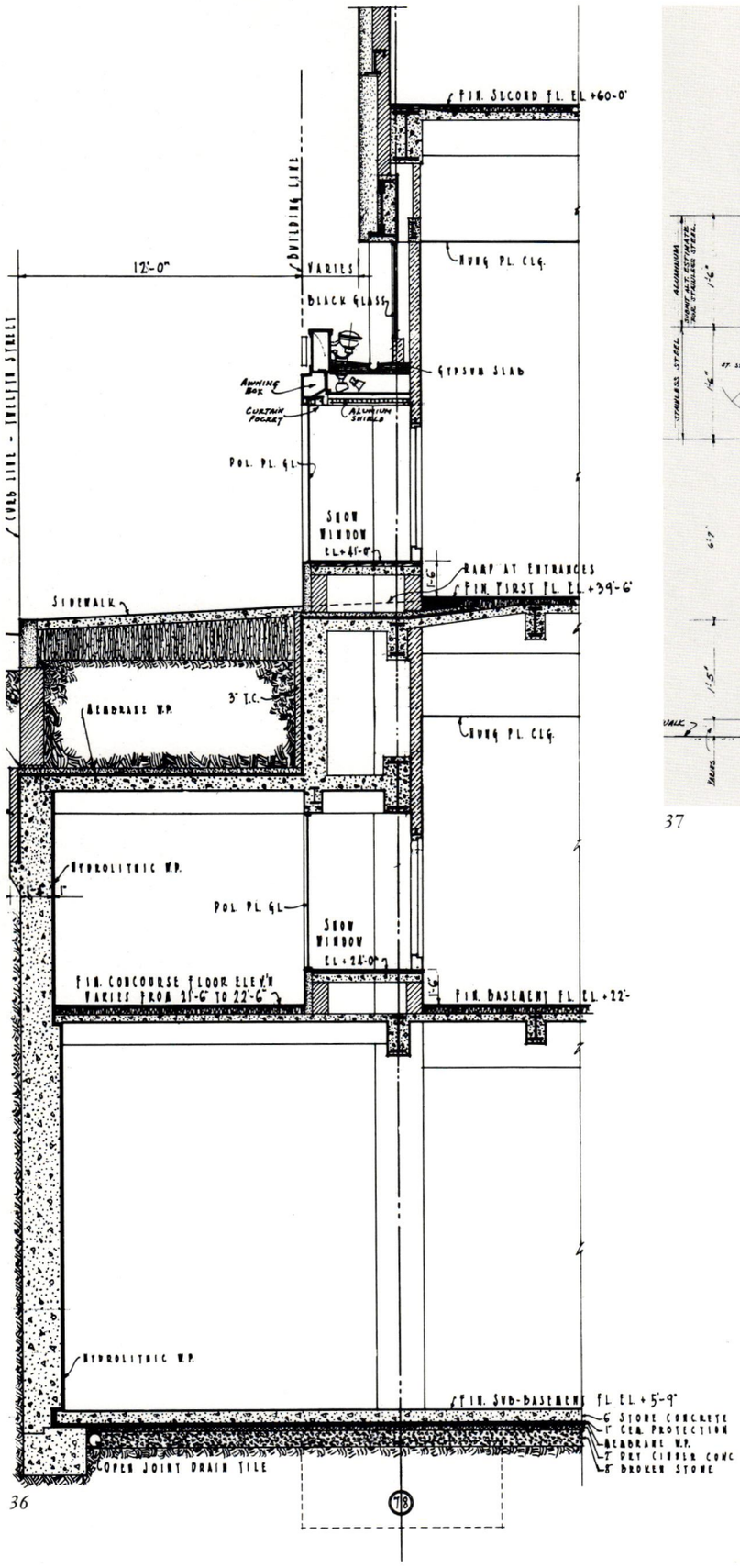
33


EXPRESS ELEVATORS
ELEVATOR LOBBY
LOCAL ELEVATORS
FREIGHT ELEVATORS
SHAFTS
MAINTENANCE
SERVICE
STORAGE
SHOW WINDOWS
RENTAL SPACE
BANK ELEVATOR LOBBY
SHOW WINDOWS
SUBWAY CONCOURSE
BASEMENT FLOOR PLAN
PHILADELPHIA SAVING FUND SOCIETY BUILDING

34


EXPRESS ELEVATORS
SHAFT
ELEVATOR LOBBY
LOCAL ELEVATORS
FREIGHT ELEVATORS
SHAFTS
SERVICE
RENTAL SPACE
BANK LOBBY
SHOW WINDOWS
FIRST FLOOR PLAN
PHILADELPHIA SAVING FUND SOCIETY BUILDING

35



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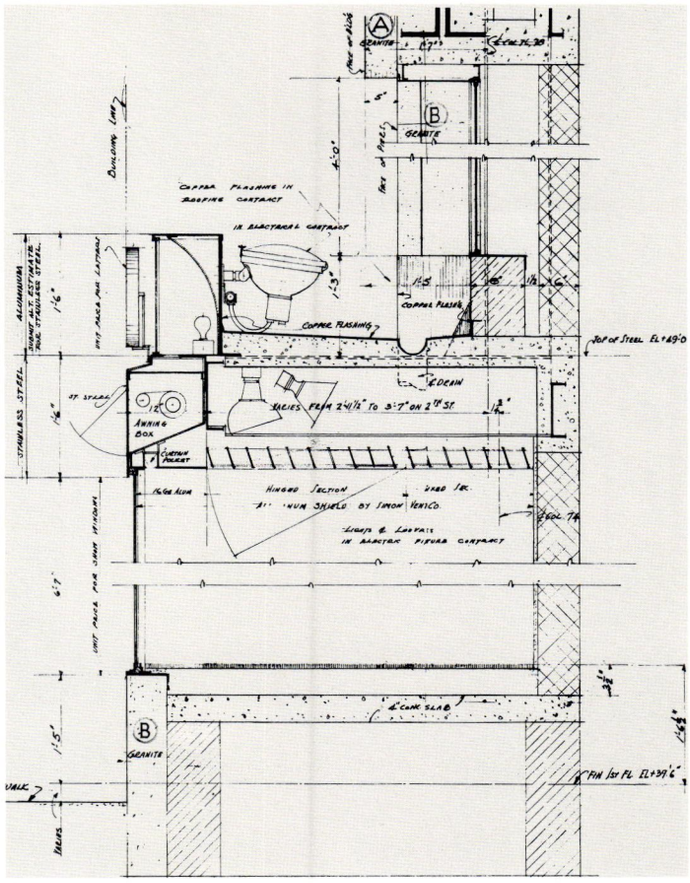


37

36. Section through Twelfth Street sidewalk, showing the basement concourse and street level display windows (similar condition at Market Street), working drawing.

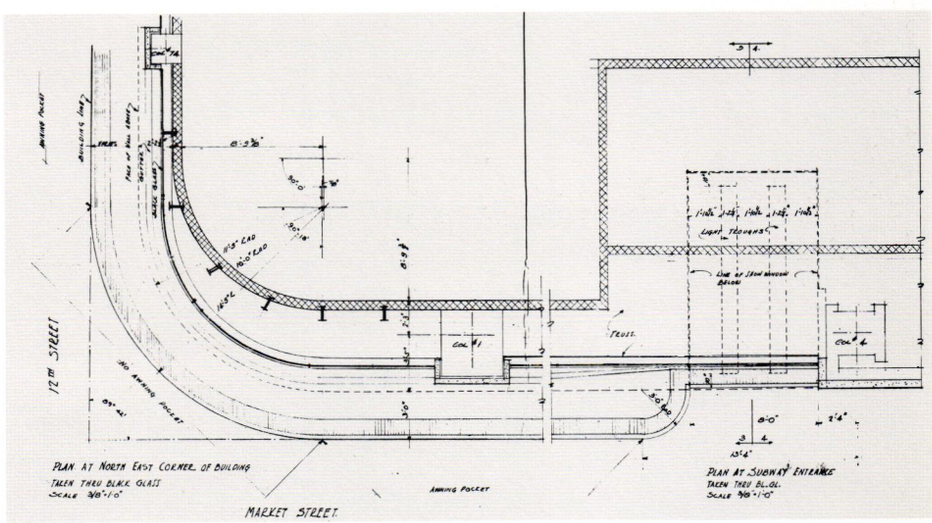
37. Detail of display windows showing the uplighting and black glass, working drawing.



38

38. Partial view of original Market Street facade showing Thompson's Restaurant and subway entrance, 1932. The street level facade is composed of a polished black granite base, above which are clear glass display cases, stainless steel panels, signage mounted on the horizontal light box, recessed black glass panels, and the polished gray granite of the banking hall exterior wall.

39. Plan of base at the northeast corner and at the subway entrance taken through the black glass, working drawing.



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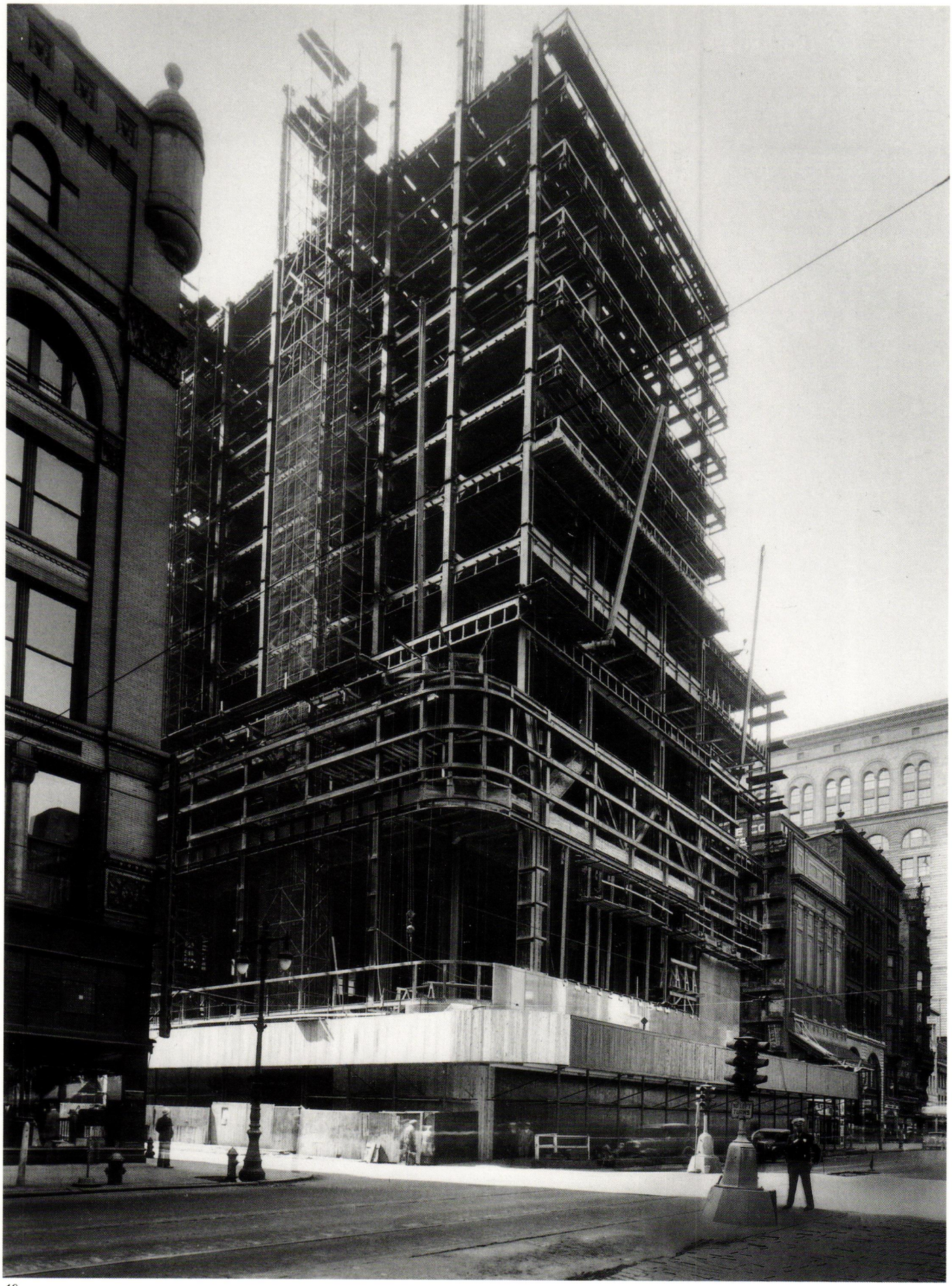

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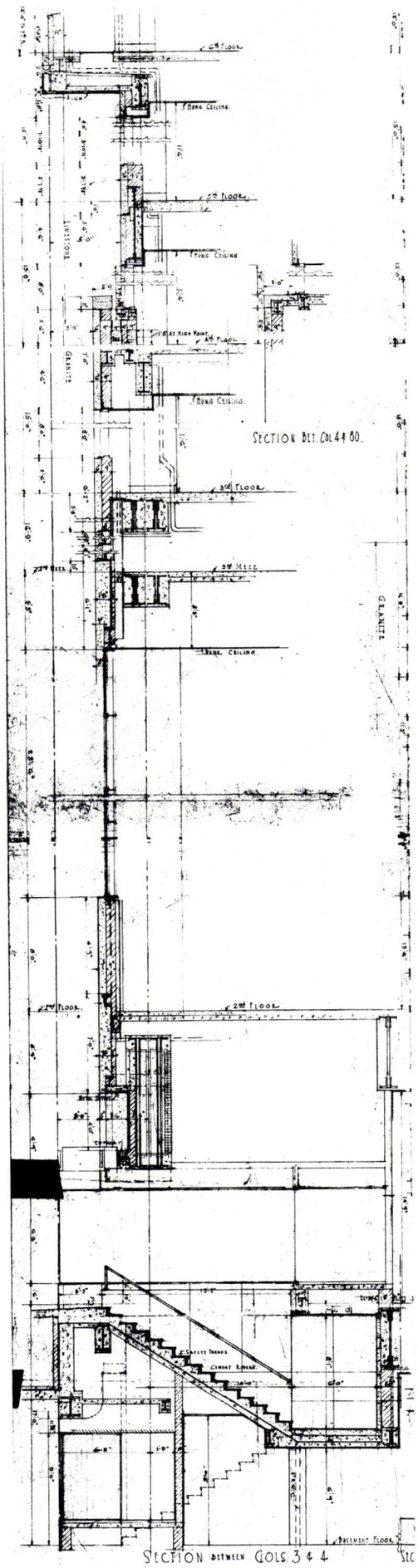
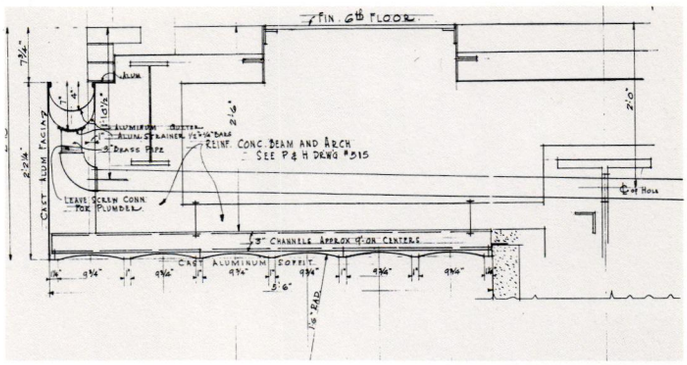




42



43

40. View of northeast corner under construction, September 1931.

41. Section through Market Street facade at subway entrance from basement to sixth floor, working drawing.

42. Detail section of aluminum soffit at the sixth floor cantilever, working drawing.

43. View of northeast corner showing the sixth floor cantilever of the office tower.



44



45

44. South wall at office tower entrance showing change in materials from gray and black polished granite to glazed black brick.

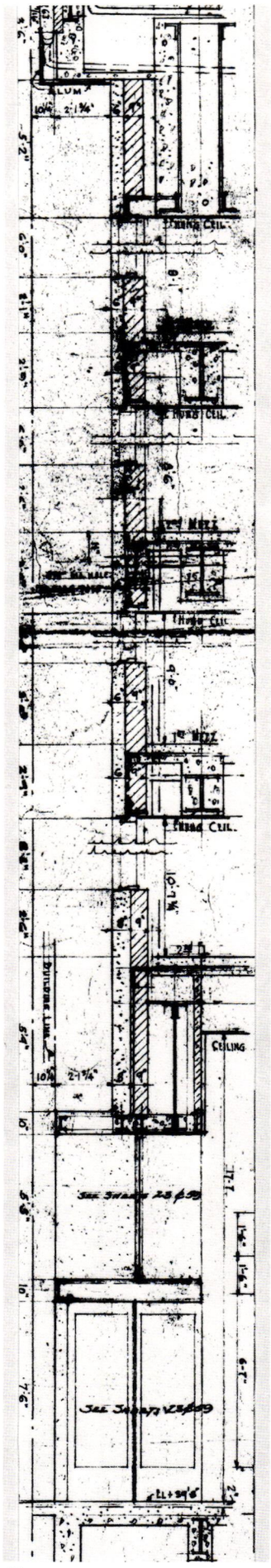
45. View south along Twelfth Street showing the cantilever at the third floor.

46. Section through office tower entrance from first floor to third floor cantilever, working drawing.

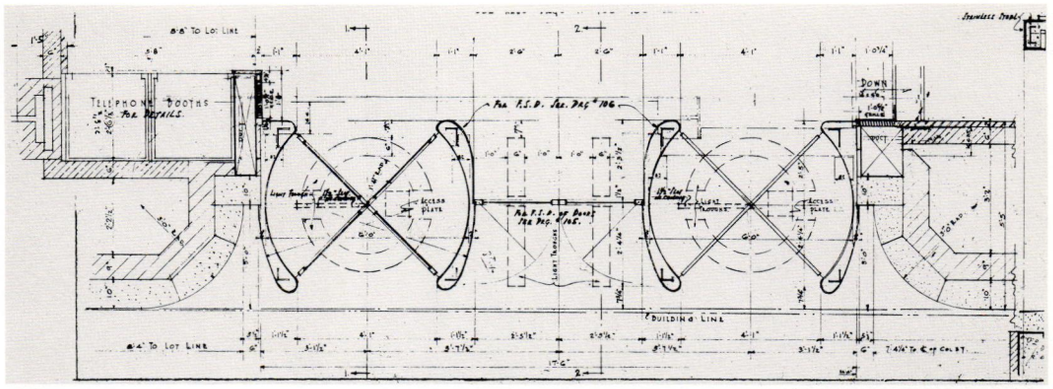
47. Plan of office tower entrance, working drawing.

48. Interior/exterior elevation of office tower entrance, working drawing.

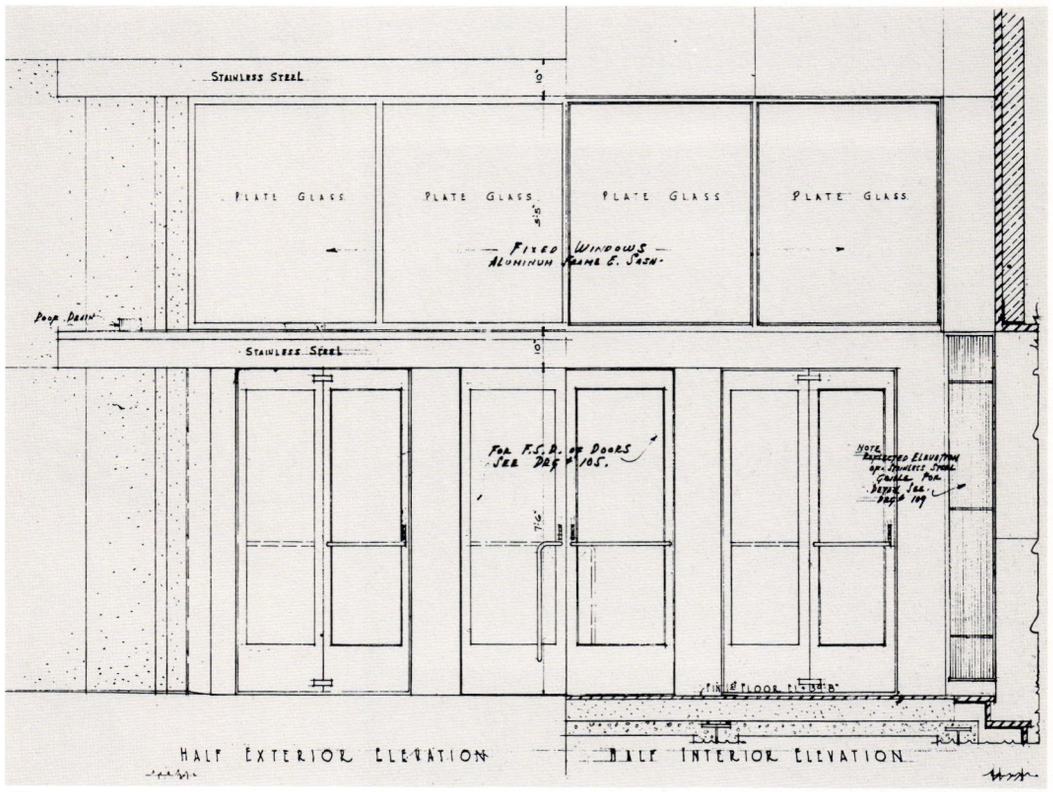
49. Office tower entrance.


ALUM.
Hung Ceil.
Fixed Ceil.
CEILING

46


TELEPHONE BOOTHS FOR PATRONS
DOWN
BUILDING LINE

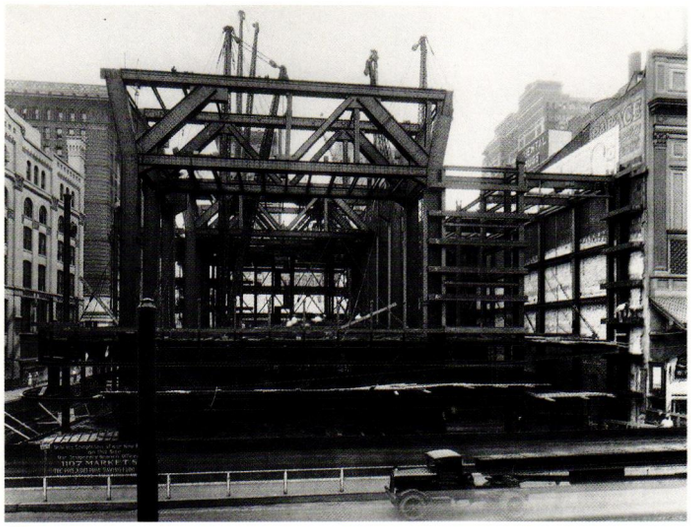
47


STAINLESS STEEL
PLATE GLASS
PLATE GLASS
PLATE GLASS
PLATE GLASS
FIXED WINDOWS
ALUMINUM FRAME & SASH
STAINLESS STEEL
HALF EXTERIOR ELEVATION
HALF INTERIOR ELEVATION

48


PSFS BUILDING
12 SOUTH 12TH ST

49



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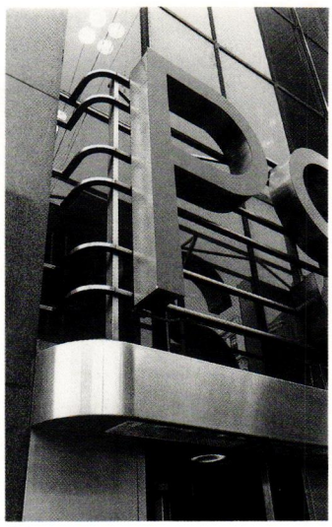

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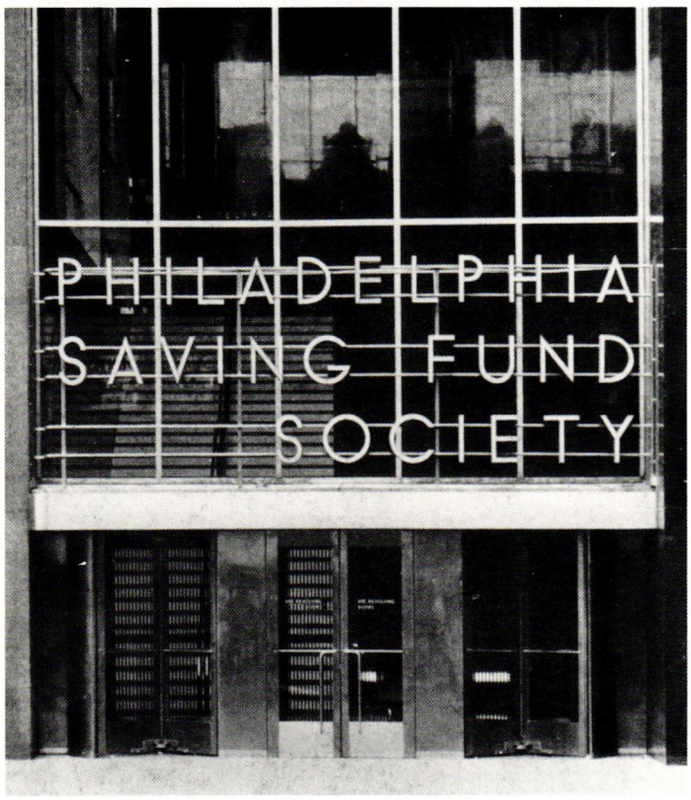

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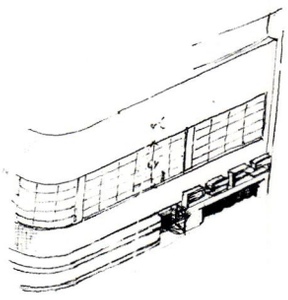

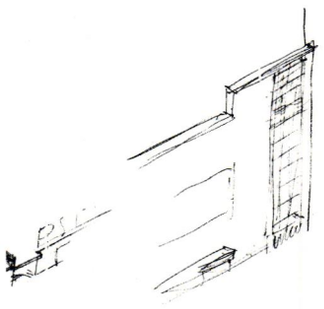

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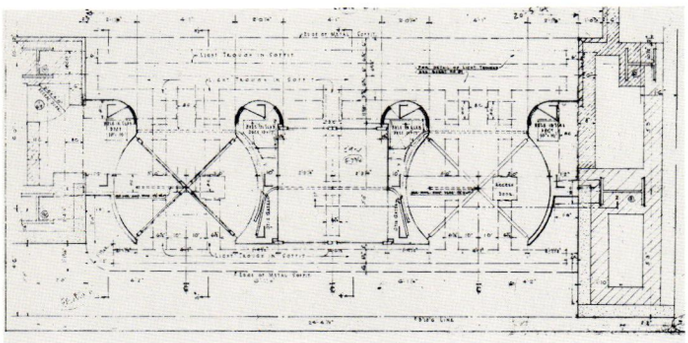

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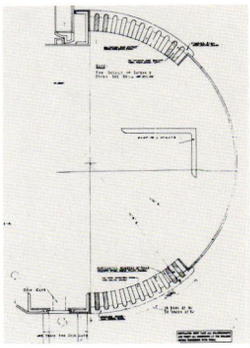
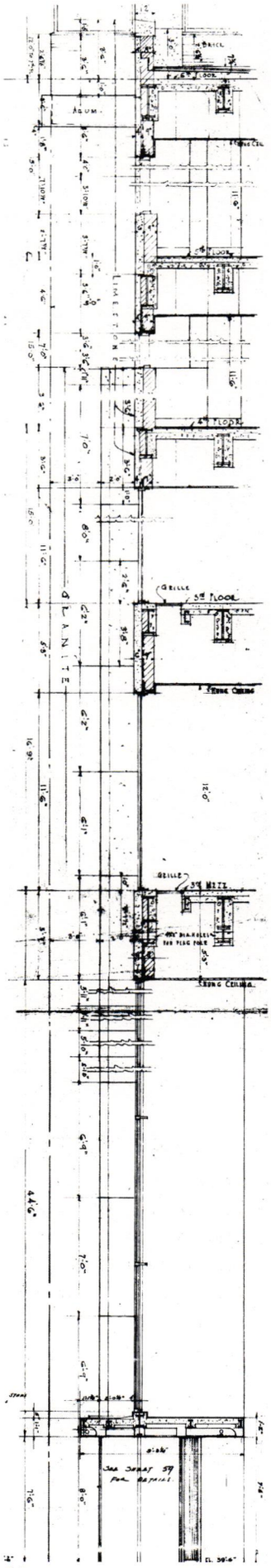


55

50. View from Market Street showing construction of the banking hall on the second floor and the bank entrance on the right, August 1931. Transfer girders, above the banking hall, support the weight of the office tower.

51. Detail of new sign at bank entrance, 1988.

52. Bank entrance with original signage. The ground floor stainless steel assemblage protrudes slightly into the street. The glass curtain wall above is recessed behind the plane of the banking hall facade.



56


57

53. Studies of bank entrance at Market Street.

54. Plan of bank entrance, working drawing.

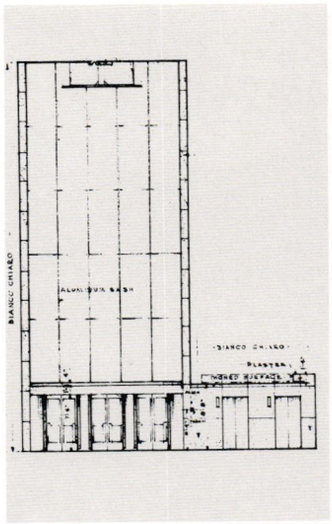
55. Detail of stainless steel heating supply grilles flanking the revolving doors, working drawing.

56. Section through bank entrance from first floor to sixth floor parapet, working drawing.

57. View to office tower from bank entrance, 1988.



58



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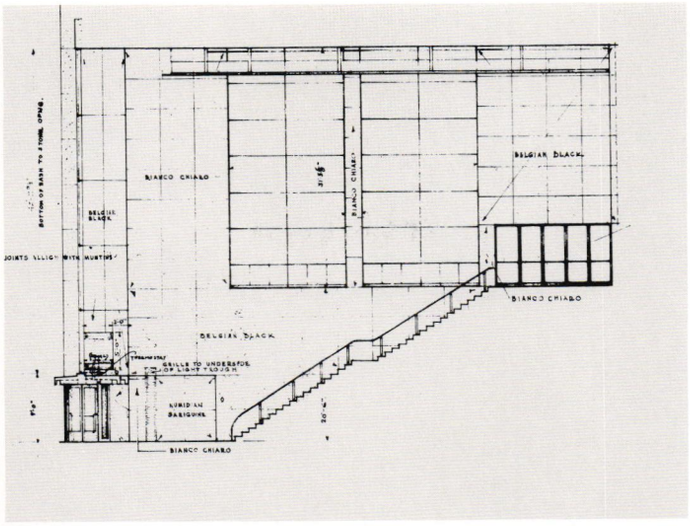

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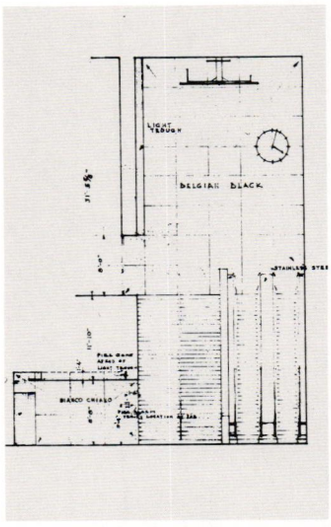

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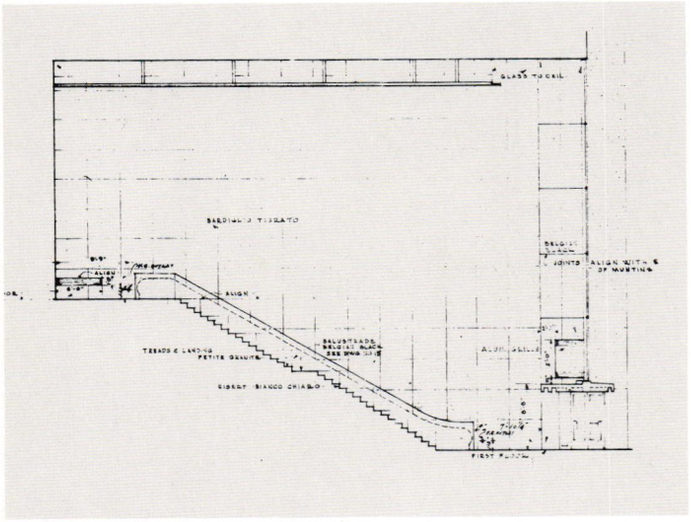

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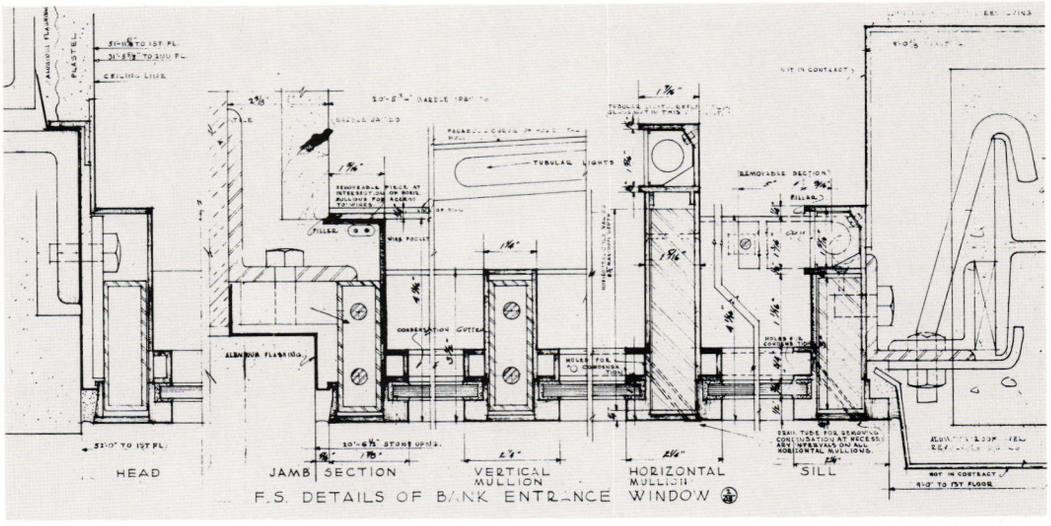


63

58. View north to Market Street from banking hall floor, 1932.

Elevations, working drawing.

59. North

60. East

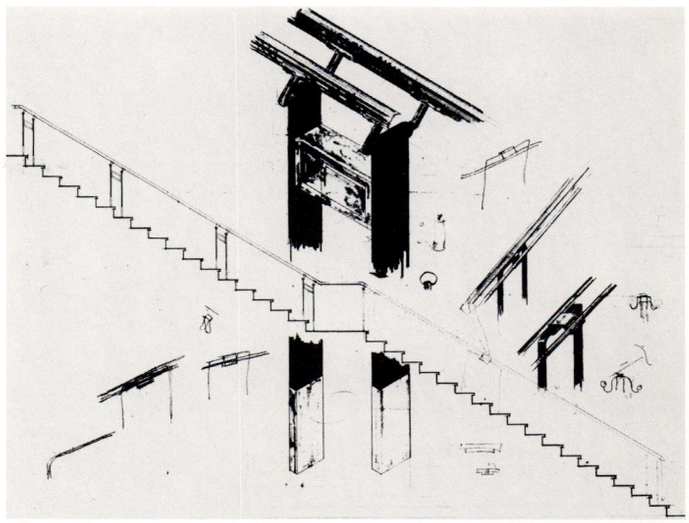
61. South

62. West

63. Detail of windows above the bank entrance doors showing the parabolic horizontal mullions with integral tubular lighting, working drawing.



64



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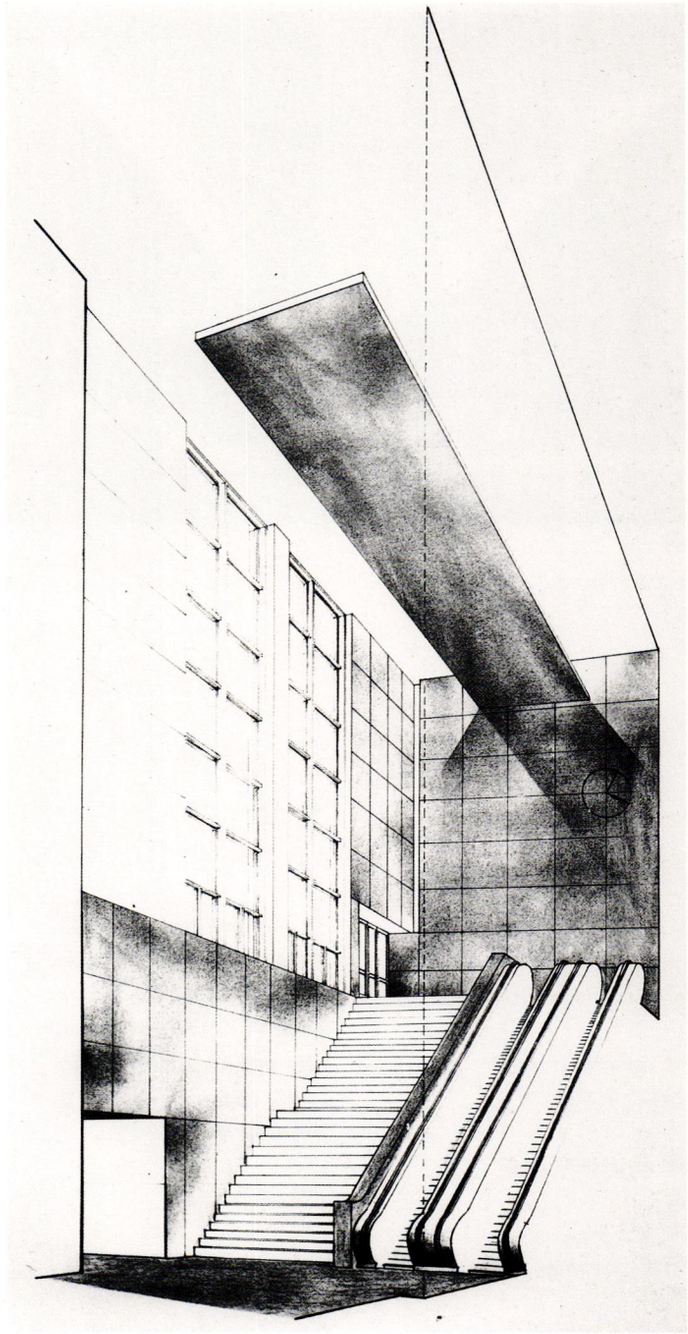
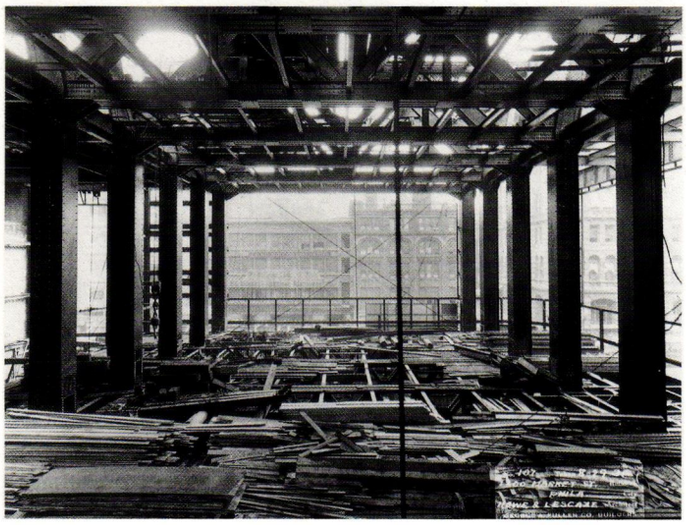


66

64. View to banking hall floor from entrance, 1932.

65. Study of handrail.

66. Perspective study.



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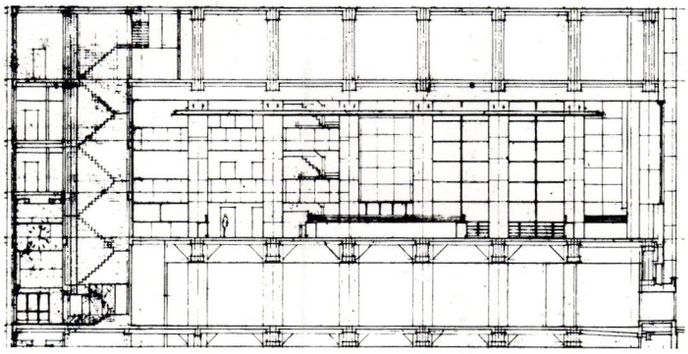

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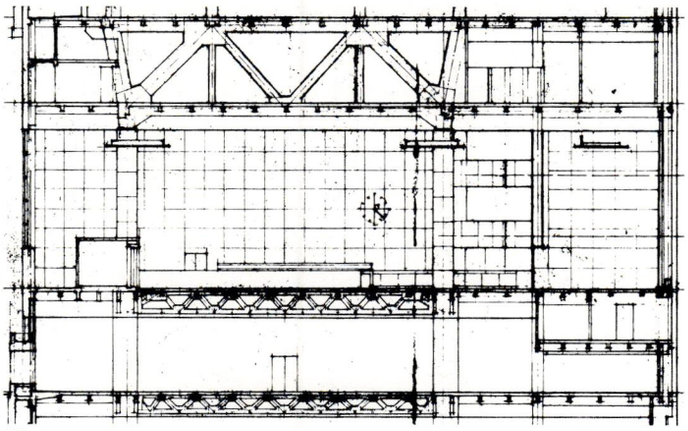

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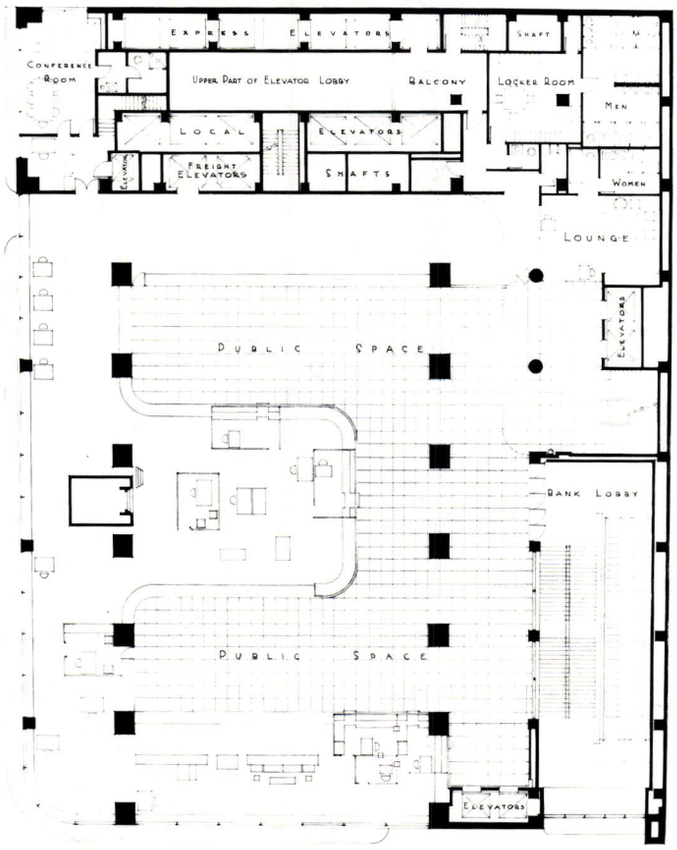


71

67. *View north to Market Street, August 1931. The columns carry the transfer girders above.*

68. *South/north section, working drawing.*

69. *View south, 1949.*

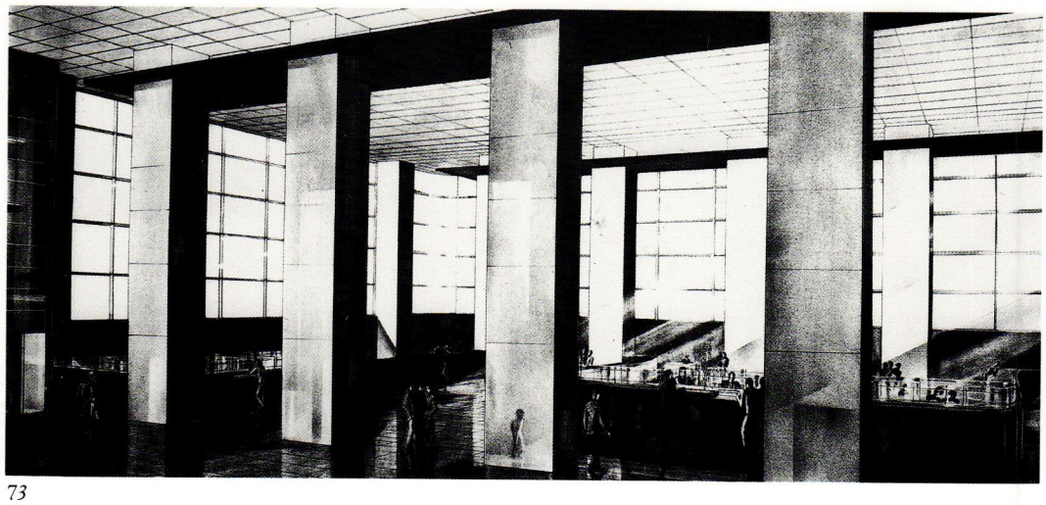
70. *East/west section, working drawing.*

71. *Second floor plan.*

72. *View south showing curved mezzanine balconies of bank offices, 1932. Balconies are clad in yellow marble. To the left of the black and white marble columns is the main public space, and to the right of the glass wall is the bank lobby.*



72



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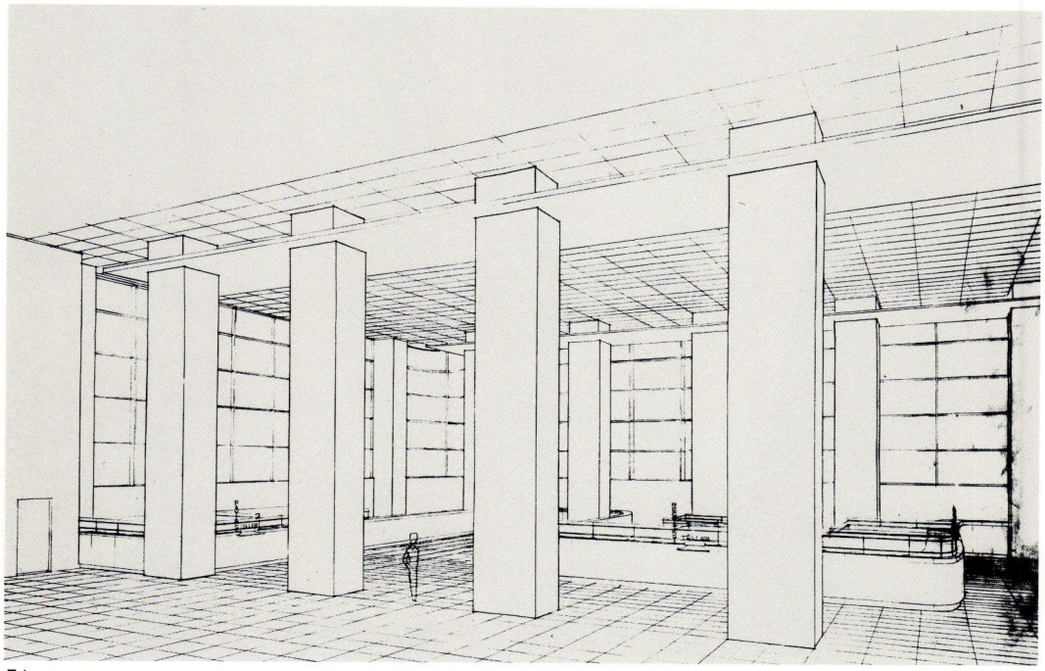


74

73, 74. Study perspectives.

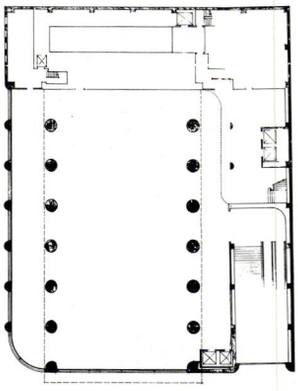
75. View northeast, 1932.



75



76



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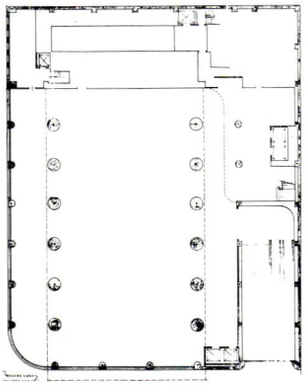

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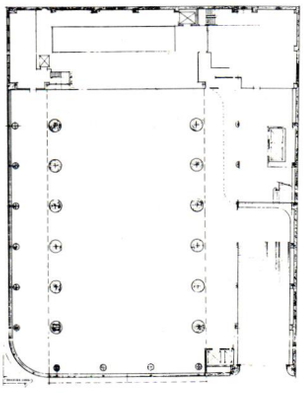


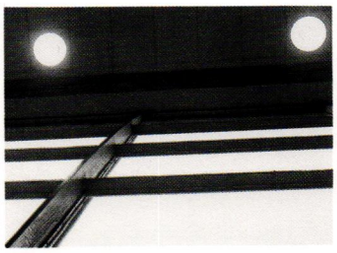
79

76. View east to Twelfth Street, 1932. The architects' design program included furniture, hardware, fixtures, graphics and typography.

77, 78, 79. Studies of the relationship of columns to exterior walls, January 1931.



80



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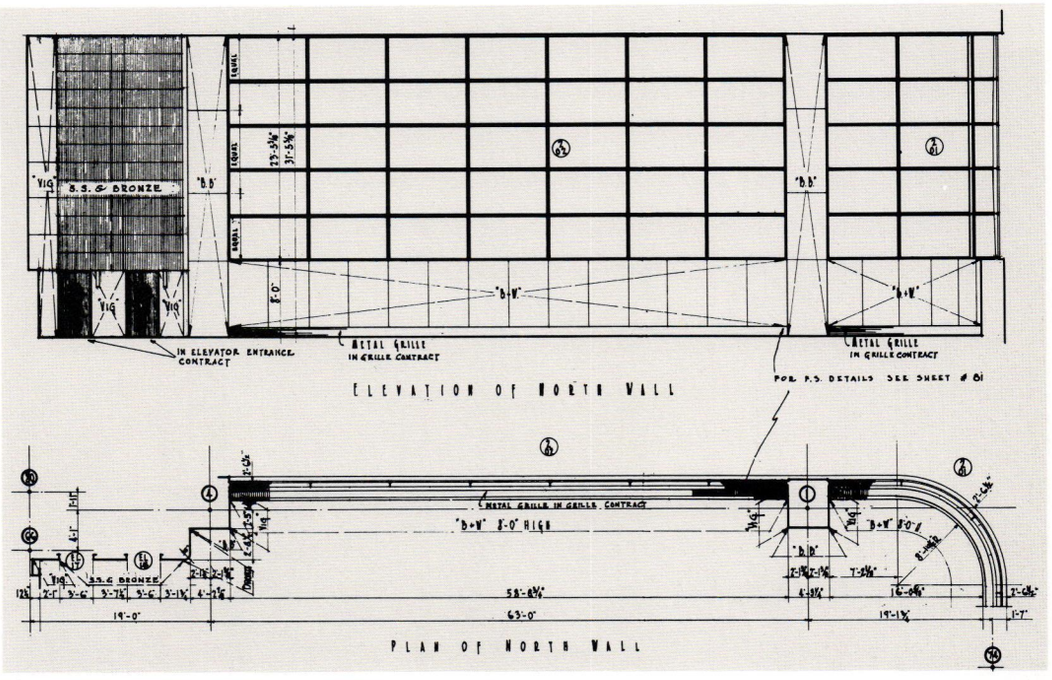

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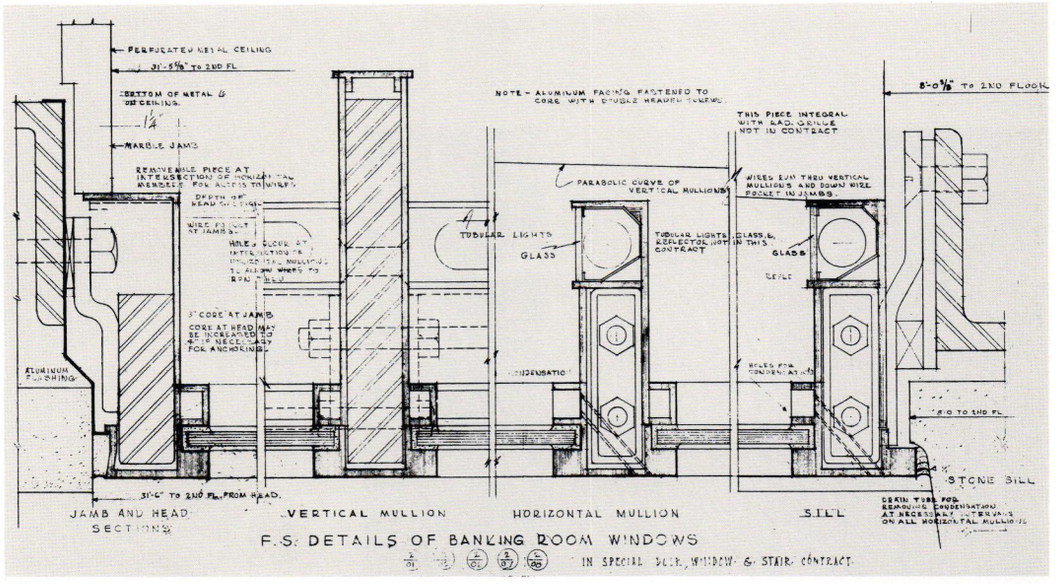


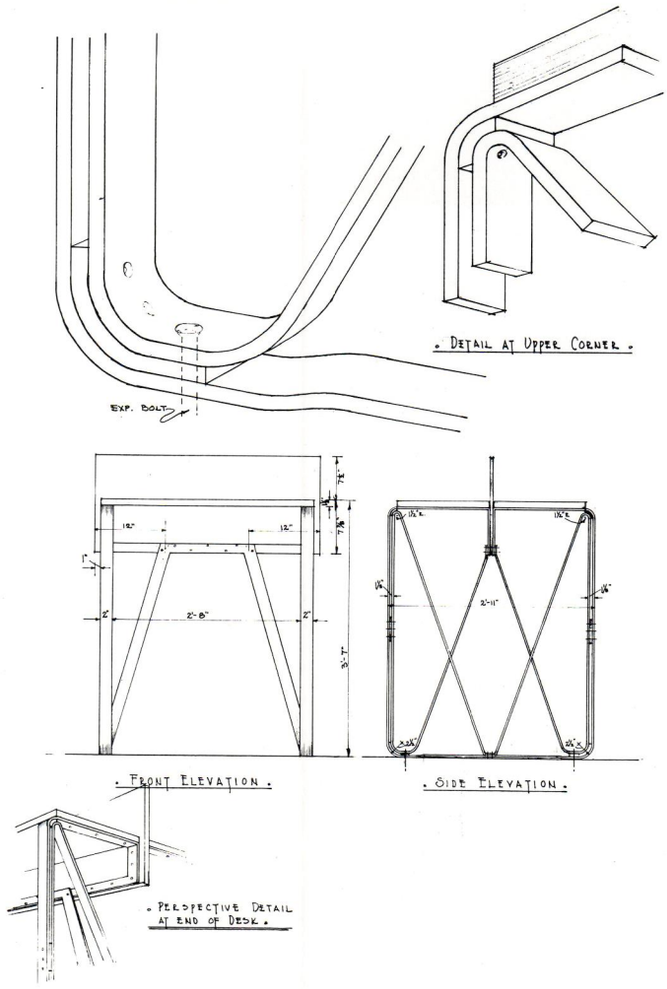
83

80. *Exterior view of fenestration, 1988.*

81. *Interior view of parabolic window mullions, 1988.*

82. *Elevation and plan of north wall, working drawing.*

83. *Detail of windows showing the parabolic vertical mullions and the horizontal mullions with integral tubular lighting, working drawing.*



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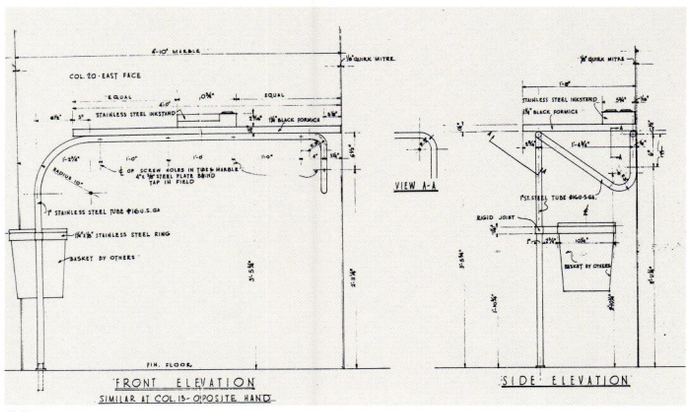
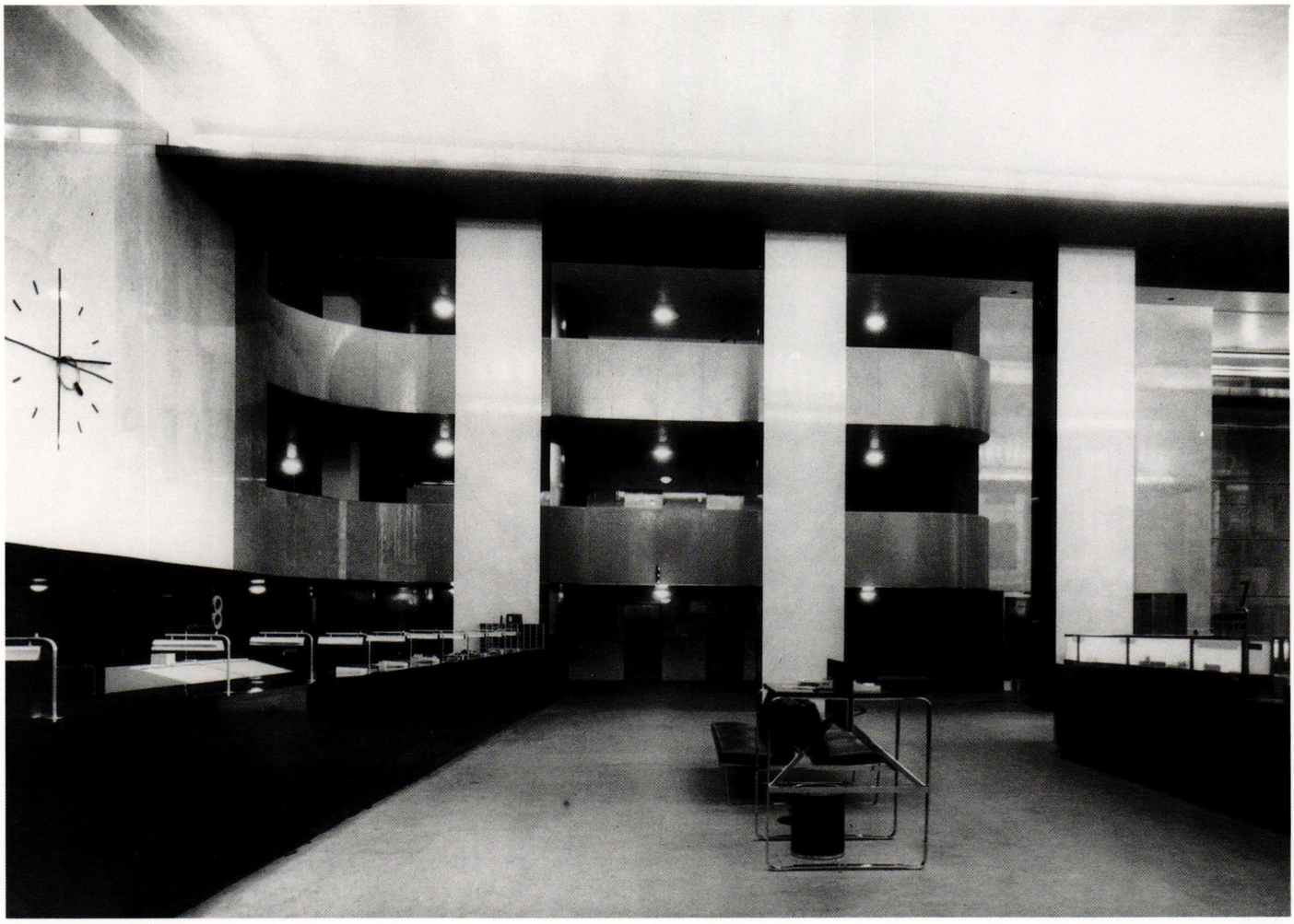


86

84. Study of high endorsement desk, September 1932.

85. Check writing counter at column, 1988.

86. Elevations of check writing counter attached to columns, working drawing.



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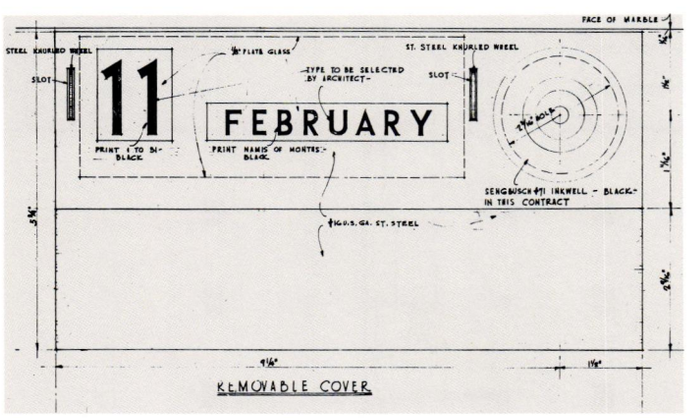

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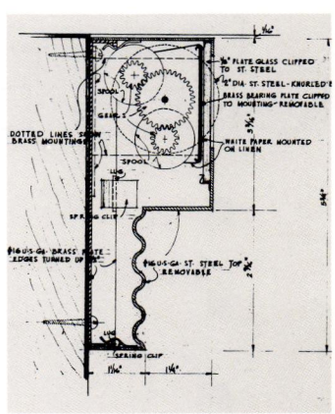


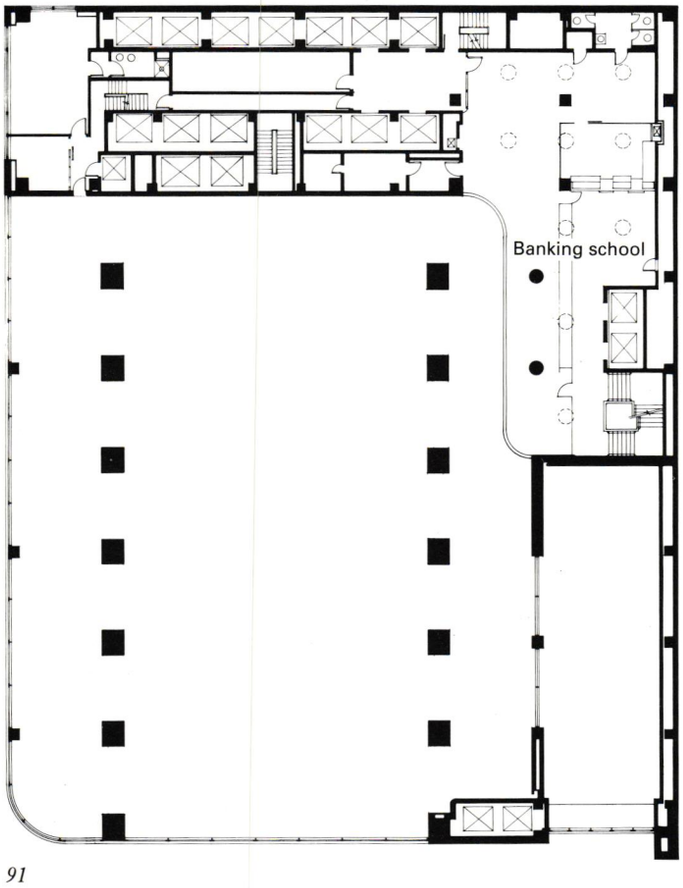
89

87. View west to first and second mezzanine balconies showing the original banking hall clock, 1932.

88, 89. Plan and section of inkstand at check writing counter, working drawing.



90



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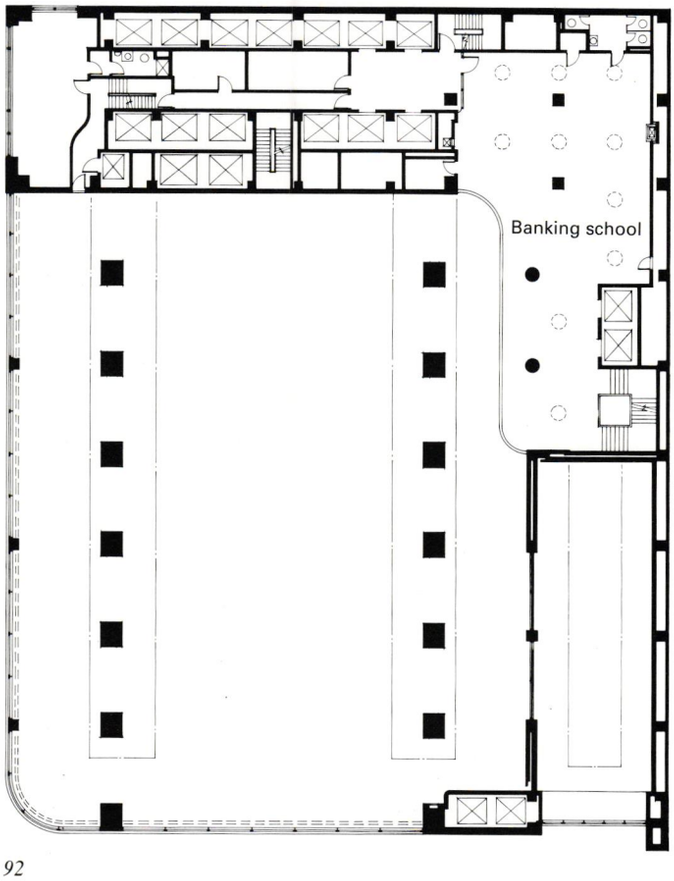

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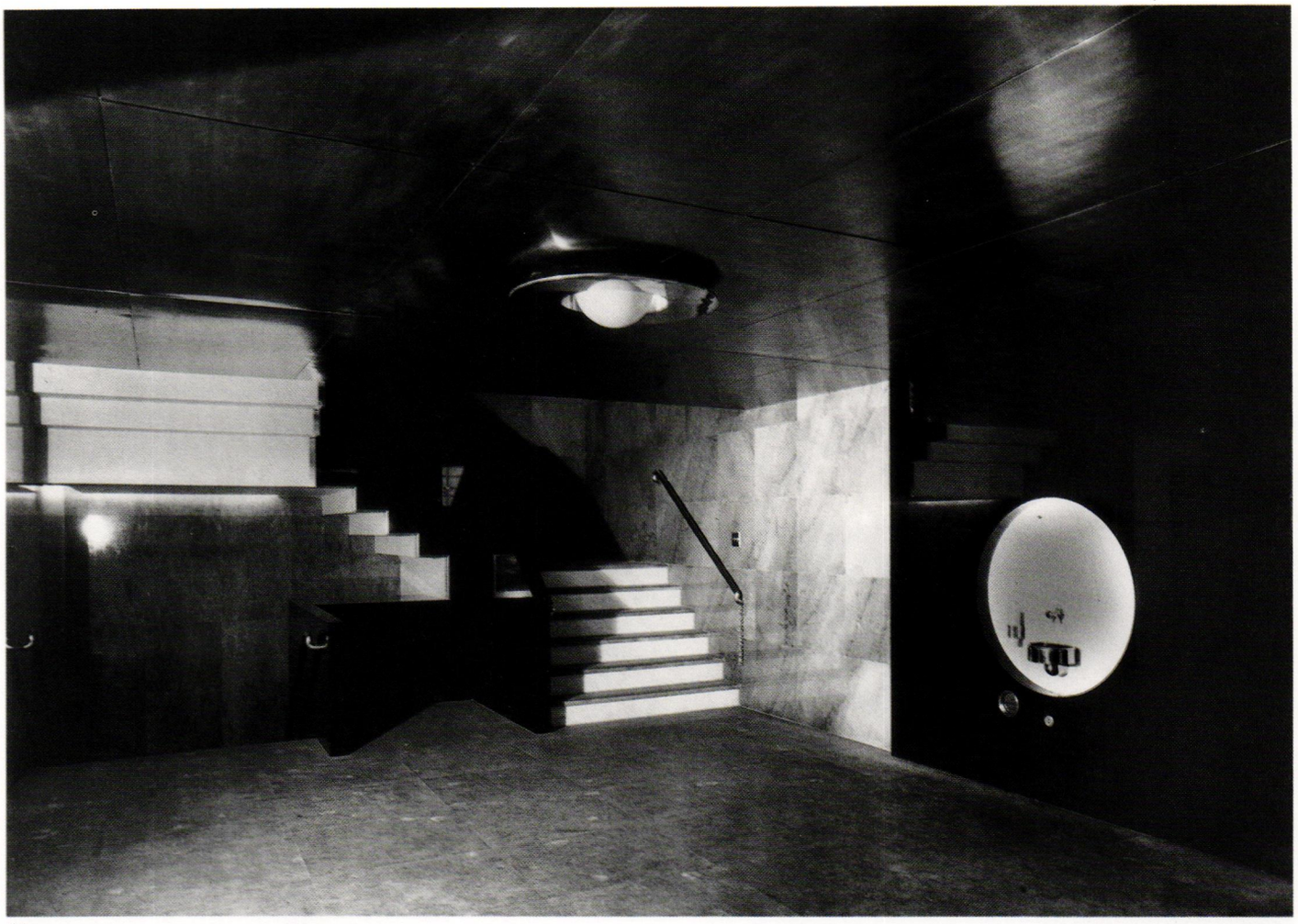

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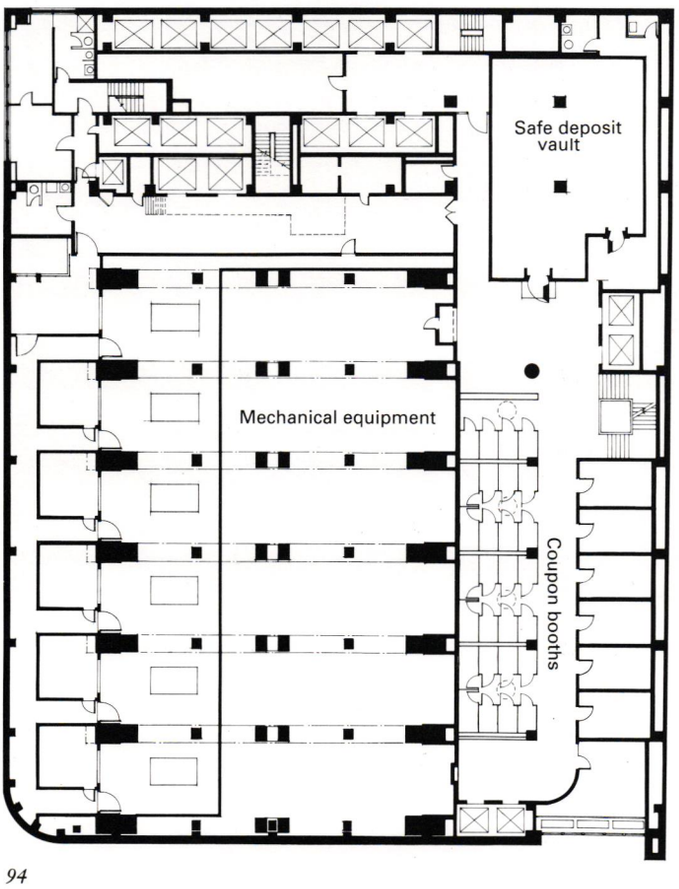


94

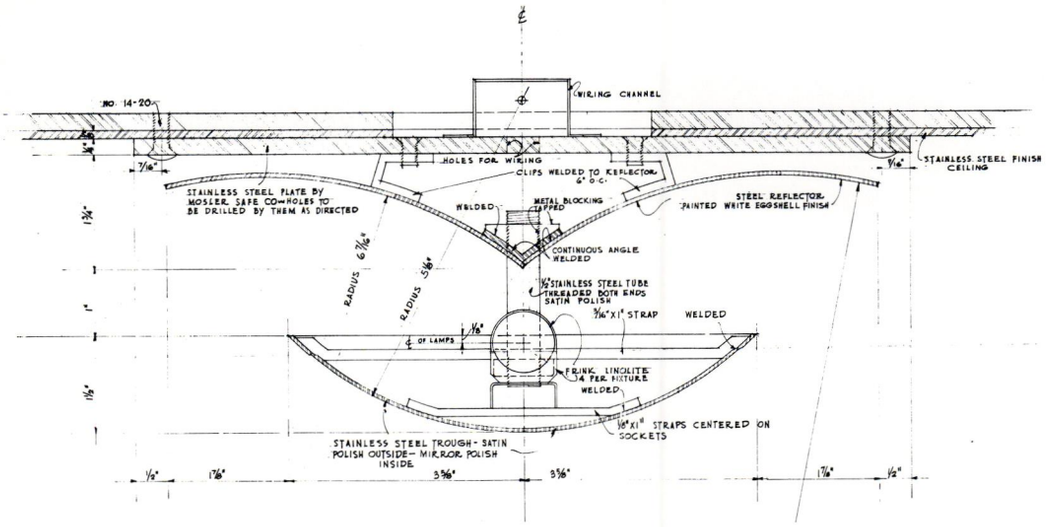
90. Stair connecting the banking hall with the mezzanines, 1932.

91. First mezzanine plan.

92. Second mezzanine plan.

93. Stair at the banking hall floor, showing bronze panels at ceiling, 1932.

94. Third mezzanine plan. The mechanical equipment is placed within the transfer girder space directly above the banking hall.

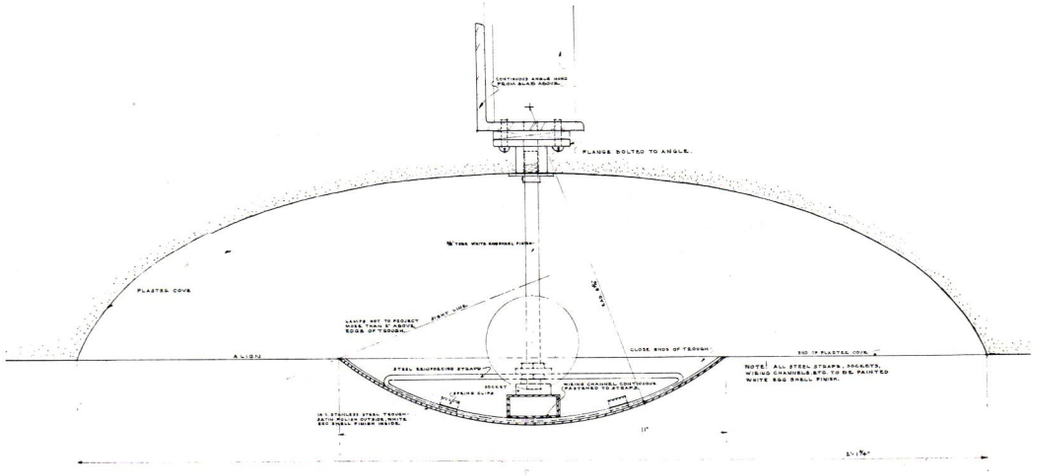




96

95. Detail of light fixture in the safe deposit vault, working drawing.

96. Safe deposit vault, 1932.



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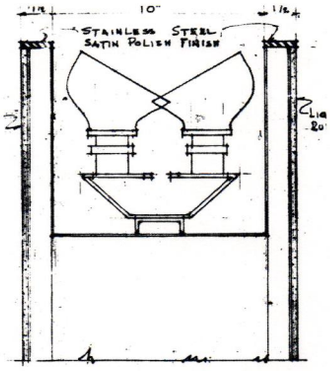

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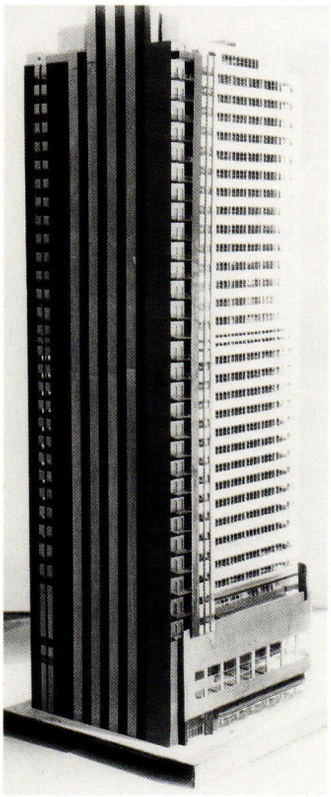
99

97. Detail of light fixture in the coupon booth corridor, working drawing.

98. Detail of light fixture at top of partitions between the coupon booths, working drawing.

99. View south of coupon booth corridor, 1932.



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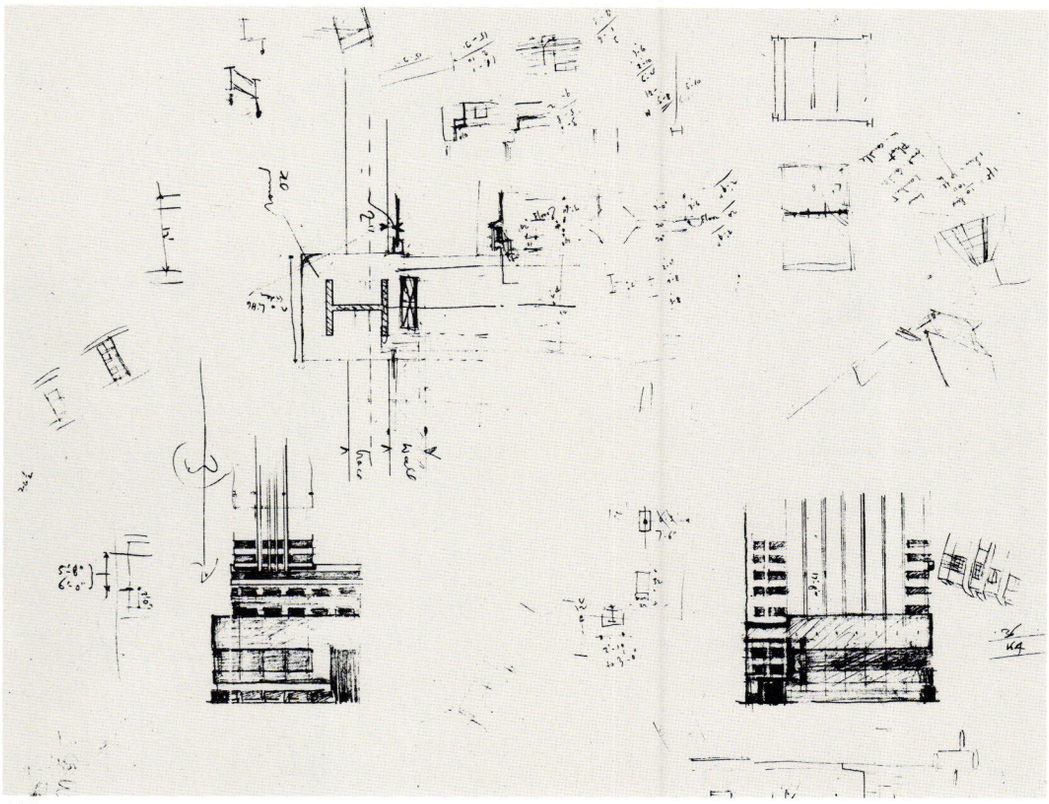

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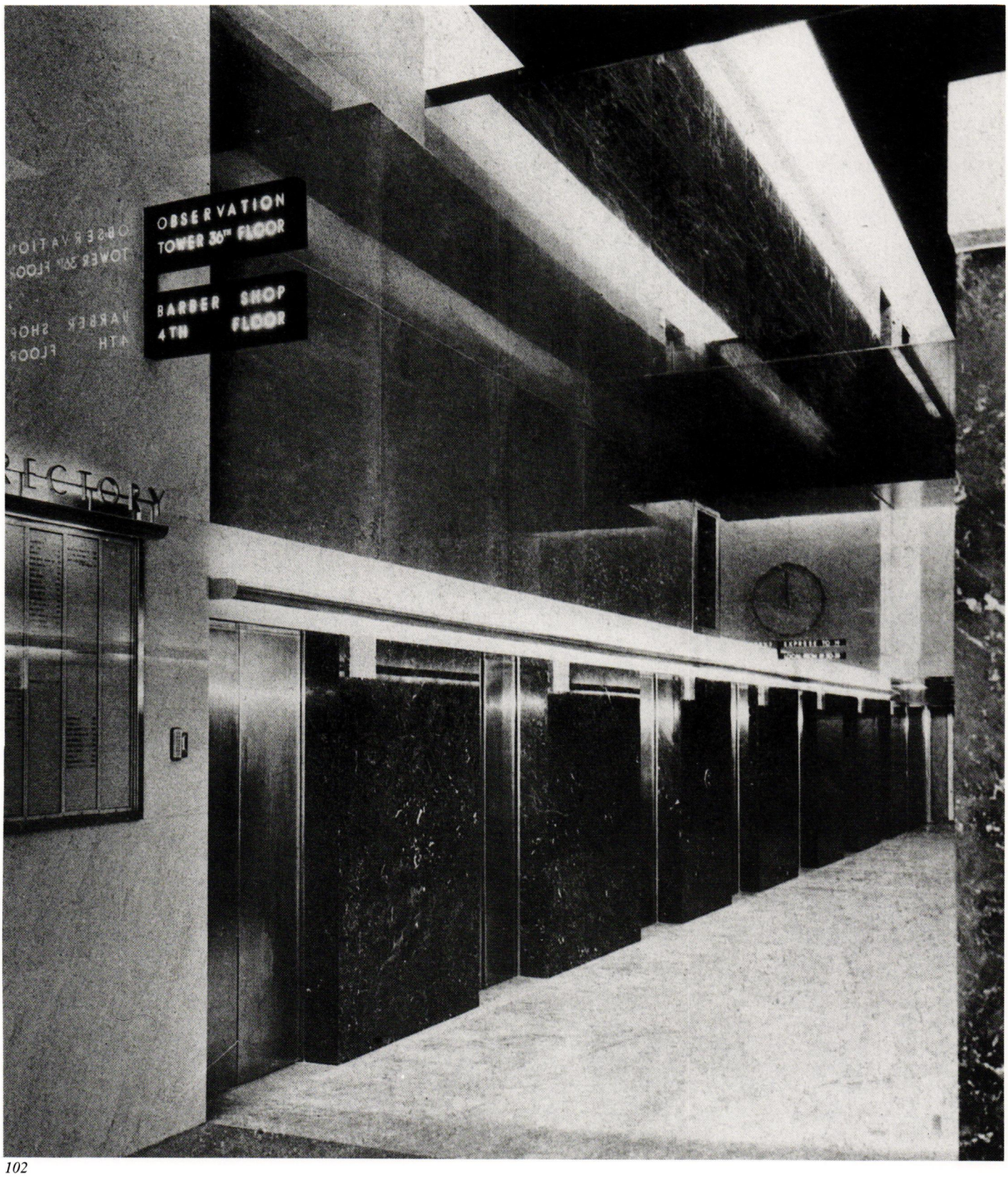
100. Presentation model, July 1930, showing an abandoned idea for vertical stripes on the elevator shaft wall.

101. Study of relationship between the facade and the structure.



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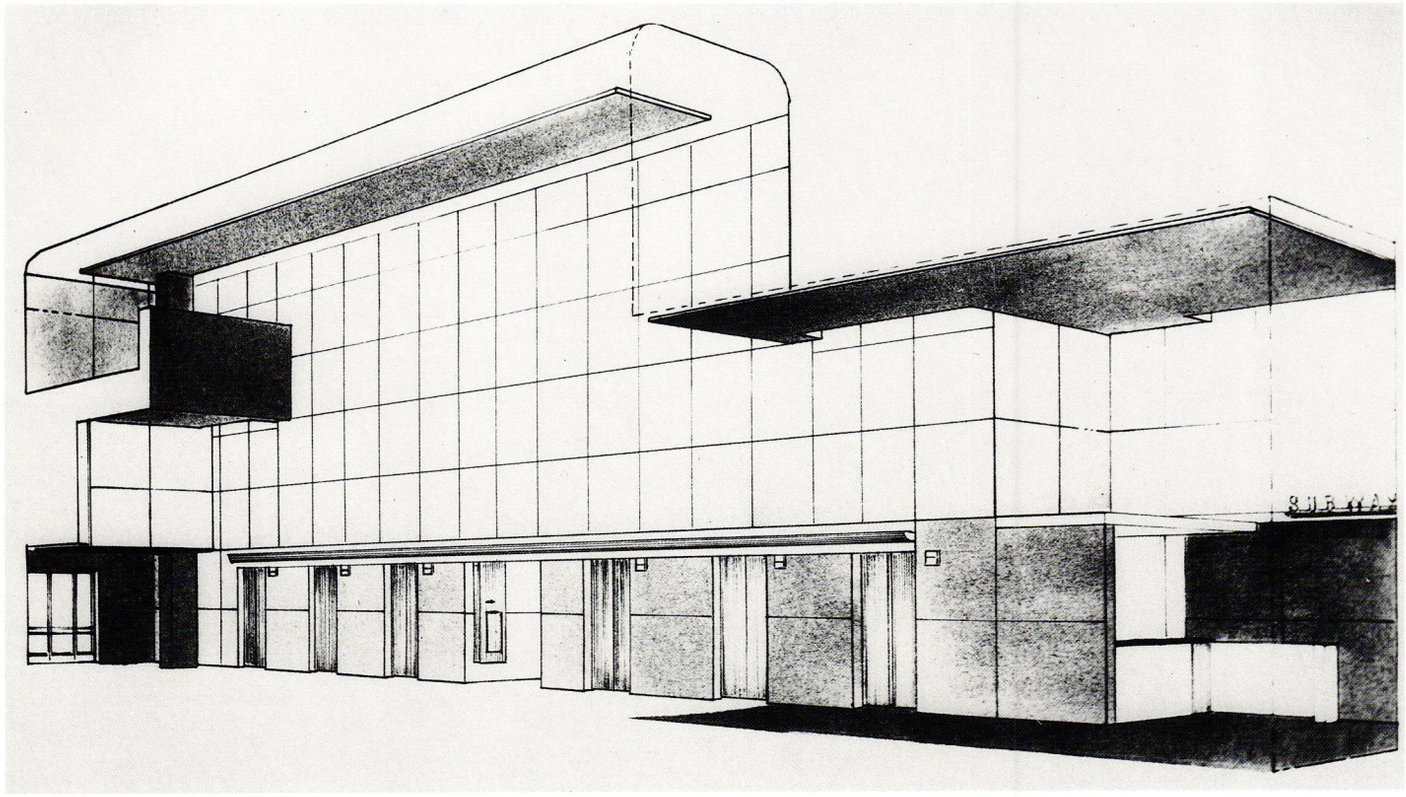
102. View west.



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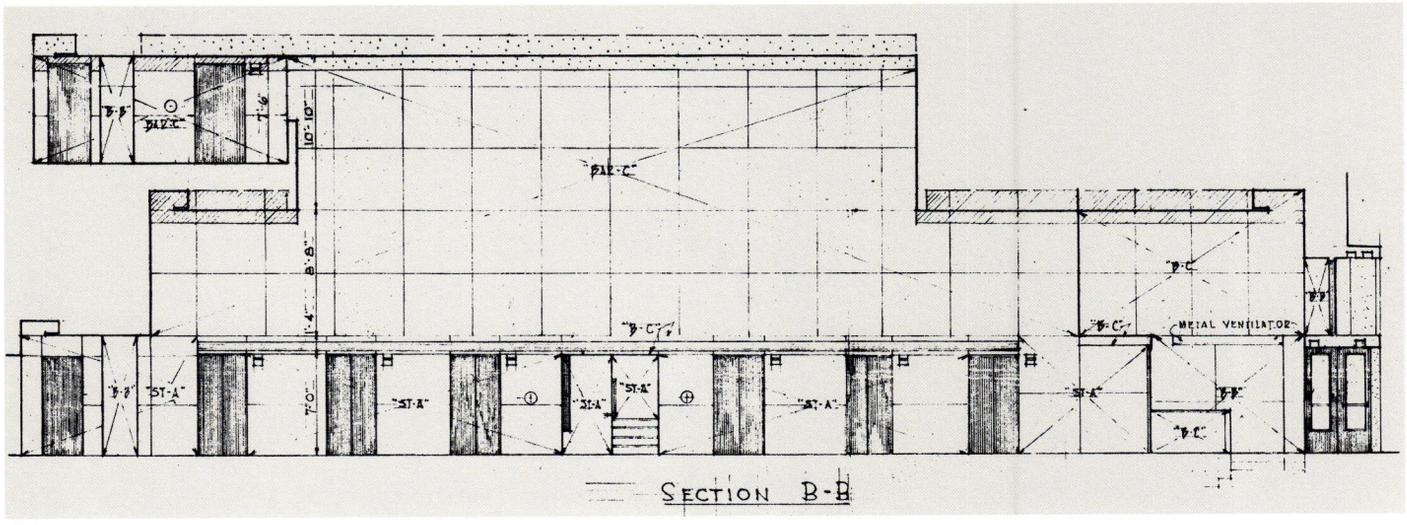
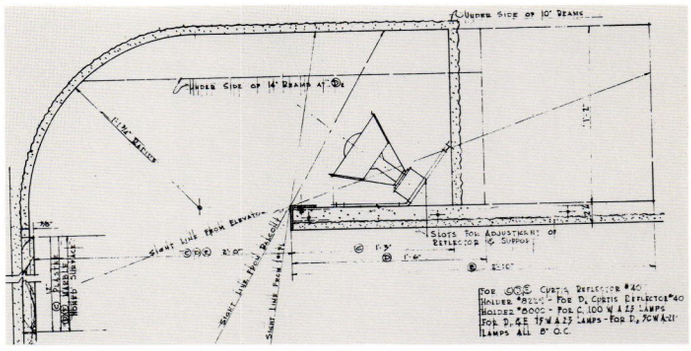


104

103. Perspective study.

104. North elevation, working drawing.



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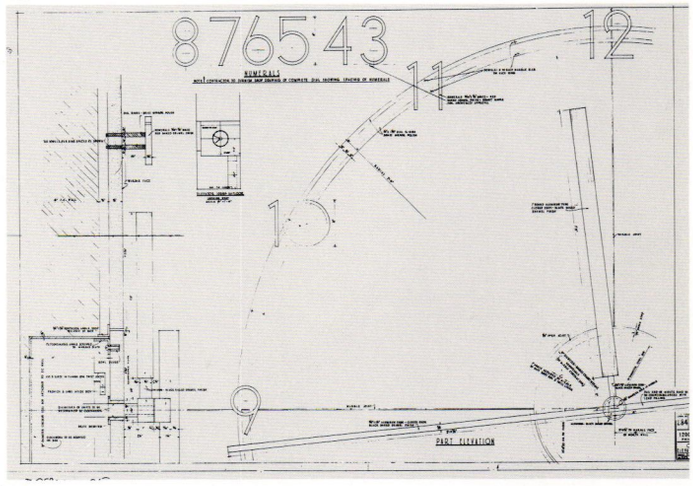

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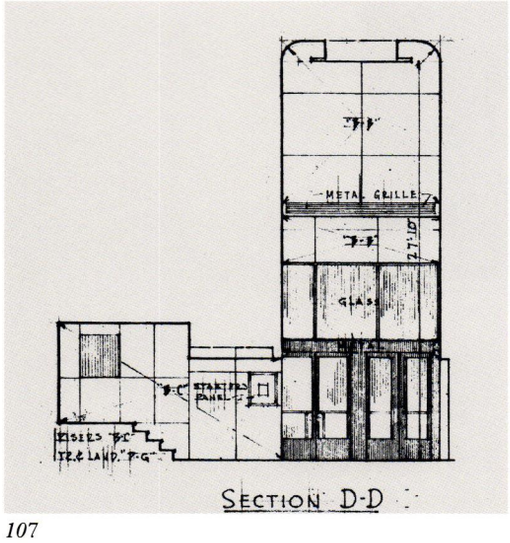

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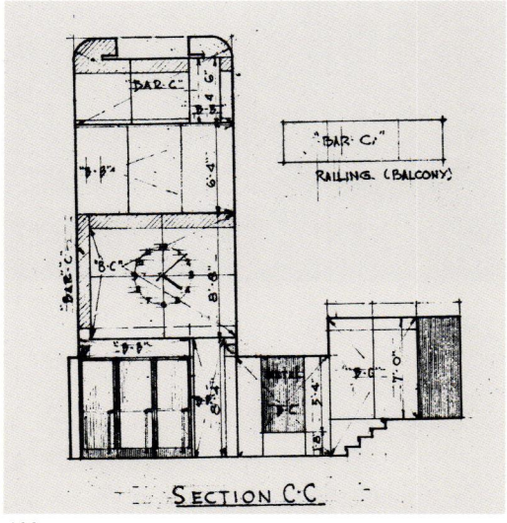


108

105. Detail of soffit lighting at the highest point of the ceiling, working drawing. Typically at the light soffits, the marble wall surface changes from a polished to a honed finish to mask the reflection of the light fixture itself.

106. Details of clock on the west wall, working drawing.

Elevations, working drawing.
107. East
108. West

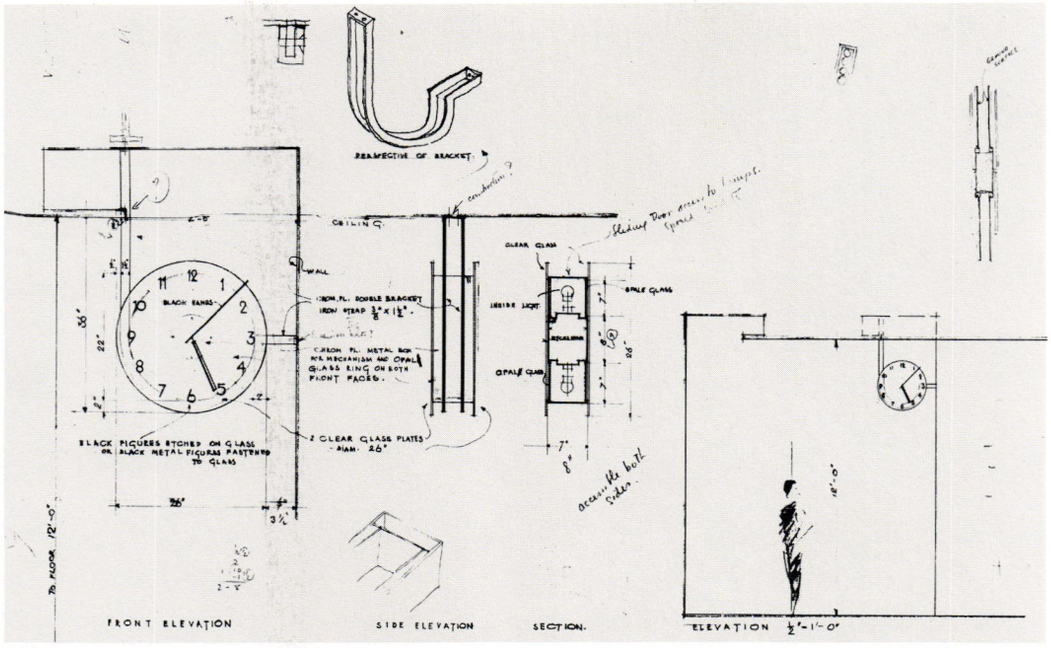


109

109. Basement elevator lobby looking west, 1932.

110. Study of basement elevator lobby clock, August 1931.

111. View west of typical elevator lobby, 1988.



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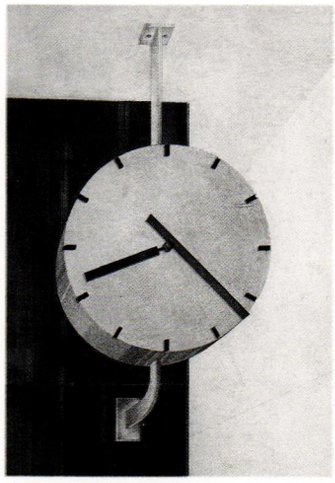

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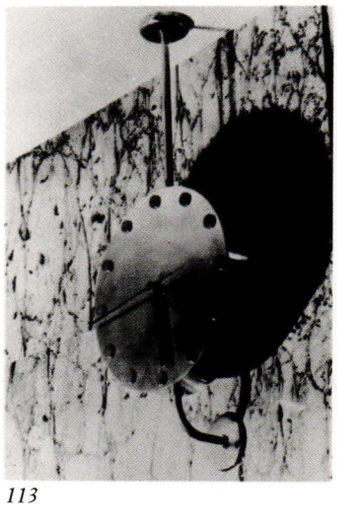
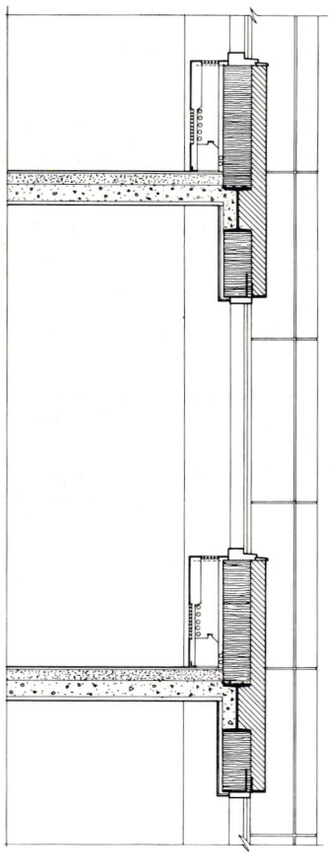


113

112. Clock at typical elevator lobby, presentation drawing, October 1931. The clock face is 18 inches in diameter and is a satin finish stainless steel; the hands are black enamel and the figures are red enamel.

113. Clock at typical elevator lobby. The clocks throughout the building were designed by Howe and Lescaze and fabricated by Cartier.



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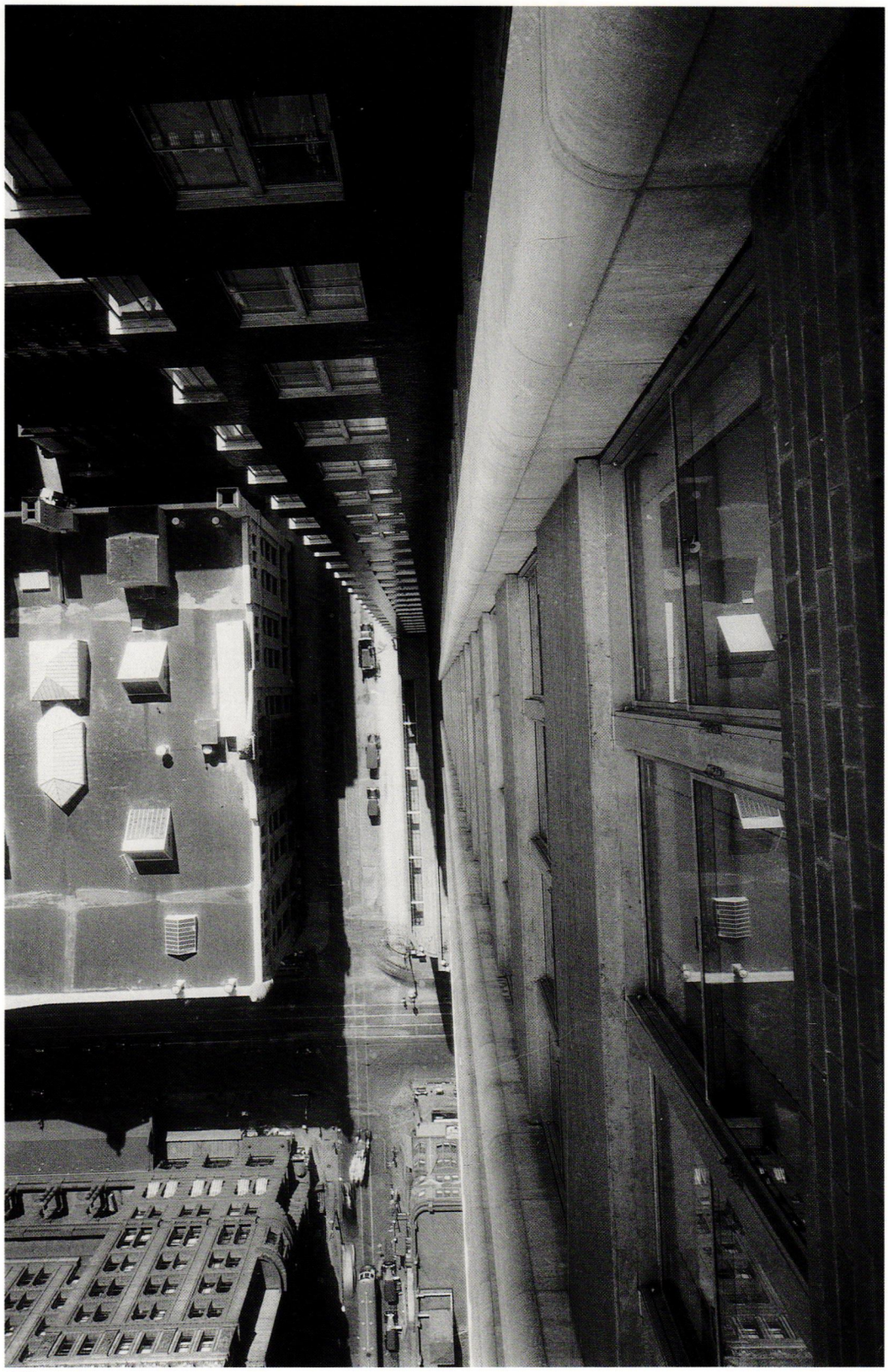

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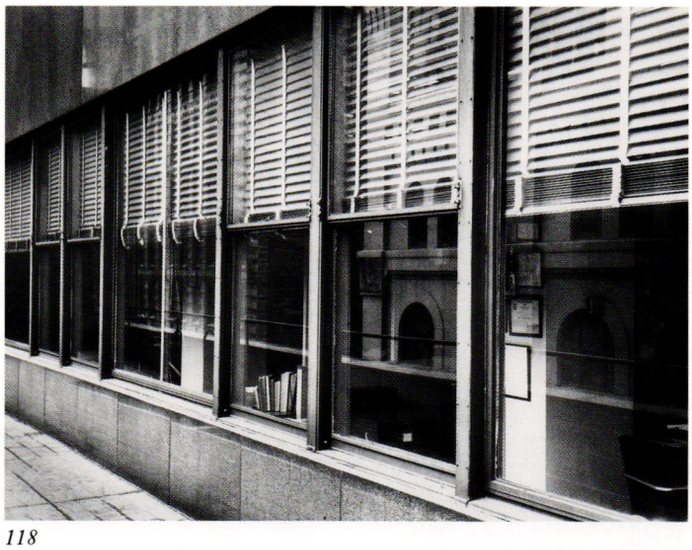
114. Typical section through east and west exterior walls at sixth through thirty-first floors showing integral heating cabinet below the window. Limestone clad pier is beyond.



116



117



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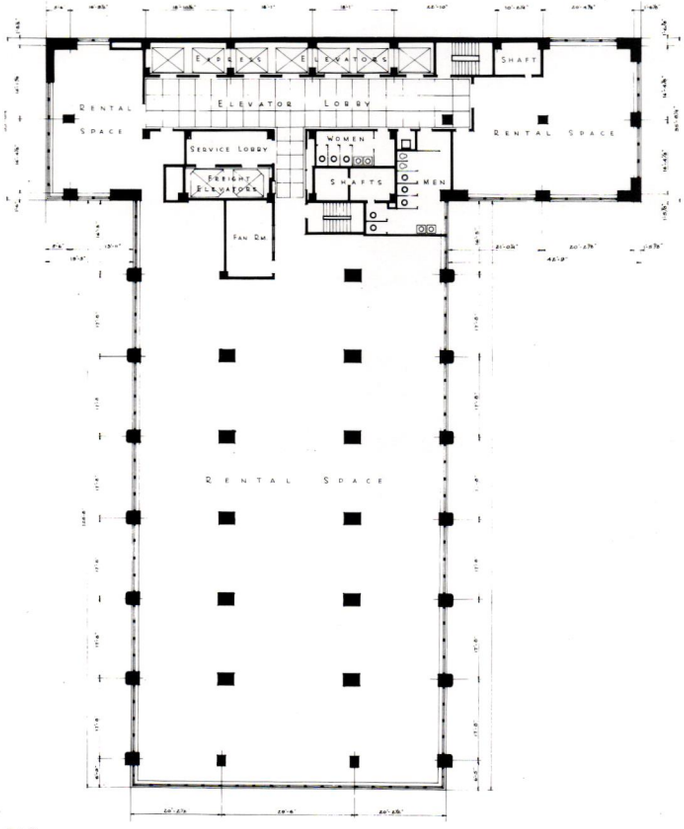
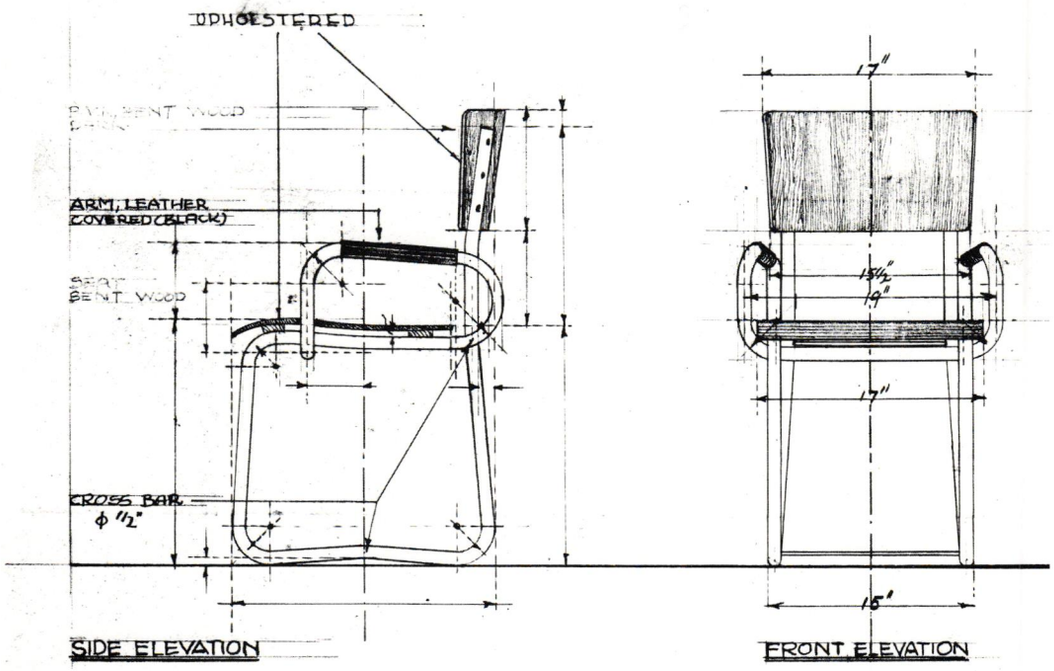


119

115, 116, 117, 118. Exterior views. The vertical piers are clad in limestone, the horizontal spandrels in matte buff brick and the elevator core in glazed black brick; the window frames are aluminum. At the twentieth floor the fenestration reflects the location of the building mechanical equipment.

119. Typical floor plan at twenty-first through thirty-first floors (similar plan at sixth through nineteenth floors). Typical floor area is approximately 13,200 square feet.



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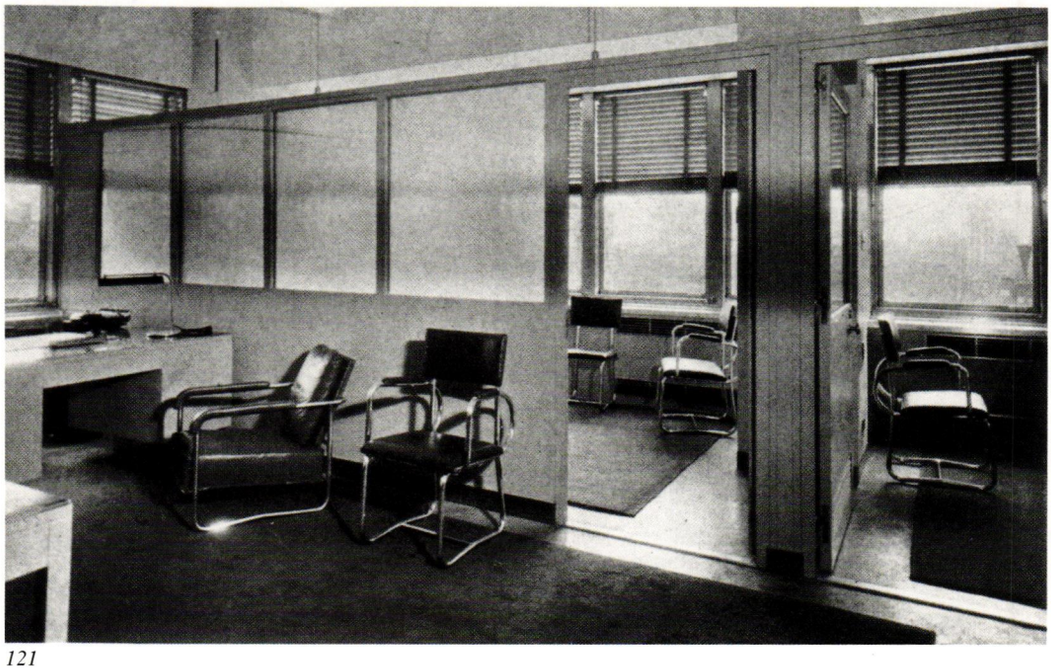


121

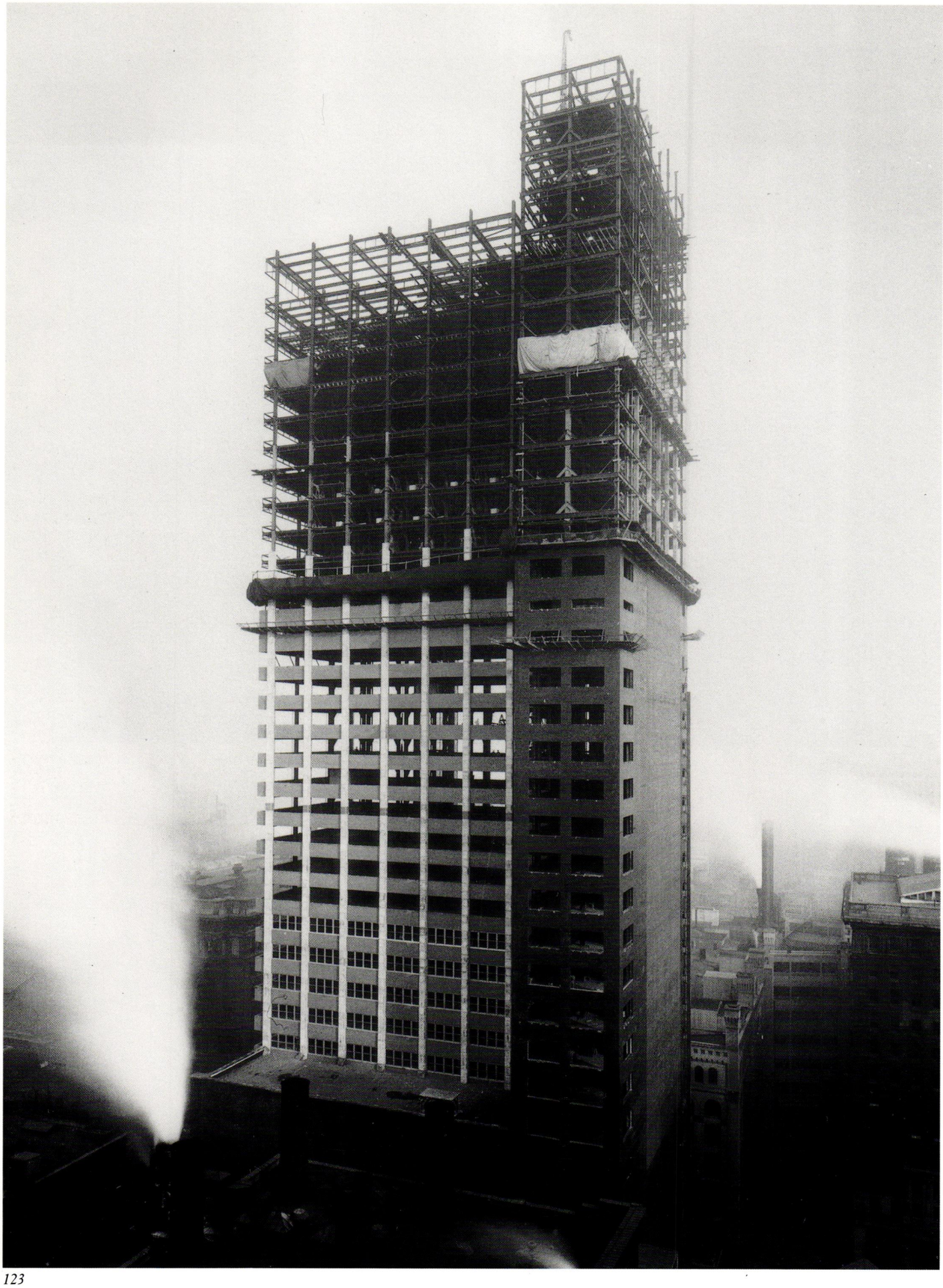
120. *Chair, working drawing.*

121. *Typical offices, 1932*



122

122. Typical office floor, 1932. Triangular elements which occur at columns are the portal frame wind stiffeners. Light fixture by Howe and Lescaze.



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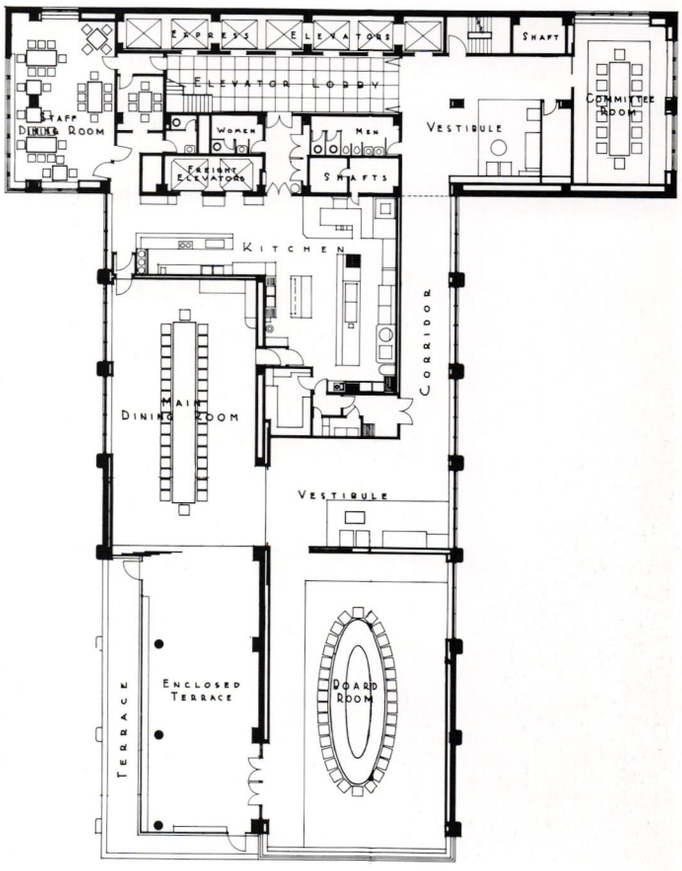


125

123. View east, November 1931.

124. View north of terrace showing furniture by Howe and Lescaze and the parabolic vertical wind stiffeners at the windows, 1932.

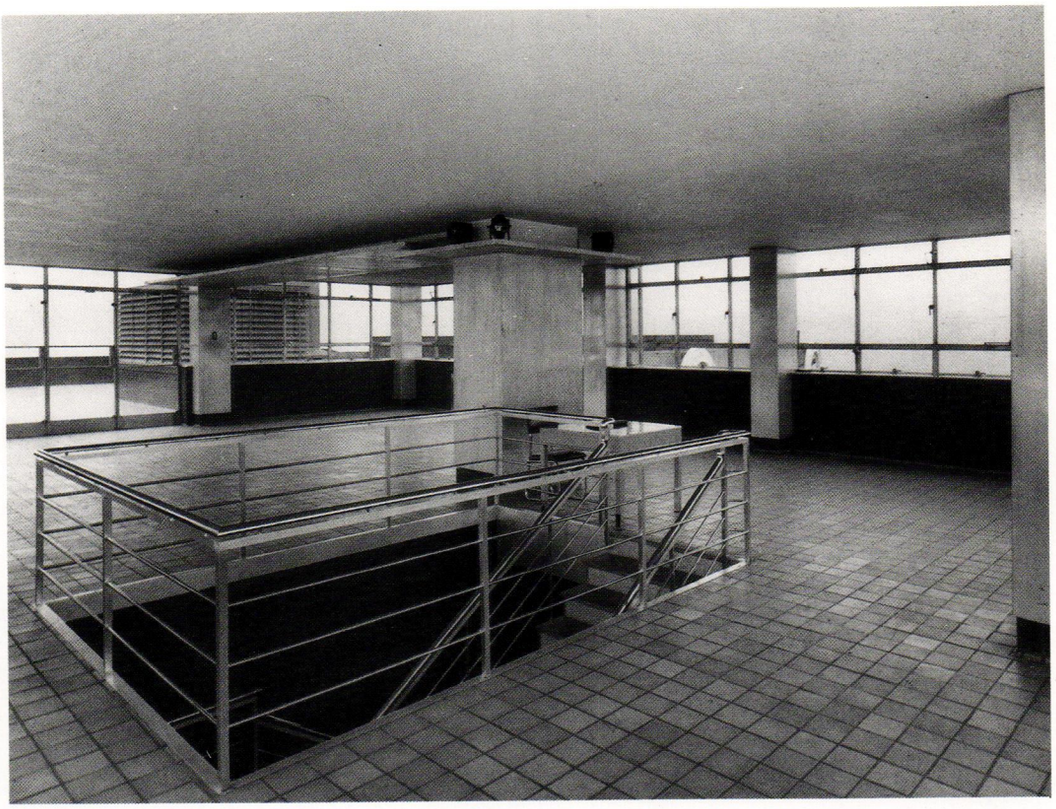
125. Thirty-second floor plan.



126



127



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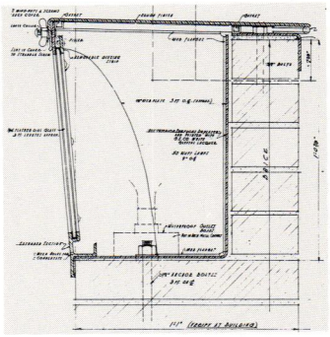

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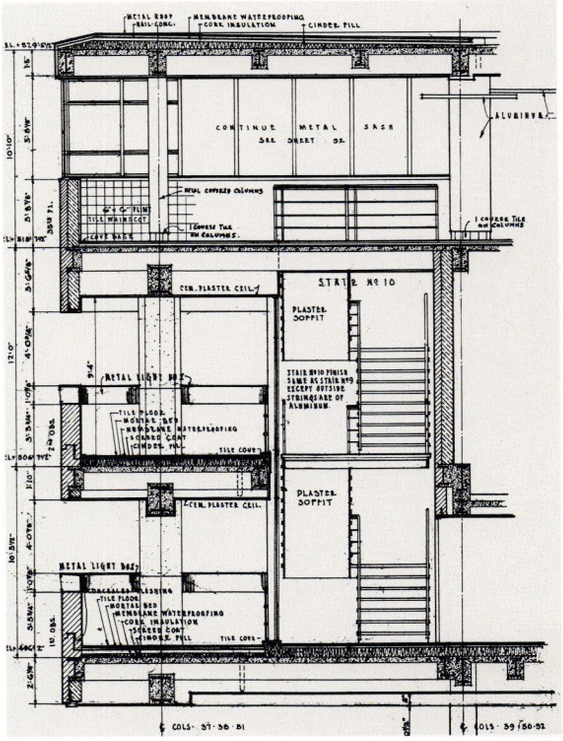


130

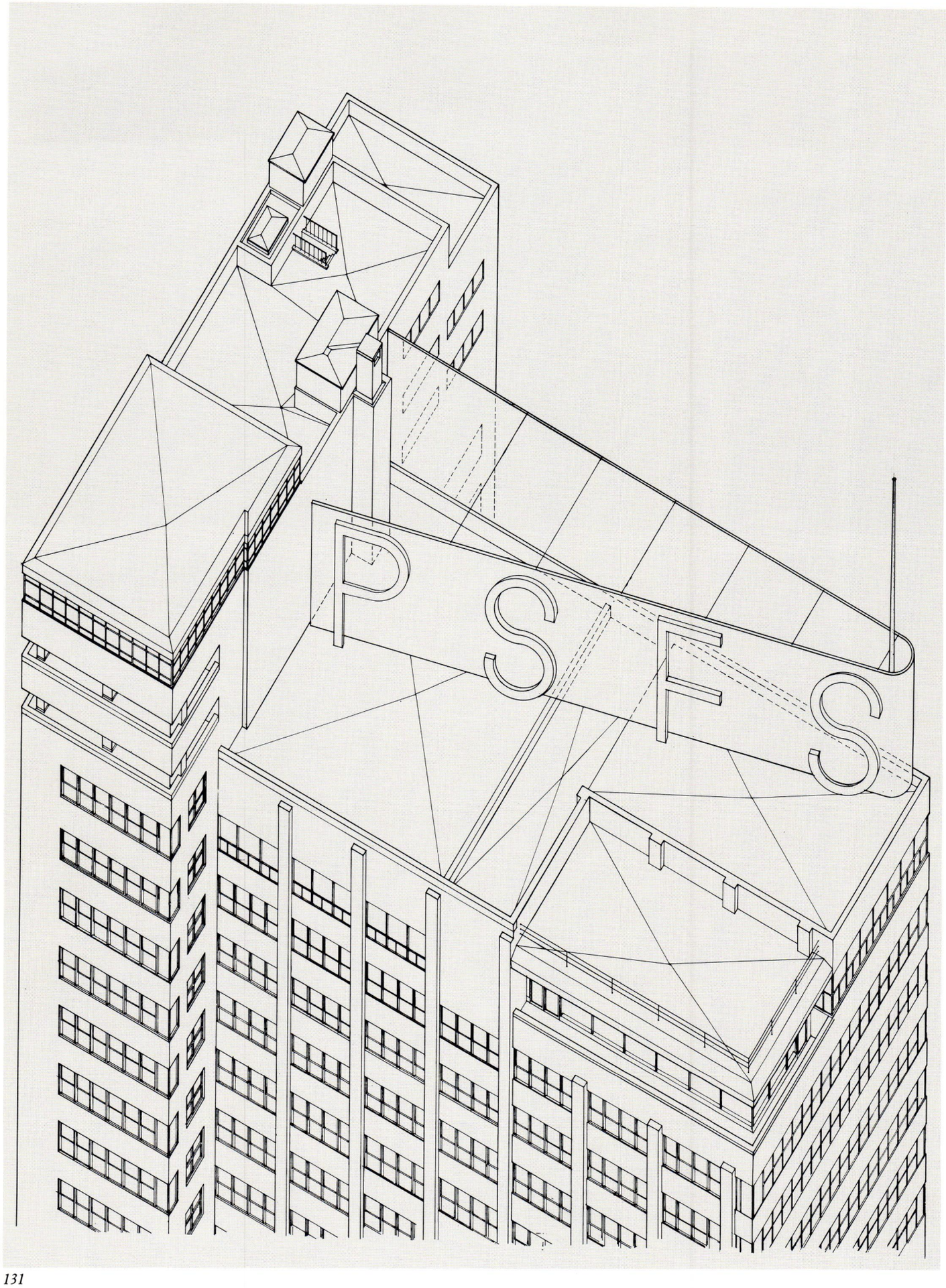
126. Stair leading to observation floors, 1932.

127. Detail of handrail.

128. Observation room, 1932. Originally intended as a public space, it has been closed since the 1940s and is now occupied by telecommunications equipment.

129. Section through typical light box at parapet, working drawing.

130. Section through observation floors, working drawing. The glass enclosed stair leads to two outdoor decks before emerging in the middle of the enclosed observation room.



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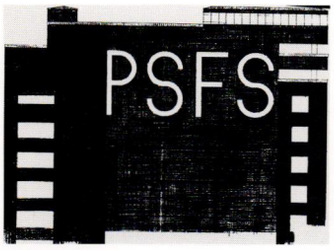

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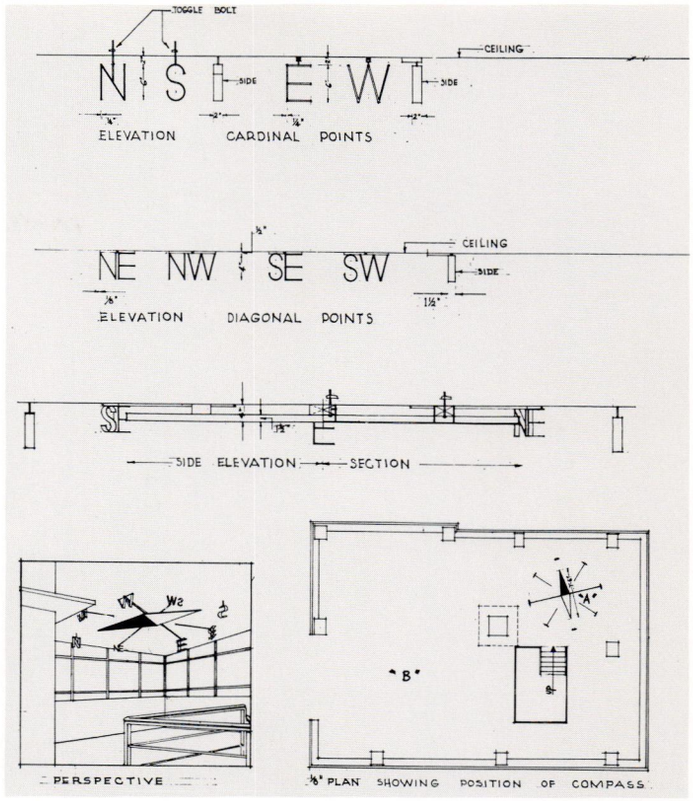

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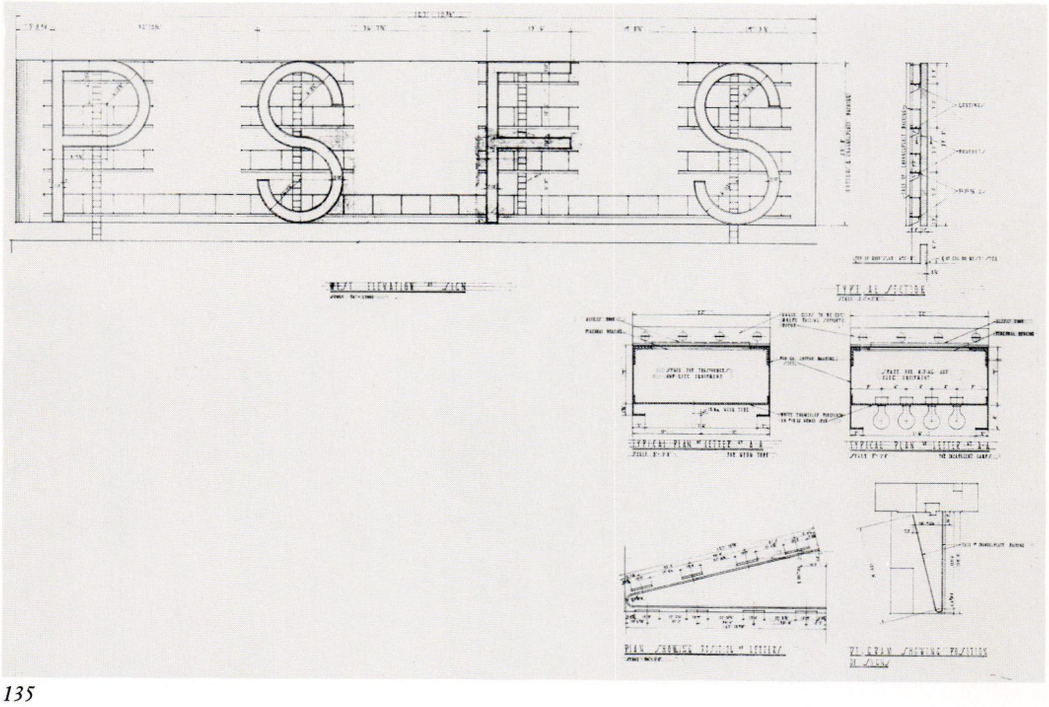

135

131. *Axonometric of the upper floors and roofs.*

132, 133. *Studies of proposals for bank name in the south brick facade, February 1932.*

134. *Study of compass for the observation room, May 1933.*

135. *The roof sign, working drawing. The sign conceals the exterior mechanical equipment.*



136

A New Shelter for Savings

Reprinted from *Architectural Forum* (December 1932).

The Philadelphia Saving Fund Society is more than the oldest and third largest savings bank in the United States. It is an institution that typifies the temper of modern Philadelphia as accurately as Faneuil Hall and the colonial fronts on Washington Square denote its momentous past. Of ancient and impeccable lineage – it was founded in 1816 by Condy Raguet, soldier, lawyer, statesman, editor and Philadelphia merchant – it boasts an enviable record of consistent growth and a continuing policy of progressive conservatism. For 116 years – ever since its first deposit by a Negro domestic – the Society has meant financial safety, economic wisdom, sound business judgment. From that one depositor the number has grown to over 450,000, whose savings total more than $310,000,000, and from the dingy cubicle of its first office the Society has expanded into five branches, ably controlled from the dull Victorian fastnesses of the 64-year-old main building.

All the branches are comparatively new. Four of them are polite, quiet little buildings, unobtrusive and tasteful, designed by George Howe who has since obviously recognized many of their fundamental improprieties. If "architecture is frozen music," the Society's main office is a frowsy minuet, the four little branches, careful, contemporary chords. But the fifth is new; it is slick and sheer and shining, and the Society, alive to the tempo of the day, has gone Gershwin. As the *Rhapsody in Blue* sets itself apart from such solid thunder as *Siegfried*, so does the Society's new building contrast with the staid neighbors of its location. A few blocks away is the frumpy, bastioned City Hall, from the top of which William Penn looks down unsmilingly upon air-conditioning equipment and a mammoth neon sign, and on South Twelfth Street, placidly nestled at the base of the smooth, new building, is a little Quaker Meeting House, whose thick red brick walls and fine colonial woodwork have withstood the dank cold and bluster of 120 Philadelphia winters.

In the opinion of many a Philadelphian this contrast is synonymous with absolute condemnation. To others the planning of 35 stories of air-conditioned, sound-insulated and multi-windowed offices is justification enough for the bank's enterprise. To a still greater proportion (about 50 per cent of an extensive prospective tenant list) that thoughtfully contemplates the Society's remarkable record of success, the building at Twelfth and Market Streets represents a courageous and thrilling accomplishment which marks the Society as a prime patron of a new architectural era.

136. View north, 1966.

But the Society's building committee would emphatically deny the implication. From their collective standpoint a building is a tool of business, an economic expedient for which they hold no brief as regards architectural tradition or aesthetic style, and if, in their well-weighed judgment, another structure could have fulfilled all the requirements of their problem, a correctly Georgian facade might now be ranged beside the little Quaker Meeting House.

An attempt at such a thing was actually made, for upon the presentation of their first comprehensive sketches the architects were very nearly convinced that their building would never be built. Howe and Lescaze drew more sketches, reasoned, cajoled, argued. Figures were examined, estimates made, and on the basis of these the Society's president, James M. Willcox, announced that the Board of Managers were satisfied that style was no essential criterion of building or banking efficiency.

On November 28, 1930, a final scheme was approved signifying in all important details the fulfillment of the Society's demands. The scheme was not Georgian. President Willcox characterized it to one interviewer as "ultra-modern only in the sense that it is ultra-practical."

"Ultra-practical." The Society's building requirements prosaically and economically set themselves. On the plot adjoining the Quaker Meeting House was a branch bank, erected as an experiment in serving Philadelphia shoppers. Useful only for temporary quarters the building was to be razed and a new one, modern, efficient, attractive, erected in its place. But the land cost had been high; the expenses of operating a large mid-town branch were heavy, and the Society early decided to exploit the rental possibilities of the future building's location. Therefore the architects' first sketch indicated stores on the ground floor and at the level of the subway concourse, an enormous banking room on the second floor, and, above, a succession of office floors, cantilevered on three sides to provide the maximum of daylight area.

It indicated further a desirable separation of office building and bank entrances. The latter entrance on the principal street (Market), was large and imposing, and (to conserve rentable area in the ground floor stores) was located at the far corner of the plan. For the same reason the elevators to the offices were placed at the rear of the lot nearest the Quaker Meeting House, with a corner entrance to them on South Twelfth Street.

The plan sketches were pondered, checked for income possibilities, and, in a slightly revised form, finally approved. In the final scheme most of the cantilevers on the east and west sides disappeared, because of a potential interference with office layouts.

The economic height of the building, carefully established by the Society and the financial department of the George A. Fuller Co., substantiated the architects' claim of 28 office floors.

The setbacks were developed from no mandatory code provisions. On the Twelfth Street side they more forcefully emphasize the bank's four lower floors. On the west side the setbacks over the administrative floors (which cover the greater part of the 21,650 sq. ft. of plot) secure permanently the greatest amount of light and air. No offices will be darkly smothered by a possibly competitive future structure.

"Modern" only in that it obeys the Society's mandate of practicality, the building's plan is chiefly distinctive for the second floor banking room and the location of the elevators on the south party wall, for the highly efficient office floors differ in no other important planning detail from those in many another similarly purposed building, save that the pier to pier windows admit a maximum of daylight.

"*Ultra-modern.*" Given an approved plan layout the development of the exterior followed, according to William Lescaze, "simply and naturally." The aesthetic philosophy of the design was, briefly, to focus the attention of the public upon the bank and to play softness against hardness. The last phrase applies to color as well as to form, to mass and to detail. As to mass, the floors that include the bank jut sharply from the office tower above and by a contrast in detail are distinct from the stores below. The office portion is liny, rectangular, hard; the bank's enclosure is smooth, broad-surfaced, and is softened by a curve at the corner of the building.

In regard to color, the base of the building is further emphasized by the play of dark granite against the oyster white spandrels of the office floors. In effect these are horizontal bands, to which, in contrast, the elevator, stair and stack tower is essentially vertical, since it is surfaced with a dark gray brick. And a sort of spine is created to which the office floors are attached like so many ribs.

Ornament is conspicuous by its absence. Here the ornamentation is a fitting technical excellence, integral with the structure itself. The surfaces of machine production are inherently beautiful, say the architects, and the combination of material, color, surface and fine workmanship produces a natural aesthetic movement supplied in other buildings by sculptured swags and terra cotta gargoyles. The architects answer the possible criticism of monotony from their conviction that a repetition of form achieves (at least in this building) not monotony but unity, and that monotony may exist only from a maladjustment of "ultra-practical" components of design.

Saving Fund Society Building: A Re-appraisal

The Old Beauty

Frederick Gutheim

Reprinted from *Architectural Record* (October 1949).

From along the Schuylkill, through the web of overhead wires, you can see it, still the biggest and proudest thing in Philadelphia, now almost twenty years since it was born on the drafting table in the office of Howe and Lescaze. A fretted white tower announces with authority PSFS, spelled out at night in red neon, still commanding the skyline.

A cynic might very well say that the last thing built always commands the skyline, and nothing much of consequence, admittedly, has been built in downtown Philadelphia since the Society erected its skyscraper in the depression days of 1932. But hold! Have the last twenty years produced anything in the way of a tall building – except for the United Nations secretariat, now a promise in steel – that provides the same functional satisfaction or as much eye food? If you had to pick the one American skyscraper, this would have to be it.

When people have finished talking about verticals in the Daily News Building, horizontals in the McGraw-Hill Building, the planning virtues of Rockefeller Center, or the simple height of the Empire State – when all this has been done, and you come down to the fundamentals of good building and design – there is PSFS. Today it is still a satisfying building, to its occupants, to the public, and to the architecturally aware visitor. It does not invite comparison. It still has an excitement to communicate, a few surprises one has forgotten since the last visit, against a pleasant sense of finding things as satisfactory as one remembered them. Most of all, the building has that unique combination of boldness, of rugged strength approaching ugliness that was Lescaze's polytechnic contribution, and of richness, luxury and refinement approaching over-refinement that was Howe's.

You admire it still, although the building belongs in the awkward age. Not new enough to be contemporary, but not old enough to have become a readily placed historical monument, it is aging gracefully. That fascinating miraculous preservation is part of its charm. There was an architectural wisecrack contemporary with the building of PSFS, calculated to jar the exponent of pure functionalism: "Yes, but will it make a good ruin?" It has become almost possible to answer that one. We can see that a modern building does not age in the same way a traditional building does. Modern materials – and double entry bookkeeping, perhaps – assure that in age the modern building will have a special charm of its own that we have not known before.

At first you think that jaunty ageless, frightening atmosphere, a little on the embalmed side, is due chiefly to the extraordinarily good maintenance the building receives. Then you think it derives from the marble, glass, stainless steel, copper and bronze, the whole battery of ageless, and nothing but ageless, materials that have gone into it. The building, piece by piece, might just as well have been built yesterday. But obviously, it wasn't.

What has aged is not the building but the style. Without even entering you see the enormous curved corner, the building's principal label of association with the modern movement of the late twenties and early thirties. Critics were not lacking, even at that time, to point out that the corner destroyed the sense of volume, but it took subsequent excesses and corruptions to kill off this cliché simply by making it tiresome. Anyhow, there it is, unarguable evidence of the period.

Inside, it is still what Frank Lloyd Wright denounced as "the cardboard box:" inside you are even more conscious of style. The monochrome interior emphasizes what must have been, twenty years ago, new and daring structural forms: the design proclaims its affinity with the T-square and the layout artist's pad. There is a strong flavor of typography. And there is a faint formaldehyde reminiscence of buildings and sketches of buildings seen in books, not of buildings seen as buildings. Was this, perhaps, a paper architecture expressing a wistfulness ingrained in the modern movement, with its many unbuilt projects and its emphasis on theory?

These characteristics, not unique in PSFS, are difficulties of that right-angled age into which it was born: nor are these stylistic details of cubism obtrusive. You think of them only when you find the building eluding criticism by explaining politely that it was not born yesterday. You could even say that no building twenty years old can with decency seem to have been born yesterday.

From the time a building is completed its destruction begins. This change the unadulterated functionalists of the twenties denied. They could not see that closely reasoned designs would grow out of date as there came change in the human needs they were designed to meet. Consider, for example, that the PSFS building, first thought of as a branch, is now the headquarters of the bank: that since 1933 traffic through the main banking rooms has about doubled. It would have been astonishing if these changes had not made necessary corresponding changes in the design of the building, invalidating the doctrine of extreme functionalism, urging a greater flexibility and more recognition of changing needs.

Yes, a series of changes, undertaken in the names of progress and of maintenance, begins to take place in a building from the moment it is occupied. The process begins most easily with decoration and other elusive details. In older buildings it spreads to store fronts, lighting fixtures, elevator cabs, lobbies, corridors, and their very facades. Advanced stages are signalized by major reconstructions. Hardly one of these individual changes can be objected to with any force, but their cumulative effect leads to anonymity.

In PSFS the process starts with the main banking room, which originally took the appearance of a cube, each side with its own character: now glass, now marble, now white, now black, now hard, now soft. The recently installed lighting changes that conception. So does the substitution for the original white nubbly textured curtain that covered nearly the whole of the room's east wall of a new curtain in a color called burgundy.

The catalog of change might be expanded. It leads squarely into questions which deserve full exploration, for which there unfortunately is not space here: How far may the architect go in translating into rigid form the fluid function at the moment of design? What is the responsibility of an owner for his work of art?

The PSFS building is our most charming skyscraper. It has, I insist, style. That style, integral throughout the building, can be tampered with only at the risk of destroying the building's chief distinguishing features. Its handsome directors' rooms on the top floor, with their views over the city and its two rivers that took the breath of the United Nations Headquarters Site Commission when they visited Philadelphia, are designed, if you please, in browns. Its chief room is a study in black and white. Its corridors are cleanly designed, sharply developed in light and shadow, boldly composed in squares and primary colors. These are the details that decide everything in the building's appearance.

If I may borrow for the heading of this art the title of Miss Willa Cather's last slim volume of stories, without her suggestion that in a gentler day it was enough to be beautiful, it may serve to express some cor clusions we may draw from our experience with PSFS. When functionalism in the United States was raw, red, and steamy-ne it found few more devoted followers than Howe and Lescaze. Theirs was the pure dogma. Up with pure function and to hell with good looks; at best, it was claimed, g looks would take care of themselves.

Yet today what remains is not function but beauty.

It is a curious, haunting, and distinctive ki of beauty, this palette of black and white, these textures of stainless steel, polished marble, and plate glass, these forms so pu cubistic. The effect may not have been calculated, although one doubts the assert but it is consistent beyond accident. It is n what one would aspire to today, but it is w one is glad someone once aspired to and succeeded in creating.



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137. Philadelphia, 1989

An American Culture of Construction

Tom F. Peters

Ever since the 1920s, an increasing convergence of architectural thought has made itself felt over the globe. The modern flow of information and international tourism encourage this. Formerly the phenomenon was referred to as the nebulous "International Style," but today it goes unnamed. Then as now, it worries many who fear a leveling of cultural variety and independence, and the fact that this body of thought is interpreted differently in the various cultures continues to escape notice; it is too subtle to excite much interest. Even when recognized, critics tended to discount such varying interpretation as provincial "misunderstanding" of the "true" meaning of a theory. But it is precisely such misinterpretation, or rather this creative misunderstanding, both within as well as across the borders of a culture, that vitalizes the manifold aspects of the world of architecture which flourishes beyond professional polemics.[1]

Architecture in the United States actually thrives on creative misunderstanding while apparently suffering both from an inferiority complex toward Western European professional theory and history and from the oversimplification of populist polemics. Meanwhile, American architecture strikes the European as familiar and yet, at the same time, as indefinably different.[2] Our built world both fascinates and simultaneously often repels the European. "Why," ask European professionals, "can we not do what works so unselfconsciously in the United States? Why are we in comparison so ensnared by our traditions and so slow to change?" Then, inversely: "Why do they seem to have no traditions at all, but jump from one form or fashion to another?" On the other hand, European architecture attracts us by its iconographic complexity, yet we experience insurmountable difficulty in translating European concepts into our own context. What we often forget is that our architecture is firmly rooted in its own theory and technology. The confusion on both sides of the Atlantic is caused by blindness to the differing value systems of the two cultural groups, and these value systems depend in turn on each culture's inherent systems of thought.

Empirical thought, which deals primarily in concrete problems rather than in concepts, is most highly developed in the United States. Based as it is on the philosophical doctrine of pragmatism, of cause and effect, empirical thought is linear in form rather than a matrix. Its opposite is conceptual thought which proceeds from the "higher" generalization to the specific. While pragmatic thought is synthetic in nature, conceptual thought is deductive or



analytical. This latter mode of thought is widespread in Western Europe, particularly in France and Germany. It is not that it is absent on our side of the Atlantic, it is of course common here too, but the underlying cultural values of our society tend to reinforce empirical rather than conceptual approaches to problem solving. This empirical approach seems to lack complexity, to recognize no subtle cultural boundaries or taboos. And it is precisely through that self-same independence from stultifying taboos that pragmatic thought can stimulate invention.

Cultural boundaries may be mere mental barriers, but they hinder us as though they were solid. It is our present lack of impermeable boundaries which the European is both fascinated with and abhors; the fascination is with the potential freedom it implies by encouraging professional "border-crossing," and the abhorrence is with the lack of formal constraints with which all American cultural stages are set.[3] But of course our culture may well be in the process of inventing its own impassable boundaries too.[4] Each group, however, the American and the European, takes only its own limitations seriously while looking askance and at best with vicarious comprehension at the other's.

AN AMERICAN BUILDING SYSTEM

Cultural differences not only manifest themselves in modes of thought or in built form, but in building methods as well. The North American light timber framing system exemplifies the pragmatic thought process. Its standardized timbers, with nominal cross-sections of increments of two inches, are held in place by sheets of plywood nailed to them. They form the seemingly flimsy stick structures indigenous to our culture and peculiar to it. Most of our present construction volume, both residential and non-residential structures of modest span, are built using this light timber frame, so its impact on our built environment is a major one. Its influence extends even beyond the scope of residential structure as it probably formed the model for the development of steel framing systems for high-rise buildings at the end of the last century.[5]

The a-conceptual nature of the system is reflected in the imprecision of its name, "frame construction." It is namely impossible to determine whether "frame construction" really is a frame which derives its stiffness from the plywood skin nailed on it, or whether it is a panel system in which the panel elements are kept from flaring and buckling by the vertical ribs and edge beams nailed to them. Both forms of manufacture are practiced and lead to the same result. It is both a frame and a panel system at once, in precisely the same way that light reacts as either waves or as corpuscles, depending on which qualities are under consideration. The definition of the system is variable, and it must be redefined every time it is used according to which characteristics are preferred.



If we use the light timber frame as a panel system, certain basic rules of erection, connection and penetration are implied. The edges of the panels become important because they serve as loci where the elements of the system are interconnected. It is impractical to break a panel at its edges because that would weaken it. But whole panels can be removed without compromising the system. If, on the other hand, we view the system as a frame, then it manifests other characteristics. The elements are no longer structurally or formally so strongly defined; they are smaller, more differentiated, and specifically tailored to each special case. They are also more anonymous than the panels are. The rules for penetrating the skin of a frame structure are different too. Small holes can be made anywhere in the system by framing their edges with pieces of "two-by-four." There are no panel edges and everything is equally connected everywhere; there are no specially highlighted loci. But, in this case, large holes weaken the system.

CONSISTENCY IS NOT NECESSARILY A VIRTUE

As our light timber frame is by its very nature ambiguous, it can indeed only be our variable viewpoint which defines its form and not any predetermined criteria such as a consistency of method or means. Our architects thus feel free to mix and match the contradictory aspects of the panel and the frame. One corner can be designed according to the logic of the panel and another according to that of the frame.[6]

Such ambiguity is uncomfortable and even threatening to the European who immediately asks: "Yes, but what is it *really*?" What is it, in other words, that constitutes its essential characteristic? We coolly answer: "Who cares?" And indeed, what difference does it make what it "really" is, if only it functions to our satisfaction and fulfills our needs? American culture esteems philosophical clarity far less than the German or the French. We fabricate and apply and disregard in the first instance what the action or the result may mean philosophically. "Something as useless as that," say we pejoratively, meaning useless in the pursuit of money, "can be left to the professors," implying those who are merely capable of analytical thought. The European, however, wants to understand first. For only when the essence of a thing as well as all its ramifications have been fully understood does that render it operational to him.[7]

Faced with our American amorphism, the European will immediately ask whether the structural concept permits such behavior.[8] And we counter with the unanswerable, because anti-conceptual, question: "Why not?" Who is to forbid what and to whom, anyway, as long as the structure is sound? What the European considers a frightening lack of clarity, frightening because it provides no familiar boundaries, the American equates with freedom of choice. The bare technological facts of building may be identical on both sides of the Atlantic, but due to differing evaluation, they mutate culturally to mean the very opposite!

In European building, therefore, the design rules of systems are set a priori. The rules are characterized by consistency and a concomitant restriction of means. Logic then demands

that the form follow from the chosen limitations. If a European intentionally contradicts this logic, he designs "exceptions" to the system. If he does so inadvertently, he calls them "mistakes."

In Europe, the will to understand and to control through comprehension follows from the need for conceptual clarity and gives rise to the high esteem accorded theoretical work. The higher value accorded empirical thought in American work follows from the cultural difference.[9] In American culture, novelty evolves frequently by way of ambiguity in interpretation rather than through philosophical analysis of the problem.[10] Our process resembles more the world of Dada than what the lay person sees as the rationalized, optimized world of building. And indeed, the Dadaist movement in franco-germanic Europe preoccupied itself with ambiguous processes of invention which its protagonists recognized as forming the basis of a nascent American culture. Their self-conscious form of "creative misunderstanding" led to a novel, anti-traditional intellectual movement, turning it, however, from an American pragmatic approach to the world into a European intellectual one.[11]

THE RUBE GOLDBERG METHOD OF DETOUR

The European celebrates limitation as prerequisite to the creation of good form whereas the American tends to avoid any restriction. Where the German insists that mastery manifests itself in voluntary restriction, we insist with equal justice that mastery manifests itself in the skill with which problems are avoided or detoured.[12] We adopt the eminently defensible standpoint that systems and concepts should be helps and not hindrances. This causes our design behavior to appear to the European eye as unprincipled and devoid of philosophical rigor. In fact, what we do negates the whole development of European design theory.[13]

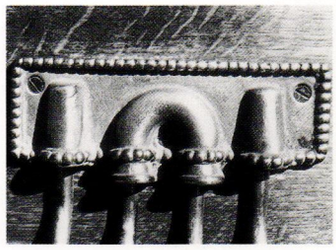
We have a lovingly admiring term for the method of detour: we call it the "Rube Goldberg method" after the famed cartoonist known for his whimsical mechanical contrivances.[14] Although the term has most commonly been used in derision and with negative import, its cultural overtones are ones of admiration for the cleverness of its detouring solutions to problems. Here the term is used in a positive sense to describe only the "method of detour" in solving problems and neither the problem itself nor its solution. The principle of problem avoidance transforms drawbacks into characteristics: the mastery lies in the economy of effort and therefore of time and money expended in solving the problem.

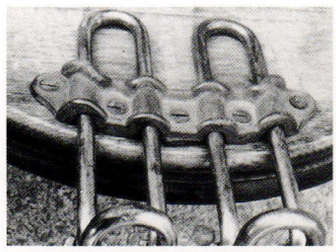
By giving the method a name we define the principle upon which it is based and we raise what was hitherto merely pragmatic to the level of a principle of design. In other words, we conceptualize the idea by talking about it; and by doing so we create a linguistic tool for the recognition of situations in which the principle is applicable, and perhaps even the recognition of the creation of the concept itself: *nomen est omen*. But the important thing is that by naming the method we render it present to our consciousness and make it into an operative means of design.



APPLYING THE METHOD OF DETOUR

The light timber framing system is not the only example of our building culture; our indigenous approach can manifest itself in any design area. An industrially produced typist's chair patented in 1895 manifests all the inherent qualities of our design culture in another way entirely.[15] The chair is made of copper-plated steel wire, cast iron and a primitive form of plywood. It was designed and prefabricated in a large series as a set of components and yet is clearly not the work of a conceptually trained designer with an interest in formal or structural logic.

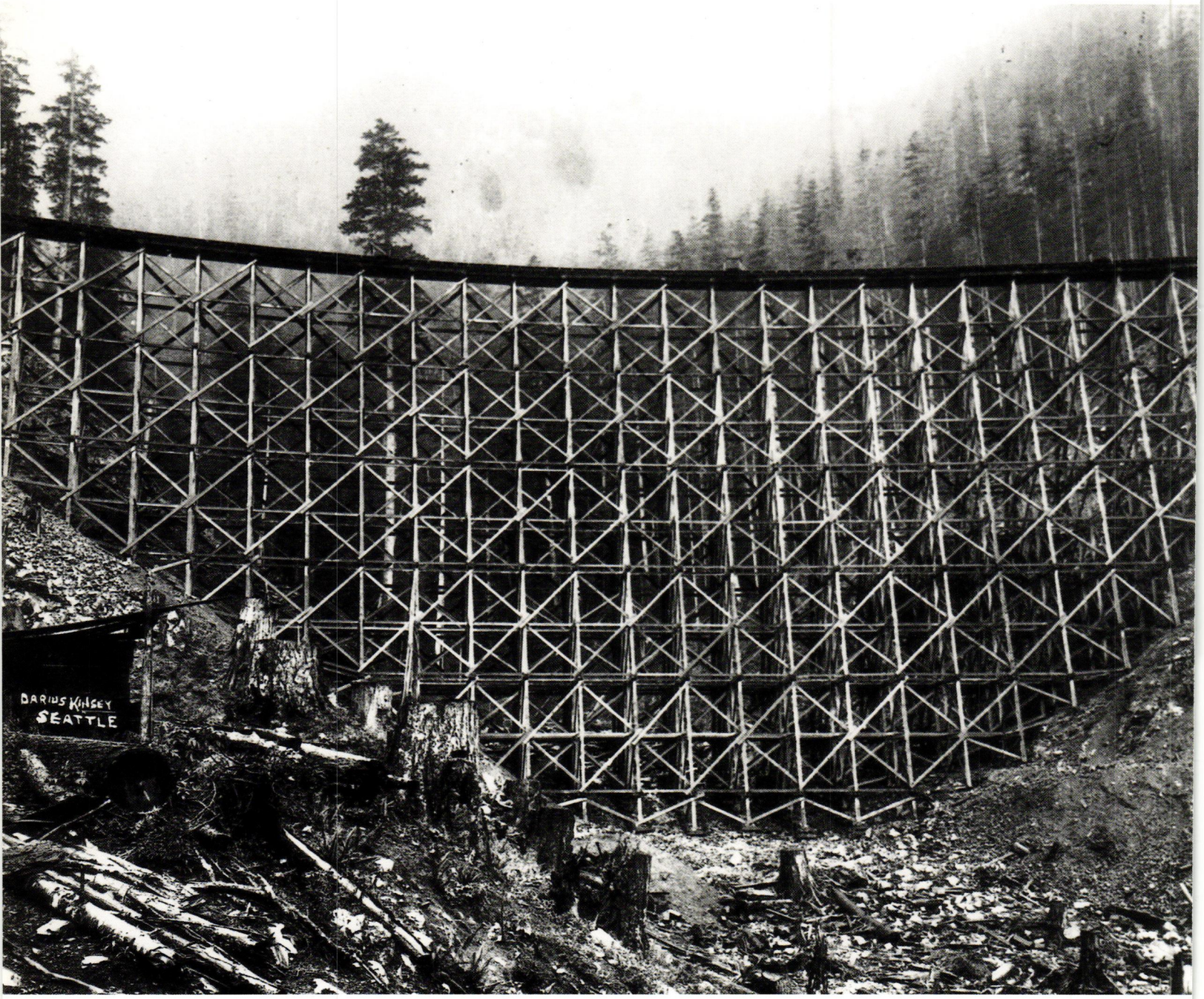




The snaking wire which forms the back support is clamped to the backrest by means of a cast-iron bracket. This connection cannot help wiggling, there is no way to prevent it from doing so, and no matter what is done, the wiggle will become ever more pronounced through use by compressing the wood slightly and wearing both the wire and the bracket. A European designer would be obliged to reject a solution of this type since adequate technical quality cannot be guaranteed. The designer of this chair certainly understood the technical "defect," but he circumvented the problem, he detoured around it, turning the drawback into a feature of the design by controlling the wiggle. By purposely "misunderstanding" the connection problem creatively, the designer transformed a poor connection into a new idea: the adaptable backrest.

The same phenomenon can be observed in the connection between the wire support and the seat: the wire will inevitably slip in the clamp fixed under the seat plate. In this case, the clamp is so designed as to permit it to slip easily in order to make the distance between seat and back adjustable. But no sooner does the sitter lean against the backrest, than the pressure he exerts will cause an overturning moment to act on the clamp. This stress will in turn jam the wire tightly in its sleeve and against the underside of the seat so that the back can no longer slip farther in or out. The principle of design is clearly the "Rube Goldberg" method of detour, inventively qualified by intentionally "misunderstanding" the problem. In both instances it is the application of the liveload, a factor not precisely controllable by the designer, which causes the desired effect of tilting or jamming. Effects that are uncontrollable are anathema to the conceptual designer. Because they cannot be proven mathematically, such effects occasion intellectual discomfort, reaffirming the European's need for a priori understanding and control of structural behavior. But lack of control is perfectly acceptable to the American, who is quite willing to approve of empirical evidence. Once again, as long as the desired effect has been arrived at *statistically*, the empiricist has no qualms in accepting and relying on it.[16]

Empirically "proven" details do not belong to the realm of conceptual thought because the connections are not seen as a family of similarly solved problems within a set of rules governing the assembly of the object. Here, the details of the chair are individual reactions to unique problems, and they create novel properties in the object by avoiding the necessity for solving the original problem, by instead solving problems that were not there at the outset.[17] The idea for the design of the connection is gleaned from the realm of practical experience in construction. It mirrors methods and processes of manufacture and the degenerative processes of use rather than conceptual thinking. And the eclectic use of structural detail in this chair also mirrors precisely the eclectic use of forms. The details are what the conceptual designer pejoratively terms whimsical or simply unsystematical, but they do demonstrate a high level of technical invention and understanding, and they continue to function perfectly after almost a century of use.


DARIUS KINSEY
SEATTLE

"ONE NAIL IS NO NAIL"[18]

QUALITY VERSUS QUANTITY IN CONNECTION TECHNOLOGY

The light timber frame is put together by means of an admittedly poor connector, the nail. But when the nail is used in large numbers and spread evenly throughout a structure, it behaves "statistically," as each nail carries the stresses of the structure in conjunction with all others. Nailed connections therefore hold because of their quantity and pattern of distribution rather than the quality of each connection. The nail is thus a "democratic" rather than an "autocratic" connector, and its success is governed by behavioral "consensus" and its "geographical" distribution throughout the structure rather than by individual excellence, much the same as our political behavior is regulated by the Gallup poll rather than by individual opinion. Of course, the nail holds some stress, just as the individual in our political system does make a decision, but the effect of the nail or the individual is entirely conditioned by its respective context. According to our political analogy, each unit or person in the system is considered to be equal and interchangeable. Any one unit may fail without endangering the whole. This is anti-elitist in nature because individual excellence is not at all a criterion of the system. But, on the other hand, anonymous statistical excellence does imply reliable stability. There is a consistency of attitude here which permeates our life from politics to construction which cannot be other than culturally determined.

This is of course a very different approach to connection technology than the traditional European one, in which every connection has to function in itself and independently from every other.[19] All methods of calculating nailed connections are based on the replacement of connection quality by the number of components. There is indeed nothing at all illogical about this: it is clearly uneconomical to expect a connector, acting in concert with other similar connectors, to withstand more than its share of stress – as though it were acting alone. The reason that European construction theory regards each connection on its own lies in the logic of the concept of system in which the connection is understood merely as one component among others. Systems are analyzed into their constituent parts in order to dimension them piecemeal, element by element, according to the nineteenth-century tradition of analytical statics. Once the whole has been fragmented into its parts, it is the connections between these parts which are seen as giving the system structural continuity. The parts in a European system must be usable in many configurations in order that the whole can function as a viable system. Therefore, the connections must be so conceived that they can satisfy many different loadbearing conditions; thus, each connection must be overdimensioned for most uses, as it has to be capable of transmitting the entire stress received from any combination of elements. Economy in such a system lies in reducing the number of elements by making each of them of the highest possible quality. From our North American standpoint this logic, useful as it may be for analysis and in the manufacturing process, is very wasteful indeed; our overriding criterion is, as we have seen, the economy of effort and cost effectiveness.

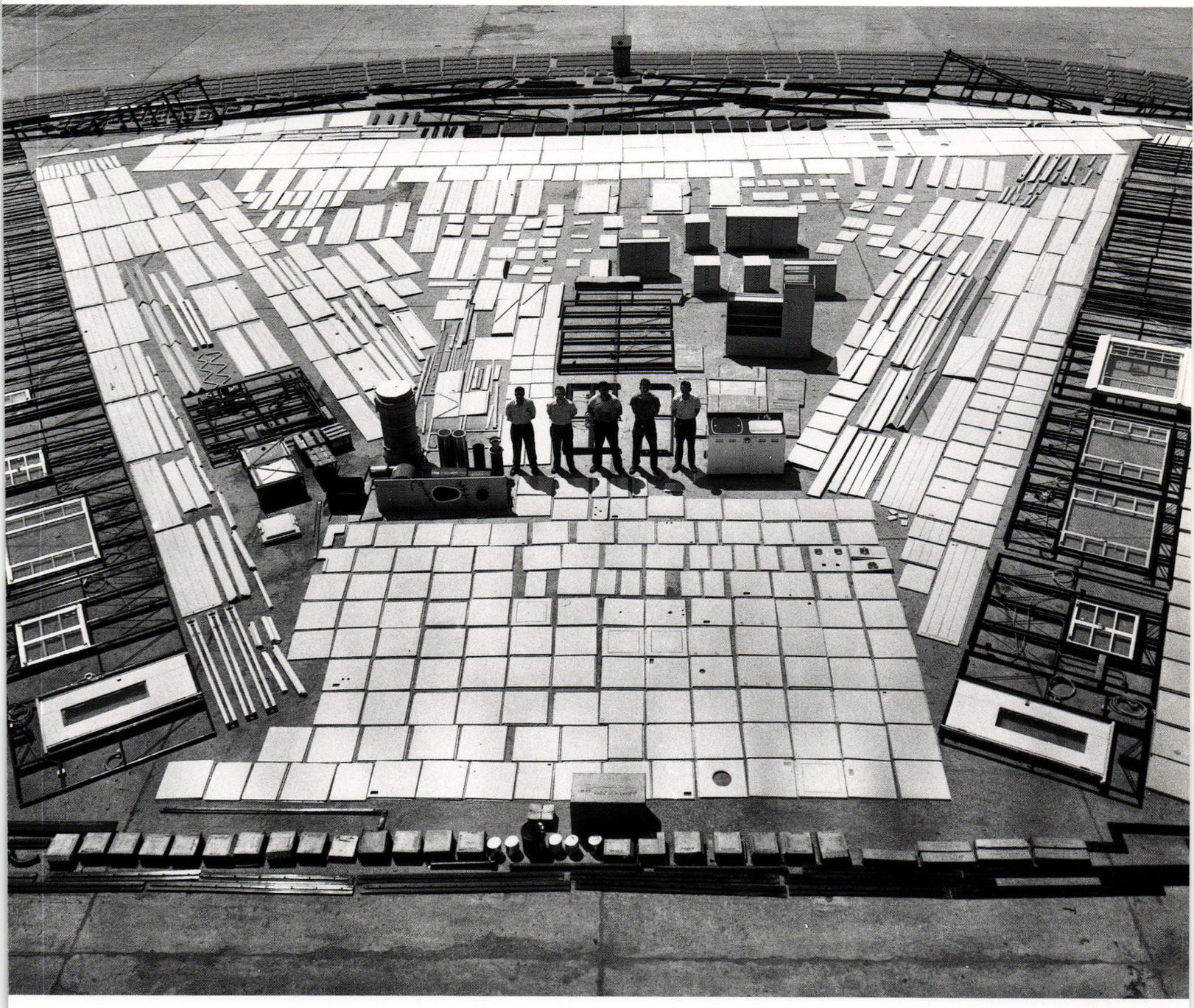
The replacement of connection quality by quantity influenced the development of the American form of timber bridge in the nineteenth century. The evolution of trussed construction on this side of the Atlantic was very different from that in Europe, although both resulted in similar forms. Materials have always been more abundant in this country than skilled labor. Builders of light timber frames and bridges very rightly doubted the capabilities of their job-trained laborers. Therefore, they replaced few good but specialized connections by many modest but identical ones. This greatly facilitated the training of their workmen and they were able to avoid an important source of construction error at the same time. The stratagem worked and the bridges they built held, even when some of their connections failed. Because of their high level of structural redundancy such bridges required a great deal less inspection than specialized ones of "higher" quality, which used less material and fewer connections. Any damage became readily apparent long before it became dangerous. The poorer quality of the connecting technology, coupled with a greater number of such connections, paradoxically meant safer structures.[20] American culture may indeed be a consumer culture in which the emphasis lies more on quantity than on quality, but here the trade-off is clearly of practical advantage.



The "statistical" or cumulative principle of many identical connectors led to a standardization of building components. The American light timber frame is a fully industrialized, prefabricated system. Studs, plywood, particleboard, nails and connectors are all manufactured in standard lengths and sizes, but in such an elementary way that precise tolerances are irrelevant and quality controls superfluous. Ironically, precision and the interchangeability of parts, the hallmarks of Yankee industrialized prefabrication from the end of the eighteenth century on, simply do not apply.

The novelty lies in the realization that quantity can replace quality. This requires that the system be seen as an integrated whole. No part can be pulled out of context and analyzed – it simply makes no sense without its context. The single nail is nothing other than a very poor connector, the single stud is a thin stick indeed. Yet together they form a sound structure. This integrated, anti-analytical approach led to the creation of the American form of prefabricated construction. And the sesquicentennial success of the American frame was guaranteed by the cunning primitiveness which gave us the greatest possible liberty in formal design. Liberty is another of our most treasured cultural values.

European building technologists also developed systems, some of them industrially prefabricated as well. But they were of a completely different type. The European approach was less synthetic and more analytical. It was not based on the logistics of the manufacture of acceptable connections but developed from simplified and incremental theoretical models of structural behavior. Such models, developed particularly in France in the early part of the

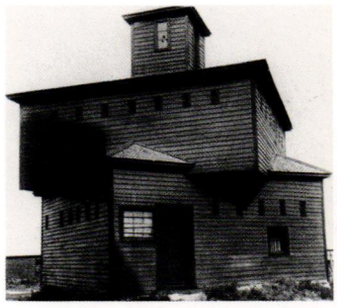




nineteenth century, permitted designers to understand and simplify the calculation of forces and thus to achieve economy in dimensioning members. These models – the simple, continuous or articulated beam, the cantilever, the hinged or fixed arch, the suspension system and so on – were seen to be addable but separate elements for reasons of computability. Each structural member, therefore, had to function independently of its neighbor, in the same way that the elements of a European system functioned independently: each form had to remain pristine for theoretical reasons.[21]

THE MONOLITHIC FRAME

The "statistical" spread of the nail throughout the light timber frame, and the consequent structural redundancy this occasions, give rise to yet another quality: they make frame structures behave monolithically in spite of skimpy materials and weak connections. Nailed frame buildings can bear the most upsetting of loads in completely unexpected ways. Forces can detour around trouble just as traffic does in a grid street system like that of Manhattan. This makes frame buildings exceedingly adaptable and resistant to abuse. Dorothy's house whirling high above Kansas in a tornado is a truly American form of load testing; no other timber building type could withstand such forces.



But there are many daily occurrences in our timber frames which are just as sensational if not as photogenic. We can remodel our frame houses to an extent that traditional European heavy timber buildings could never accommodate. Any hobby-minded person can and indeed does disjoin, eliminate or mutilate any and every member of his house without precipitating a structural catastrophe. Almost everything can be removed with impunity before a light timber frame will collapse. This need for extreme and unprofessional modification is a long-standing characteristic of American construction. Such a non-professional attitude to house construction does exclude architects from most general housing work and particularly from modification. But this foolproof, do-it-yourself freedom, inconceivable in a European building, is another of our most treasured traditions.[22] It is an inalienable criterion for the design and construction of our housing. If a timber building cannot be "maltreated" in this manner, it is simply not an American house. Not by overdimensioning the structure do we attain this freedom – that would be the European way of accomplishing this type of redundancy. We achieve it by replacing quality with numbers, which inadvertently bestows upon the structural system both monolithic behavior and an ambiguous relationship between construction and form.[23]

FORM AND STRUCTURE

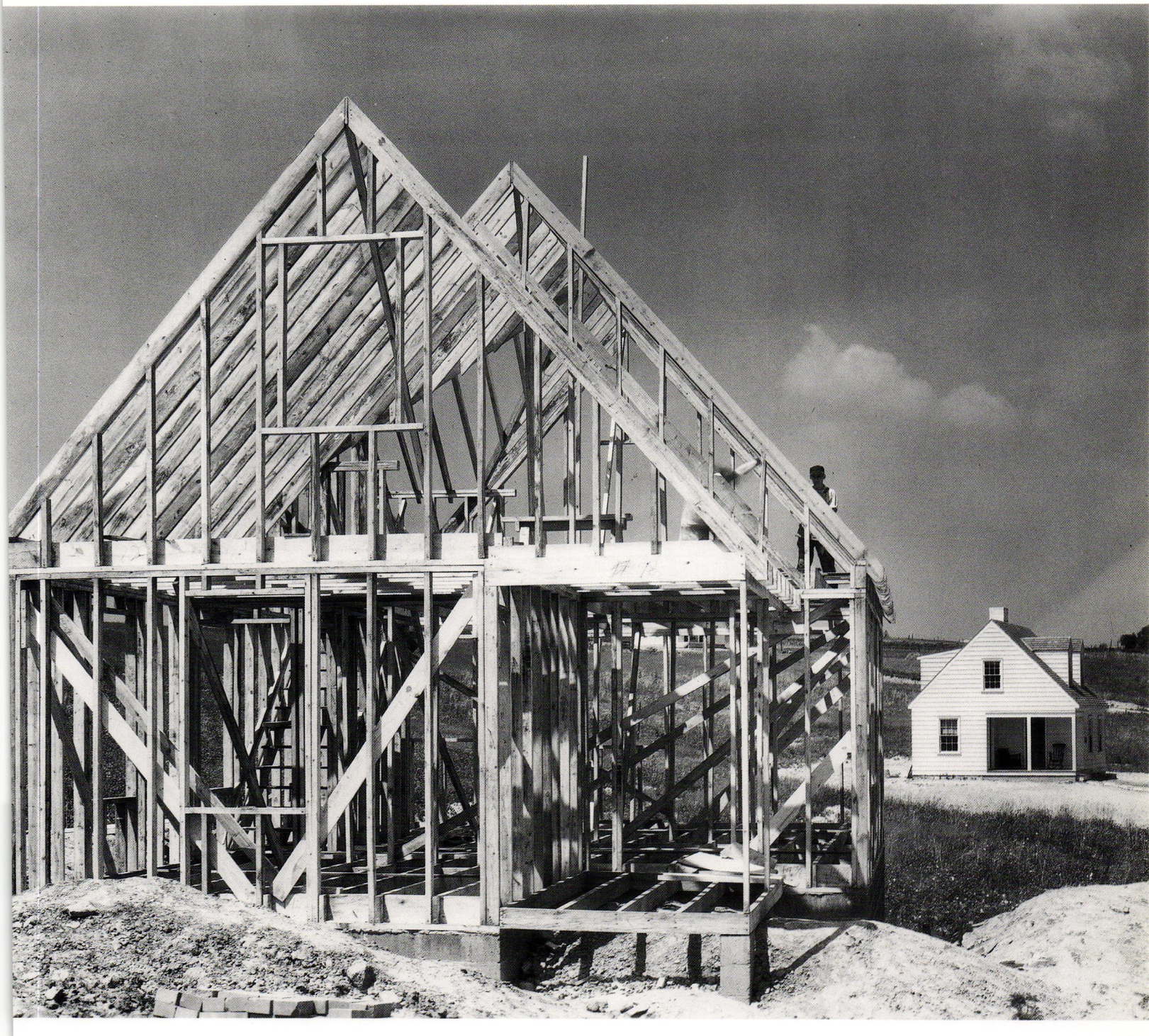
"Nail the hell out of it!" the contractor cries in earnest when faced with a particularly complex connection problem. What the result looks like is immaterial, as the whole is soon to be covered with a skin anyway, to give it form. Conformity to the rules of a system and their

response in form have no place here. Ours is a culture of the primacy of packaging over substance. American automobiles are traditionally styled rather than designed, and as any gourmand knows, it is the icing and not the dough that makes the cake. Ours is the Angel Food Cake of sugary visual delight, not the solid Schwarzwälder Torte in which no covering masks the layering of taste and texture.[24]

The typical American separation between structure and form never defines a dialectic design relationship, nor does it imply a mutual control analogous to the role of the legislative, the executive and the judiciary in our political system. It is perhaps more akin to the divorce between church and state in our society, which is unique in its uncompromising radicalness and which can, on occasion, also adopt hilariously extreme forms.[25] The separation between form and structure is thus not only related to a socio-political concept to which we assign value, but it is also, historically, based on the lack of a culturally bound iconography. This helps to explain our free choice of style, much freer than the eclecticism of nineteenth-century Europe, which probed the concept of appropriateness in the relationship of function to form and style against the background of historical meaning.[26] It may also help to understand the post-modernist, licentious mixing of formal metaphors, which can only be seen by the European designer as some kind of feeble joke, as he is only able comfortably to graze in segregated historical paddocks.

Choosing a style in the American sense conceals a paradox. Historical style implies and thereby creates the illusion of temporal permanence. At the same time, it illustrates cultural impermanence by the butterfly-like frivolity with which the choice is made, with very little in the way of support other than personal preference. Based on the strict separation of structure from form, North American designers, therefore, have formal languages at their disposal which are really free of premised meaning. They are no longer tied to history but are open to unbounded interpretation, to creative misunderstanding. Historicizing designers in our culture have thus always been able to graze on the prairie rather than in the historical paddock, an enviable situation. And, if we wish, we can even create our personal history in our own image. There is, therefore, not only a formal but also a temporal ambivalence underlying our slowly evolving design autonomy.[27]

The light timber framing system and the manufacture of the typist's chair illustrate a number of the salient characteristics of a unique design and construction process founded on empirical thought. The danger inherent in the empirical method is clear to all of us who design, but the possibilities are probably less so. We remember that all cultural invention is vulnerable, dangerous, simply because it is hypothetical, tentative and open by nature. But it is also evident that American concerns and motives differ radically from those of other cultures. The fabric of an American approach to design, or of any other facet of our life for that matter, is that of which our culture itself is made. It will therefore be from the iconography of American culture, however nondescript it may initially appear to us, that the solutions to our concerns must issue.



NOTES

1. The concept "creative misunderstanding" designates an intentional or unintentional reinterpretation of an accepted and expected meaning. The concept stems from the movement, prevalent in the 1960s, which examined design methodology and process. It was coined by William J. Gordon and George M. Prince in their writings on design methodology which they called "synectics." (See William J. Gordon, *Synectics: The Development of Creative Capacity* (New York: Harper & Row, 1961) and George M. Prince, *The Practice of Creativity: A Manual for Dynamic Group Problem Solving* (New York: Harper & Row, 1970); I am grateful to Tom Emodi, Technical University of Nova Scotia, for these references.) The phenomenon, commonplace enough to the artist, was picked up by architects from Harold Bloom's 1975 book, *Map of Misreading* (New York: Oxford University Press, 1975), according to Mark Jarzombek, Cornell University. But, until now, it has remained unnoticed in architectural theory.

2. I shall use the adjective "American" for convenience rather than Frank Lloyd Wright's contrived "Usonian" to denote cultural traits manifested in the United States. We must remain aware, however, that the other major American cultures, for instance those of our immediate neighbors, Mexico and Canada, are quite distinct.

3. Crossing borders between fields, cultures or professions leads to a shift in values and thus a shift in perceptions on the part of the "border-crosser." According to Sander Gilman, Cornell Unversity, this term was coined by the anthropologist Clifford Geertz in the late 1950s or early 1960s.

4. The heterogeneous cultural mix of our society has until now tended to de-emphasize the value of consensus. And it is that lack of absolute closure that fascinates the European. The creation of a consensus seems to have been one of the original intentions of the concept of the "melting pot," and many now deplore this as a cultural leveling process similar to that of the "International Style." The danger is possibly quite real: the recent term "silent majority," although apparently merely a politically expedient fiction, indicates a continuing yearning by a portion of our nation for the comfort of such a confining consensus.

5. See Tom F. Peters, "The Rise of the Skyscraper from the Ashes of Chicago," *American Heritage of Invention and Technology* (Fall 1987): especially p. 16.

6. The houses of Frank Gehry spring immediately to mind as does the older "woodbutcher" tradition, a term derived from the 1973 book, *Handmade Houses: A Guide to the Woodbutcher's Art*, by Arthur Boericke and Barry Shapiro (San Francisco: Scrimshaw Press, 1973). However these tendencies may develop in the future, our native and originally anti-conceptual design method permits a fascinating open-endedness in formal expression.

7. However, we do need to keep in mind that "understanding" is also a matter of cultural definition: everything is explained in terms of other concepts whose essences are as equally inscrutable as the concepts themselves.

8. There is a half-humorous, half-ironic self-evaluation of Germanic culture which states that everything not expressly permitted (by law) is forbidden. *Darf man das?* or "Is it allowed?" is a common German question which in its general

applicability to almost any situation is untranslatable into English. The corresponding characterization of general Anglo-Saxon culture would be that everything not expressly forbidden by law is fair game.

9. American society values the theoretical physicist only because we believe that his work leads directly to industrial application and thus to earning power. It is generally the applier, the inventor who truly excites our admiration. Einstein, our culture's icon of "The Physicist," is considered to be a humorous and lovable curiosity, an intellectual teddy bear – a far cry from the cultural value assigned to him in Europe. Posters depicting him as a super-annuated proto-hippy are common. Edison and Bell, our cultural icons of "The Inventor," on the other hand, are held far more in awe. Photographs of them are always properly heroic; there is nothing even remotely humorous or condescending about our admiration for them. In Europe, on the other hand, *bricoleur* in French or *Bastler* in German (empirically bumbling inventor, tinkerer, dabbler, handyman) are derisive terms.

10. The Germans and French differentiate between "the essence of a problem" – *das Wesen eines Problems*; *l'essentiel d'un problème* – terms denoting the conceptual aspect, and the problem itself, encompassing the specific side of the matter.

11. Mark Mack examined the antithesis of the American approach in an analytical, "euro-systematic" use of the stud, nail and concrete block in his noted exhibition "Furnitures 82," held in 1982 in San Francisco. Particularly his four-poster bed made of two-by-fours dealt with the perennial problem of the Ionic column: how to turn a corner logically in a directional system using a corner post which looks different from one side than from the other. This is a conceptual concern that is meaning-less to framing contractors.

12. The German proverb states: *in der Beschränkung zeigt sich der Meister* or "the master manifests himself through restriction." In fact, we do not disagree with the German proverb, we merely replace "restriction" by "cost effectiveness." We transform what we deem the negative connotation of "limitation" into the ethic of saving, not of materials or the environment, but of labor, which has always been scarce in our society. It is an apparent paradox that our culture's overriding concern with economy of effort should be coupled with a blatant celebration of consumption, but it contains its own inherent logic: we save effort in order to produce more at less cost.

13. At present, all American schools of architecture are entirely dependent on traditional European models of conceptual thinking. It is therefore important for us to remember that our indigenous method of detour is in every way as logical and potentially as rich as the foreign insistence on conceptual consistency.

14. Reuben Lucius Goldberg (1883-1970) was an American cartoonist and humorist critic of the rampant and uncritical adoration of mechanization. The term "Rube Goldberg" does not yet appear in the 1944 *Dictionary of American Slang*. The first use is documented in 1956. Then it appeared in *Webster's Dictionary* in 1961, in *Time* in 1962, in *Johns Hopkins Magazine* the following

year and in 1978 in *Nature*, thus documenting its penetration into ever more socially acceptable usage. See *Rube Goldberg vs. The Machine Age*, edited by Clark Kinnard (New York: Hastings House, 1968).

15. The patent for this chair (#552.502) was noted in an editorial in *Domus* by the Italian designer Mario Bellini in October 1986.

16. "Proof," like "understanding," is subject to culturally definable consensus. Here "the proof of the pudding lies in the eating," not in abstract deduction. This empirical freedom existed in European culture too, but it was lost in the Industrial Revolution.

17. Today, with the ubiquity of computer methods of modeling and analysis which, due to their speed, are able to deal with far more complex problems than ever before, such empirical methods are swiftly becoming conceptualized. It remains to be seen whether this is conducive or detrimental to the Rube Goldberg method of detour.

18. Heinz Ronner, at the Swiss Federal Institute of Technology (ETH) in Zurich, coined this pedagogical slogan to dramatize the statistical as opposed to qualitative characteristics of nailed connections.

19. The American attitude to connection technology may be unusual, but it is by no means unique. It does, for instance, bear a certain resemblance to traditional Japanese timber framing in which stiffness is achieved "statistically" by the cumulative resistance of a multitude of orthogonal connections rather than through shear bracing as we know it. There are still differences though, as *resistance* to horizontal forces in Japanese framing is achieved partially (just as it is in the traditional Viennese bentwood chair) through *accommodation*, by absorption of energy in the movement of the unstiffened connections rather than by *opposition* to the action of the force. All these examples, of course, relate to their respective socio-political matrices, and an examination of these relationships in other cultures would prove most rewarding indeed.

20. Inspection and maintenance have only recently become of pressing concern to us in this country. "If it ain't broke, don't fix it" runs our popular adage – an unknown sentiment in Europe, where great effort is generally expended in maintenance so that things do not break. The cost effectiveness of both approaches is complex and has to be determined from case to case. One reason for our long-standing neglect of maintenance may be our having gradually reduced redundancy in long-span and high-rise structures. We have done this through ever more refined techniques of calculation and better knowledge of material behavior. Yet we have not recognized the broader consequences of this form of economization, as the more reflective and more material and energy conscious European builders have.

21. The best continental European bridges of the nineteenth century exemplify these theoretical models, while the corresponding American ones are almost invariably hybrids.

22. The need for unlimited remodeling was graphically demonstrated by the iron founder James Bogardus, in an advertisement showing his factory (built in 1849) in which he illustrated the supposed

subtractive advantages of his cast-iron framing system. See James Bogardus, *Cast Iron Buildings: Their Construction and Advantages* (New York: J. W. Harrison, 1856).

23. We have encountered the concept of redundancy several times now. It is the one factor which guarantees this desirable high level of design flexibility in our building culture. On the negative side, it is certainly closely related to our wasteful use of natural resources and to our traditional reliance on semi-skilled labor which is, in itself, another form of waste: that of educational potential. The use of structural redundancy in continental Europe ended with the rise of traditional analytical statics in the first decades of the nineteenth century (see Tom F. Peters, *Transitions in Engineering: Guillaume Dufour and the Early 19th Century Cable Suspension Bridges* (Basel: Birkhäuser, 1987), especially pp. 9-11). Today, it is gradually beginning to excite interest again, due to the dangerously high precision of computer methods of structural modeling and dimensioning, which leaves no room at all for accommodating the unexpected.

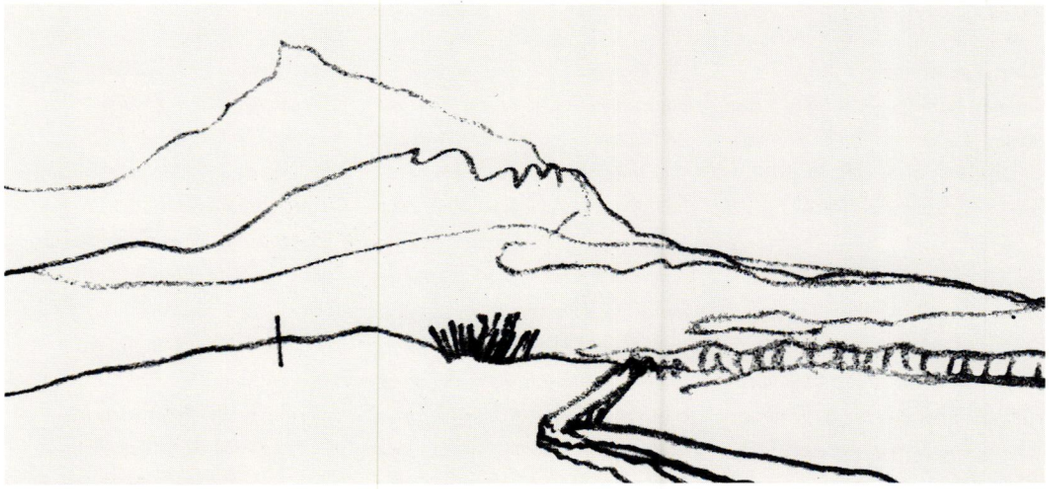
24. However, the analogy masks our true values, just as the fixation on European models inverts and thus hides the true qualities of our building culture: it is not really the aristocratic cake at all that represents the essence of our culture, but rather the democratic pie, and that is, of course, all content. The British expression "that's a piece of cake" becomes "as easy as pie" in America. The pie as symbol of the "American Dream" was brilliantly captured by Joe Hill (1879-1915) the popular bard of the radical International Workersof the World, in the famed satirical refrain to his song, "The preacher and the slave," composed about 1906:

You will eat bye and bye
In that glorious land above the sky:
Work and pray, live on hay,
You'll get pie in the sky
when you die.

25. This was written in the aftermath of both post-modernism and the 1987-88 ecclesiastical PTL scandal.

26. Gottfried Semper's pamphlet on Gothic versus Classical, *Ueber den Bau evangelischer Kirchen. Mit besonderer Beziehung auf die gegenwärtige Frage über die Art des Neubaues der Nikolaikirche in Hamburg und auf ein dafür entworfenes Project* . . . (Leipzig: B.G.Teubner, 1845), is a good early German example of such an examination, as are the subsequent theoretical works of A.W. Pugin, Ruskin et al. in Britain, and Viollet-le-Duc and others in France.

27. Sigfried Giedion's last and uncompleted work bears the title *The Eternal Present: A Contribution on Constancy and Change* (New York: Bollingen Foundation, 1962-64). Giedion was strongly influenced by American culture and intended to imply by the title of this work that, in contrast to previous modern doctrines, history has its place within our modern design repertoire because it is present to us. This is, of course, not an original thought, but it does correspond rather well to American cultural needs. What Giedion did not say, but which follows from this thought, is that our understanding of history also mutates with a changing temporal standpoint. Objectivity is non-existent. And it is on the basis of such thoughts that we can legitimize our freedom to manipulate historical form and style.



1 Landscape, Morocco, 1951

For the language of his architecture followed very closely the contours of the building programme he was following at the time. And it did this because of one very striking characteristic in the "structure" (abstractly speaking) of his creative attack. This can be epitomised by drawing two forms – an ideograph of two lines – one straight, the other serpentine; we can transform the lines into planes, and whether we view it as a plan or a section it will recall to us the archetypal Aalto space, in which the juxtaposition of a strictly flat plane with a rhythmically wavelike surface seems to charge the air of the space like the beating of a giant wing. But these two forms can also be imagined as the lines of an encephalogram – an imprint of the brain's processes, in the sense that there seems always to be in the "argument" of an Aalto building a complementareity between the rigorous plane of analysis and the turbulent wavelike surge of fantasy. Colin St. John Wilson [1]

The Imaginary Mountain

The Significance of Contour in Alvar Aalto's Sketches

Mark A. Hewitt

It is a paradox of modern architecture that, in an age dominated by rationalist theory, the sketch has become a legitimate means of expressing complete architectural concepts. The concept sketch, encapsulating many of the formal, theoretical and phenomenological aspects of a design in a single stroke, now occupies an important place in the canon of architectural representation. The sketch is fresher, more vivid, more personal than the mechanistically produced presentation drawing. In a sense, this seemingly informal and irrational drawing type can be proof of the clarity and objectivity of method which has been a hallmark of twentieth-century theory. And, as important, the sketch can express the romantic, avant-garde gesture of creative individualism that nearly all contemporary artists cultivate.

Study sketches were not always seen in this light. As Werner Oechslin has pointed out, sketches were historically considered to be personal, subjective explorations reserved for the architect in the privacy of his studio, not for public dissemination.[2] The earliest use of the study sketch dates from the *quattrocento*, when advances in papermaking made trial and error exploration possible for both painters and architects. It was not until the eighteenth century that architects developed the sketch as a drawing type in its own right. The baroque scenographic *cappricio* was one such form, brought to a high artistic level by such draftsmen as Filippo Juvarra. Travel sketches, recording the monuments of the grand tour, were the most significant eighteenth- and nineteenth-century instruments of the sketcher's art, sometimes shown in exhibitions. Great draftsmen such as Schinkel, Norman Shaw and C.R. Cockerell used the travel sketch as fodder for ideas, but never confused the freely conceived drawing with a fully formed architectural concept, which was always presented in precise renderings.

The first important use of the sketch as a codified instrument of design came through the French Beaux Arts system. The all important *esquisse*, an academic drawing more akin to a rough draft of the complete building, presented always in plan, section and elevation according to a conventionalized layout, was used in the *concours* process as a means of judging the quality of a *parti* or complete design concept. Yet this drawing was fundamentally different from the free, abstract "idea sketch" which emerged in the twentieth century as an icon of architectural expression.[3] With the advent of abstract, gestalt conceptualization fostered by the Bauhaus system, and the avant-garde linkage between abstract art and architecture, the idealized first sketch took on greater significance – somehow closer to the pure idea behind a design.

Architects make idea sketches in order to facilitate thinking. Especially in the earliest stages of design, when mental images and vague intuitions of a concept are all that inhabit the imagination, the sketch is the litmus test and first manifestation of an idea. A set of crude, incomplete and imperfectly formed drawings can aid in the crystallization of a formal concept. Because the interactive sequence of sketch representations records

1. Colin St. John Wilson, "Alvar Aalto and the State of Modernism," *International Architect* 1, no. 2 (1979): p. 30.

2. Werner Oechslin, "The Well-Tempered Sketch," *Daidalos* 5 (September 1982): pp. 99-112.

3. This valuation of the sketch is in part attributable to the close relationship between modern art and architecture achieved in European avant-garde circles. The fusion of painting, sculpture, architecture and applied arts in the Bauhaus *vorkurs* helped to legitimize the design techniques of the graphic artist for architects in the 1920s, and freed them from the representational constraints of academic drawing. Painters and architects were kindred spirits, as Ozenfant, Léger and Le Corbusier proved. Representational barriers and conventions were gradually broken down by such art movements as Constructivism, Futurism and De Stijl, so that the architect could invent his own modes of design and expression. The free sketch was only one of these new forms.

a mental schema peculiar to each individual architect, a study of such drawings can help to unveil modes of conception and formal preoccupations. It is our purpose here to study the sketches of one architect in the hope of making such a discovery.

No modern architect is more closely associated with the freely composed *ideenskizze* than Alvar Aalto. A large part of the mystique of Finland's great master is bound up with his intuitive, expressionistic, wavy line sketches. It is impossible to think of his built projects without imagining those initial quivering, free-spirited, exploratory sketches. The amorphous forms of his later works are perfectly reflected in his drawing style. This essay will consider the significance of these drawings to Aalto's design method, with particular attention to the ways in which they are used to define form in mass and space. Through an analysis of his unique sketching method, several of his key formal innovations and preoccupations can be better understood, especially his attitude to the contouring of space in plan and section.

Alvar Aalto clearly believed that the act of sketching was fundamental to the creation of architectural form. With the publication of volume one of his *Complete Works* in 1963, his startling soft pencil "first sketches" appeared alongside formal presentation drawings and photographs of a given project. Here in print is the architect's official version of his creative process; the sketch is the key starting point of each design. Critics have been mystified by the seeming irrationality of these drawings. Werner Moser, writing in 1970, was spellbound, remarking that Aalto employed the soft line deliberately, "as if a more abruptly explicit procedure might hurt the basic idea which he is experiencing in his mind."[4] Malcolm Quantrill likewise found Aalto's design procedure more like "play"; he wrote, "his sketches are, in the true sense, explorations: they move towards solutions not at all in the conventional way but more in the free conceptual manner of the Baroque spatial tradition."[5] Other critics have pointed to the emotional qualities of the sketch as crucial to Aalto's view of design as an extension of the life force.[6] As Karl Flieg wrote after observing the atelier in 1968:

Personal contact with Aalto repeatedly shows how earnestly and with what awareness of his calling he attempts to grasp all the problems of life in our age and seeks to make them visible in some form. He has little time for formal architectural theories; to discover form literally and metaphorically is the task of every individual, and theories are of no help here; only life that is lived and observed can furnish guidelines.

Every project is elaborated by Aalto alone with countless sketches, ranging from purely conceptual drawings and designs to recognizable details. Then the chief architect responsible for the execution of the project interprets the material. In close collaboration with Aalto, he then works the sketches and the pictorial explanations into a presentable conceptual plan for the client and for the construction engineers.[7]

Here was testimony to the crucial importance of the sketch. In the post-war studio the project architect and draftsmen stood by to translate the master's murky doodles into finished buildings – often a rather challenging task. The architect thus abetted those interpreters who saw him as a child of nature, jettisoning in his later works the trappings of orthodox theory for a compositional process based upon speculation, exploration and formal discovery through freehand drawing.

Aalto's writings also support the notion that he was an intuitive designer who encouraged the subconscious to come forth while drawing. His now famous remarks on architecture and abstract art, first published in *Domus* in 1947, concerned the design of the Viipuri Library, in which "primitive" or "childlike sketches" of "fantastic mountain landscapes" and skies with "many suns" were used as metaphorical analogies for the building's *parti*.[8] He saw architectural form in line, figure, mass, color and texture, much as an abstract painter does, and deliberately connected his architectural ideas with those in his sporadic oil paintings, first extensively published in *Synopsis*. He spoke of sometimes forgetting "the maze of problems" in a complex program and drawing "in a manner rather like that of abstract art. Led only by my instincts I draw, not architectural synthesis, but sometimes even childish compositions, and via this route I eventually arrive at an abstract basis to the main concept, a kind

4. Werner M. Moser, "A Survey of the Work of Alvar Aalto," in *Alvar Aalto: Synopsis* (Basel: Birkhäuser Verlag, 1970), p. 184.

5. Malcolm Quantrill, *Alvar Aalto: A Critical Study* (London: 1983), p. 243.

6. See, for instance, Juhani Pallasmaa, "Towards a New Humanism: Aspects of Aalto's Architecture and Thinking," *Space Design* 1 and 2 (January and February 1977): pp. 10-12; and Carlo Ludovico Ragghianti, "Alvar Aalto's Creative Imagination," in *Alvar Aalto 1898-1976*, catalogue from the Finnish Museum of Architecture (1978): pp. 129-33.

7. Karl Flieg, "The Architect in his Workshop," in *Alvar Aalto 1963-70*, vol. 2 (Zurich: 1971), p. 9.

8. This apparent interview was republished by Göran Schildt in *Luonnoksia* in Finnish (Helsinki: Otava, 1972), and subsequently translated into Swedish as *Skisser* (Söderström & Co. Förlags Ab.) and into English as *Sketches: Alvar Aalto*, edited by Göran Schildt and translated by Stuart Wrede (Cambridge, Mass.: MIT Press, 1978) where it has been titled "The Trout and the Mountain Stream." The original article in *Domus* (nos. 223-225 (October - December 1947): pp. 3-15) bears the Italian title "Architettura e arte concreta." As might be expected, not only the title suffers from multiple translations and liberties taken with the text.

of universal substance with whose help the numerous quarreling sub-problems can be brought into harmony."[9] Viewed impressionistically, or as works of art, Aalto's sketches reinforce this apparently ironclad testament to the spontaneity of his design process.

The myth of Aalto's "irrationality" has excused some critics from probing his sophisticated thought processes. How, for instance, does one explain the fact that he used far more conventional representational techniques during his early years, and adopted a more objective drawing style for his International Style buildings in the late twenties? Did his mode of conception change from one phase of his career to the next?[10] Are his idea sketches merely free expressions of thought without a method, system or canon, or can a pattern of design be distinguished when considering his drawings over an extended period? On the basis of preliminary evidence from those drawings which have been released by the Aalto archives, it seems that a systematic, rational pattern is present in Aalto's design sketches. Aalto's supposed free approach to space and mass is in fact precise and sophisticated, and very much in line with his early training in both surveying and academic architectural design. For although he was perhaps uniquely aware of unconscious feelings for formal relationships, Aalto was also rigorously governed by a thought process that was architectural, not painterly.[11] Only via such a conceptual mode could he have produced the complex and ingeniously heteromorphic buildings of his later years.

The keys to understanding Aalto's approach to design are three, and they closely follow a methodology which I have outlined in an earlier essay on architectural drawing. First, the designer's habits of mind over an entire career must be analyzed; in Aalto's case this requires a comparison of drawing types during the various phases of his career. Second, the characteristics of the architect's drawings – media, type and mode – must be examined. While superficially different, Aalto's drawings demonstrate an invariance in several important facets. Thirdly, Aalto's attitudes toward the reciprocity of plan, section and massing may be studied using the idea sketch as a key to the ways in which forms were conceived and represented.

9. Schildt and Wrede, *Sketches*, p. 97.

10. My use of this term stems from an earlier essay of my own, "Representational Forms and Modes of Conception: An Approach to the History of Architectural Drawing," *Journal of Architectural Education* 39, no. 2 (Winter 1985): pp. 2-9.

11. According to Göran Schildt, painting played a vital role in Aalto's attitude toward design throughout his career. He gave up thoughts of becoming an artist early on, but used sculpture and painting actively as a means of exploring architectural ideas. "Aalto expressly stated that, unlike Le Corbusier, he had no independent ambitions as a painter." He painted because "it allowed him to develop his architectural sensibility in the same way as wood sculptures provided him with the experience of material." Schildt, *Alvar Aalto: The Early Years* (New York: Rizzoli, 1984), p. 157.

Aalto's academic training in architecture at the Helsinki Institute of Technology was a rigorous, Beaux-Arts-influenced curriculum in which drawing was emphasized.[12] Though little is known of the years Aalto spent as an architectural student (1916-21), his design habits were formed around conventional techniques of academic representation: the *esquisse/rendu* method, wash rendering, and the use of simultaneous plan/section/elevation modes on a single sheet. In the academic atelier system, the student is taught to understand architectural form holistically, by analyzing a building along the cardinal axes and drawing it orthogonally. By placing the plan, section and elevation on a single sheet in both the *esquisse* and the rendered design, the student is forced to conceive not only three-dimensionally, but pay particular attention to the relationships between plan and section. Aalto never forgot the lessons of the academic classical method, though he rejected its ideology in the 1920s.

Another strong influence on Aalto's drawing technique was the representational style of the National Romantic School, which reached its apex during his school years. Here he learned the conventions and preoccupations of picturesque composition in perspective. He was also attracted to soft media: charcoal and pencil. Eliel Saarinen's soft sketching pencil renderings can hardly have failed to influence the young Aalto.[13] There are striking similarities between the pencil line drawings of the two masters, though Aalto never became enamored of pencil renderings per se. The pencil or charcoal could suggest the textures of materials, flora and the influence of the hand more evocatively than any other medium, and was well suited to the romantic Arts and Crafts ideal. This feeling for texture and light can be seen in Aalto's 1926 sketch for the church at Muurame. (2) In his earliest years as a student, Aalto was drilled in the methods of an academic architect, while also witnessing the high point of National Romanticism. The lessons learned then cannot have dissipated as he developed his working techniques as a mature designer.

The pre-1925 drawings of Aalto's romantic classical buildings which have recently come to light bear this out. His presentation drawings (in ink or pencil line) and sketches depend on conventional orthogonal views which convey classical frontality. The only suggestions of Aalto's later free style occur in his use of perspective modes, such as in the *esquisse* for the 1924 Palais des Nations competition; here the plans run down the center of the sheet in Beaux Arts fashion, while picturesque views of the massing are studied on the sides of the page. (3) It is important to note that even in his early work the architect tended to resist heavy shade and shadow rendering in favor of line drawings, primarily in pencil.

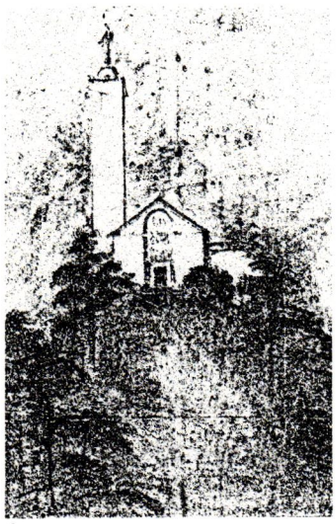
Aalto's other acknowledged early influence, Gunnar Asplund, contributed in two essential ways to the younger architect's attitude toward design. First, Asplund's almost Freudian use of the primitive, childlike, and subconscious realm in his work imparted itself to his protégé; this is the root of Aalto's professed reliance on the emotional realm in his later works, his naive freedom of formal speculation.[14] Equally important to the younger architect, Asplund was almost compulsively speculative in his design method, making sketch after sketch, revision after revision in each project, to arrive finally at a complex design.[15]

12. Schildt, *The Early Years*, pp. 172-82.

13. Frederick Gutheim, *Alvar Aalto* (New York: George Braziller, 1960), p. 10.

14. This has been demonstrated by Stuart Wrede in *The Architecture of Gunnar Asplund* (Cambridge, Mass.: MIT Press, 1980), p. 94.

15. Wrede, *Gunnar Asplund*, p. 221.



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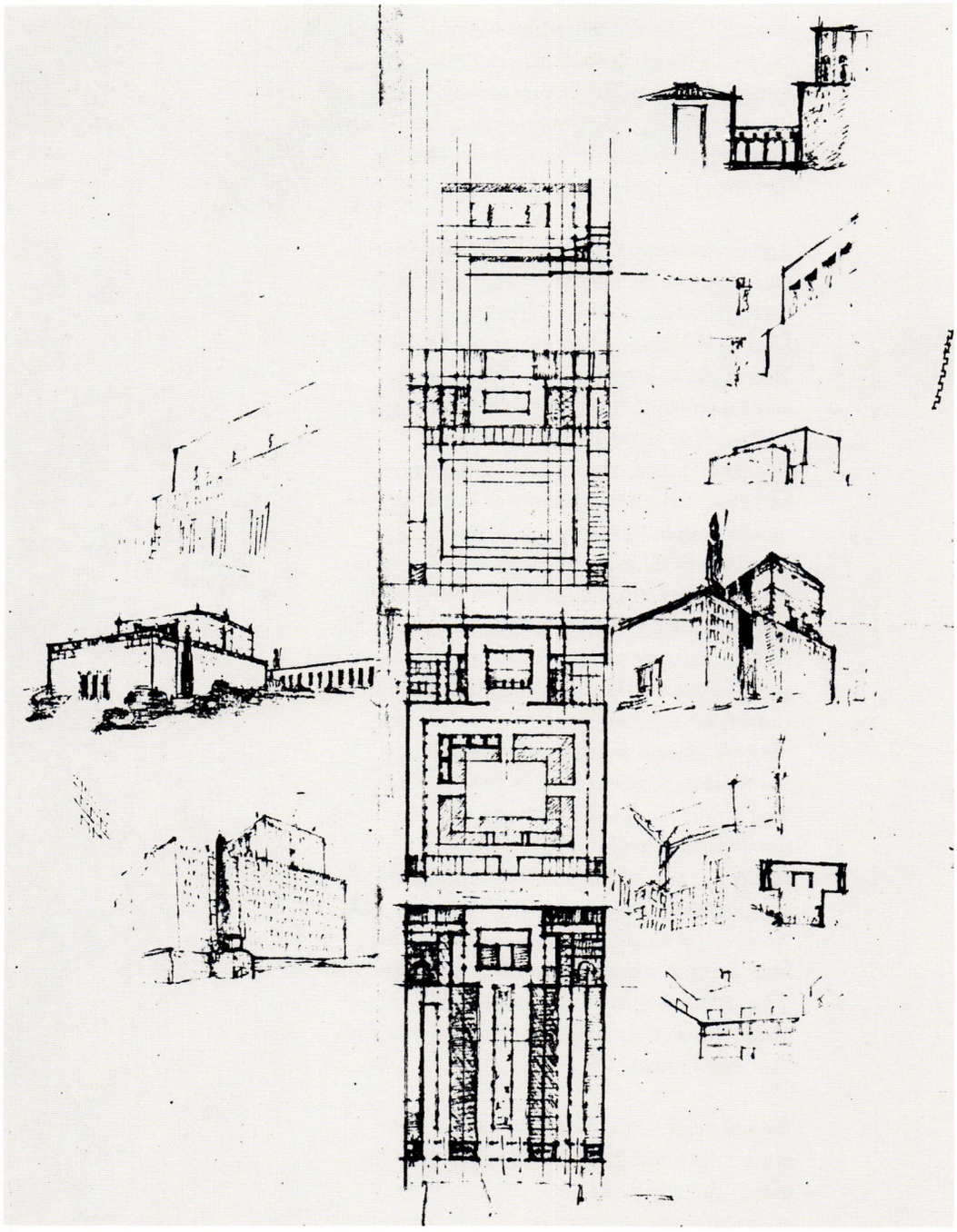

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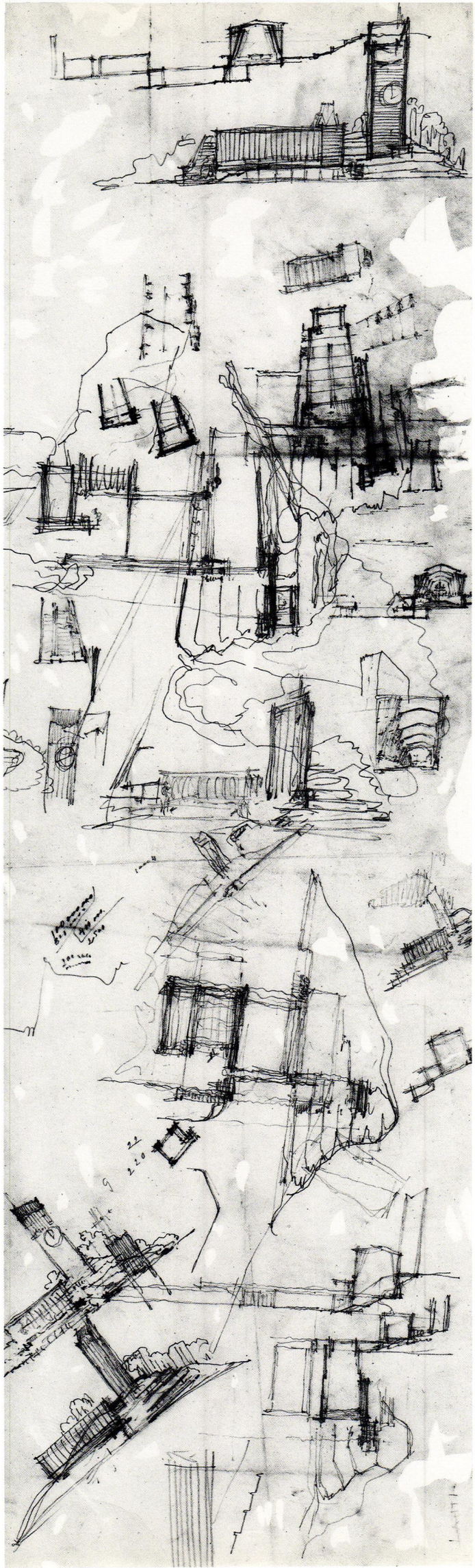
Though Aalto attributed his use of the sketch to his childhood experiences under his father's "white table," he must have assimilated Asplund's sketching penchant and used it in conjunction with more formal design methods learned in school.

Aalto's drawings themselves give us ample evidence of a consistent approach to design through medium and mode of representation. During the years following the end of World War II, Aalto's atelier was re-established and his working method and drawing style coalesced to a point at which neither Romantic Classicism nor the International Style exerted undue influence. Aalto's draftsmen continued to use precise, pencil line drawings in their presentations, drawings in which architectural elements are accurately delineated without overly abstracting or conceptualizing forms. Textures and materials are indicated without extensive rendering. In fact, when shadows are cast in hatching, they are almost as schematic notations, not realistic suggestions of shade and shadow. The modes of representation are conventional orthogonal drawings: elevations, sections, plans, site plans, with an occasional perspective or axonometric. Monochromatic wood or paper models of preliminary and final designs capped the presentation process. The architect clearly valued precision in his presentation drawings, a precision which only line could impart.

Paradoxically, Aalto's sketches from this period are among the earliest to display his loose, quivering line style. Although the apparent spontaneity of the line is suggestive of a purely speculative method, most of the published sketches follow a predictable problem-solving system based upon academic training. His apparently indecipherable concept sketch of the church at Lahti is in fact extraordinary multiple representations informed by the *esquisse* technique: a tiny plan or plans at the center surrounded by projections into section, elevation or perspective. (4) The use of a soft pencil or charcoal crayon is deliberate and important, for Aalto's sensitivity to line weight and his ability to build up forms out of many traces allow him to explore difficult and complex formal patterns with a precision unavailable to lesser draftsmen.



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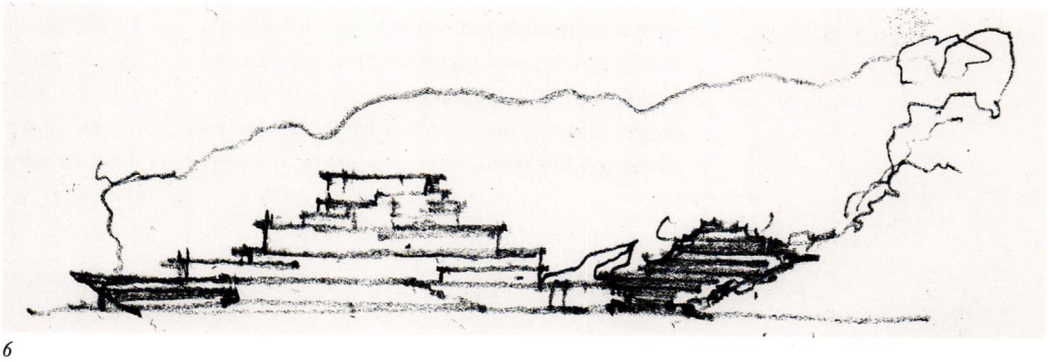

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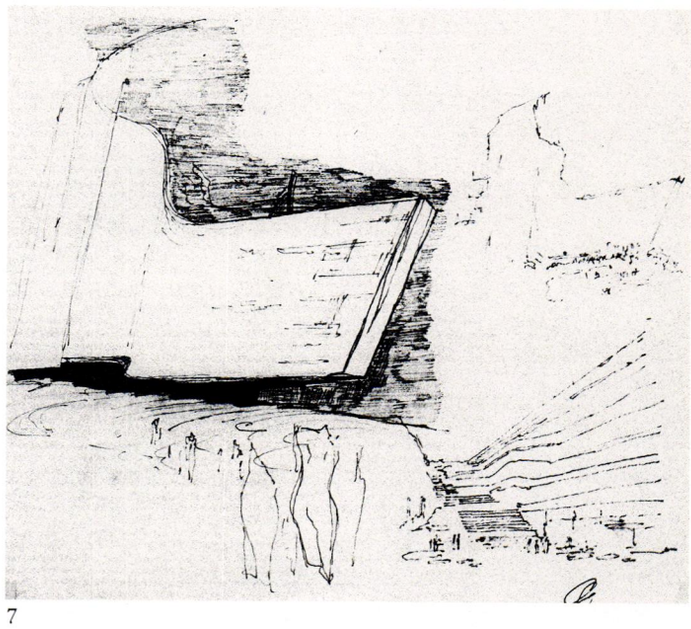
His formal ideas could be expressed with a subtle directness through the emerging lines themselves, tracing plan shapes, masses, and contours of land and building form. These sketches are very small, but have a scalar accuracy which is almost uncanny. Aalto was by this time an architect of twenty-five years experience, and his eye-hand perception was superb. Miniatur-ization allows a complete depiction of all aspects of the design on a single sheet, rolled out continuously like a Chinese scroll.

Aalto's sketches also demonstrate a willingness to find the representational mode suitable to each problem after the basic ideas were worked out. The great curved amphitheatrical form of the Otaniemi Technical Institute lecture hall, studied in multiple sketches, finally found expression in a bird's-eye perspective. (5) At the Aalborg Art Museum (6) and the unexecuted museum for Shiraz, Iran, an echeloned elevation sketch was used to depict relationships between building mass and landscape. One of Aalto's most evocative, naturalistic sketches is the 1959 interior perspective of the undulating balcony form of the Essen Opera House (7),



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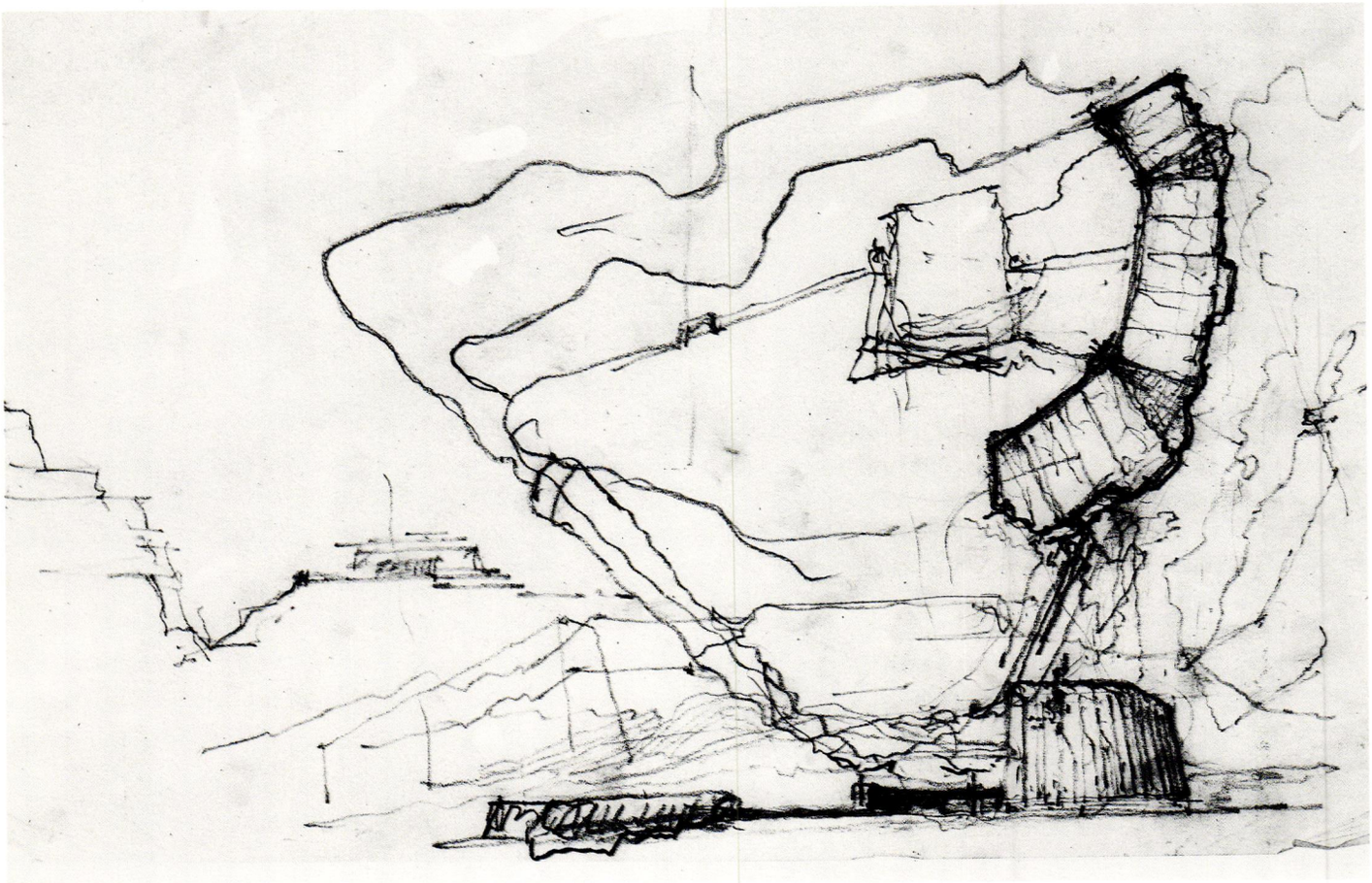
influenced by his earlier project for the 1939 New York World's Fair Finnish exhibition. The organic and geological metaphors in his work are rendered tangible in this brilliant drawing.

The pattern which emerges from an examination of a number of the sketches from the post-war atelier is one of a consistent conceptual process, through a predictable series of modes of representation: plans, sections and perspective views followed by details and tracings of drafted drawings to refine the design. What is significant is the way in which Aalto's line work builds a figure out of the page. Mature and self-confident draftsmanship coupled with the use of a soft drawing instrument allows him to literally search for answers through line, to make an intuitive search guided and prodded by the informed disposition and superposition of lead upon paper. It is not only his extraordinary control of the quality (thickness, gradation, opacity, etc.) and the composition of linework that clearly sets him apart from any other twentieth-century architect; it is also the way Aalto's personal drawing technique used line to define space and mass. His was fascinated by lines – as expressions of movement, as grids, as sinuous waves, as manifestations of natural forces, as laminations in wood furniture, as growth rings in trees, as striations of brick, tile, wood, even the bundled flutes of columns.

Painters and architects trained in the classical tradition recognize the role of contour in defining form. They are taught to understand figural relationships first through line and then through skiography or shade and shadow. Linear values depict the precise, geometric armature and overall mass of any object; lines are used to define planes (in this way the mathematician and the artist use the same conceptual schema). For Aalto, free form or geometric lines were the direct



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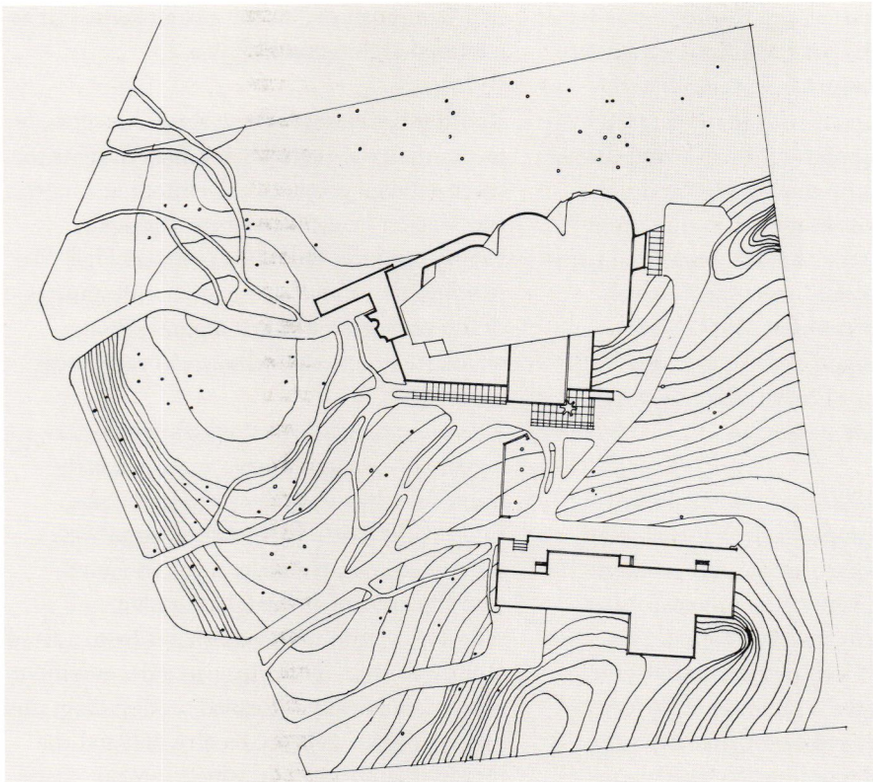

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notations of space-defining planes; the plan or section line of two dimensions on the page is, in reality, a three-dimensional plane. Searching for the right form meant exploring the relationship between the controlling contours of plan, section and elevation to achieve a visual and sculptural balance. Space and mass were in effect, interchangeable, in opposition yet also analogous.

The relationship between interior volume and exterior mass, manifested in outlines, is the fundamental plan/section dichotomy which all beginning architects learn to control and explore through drawing. Aalto's understanding of this relationship was particularly acute, as the complex volumetric and massing configurations of his buildings confirm. The contour line is the controlling force both in his buildings and his drawing technique. But contour holds for Aalto another significance which was associated with neither graphic art nor architecture.

As Göran Schildt has pointed out, Aalto was profoundly influenced as a boy by his father's surveying practice; he loved maps. The cartographer's use of the contour line to delineate both land masses and topographical features expresses itself forcefully in Aalto's buildings and site plans. As Schildt writes:

I would like to remind the reader of the "white table" under which he had played as a little boy, while his father and his assistants sat around the table-top, busy drawing maps. To be allowed to climb up onto some unoccupied chair and "draw with the others" in his own way was just as great a mark of distinction for the child as being allowed to accompany father out into the countryside was for the teenager. The surveyor's attitude to nature is flexible and dialogic of necessity; all that he does has to be adapted to the terrain, the landscape and previous building.[16]

It is striking when looking at Aalto's sketches how much the mapmaker's contour line asserts itself, and how the architect seems to build up forms as if he were marking the stepping contours of a mountain or hillside at conventional vertical intervals.[17] At times he seems to cut away the building form as if moving earth, or to build up organic masses out of rock-like planes. Yet he does so, not as a sculptor modeling clay, but analytically, like a surveyor describing a complex land form. A powerful example of this is the concept sketch for the town hall at Kiruna (ca. 1958), in which the cupped shape of the building plan seems to grow organically out of the wavy, concentric rings of landform and tree lines, eventually to appear at the bottom of the sheet in elevation. (8) In the site plans of the Säynätsalo town hall and Imatra church (9), and the almost archetypal figure/ground plan of the Muuratsalo summer house, the counterpoint between topographic contour lines and plan outlines achieves a poetry that is at the heart of Aalto's attitude toward building and landscape. This almost improvised reflexivity could only have been acquired by a cartographer's son. The buildings often appear quite literally to be the "imaginary mountains" which Aalto spoke of in his essay on the Viipuri Library.

The mountain metaphor not only forms the direct analogy for many of Aalto's building/landscape images, it also allows us to understand something of his complex handling of the critical relationship between interior and exterior. A section, like a plan, is formed by two related (inner and outer) contours, which conceptually slice the building apart along an axis, revealing planes (floor, ceiling, roof) of different registers.

16. Schildt, *The Early Years*, pp. 200-201.

17. I should like to thank one of my students, Ernest Maldonado, who pointed out this, among other things, in a fine paper on Aalto's drawings.

Aalto, the linear artist and the cartographer of form, explored space and mass with a rare perspicacity through his sketches, nearly always playing games with the dichotomy between plan and section. By drawing the plan and the section of a project in the earliest stages of conception, in miniature "idea sketch" format, Aalto represented complex ideas and spatial forms speculatively. The contour line motif appears in any number of forms and at various scales; it is a powerful means of representing forms that drawing alone possesses.

In his mature buildings, Aalto explored three primary juxtapositions between plan, section and massing contour. He worked somewhat in the vein of a composer using the interplay of rhythm and melodic line, or the multiple-part writing of counterpoint itself. He composed a building at various levels of inquiry beyond the plan/section dichotomy by setting interior spatial contours against exterior massing, massing against landscape contours, building grids against urban grids. His dependence on line in sketching allowed him to conceive in this way. It is appropriate to describe his three design strategies in terms that have musical as well as visual analogies:

Reflexive: This relationship between plan form and section form is the simple, direct translation of the contours of one to the other, with variations. As in a complex land form, the morphological contour of any cut along the horizontal plane approximates any cut along the vertical plane.

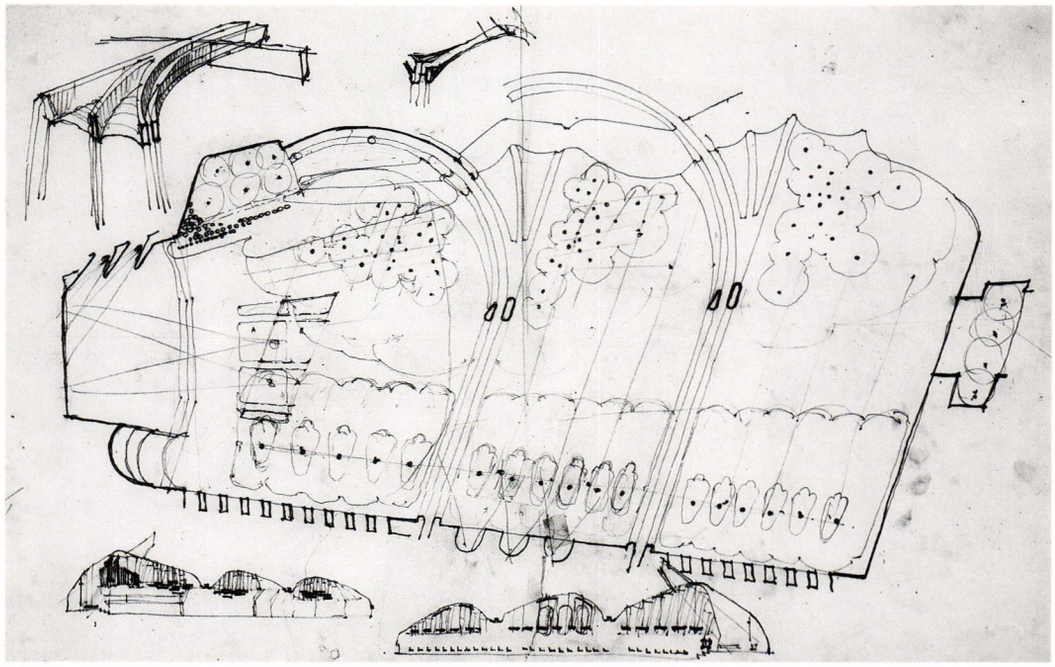
Contrapuntal: Here, deliberately contrasting interplay between plan and section is employed. Plan and section are given autonomy. This is the most difficult and dialectical strategy of spatial and massing design, and was used only sporadically by Aalto to brilliant effect. In topographical terms, the mathematical description of horizontally cut contours and vertically cut contours would be fundamentally different: a straight line against a wave, for instance.

Figure/field: This strategy sets up a bounded domain, often delineated by a common grid or orthogonal geometry, in which a single form or set of forms is positioned, not simply as a "composition" in the gestalt sense but as a unified architectural figure.

In order to illustrate these three concepts, let us examine the sketches and final designs for three seminal projects: the church at Imatra, the Maison Louis Carré near Bazoches, France, and the Finlandia Concert Hall. We will find that they are in fact manifestations of the very same thing, a mental schema which treated mass and space as reciprocal.

The most renowned of Aalto's projects to be guided by the reflexive approach is the beautiful white church at Vuoksenniska, Imatra (1956-59). Here Aalto began with a strong idea of a tripartite nave, modeled spatially around an undulating plan, and a reflexive section which emanates from a fixed point, the altar. This idea was a development of the acoustically informed section diagrams for the Viipuri Library lecture hall and the Helsinki Kulttuuritalo, where interior space and exterior massing are sharply differentiated. At Imatra, the dialogue between interior and exterior is even more intense as Aalto opens the space between the walls to allow light to refract within.

The extensive sketches for this building illustrate the many ways in which Aalto used lines to give definition to the formal and pragmatic aspects of a problem, so that each wall, space and geometric configuration could be appreciated both for its abstract qualities and its responsiveness to some requirement of the program. An early *esquisse* shows that the architect conceived the site organization from the start as a rectangular forecourt with the bell tower at its center, which would act as a foil for the three rounded volumes of the nave fanning outward from it. (11) Around the small plans on this sheet are drawn a schematic section revealing the close relationship to the plan volumes, and an elevation showing the slanting form of the roof (eventually in the opposite direction) juxtaposed with the vertical bell tower. Again, we see the architect employing a tightly controlled, *esquisse*-like technique to establish the basic ideas. Later section sketches refine the acoustic and lighting design of the interior, and explore the space between the inner and outer walls. (10)



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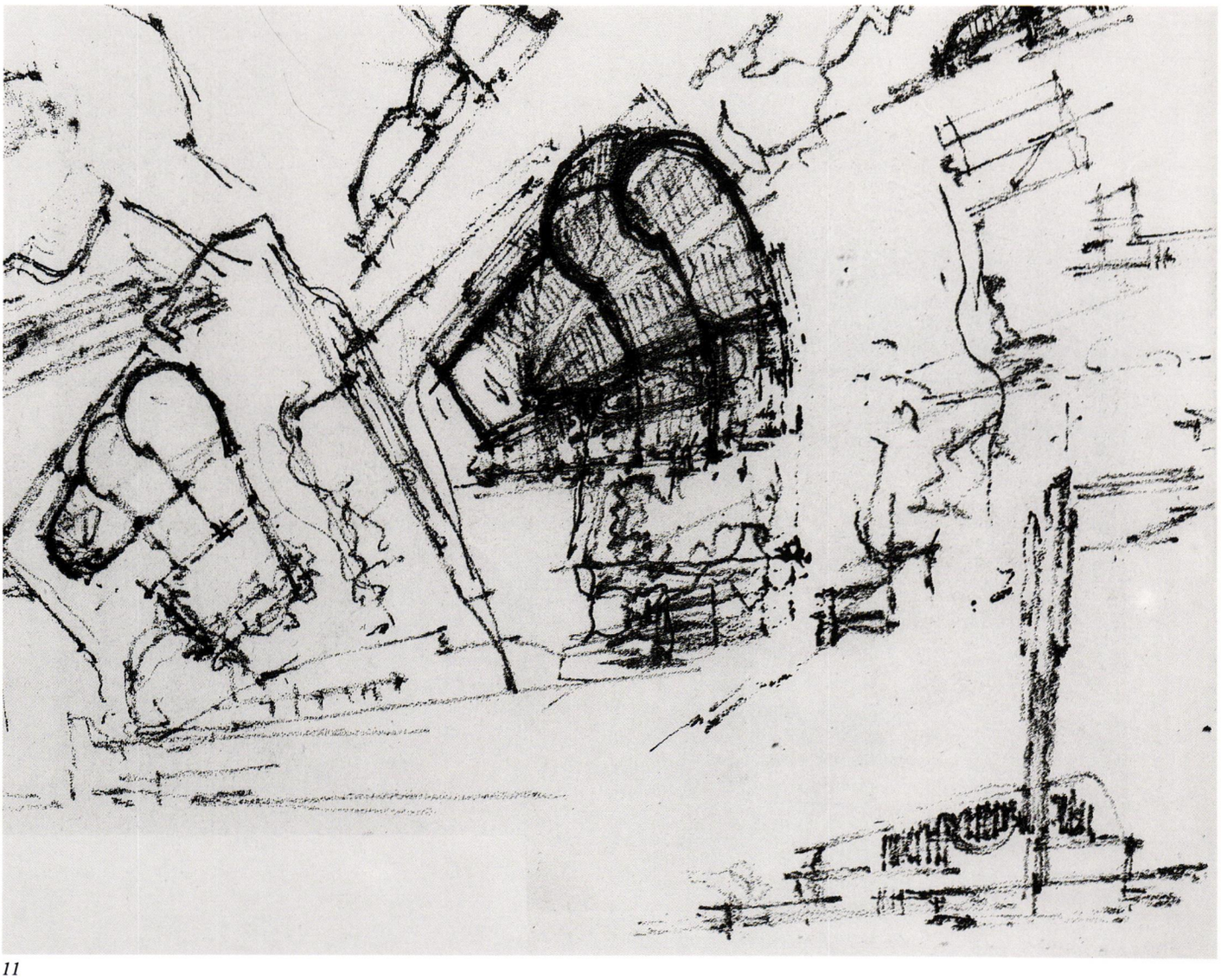

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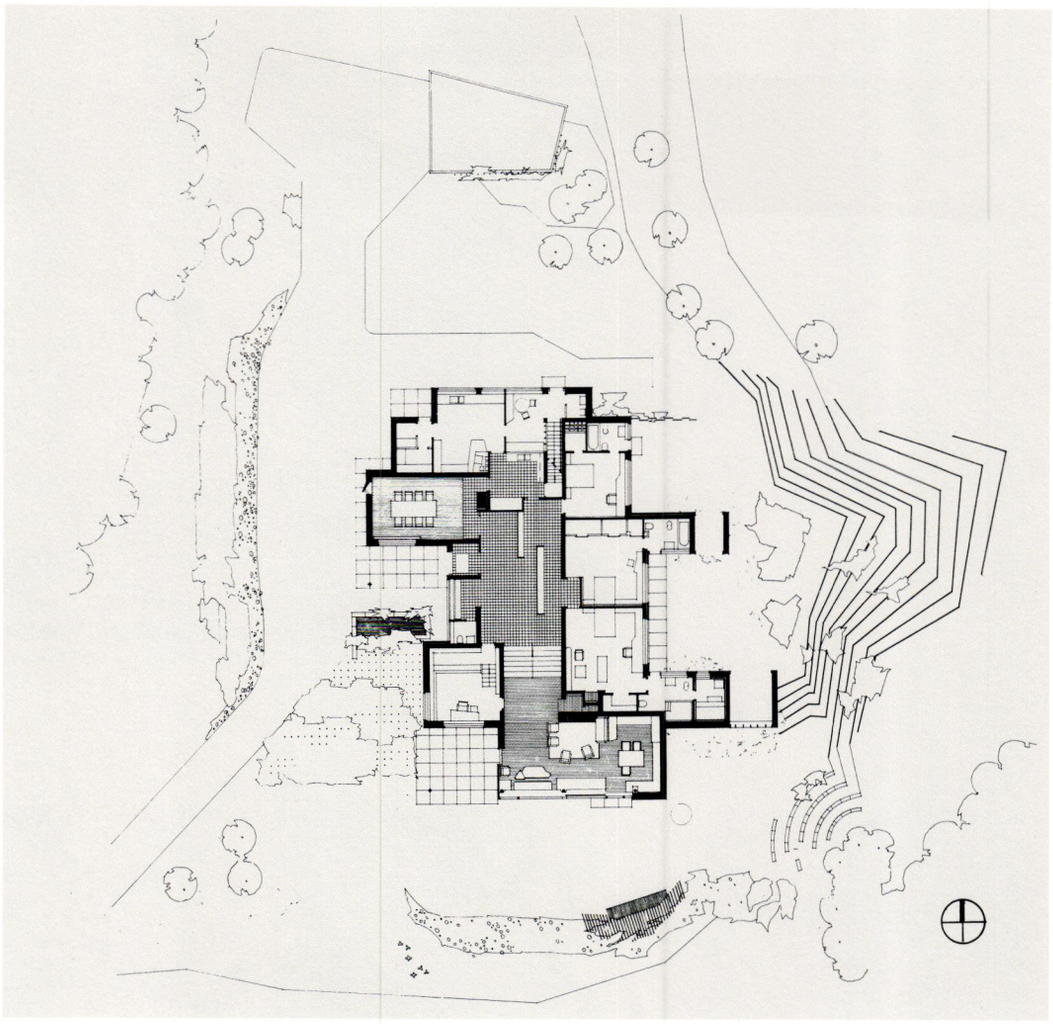

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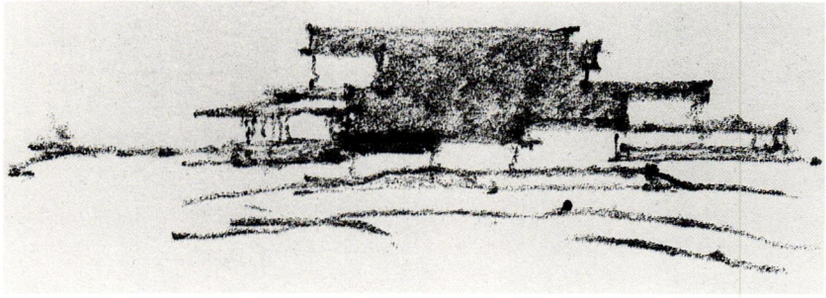

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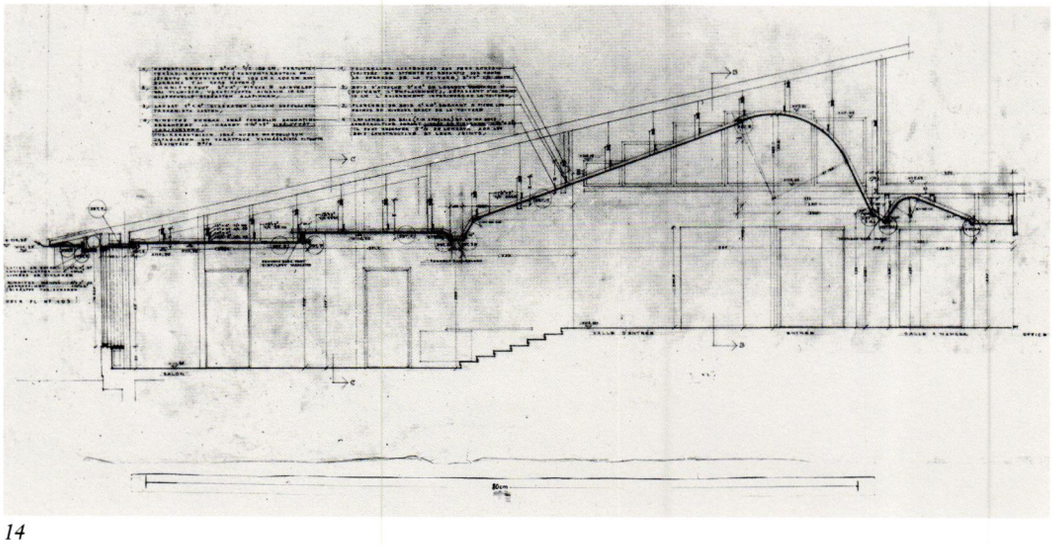

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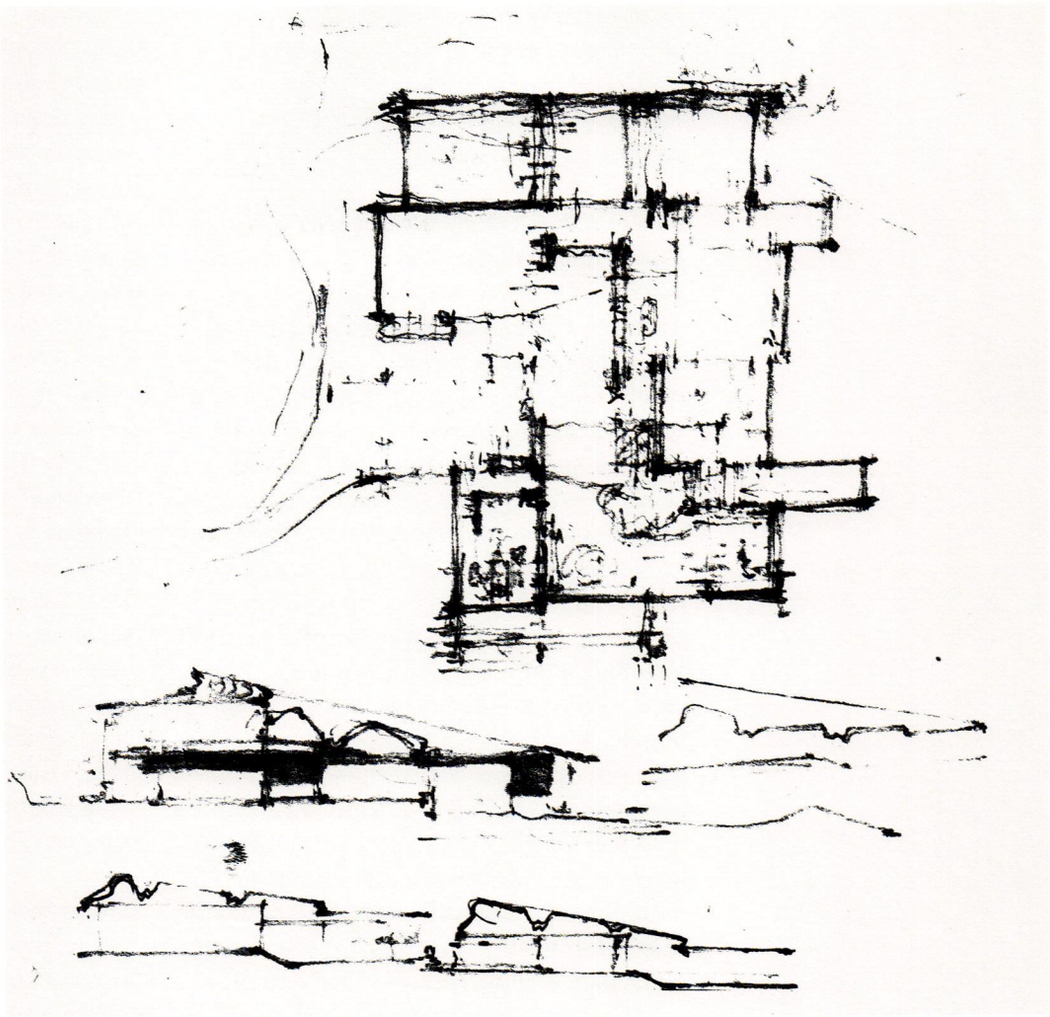

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In these drawings the basic wave-like shape of the plan seemed to conjure up out of itself a myriad of other related forms, as Aalto's imagination caught fire in the design process. His sketching technique facilitated a free thematic study of formal variations which seemed to lead him directly from one design to the next and from one subject to another during this fertile period in his creative life.

In the extraordinary 1956-58 summer house for the art collector and dealer Louis Carré, Aalto adopted a more dialectical approach in which he deliberately combined conflicting orders and lines of force in the same composition. The plan reads as an interlocking configuration of open and closed rectangles, which addresses the different views and conditions of the landscape and embraces private outdoor spaces. (12) The south elevation appears as a simple, single pitched roof running downhill, dramatically reinforcing the dominant characteristic of the site. (13) The major north/south section, buried within this rectangle and wedge massing, is hollowed out in a continuous wave, producing three semi-distinct spaces akin to those in the Imatra church. (14) When read together the effect is indeed contrapuntal, and that is precisely the way Aalto's sketches represent it, with all three ideas on the same sheet, as one unified architectural idea. (15)

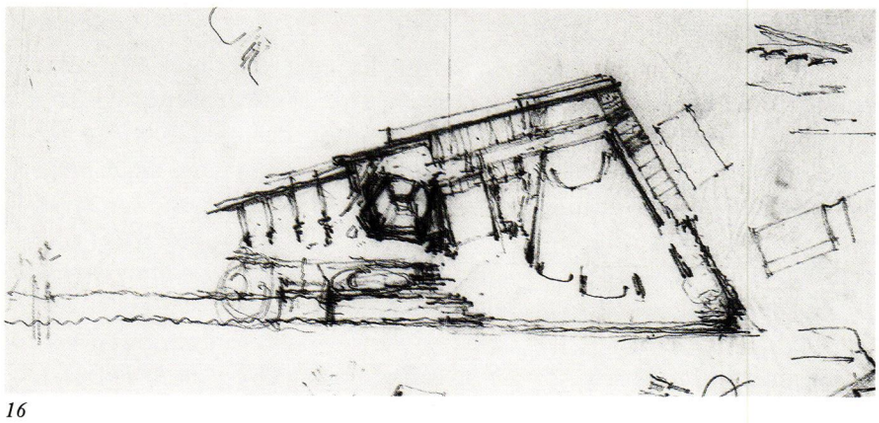
In the development of the building these concepts are tenaciously adhered to, as if to deliberately create dichotomies and contrasts: the plan becomes more fragmented to open up to the landscape and admit east/west light, with the dining room, hall and living room forming a continuous ⅂ shaped figure; the wedge-shaped roof form is cut away to allow the plan to work, but never so as to compromise its basic mass; and the surprising wave-like section through the hall develops as an expansive single volume which creates surprise and grandeur upon entry to the house. The apparent lack of integration, while seemingly incongruous in

relation to the preceding projects, is really an extension of the space/mass reciprocities which had been achieved at Vuoksenniska. A unity of concept is achieved without sacrificing formal diversity.

One of Aalto's last great works, the Finlandia Concert Hall (designed in 1962, constructed in 1967-71) in Helsinki shows the way in which his complex sketching technique had evolved to promote a kind of figure/field relationship. The famous juxtaposition of the two rock-like auditorium figures within the wall-like envelope defined by Aalto's civic center plan is almost a summation of his attitudes to building and landscape, to free forms versus urban grids, to the "imaginary mountain" on the fixed horizon. Aalto's design sketch for the hall level plan first defines the long line of movement up the multiple staircases, then the outer boundaries, and then tentatively sets the fan forms of the two auditoria in a dynamic relationship within these boundaries, as figures in a neutral field. (16) A second sketch of the entry level and sweeping staircase brilliantly depicts movement itself, the lines gradually darkening to find the proper forms. (17) The complex articulation of the plan eventually is projected into the organic, acoustically informed sections of the two halls. (20) It is important to note that while movement and acoustics formed a functional rationale for many of the gestures for this and other Aalto works, he perfected the contours of space and mass through the technique of sketching, basing the final lines on visual balance, dynamism and beauty. (18, 19)

Aalto found the naturalistic, formal poetry of his "imaginary mountains" through his uncanny ability to draw speculatively, yet with a descriptive precision that only a superbly rational architect could muster. By using the conventions of topographical contour from cartography and classical figural drawing simultaneously, Aalto combined science and tradition. He was thereby able to mold complex space and mass through the relatively simple conventions of drawing with lines – lines that articulated the outlines of form. This freed him to create the almost impossibly amorphous and "irrational" elements which increasingly distinguished his post-war buildings. He was able to juxtapose figural cut lines in several directions simultaneously, playing with spatial registrations in much the same way a composer sets one line against another. His three primary strategies for these juxtapositions, reflexive, contrapuntal and figure/field, formed the basis for an inventive canon of themes and variations in several dozen works from the 1950s onward.

Aalto's extraordinary synthesis of space/mass composition in his post-war work advanced the production of architectural form in ways which are only now bearing fruit in the work of contemporary architects. The sketch, far from being an improvisational or speculative notation, as it was for other modern architects, became the most powerful design tool in Aalto's repertoire, allowing him to proceed into realms of volumetric, planimetric and massing composition which most architects



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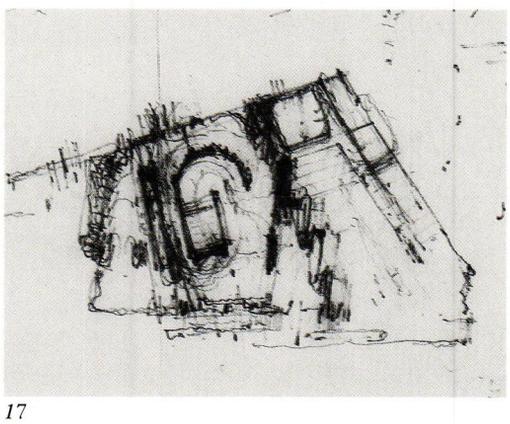

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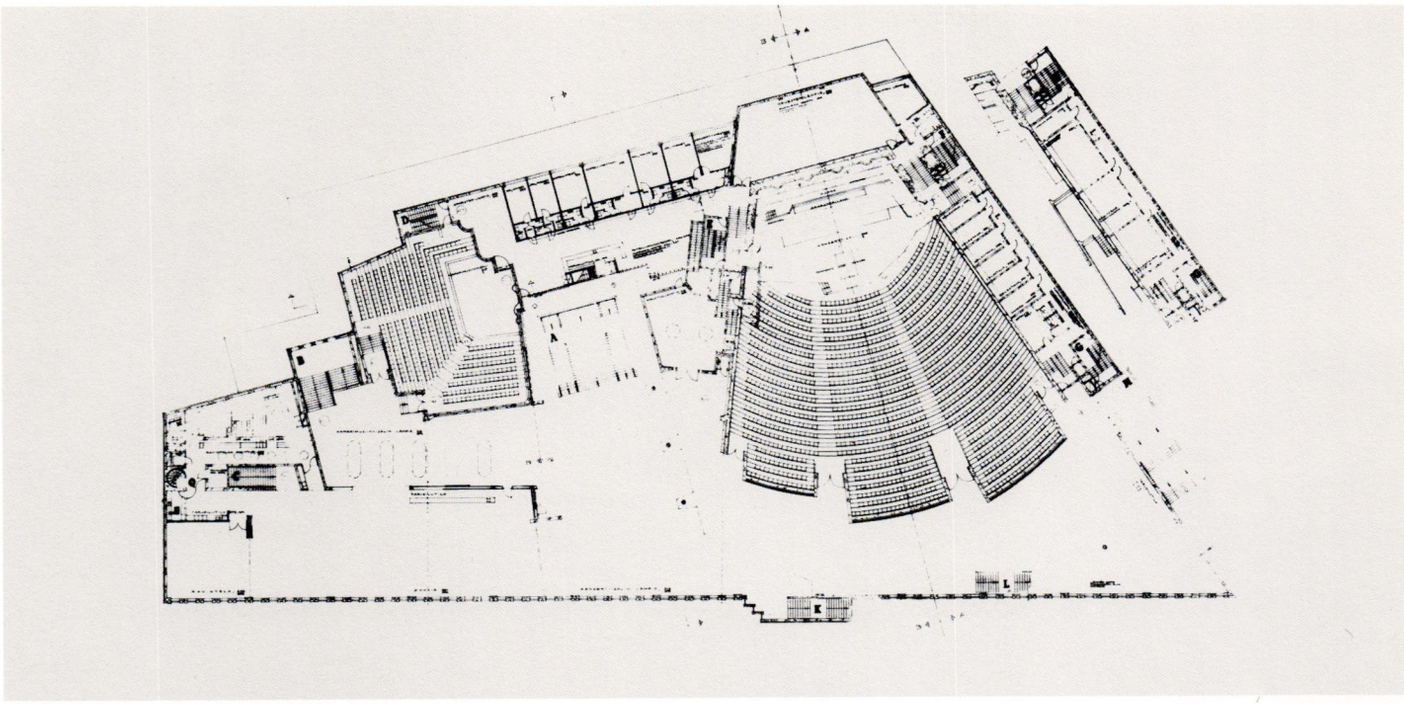

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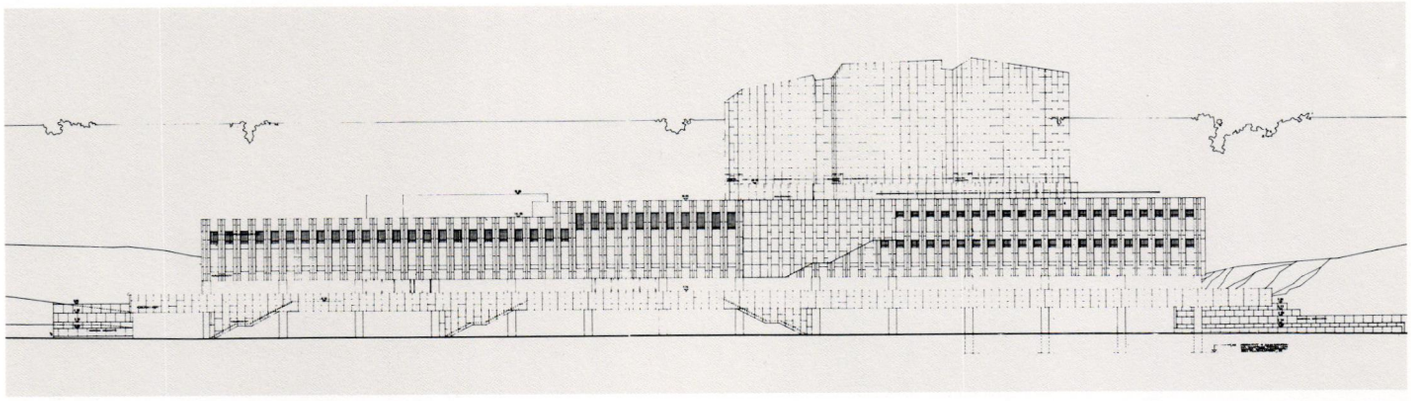

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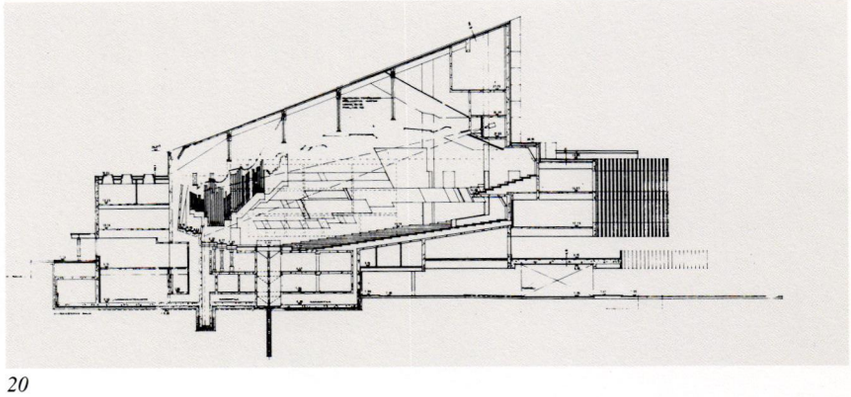
could not have conceived. His unique conceptual schema seemed to embrace the poetic qualities of form in drawing while simultaneously adhering to a precise, analytical methodology. Unlike many rationalist designers, he refused to separate the two, as his writings confirm.[18] It is impossible to ignore the primal, organic beauty behind his sketches, yet the romantic qualities of the drawings should not obscure for the observer the architectural clarity behind each idea. Alvar Aalto's sketches rank among the great works of twentieth-century draftsmanship, and are rightly considered works of abstract art. Yet they are also precise and descriptive keys to Aalto's complex mode of conception, offering a rare view of an imagination that somehow combined fantasy with rationality, fused mass and space into a single concept, and united building and landscape with a cartographer's eye.



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18. See, for instance, Alvar Aalto, "Rationalism and Man" (1935) in *Sketches*, edited by Schildt and Wrede, pp. 47-59.



"This Goodly Frame, the Earth"

Alexander Purves

"This Goodly Frame, the Earth," from William Shakespeare, *Hamlet*, Act II, Scene 2.

To understand our world we structure it into vertical and horizontal components. The horizontal relates man to the world as he knows it; it relates man to man. The vertical describes the world and mankind in relation to the unknowns of what is "above" and what is "below." The horizontal is served well by logic; degrees of longitude and latitude position us exactly. The vertical calls on imagination; intuition and faith are our guides. The plan explains the horizontal; the section explores the vertical.

The symbolism of the horizontal opposes right and left, east and west. The sunrise signals birth; the sunset death. But the sensations of climbing and falling are more powerful than those of moving to the right or left, and the symbolism of the vertical holds a power that is called upon to represent supernatural forces beyond the scope of our understanding. God rules in heaven above us, Satan crouches below.

We likewise understand architecture in terms of horizontal and vertical. But whereas symbolically the vertical touches the ultimate limits of imagination, building can only imply these extremes. Building can extend horizontally without limit, but vertically it confronts gravity. It must bear on the earth, and height is limited by the capacity of physical structure. Our imaginations, however, have invented structures that can stretch up to another world. Gershwin's *Stairway to Paradise* leads to the same place as Jacob's ladder. Man has even tried to physically construct such a superhuman proposition, but no actual structure can reach those places that are located in our imaginations. The Tower of Babel was a doomed enterprise.

But accepting the physical limitation of building does not limit the desire for architectural form that speaks of ultimate meaning. We assign significance; we depict our imaginative constructs; we represent.

The mountain, geological or artificial, is the place on earth that is nearest to heaven, and mountains have been understood to be the dwelling places of gods, whether at Parnassus or Taos, Ur or Palenque. The Giza pyramids, polished and shimmering in the sun, were bursts of brilliance that testified to the divinity of the Pharaoh and to the proposition that his person linked mankind to God. And we represent heaven on earth: the dome of the Hagia Sophia aloft above a ring of light, the whirling clouds and weightless divinities of a Tiepolo ceiling.

But Shakespeare's Claudius despairs: "My words fly up, my thoughts remain below." The cathedral spire is balanced by the crypt. Whereas we imagine "heaven above" with anxious yearning, we are ambivalent about the realm under our feet, down below the surface of the earth. On the one hand, if we travel with Orpheus into the underworld, we encounter the Furies who inhabit a dark and mysterious domain, and we recall our own experience of cellars – dank, suffocating and with dark, unclear boundaries. But if we follow the dancing

princesses of the fairy tale, we descend a miraculous staircase into an enchanted landscape. The depths of the earth can be malevolent, a place of ultimate despair, or the very source of life itself, an ambiguity that Ingmar Bergman's *Virgin Spring* vividly presents as the transformation of the site of an ugly and ferocious act into a spring of regenerative beauty. The well remains a powerful reminder of the life-giving power of earth. In the center of the floor of the Pueblo Indian's sacred underground *kiva* is a small hole, the *sipapu*, which acts symbolically as the opening through which the life energy rose from its source to the surface of the earth, the domain of mortals.

Boullée's Temple of Nature states the proposition clearly.[1] Architecture, the work of man, is positioned between earth and heaven. A ring of anthropomorphic columns locates the horizontal plane where man operates, while above him is heaven and below is a balancing hemisphere, clearly of the earth. This image from the Enlightenment locates man in the middle of the equation. Heaven and earth qualify his position, but whereas the horizontal limit defined by the columns is distinct, the vertical limits are not. The dome of the sky is hard to gauge, and the grotto suggests access to an underworld.

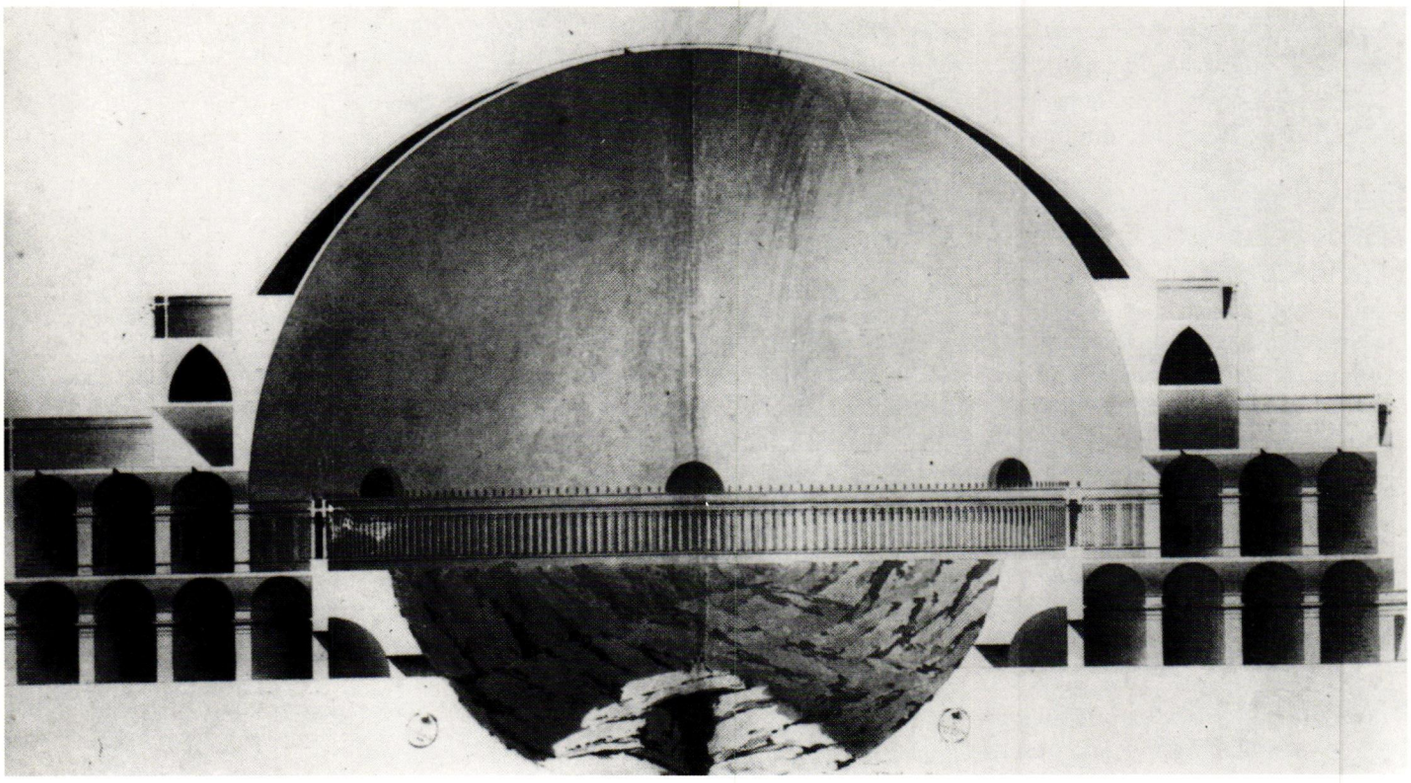
In Hindu and Buddhist mythology Mt. Meru stands at the center of the cosmos and is the paradigm of temple structures. This sacred mountain's vertical axis pierces the intersection of the horizontal cardinal axes to form a comprehensive three-dimensional symbol of center. As opposed to Boullée's Temple, the axes of this mythological mountain project outward, not only across the surface of the known world, but high into heaven and into the depths of the earth. The typical temple, based on the form of Mt. Meru, appears to be a pyramid which would embody only the upward component of the vertical axis as in the ziggurat or the Tower of Babel. However archaeologists have observed that fish and other underwater creatures are carved on concentric wall surfaces, in locations nearly inaccessible, which stand for the condition that the pyramid would engage if it were built down into the earth to the same degree as it is built up into the sky. By a kind of telescoping, the makers of these monuments represented the proposition that the sacred Mt. Meru reached as far into the underworld as it did into the heavens.[2]

1. In *Etienne-Louis Boullée de l'Architecture Classique à l'Architecture Revolutionnaire* (Paris: Arts et Métiers Graphique, 1969), Pérouse de Montolos identifies this project as "Temple à la Nature."

2. George Cœdès, *Angkor: An Introduction* (Hong Kong: Oxford University Press, 1963), p. 44.

Below: Etienne-Louis Boullée, Temple à la Nature

Right: Angkor Wat





Of course the earth itself can be manipulated. The unsettling form of Le Corbusier's Maison de Jeunesse in Firminy is finally resolved by the berm at the opposite end of the playing fields. The berm's mass balances the negative space created by the huge diagonal overhang of the building. Arne Jacobsen's use of berms in his Tom's Chocolate Factory outside Copenhagen may have been a device to shield the site from an unattractive neighbor, but the stepped berm itself reflects the long, low profile of the factory and extends the composition to include the landscape. These berms at Tom's Factory begin to have the same effect as the dykes of Holland, which replace the expected horizon and produce an uncertainty about one's position in space.

Architectural form responds to the form of the natural terrain and that terrain is modified in response to the architecture. A symbolic bond is established between the two. In terms of the transition from natural to manmade material, this bonding has traditionally been the role given to the garden, which constitutes a physical zone of mediation or connection. The garden may adopt the geometry of architecture, as at Vaux-le-Vicomte, or may simulate the undisturbed landscape, as at Stourhead, but in all cases nature is ordered by man. By extension, whenever one cuts a tree or plants a spade in the earth one is making a kind of garden.

The plan of Vaux-le-Vicomte shows the position of the chateau at the center of an axial composition of elaborate parterres. What can only be revealed in section, however, is the manipulation of the ground plane where slopes are introduced to distort perception, where water level occurs at a variety of elevations, where from certain points of view the distant building appears to stand on a base that is in the foreground. All of these manipulations effect a sense of eery dislocation, where those elements that we most depend upon to give us our bearings (horizon, water level) are rendered ambiguous; and we leave behind the normal assurances of the natural world and enter a conjured realm of artifice.

But in addition to acting as a physical linkage, the garden can also be used to establish a metaphorical context that includes nature as well as man. It can give physical form to an intellectual proposition wherein the opposing elements of artifice and nature, logic and intuition can be reconciled. At the Villa Lante, water flows from a grotto, its source at the edge of the *bosco*, by way of a sequence of increasingly architectural hurdles, to come to rest eventually in the precise parterres of rationality, symbol of the ideal city. The water has known both the waterfall and the basin, and whereas the Renaissance patron would have understood this journey as one of achievement, he would have had to acknowledge that the source of the energy was in the world of intuition.

More attention is given to discussing modern architecture in terms of itself, to the compositional finesse of individual buildings or building groups, than is paid to the relation of these buildings to their settings: how specific buildings appear within their landscapes, how they engage the earth, and what image of nature they present from within.

It is at the scale of the individual house that the Modern Movement has produced its masterpieces. Here the consistently high quality of invention that is demanded can be sustained if one is to approach each component of a design problem *de novo*. At the scale of the house, a building remains relatively small against the generous backdrop of nature; the figure never threatens to become the ground. And in isolation, the adoption of an unfamiliar language is no handicap. The very abstraction of that language can comment with eloquence on the physical reality of nature.

In this respect two modern houses come to mind: Fallingwater by Frank Lloyd Wright and the Villa Mairea by Alvar Aalto, both dating from the late thirties. Both are villas in the

traditional sense, that is they are country retreats, second houses for clients who spend most of their time in cities. However, they are "modern" villas, free to be set deliberately into the landscape without the need for their own elaborate support systems. They are not small communities like the villas of Pliny or Cardinal Barbaro. They are not Victorian country houses built to accommodate the retinues of the owner's family and of its guests as well.

Gone are the elaborate parterres, the vegetable gardens, the livestock, and the outbuildings that supported an operation of a much larger scale. And with them go the traditional buffers between house and countryside. Here house confronts nature directly. These are not dwellings that developed over generations on a particular piece of land. Each of these houses was designed for a wealthy, supportive client and was willfully placed in the landscape. Any relationship with the land is by choice, not necessity. The appearance of the building in the landscape and the view onto the landscape from within the building are under the architect's complete control and reveal an attitude about nature and our place within it.

These houses are particularly revealing of chosen attitudes, because they represent the first generation of country houses built without the traditional constraints of climate, construction techniques, and dependence upon a rural support system, all of which affected the building's relationship to landscape. Steel and reinforced concrete effectively eliminated the need for the bearing wall, thus the degree of enclosure became a conscious choice – an aesthetic decision – and the architect could sidestep the formal implications of gravity. Technology had overcome the need to limit windows to retain heat or to accommodate the availability of glass. The automobile made possible the isolated house. Food could be bought and brought, it did not need to be grown. One elected to retreat into the countryside for pleasure.

Neither house has a formal garden with elaborate borders or geometric lawns, but if we expand the meaning of garden to include all landscape that has been restrained to act as an intermediary between building and "raw" nature, then each villa has its garden – sometimes appearing completely "natural" but administered none the less.

At Fallingwater, Wright's intention was to wed the house to a very specific piece of land. The Kaufmanns had had a long association with Bear Run and knew the land intimately. They had built a previous camp on the site, which they had enjoyed for fifteen years before the second building was considered. They were used to swimming and to fishing in the stream, and as the house was fitted in and around the rocks they knew so well, the boulder that was Mr. Kaufmann's favorite spot for sunning became a foundation for the chimney and the hearth stone of the living room fireplace.[3]

3. Donald Hoffmann, *Frank Lloyd Wright's Fallingwater: The House and its History* (New York: Dover Publications, Inc., 1978), p. 3ff.

The house at Bear Run is rooted in the lower register of Boullée's Temple. The cleaving of the earth over time by the stream creates a site that lies low, recessed. This is not a heroic site. The place speaks of intimacy, of organic growth, a place where a seed might germinate. We are low, protected, embraced by the land. And we hear the sound of water, sometimes strong, sometimes weak, but ever present.

This wooded glen appears to be completely natural, but it has been carefully tended, lower limbs pruned, unwanted undergrowth removed, so that the trees, the rhododendrons, the ferns can all be enjoyed for their particular shapes but together form the image of the forest. Even before Fallingwater was planned, the Kaufmanns were engaged in a program of conservation, cutting out dead chestnuts, planting spruce to fill in the openings in the forest, replenishing the trout.[4] A certain artifice is at work, but an artifice that is necessary if one is to reveal the character of the land. This is critical to Fallingwater, because one's gaze is rarely guided upward to the sky, but is constantly led out horizontally into the darks and lights of the forest.

4. Hoffmann, *Frank Lloyd Wright*, p. 10.

Driving down to Fallingwater, as the Kaufmanns would have done, one passes through miles of the rolling farmland and wooded hills of western Pennsylvania. It is a gentle and welcoming landscape. On the property itself the driveway winds through oaks and thick rhododendrons higher than the eye, until it curves around a low hill to run parallel with the flow of the stream. Shortly one catches sight of the building at some distance ahead and slightly lower, resting gently against the opposite slope, horizontal bands within the trees. In the first instant one does not see the full profile of the house. This is a building that unfolds, that reveals itself in stages, like the forest, and discloses secret places as you come to explore it.

Fallingwater is smaller, more intimate and delicate than photographs suggest. The wide angle lens tends to exaggerate the scale of the building and makes it appear to thrust energetically out of the natural surrounding. On the contrary, the house rests within the landscape, and for all its dynamic composition, it seems very much at peace. The famous view from below the falls is from the one position where the building appears imposingly dramatic.

The house reads as an asymmetrical pattern of horizontal lights and darks, where roof planes do not align with floor planes, and deep shadows, like those below the rock ledges, obscure supports. The house appears to fuse with the land, as the distinction between nature and artifice is not drawn between earth and structure but between the stone and concrete elements of the building. Wright has separated those two aspects of the vertical, lightness and weight, assigned to each an architectural equivalent, and then recomposed them, not one above the other but interlocked. Even the "artificial" concrete, despite its geometric shape, does not appear alien to the context. The height of the parapet bands is similar in dimension to the faces of the rock ledges in the stream below, and the concrete is painted the strongest color in the range of the buff sandstone. Neither white nor black is used, only colors that belong to the earth.

The highest edge of the building is stone, but it is not read in silhouette against the sky. Like the bottom edge it merges visually with the land behind. The concrete parapets and roof planes, however, are sharply defined and read light and uniform against a dark and variated background. But even these planes are gently rounded at top and bottom to soften the crispness of the edge, allowing a delicate modulation of color toward the brightness of the sky and toward the darkness of the shadow. The gravel stop of the roof planes is held back from the rounded edge so that it is unnoticeable.

The experience of Fallingwater is of upward and downward impulses balanced by strata of space. The insistent horizontals calibrate one's vertical movement. At first sight of the house, one's eye level is approximately the same as that of the upper roof. Walking downhill to the bridge, the perceived relationship of the cantilevered horizontals is constantly adjusting. Crossing the bridge, one's eye is drawn down to the sculpture of a mother and child by Lipschitz that stands on the wall between the pool and the stream, a figural representation of birth, of growth, of nurturing. Surrounded by water, the figure of the mother with her arms outstretched is placed so that her back is protected by the rock foundation wall, not unlike the siting of the house itself.

The bridge is at the lowest elevation in the entrance sequence, and the rising movement that follows continues to the entrance and up through the house. Beyond the bridge the ground rises on the right to form a cliff that deflects the drive to the left towards the entrance. One senses a rise in grade, but actually this change of grade is negligible. The lines of stratification on the face of the cliff slope down to the left, exaggerating the sense that the drive is rising in that direction. Passing through the entrance gallery, one's eye is again drawn to the south light and around to a crevice in the rock foundation walls where steps drop abruptly to the pool – a last view of water before stepping indoors.

Within the building the pattern of upward movement refers to the climbing of a hill. The experience is not abstracted, because the reference is to the actual cliff face, and the climb is more literally represented by shifting the runs laterally as they rise toward the light and view. Directly inside the entrance door one can catch a glimpse up to the right through the entire stair sequence, but a burst of strong south light pulls you to the left up to the living room. Though the change of level is slight, these three steps are very important, for they lift away from the slope, breaking your connection with grade and carrying you to a level where it feels natural to be among the branches of trees. The notoriously low ceilings over the windows (in the bedrooms they are only 6'- 4") induce a pressure that is only released by the view beyond. From a sitting position the ceilings are more comfortable and the heads of the windows are well above eye level. This is particularly effective in the living room where the band of windows above the south window seat reveals tree trunks and rhododendron bushes that appear close enough to touch, though they are on the other side of the stream. The sense of elevation is exaggerated by the light that is reflected up into the living room from below through the hatch above the suspended stair. In summer the hatch opens to a welcome flow of air, cooled by the stream, which circulates through the living room. But the equilibrium of the house is really maintained not by the extended horizontal view into the woods, but by the compensating balance of the open terraces, where finally one can see up to the sky and break the downward insistence upon earth and water.

Wright uses many devices to blur the distinction between inside and outside, in order to reinforce the grounding of the house. The line between earth and construction is indistinct. Door sills are recessed to be flush with the paving stones inside and out. Glass is set directly into stone, and the glass itself is startlingly clear, having been fired three times. The corner mullion is eliminated where the glass is fixed and mitered, and at the casements it disappears completely when the windows are opened. Interior planters obscure the sills of the window, so that indoor flowers join visually with the foliage outside, and a moss garden runs uninterrupted below the glass of the guest wing bridge. The trellis above both interior hatchway and exterior terrace receives and admits light equally indoors and out, making the intervening window vanish.

In this manner the house at Bear Run fuses visually with the landscape, but physically all contact with the land is made through the heavy stone walls. Within the "abstract" concrete portion one moves freely out of the house but not onto the land. There are a great many doors, but they lead to terraces where one is lifted among the trees, but is unable to touch them.

Aalto's Villa Mairea stands in a clearing within a dense forest. Like Fallingwater it is surrounded by trees, but in this case they are the dense evergreen pines of Finland and not the deciduous oaks of Pennsylvania. The forest is dark throughout the year, so that the black-green of the branches and the red-brown of the trunks form a constant background. One can follow the rhythmic march of the tall, straight pines into the distance, but because the trees are so thick, one's gaze is soon lost in the shadow, and the forest appears dense and impenetrable.

Whereas the approach to Fallingwater draws one's attention down into a hollow and to the stream at the bottom of that hollow, one moves up to the Villa Mairea, and the eye follows the masts of the trees as they stretch to the sky. Also in contrast to Fallingwater, Aalto's house frames a courtyard, capturing a piece of nature within its boundary. Making a clearing is of necessity a first act, and in the courtyard Aalto retains this feeling of carving a primitive dwelling place out of an alien forest. At Fallingwater Wright projects the house into the volume of space formed by the valley. Aalto enfolds nature within a domestic precinct, framed in part by the building and in part by an artificially formed earth berm. This soft-edged, gentle berm, a positive shape balancing the negative of the pool, replaces the rectilinear stone

wall that appears in earlier schemes, letting nature engage in the definition of the intermediate space. The berm is a limit less hostile to the pines but also less decisive – more tentative and equivocal – less defensive against the dark mysteries of the forest.

Aalto interweaves the natural materials of the forest with the machined forms of a technological culture. He is as comfortable with the language of the axe as with that of the machine shop. The trees that surround the villa are critical both to its composition and to its materiality. Wood is used throughout, although it is not the primary building material. On the exterior its vertical patterning, especially on the entrance facade, continues that of the trees through which one sees the house. Peeled wooden poles find their way onto the building as does sod, and the hard edges of machined pieces are found in the landscape. The pool takes an irregular shape but one that has been carefully drawn and sharply edged with a band of cut stone. Steel light fixtures sprout out of the bushes like giant, fantastic wild flowers – each different – their delicate stems recalling the trunks of the trees behind them. The house delights in unexpected variety. The attitude is different from that of Wright, who distills extreme qualities of nature, the solidity of rock, the lightness of a leaf, and expresses them in juxtaposition. Aalto weaves the many strands together while maintaining their independence. He does not draw the unadulterated materials of nature into the house as paving stones or moss garden. Nothing appears to be a happenstance of nature when it has in fact been constructed, but the references back and forth between natural and man-made are so numerous and interwoven that the line between them vanishes. The eye constantly darts to make unexpected connections. Trees with their bark stripped look like pipe rail, polished wood floors have the sheen of tile.

Aalto threads the trees of the forest through the building. Poles that are bound in groups to support the entrance canopy take up the irregular rhythm of the trees and lead the eye to the door. Within the building they move through the entrance hall, guiding one to the left along a curved free-standing wall. Above this wall and through this set of poles one sees a cluster of similar poles surrounding the stair. As one moves, these poles are seen to ripple past one another as trees do when one walks through the woods. At the window that looks out to the garden beyond, the corner of the fireplace mass is cut back in an Arp-like arabesque to tease the edge between light and dark; and also, perhaps, to allow someone entering the room to see the poles of the stair against the trees without the intervention of an architectural framing edge that would clearly separate inside from outside.

Wright paves the floors and terraces of Fallingwater with the stone of the site, but whereas the hillside drops abruptly to the stream, the floor levels lift free from the ground and stretch out like branches into the air above the water. Ironically, Wright effectively dissociates the rooms of the house from the earth itself. Aalto, on the other hand, rests these spaces solidly on the ground. From the driveway and the forest floor, one ascends along a path through the building to the higher lawn of the courtyard. This rise in elevation, of approximately six feet, is reinforced by a sequence of paving materials of increasing refinement. The gravel drive that curves up a slight grade to the house is met by steps of naturally cleft stones, set in an irregular pattern, grass growing between them. On the rough stones before the front door rests a single smooth rectangular stone step, which in turn leads to the slate of the vestibule. At this point one stands in an intermediate place – between earth and dwelling, between rough and smooth – a zone represented on the exterior by the vertical band of slate that separates the white brick from the stone and which extends both above and below the sill of the entrance door.

Within the building one mounts four more steps to the main floor; the materials change from slate to tile, and from tile to polished wood. Each increment is carefully gauged to reflect the transition from wild forest to civilized dwelling and, within the dwelling, from more

public to most private. Carpet is introduced on the stairs that continue up to the bedroom floor. These open steps have the airiness of ladder rungs, not to be confused with those steps that are of the earth.

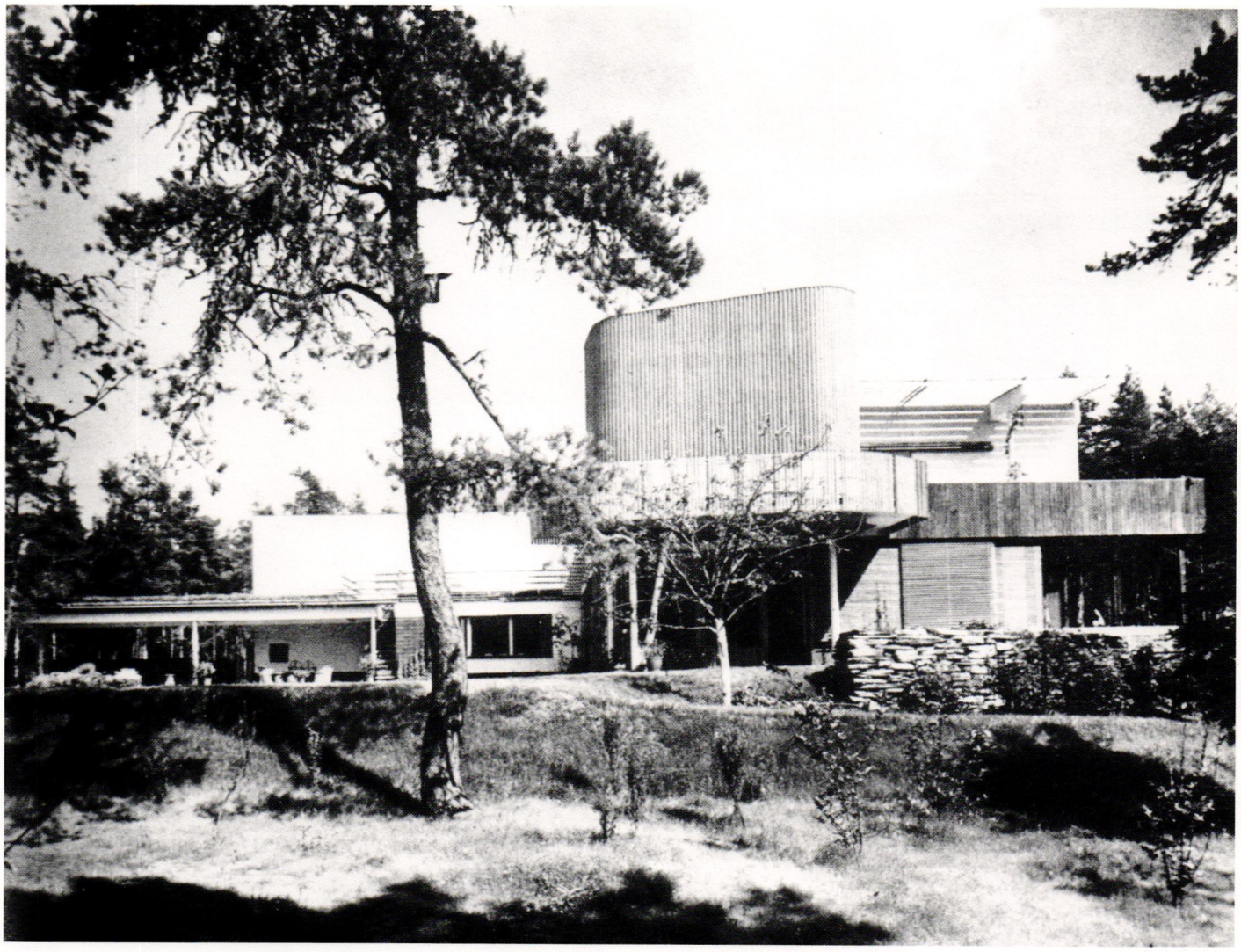
Outside, a transformation of natural forest to artificial building rises clockwise around the courtyard. Trees pass to artificial berm, to a rustic fence that seems to grow out of the ground, to a wood lattice gate which gives over to the more substantial but roughly laid-up stone wall, to the sauna pavilion with its sod roof. The wood construction changes to steel as the building turns the corner, though it still continues to support a sod roof. At this point the balance has tipped from man manipulating nature to nature invading the man-made. The blue tiles on the dining room wall continue the deep shadow line of the covered patio and interlock with the white stucco where the rough stone steps slip behind a white steel column. The sod roof gives over to a railing of steel and wood that appears, from the ground, to be hastily thrown together because of its seeming irregularity. From here around to the living room windows, trellises encourage vines to grow over the lower portion of the building, covering not only the edges of the windows but the base of the building itself. And finally the full two-story garden facade of the villa is presented. The upper floor is a clear white block lifted off the earth. However, as the eye moves on to the curved volume of the studio which caps the composition, a free stroke against the sky, the abstract white of the brick is gone to be replaced by vertical wood strips, returning to the texture of the forest.

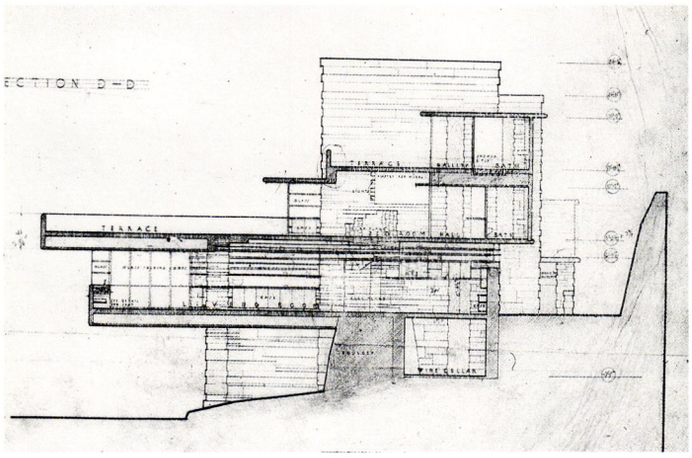
The vertical manipulation of each building results from its particular lockage with the land – physically, visually and metaphorically. However, the metaphors are not neat. Both houses reject tidy analysis. Although the experience of rock dominates Fallingwater, and although one clearly climbs a hill within the house, the section drawing shows the building reiterating the general slope of the terrain but itself standing free of the cliff. The image of the section suggests a tree, rooted in the rock and branching into cantilevered terraces. The mixture of these two metaphors – the cliff and the tree – collides in the choice of stone paving for cantilevered terraces. And yet, although this decision may be disturbing in the abstract, the experience of the house overwhelms any such reservations. This is a house about emotion, not about rationality. The power of going down to water, of climbing rocks, of emerging mid-air, this power is irresistible.

Fallingwater, in the hollow of Bear Run, never rises above the embrace of the earth. Within the house one climbs higher and higher, but stone is always under foot, and the architectural character of the upper floors is like that of the lower. Change occurs not from bottom to top but laterally as the building grows out from contained spaces to open terraces. The Villa Mairea, however, stands on high ground, and its architectural character changes as it climbs and finally lifts up from the earth. Whereas the public areas on the ground floor are porous, engulfed by vines and opening generously onto the courtyard, the private upper floor is contained and hard-edged, reached not by a continuation of the broad ground floor steps but by a narrow and delicate stair. But as with Fallingwater, ambiguity enriches implication, for this upper floor stands on its own ground, a sod roof, and within the courtyard one wonders whether one has reached a crest or is below the surface of the earth.

Fallingwater and the Villa Mairea are themselves like gardens in that they create controlled contexts within which nature and artifice can converse. Both houses appropriate the dominant natural characteristic of the site – at Fallingwater, the rock ledges, and at the Villa Mairea, the pines – and represent them in architectural terms. These surrogates mediate between the natural surrounding and the explicitly man-made elements of the building. And, while both houses intimately engage the land, both are able to lift free. They speak of depths and of heights, drawing nourishment from the earth yet striving for the freedom of the sky.



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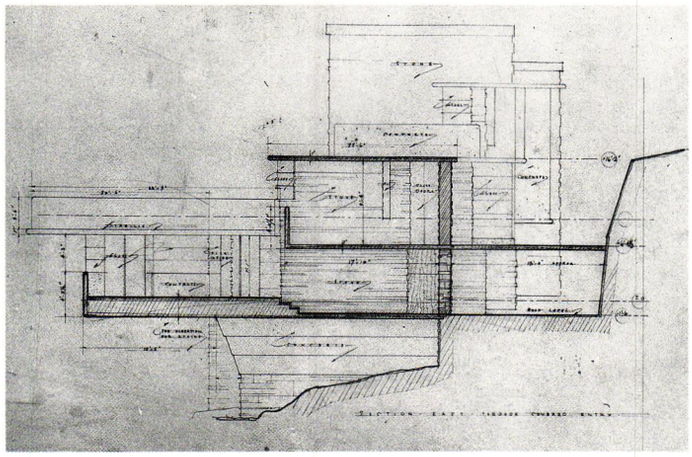
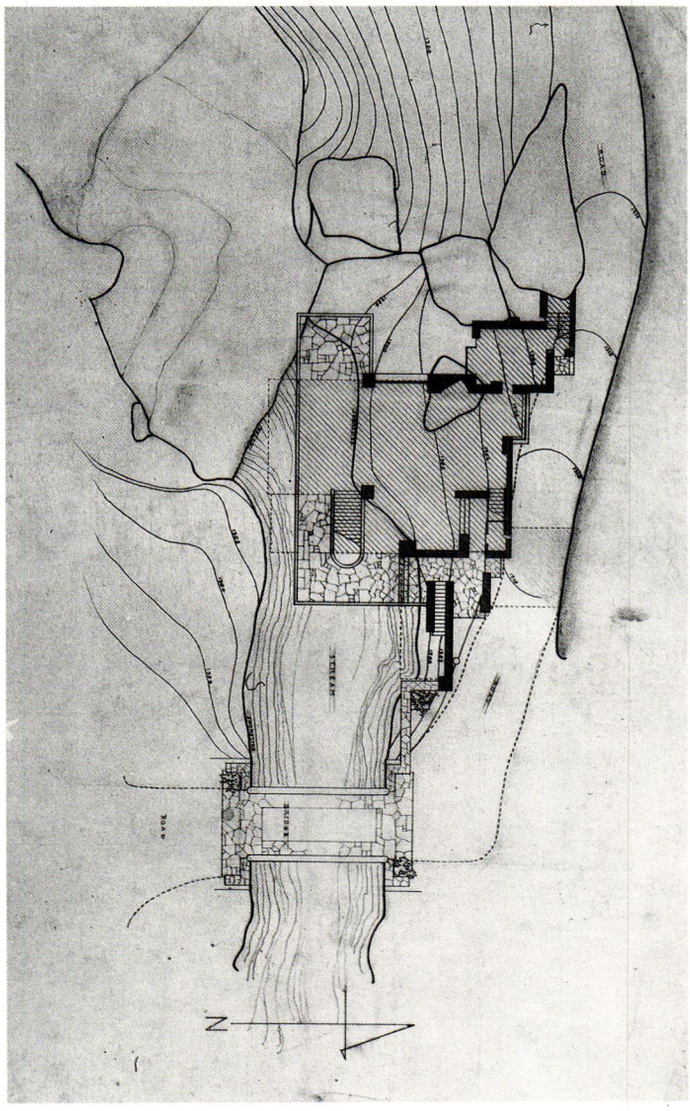
WINE CELLAR

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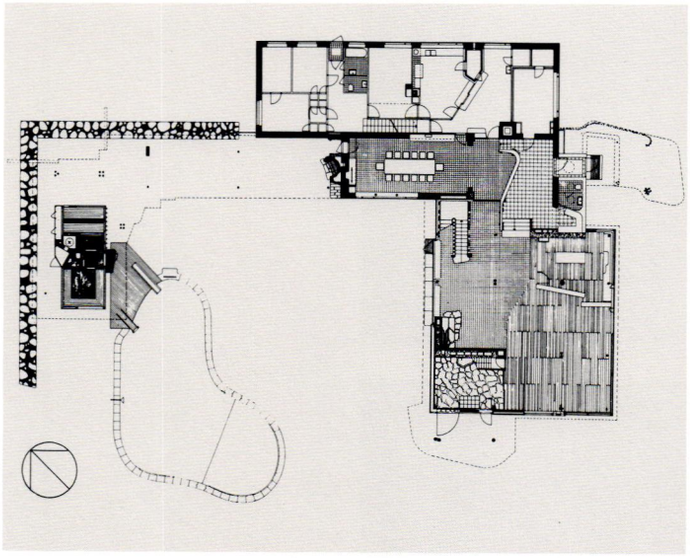
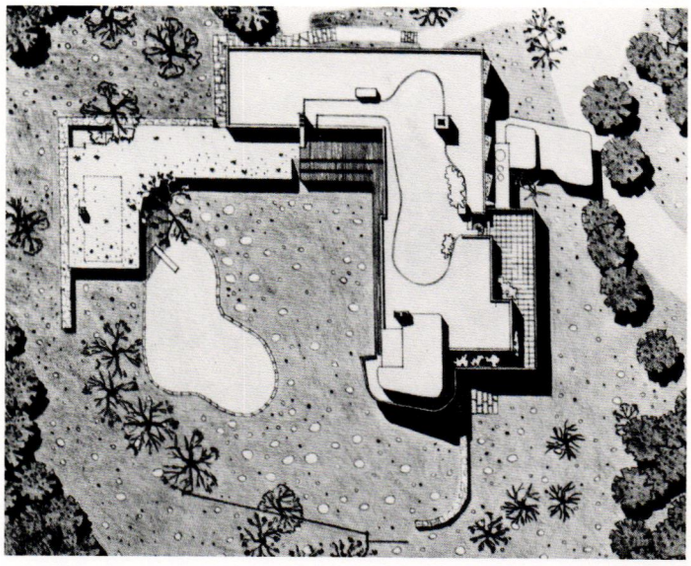
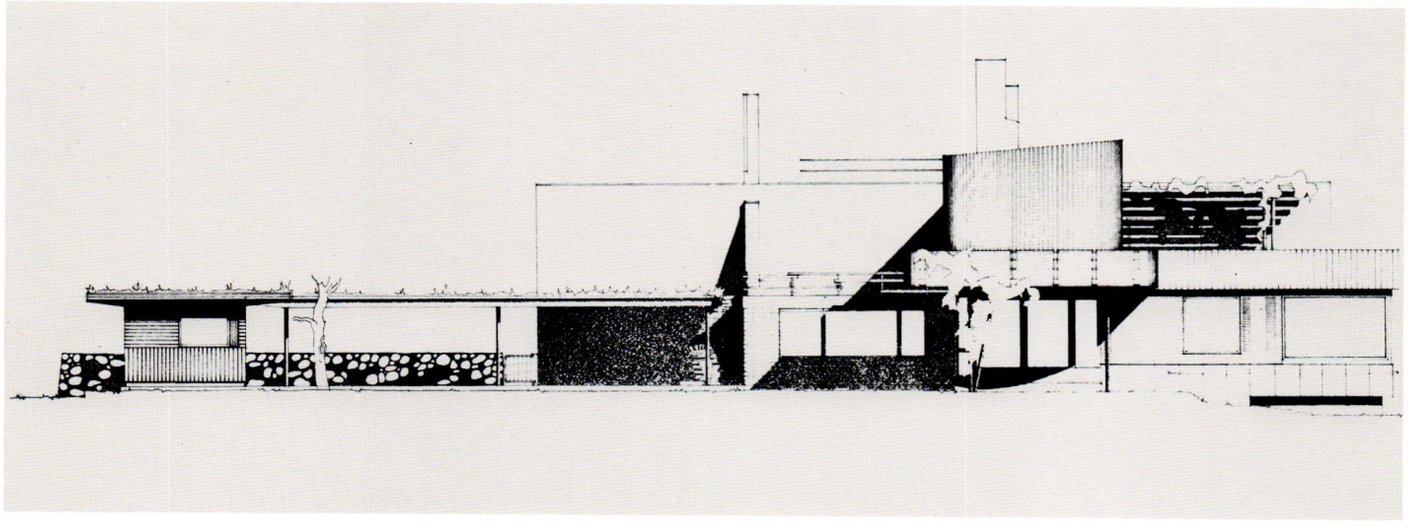
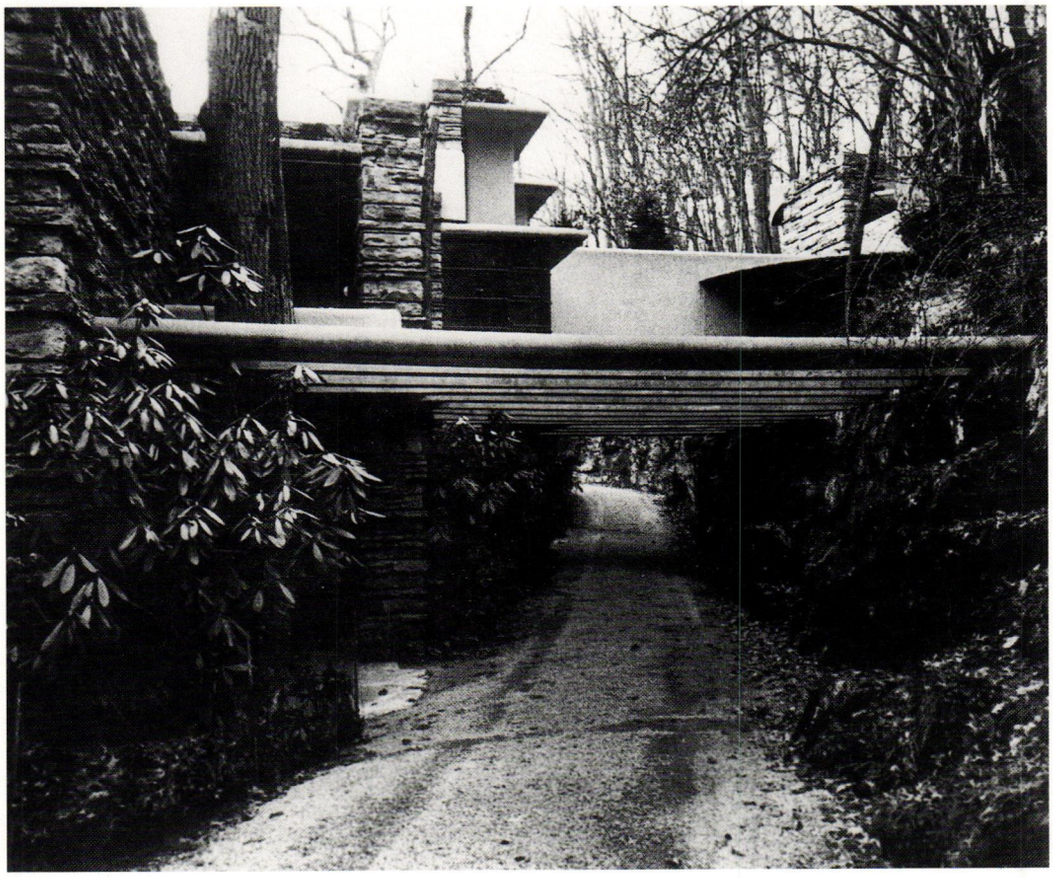
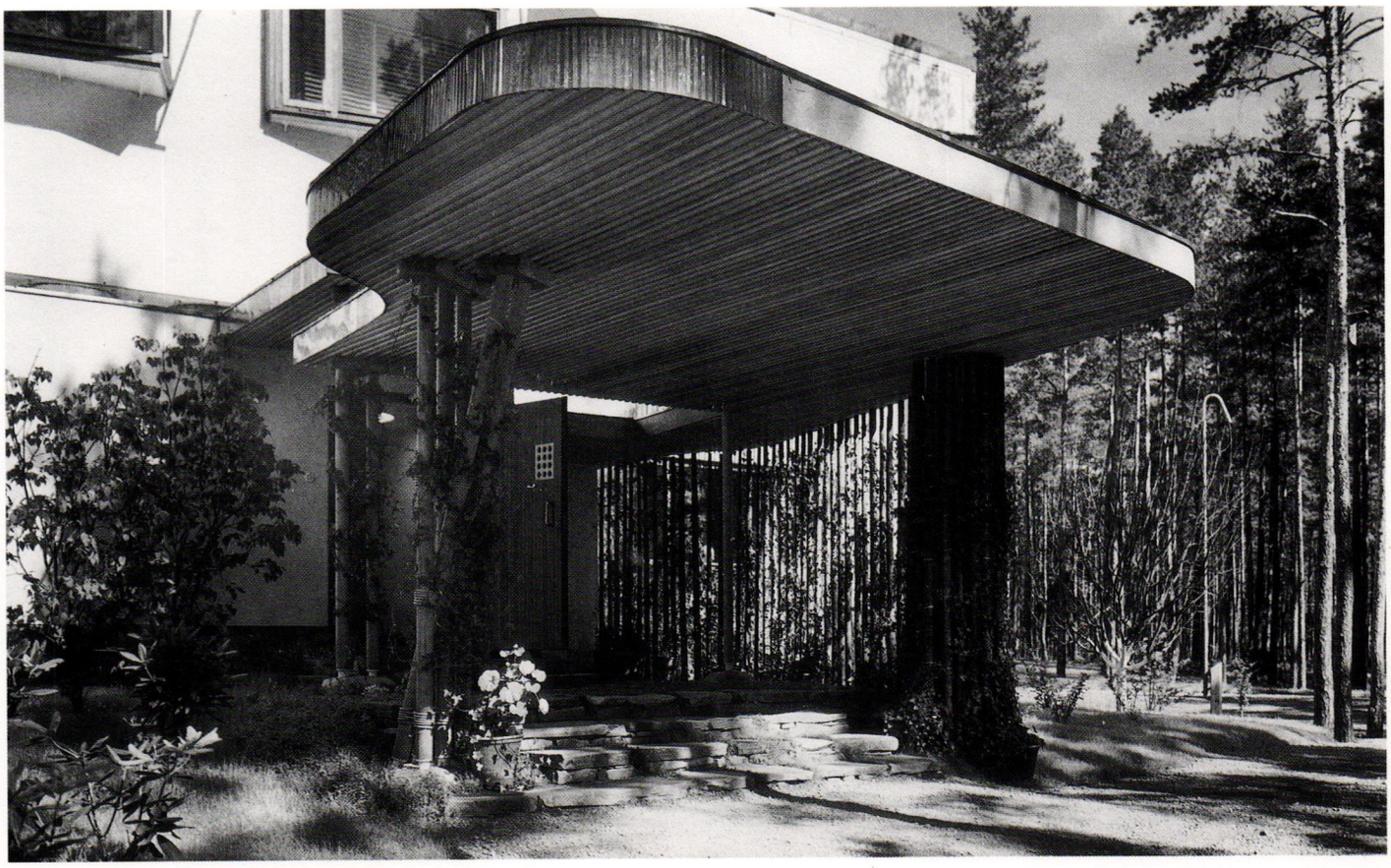












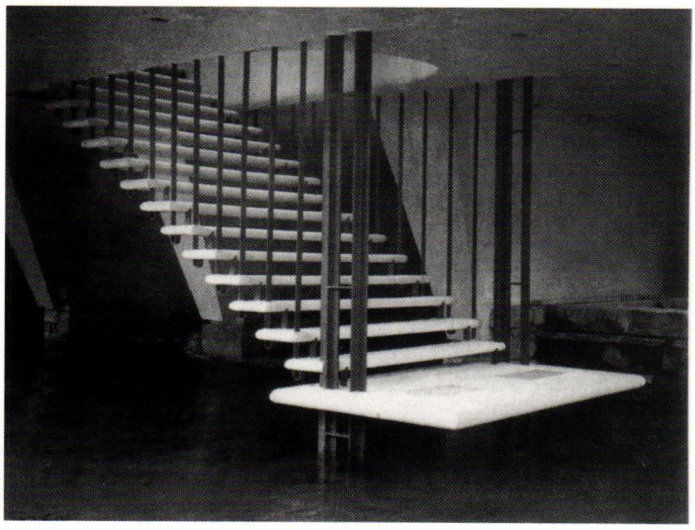


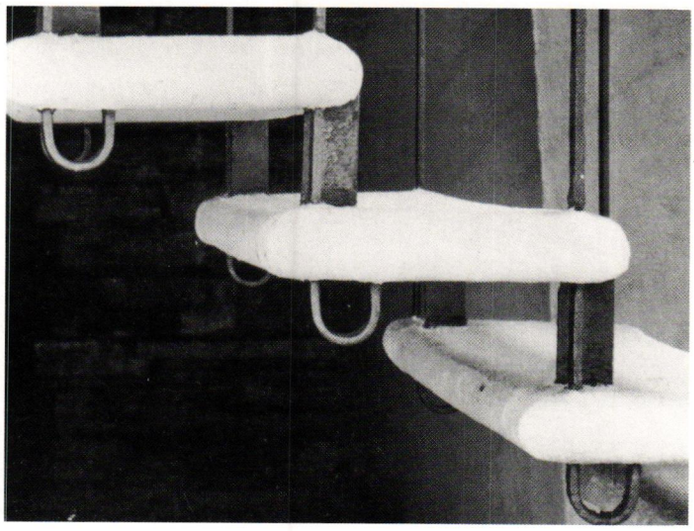








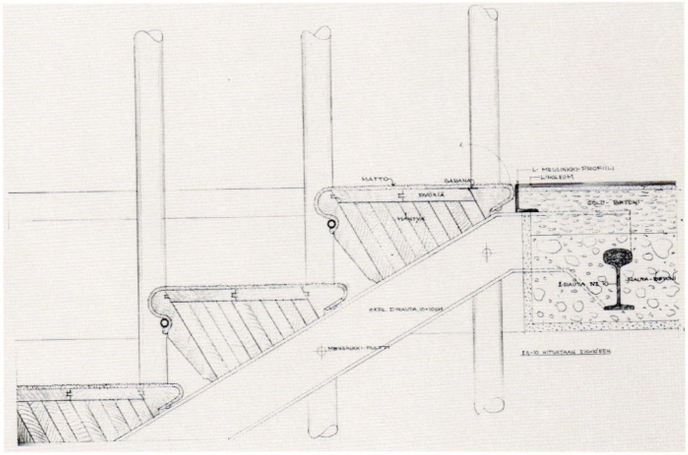




















Base: A Museum: Homage to Gibellina Vecchia, 1985

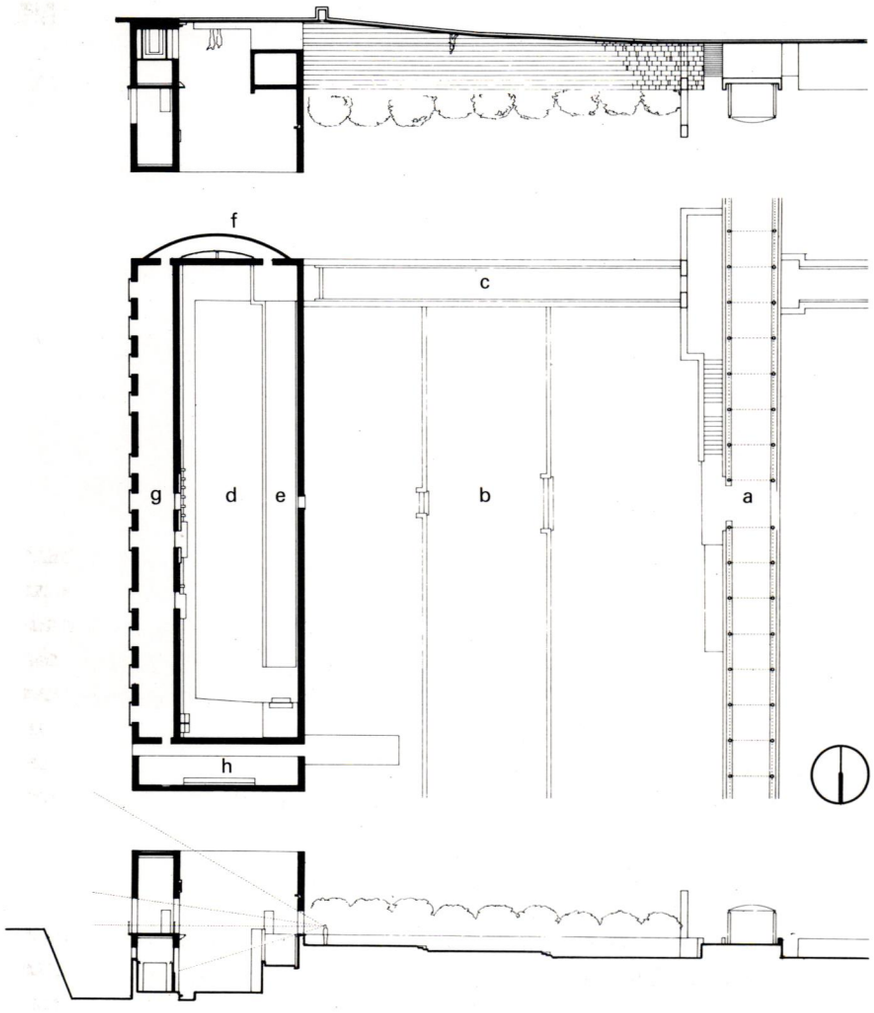
Gibellina Nuova, Sicily

Francesco Venezia

. . . First – and final – choice of project: to ensure that the setting for the old fragment should be sheltered and apart from the new city; therefore to reconstruct it inside a building with a construction around it to avoid a confrontation – where it would lose dimensionally – with the new township. To put up a building which would be complete and at the same time able to preserve the fragment's particular nature, allowing it to establish in its new surroundings its specific characteristics as a ruin. To re-establish somewhere in Gibellina Nuova the old links with the surrounding countryside, situating the new building on the edge of town, touching the country, with an entrance way set in a [many leveled] garden.

The fragment is set in a wall rhythmically scanned by courses of yellow sandstone with alternately plain and patterned faces. To emphasize the sense of the ruin's arrival in its new location, the whole stone facade rests on a plinth of concrete with a projecting moulding whose shadow, projected onto the line of attachment between the facade and the ground, accentuates that sense of detachment, almost of levitation, of the gigantic wall screen. The same effect is enhanced by the two lateral cut-aways [or recesses in the east wall], one of which constitutes the only access to the museum: the old entrances of the facade in the central part are either partly or wholly screened off [and the other recess reveals the wall construction].

Constructing means starting from the roots and going upwards, giving the building stability, providing it with the strength necessary to oppose earthquakes, erosion, the wind. The rising itself of a building conveys strength, for its height dramatically symbolizes the struggle against forces that want it down, on the ground. But once the bulding stands there, its life flows downwards. The construction lives between two poles: settling in the ground, rising upwards. . . .



1. Site plan and sections.

a. Pergola

b. Terraced garden

c. Entry ramp

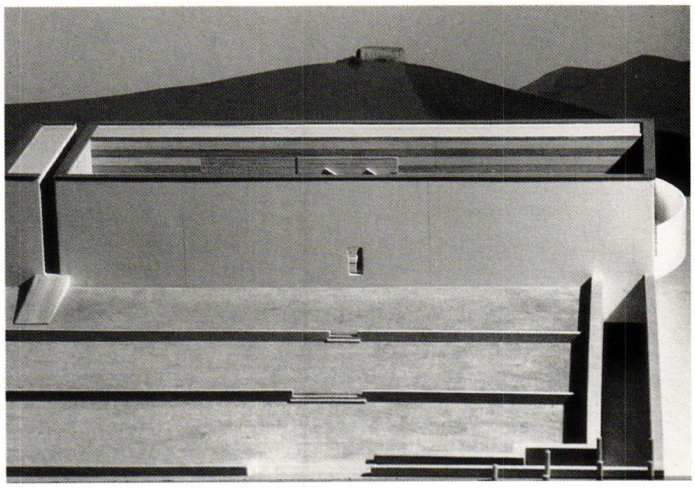
d. Courtyard

e. Ramp

f. Suspended passageway

g. Upper gallery

h. Riposo



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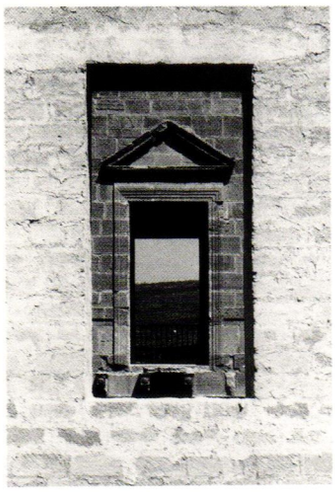

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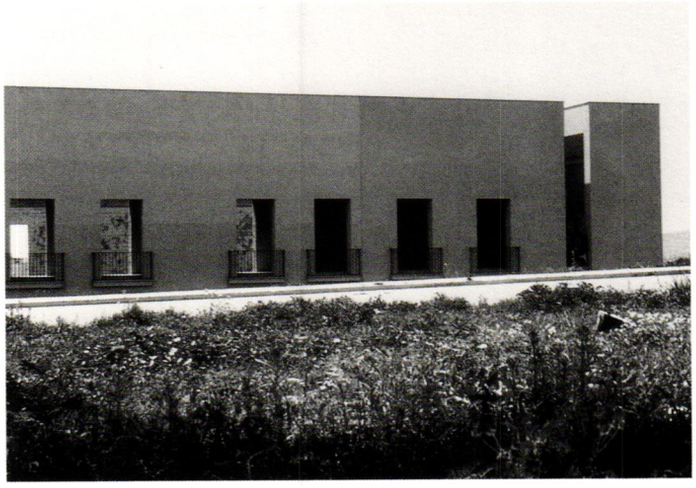

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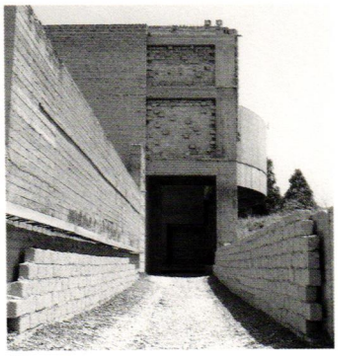

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2. Model of the museum with hills and farmhouse beyond.

3. View from window at terraced garden looking through courtyard to hills beyond.

4. View of east elevation from road, (riposo *on the right).*

5. Entry ramp; suspended passageway shown on the right (under construction).



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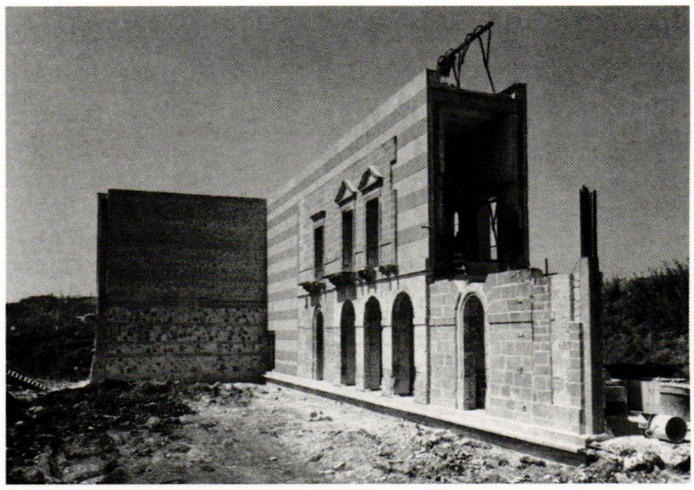

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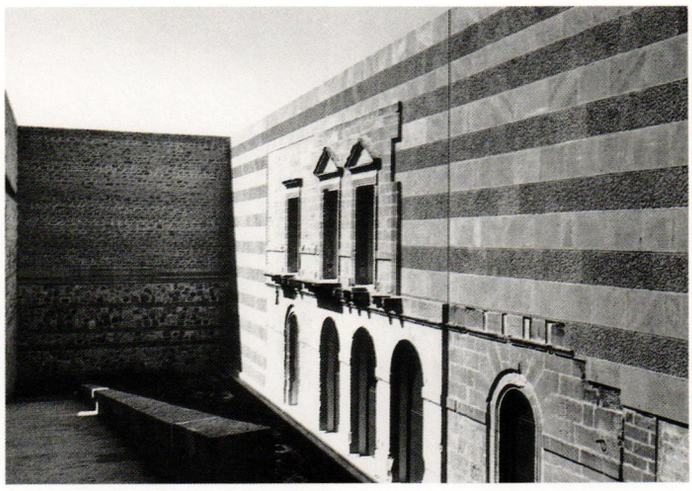

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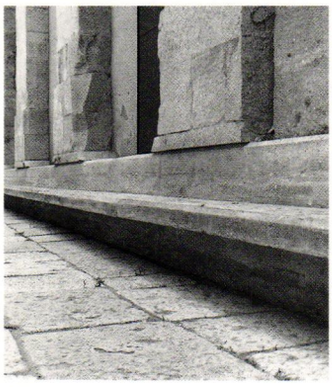
6. The ruins of the Palazzo di Lorenzo, Gibellina Vecchia, following the earthquake of 1968.

7. The construction of the courtyard: the concrete frame with stone blocks awaiting installation.

8. The construction of the courtyard: the facade fragment moved to Gibellina Nuova.

9. The courtyard: view from top of ramp.



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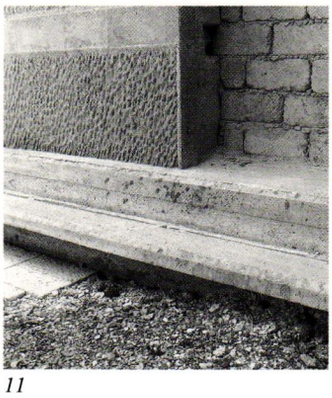

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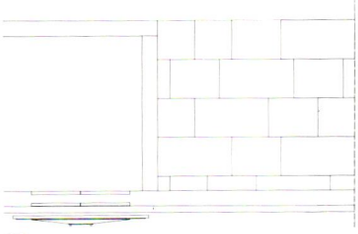

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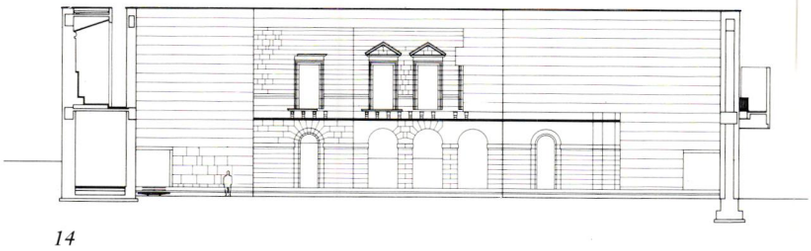

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10. *The courtyard: detail at base of facade fragment.*

11. *The courtyard: detail at base at wall recess where brick inner wall is revealed (south end of courtyard east wall).*

12. *The courtyard: detail at top of facade fragment.*

13. *The courtyard: detail section and elevation of entry to lower gallery.*

14. *North/south section.*



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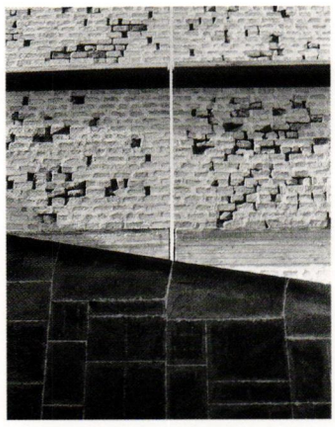

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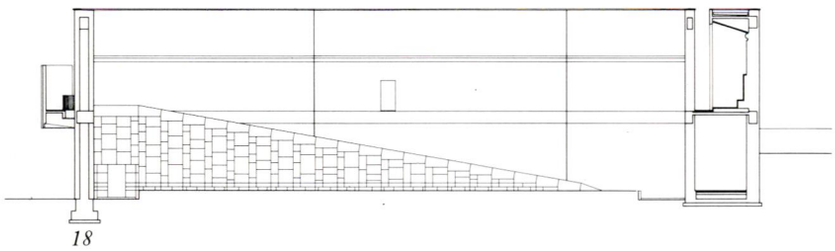

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15. *The courtyard: detail of ramp.*

16. *The courtyard: elevation of ramp with courtyard wall beyond.*

17. *The courtyard: ramp with window onto terraced garden.*

18. *South/north section.*



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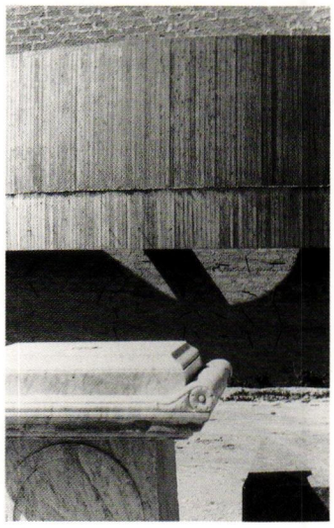

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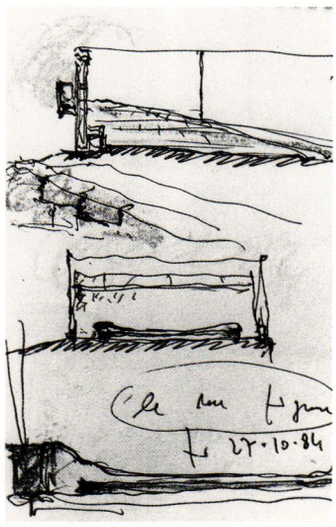

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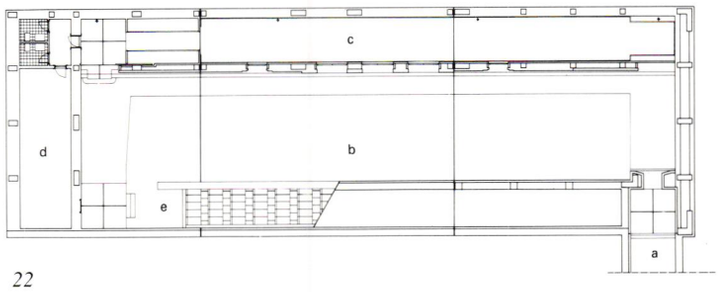

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19, 20. The suspended passageway: exterior views.

21. Sketch of courtyard and riposo.

22. First floor plan.

a. Entry

b. Courtyard

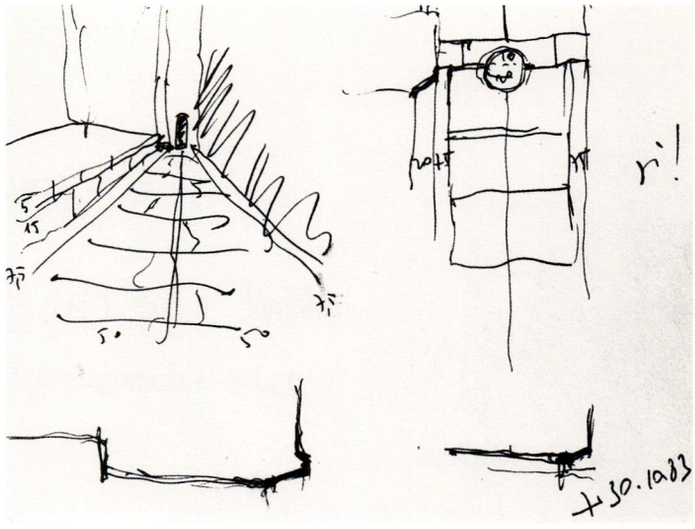
c. Lower gallery

d. Storage

e. Ramp



23



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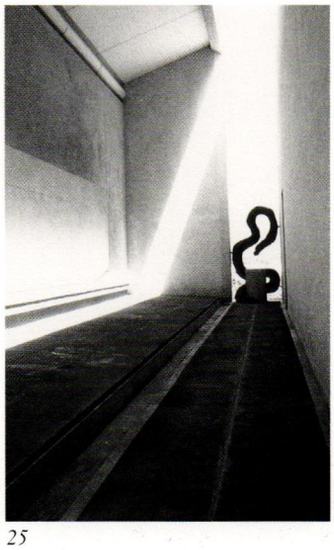

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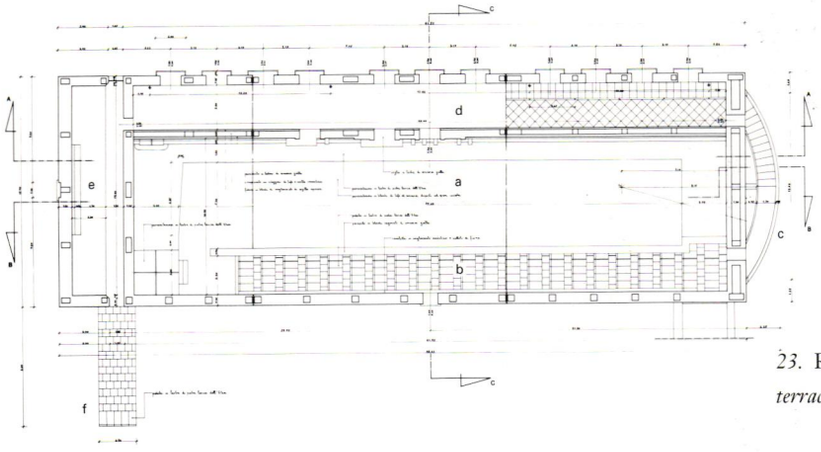

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23. Riposo *and ramp to the terraced gardens (under construction).*

24. Riposo: *sketch perspective and plan.*

25. Riposo: *View of serpent and cylindrical water container, showing trough at floor.*

26. *Second floor plan.*
a. Courtyard
b. Ramp
c. Suspended passageway
d. Upper gallery
e. Riposo
f. Ramp to terraced garden

Wall: The Time's Building, 1984

On the Takasegawa River, Kyoto, Japan

Tadao Ando



1. Entry plaza from the Sanjo-Kobashi bridge.

At times walls manifest a power that borders on the violent. They have the power to divide space, transfigure place, and create new domains. Walls are the most basic elements of architecture, but they can also be the most enriching.

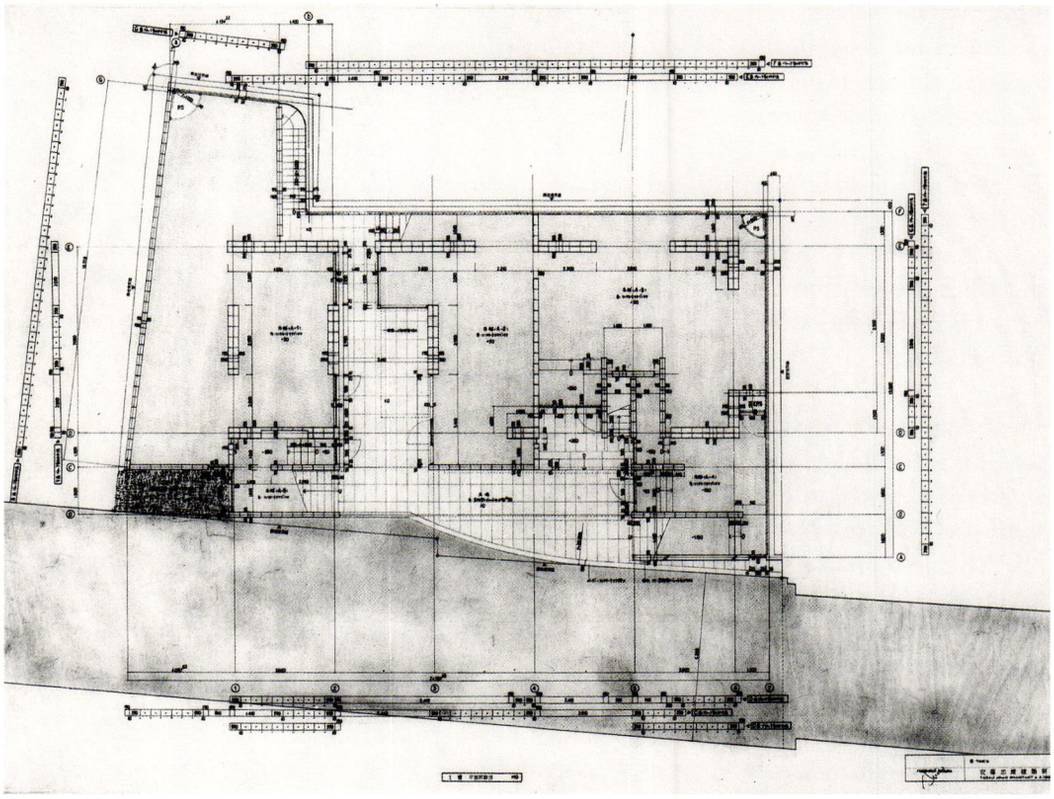
Historically, walls have had negative associations for many people. The enclosing boundary of a penitentiary immediately comes to mind when one thinks of walls, and they are often perceived as devices that physically and psychologically separate the inside from the outside. Walls are heedless of the inmate's longing to be outside and forcibly keep him in. To the outside world, the walls of the penitentiary proclaim that the place is for those who are to be shunned. Walls are symbols of separation and have been regarded as a means of closure. Having been relegated to such roles, they have quite naturally been used only to cut off space.

To reject what is to be abhorred and to accept only that which is desirable – these actions are very much a part of man's most basic behavior, that of habitation. It is a central concern of habitation to keep out the external world and to protect the world inside, to accept and assimilate only those aspects of the outside world that promote the maintenance of the inner realm. In other words, habitation depends on the skillful manipulation of rejection and acceptance.

There is generally less tension in the act of acceptance than there is in rejection. To accept is to affirm and with this one tends to put down one's guard. However, if everything is allowed to penetrate into the interior, the internal world disintegrates and its centrality collapses. This results when there is an absence of tension in the act of acceptance. I believe therefore that tension should be as present in acceptance as in rejection. In architecture this tension signifies an intense confrontation between the inside and the outside. Thus, those places where the internal order meets the external order, that is, the areas of fenestration in a building, are of extreme importance.

In my buildings, walls play a dual role, serving both to reject and affirm. By positioning a number of walls at certain intervals, I create openings. Walls are freed from the simple role of closure and are given a new objective. They are calculated to accept even as they reject. The amorphous and immaterial elements of wind, sunlight, sky, and landscape are cut out and appropriated by walls which serve as agents of the internal world. These elements are assimilated as aspects of the architectural space. This tense relationship between inside and outside is based on the act of cutting (as with a sword), which to the Japanese is not cruel and destructive but is instead sacred; it is a ceremonial act symbolizing a new disclosure. To the Japanese this act has become an end in itself. It provides a spiritual focus both in space and time. In that tense moment, an object loses its definition and its individual and basic character becomes manifest. Walls "cut" into sky, sunlight, wind, and landscape at every instant, and the architecture reverberates to this continual demonstration of power.

The more austere the wall, even to the point of being cold, the more it speaks to us. At times it is a sharp weapon menacing us. At times it is a mirror in which landscape and sunlight are dimly reflected. Light that diffuses around a corner and gathers in the general darkness contrasts strongly with direct light. With the passage of time these two "lights" blend and enrich the space. Man and nature, mediated by architecture, meet.



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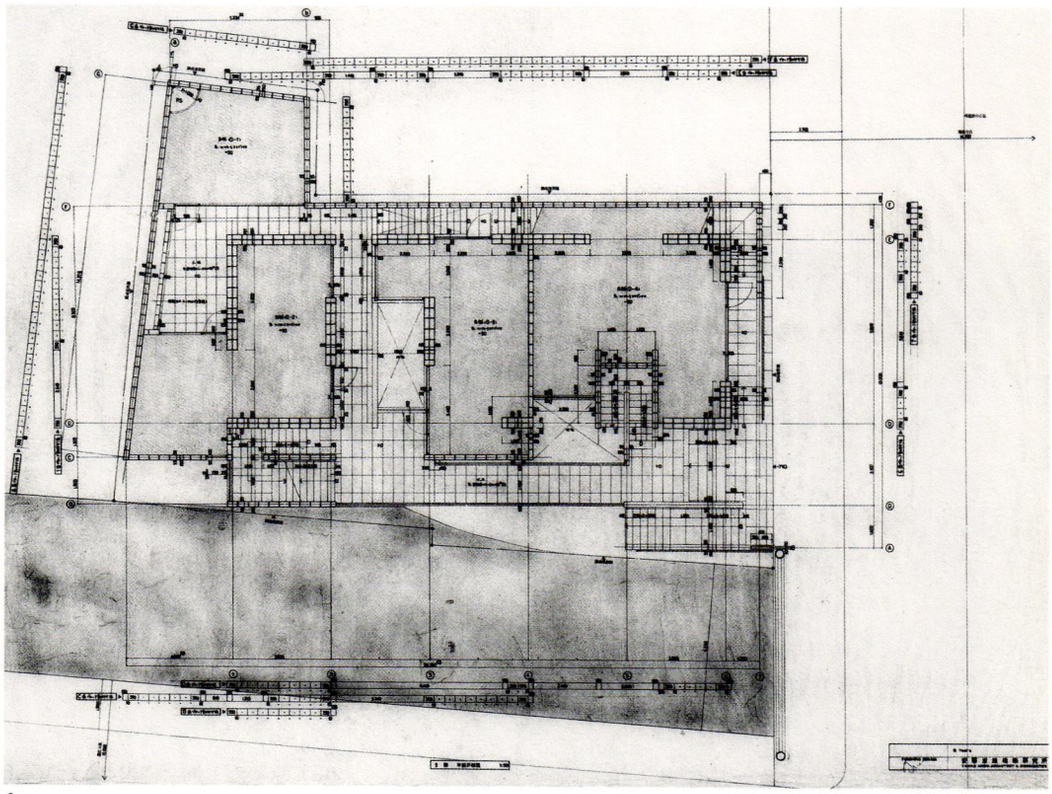
2. First floor plan.



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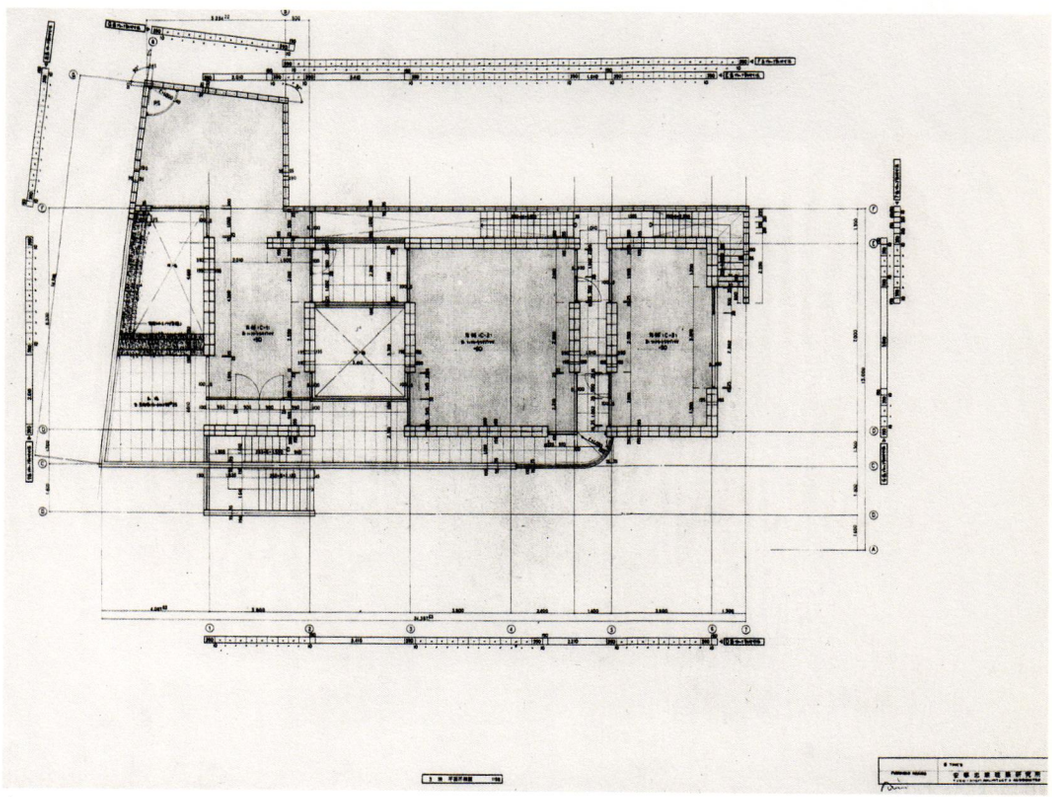

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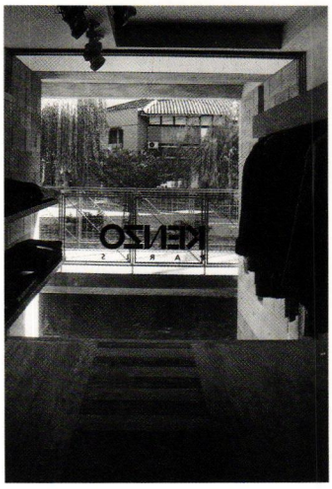
3. *Second floor plan.*

4. *Third floor plan.*



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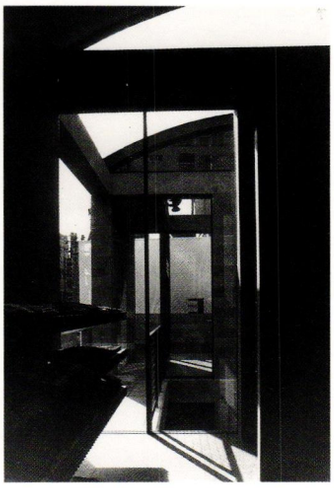

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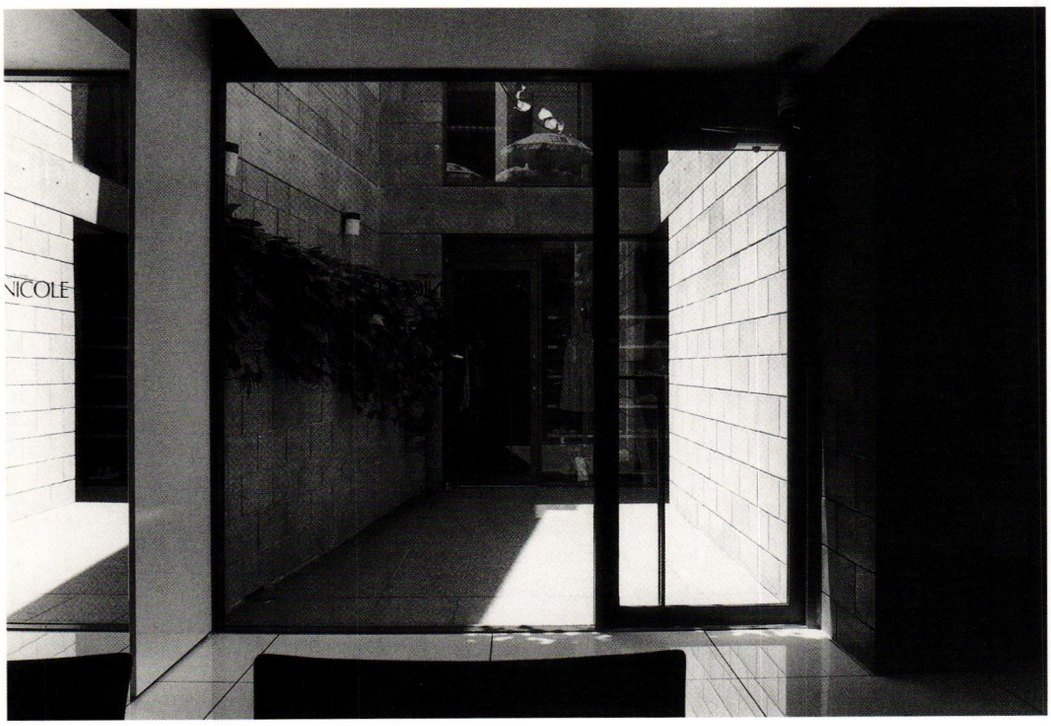

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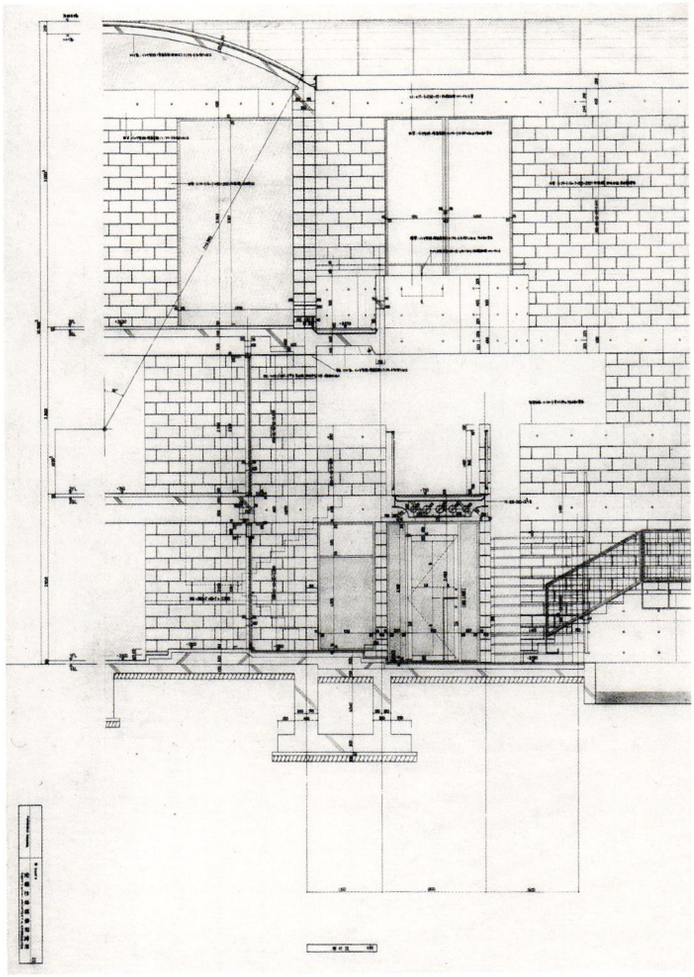
5. *Shop window at second floor with steel walkway beyond.*

6. *Interior court at third floor shops.*

7. *Interior court at second floor shops.*



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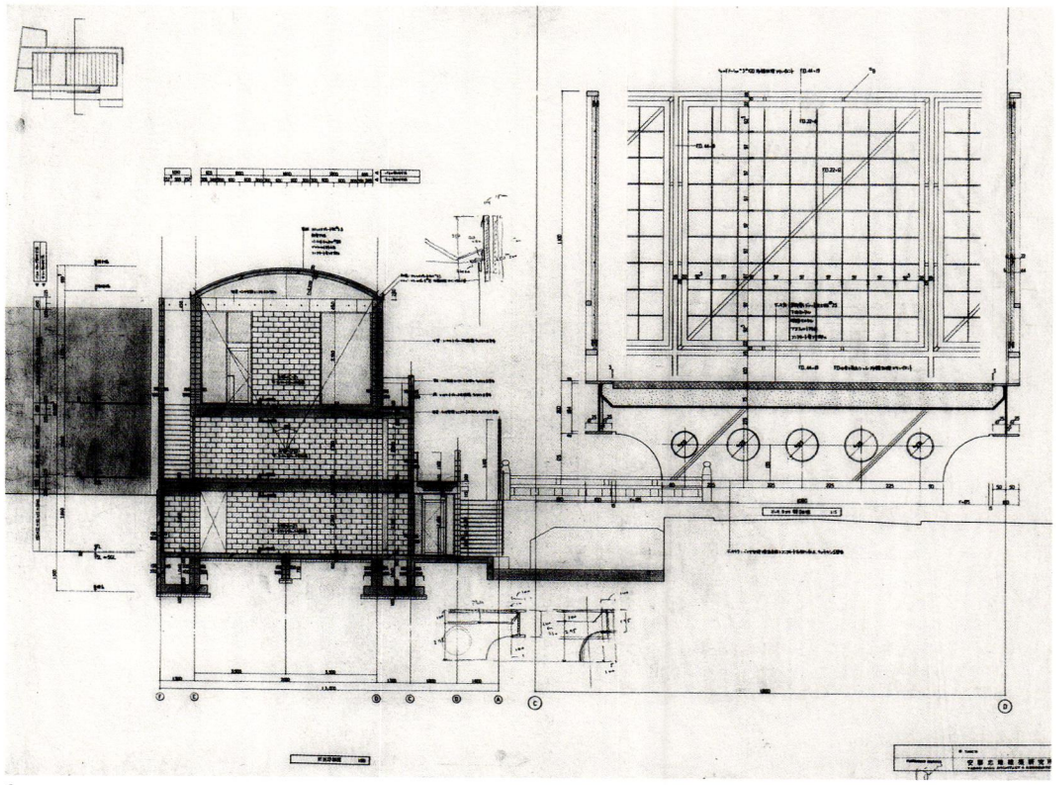
8. Composite detail section / elevation at entry plaza.



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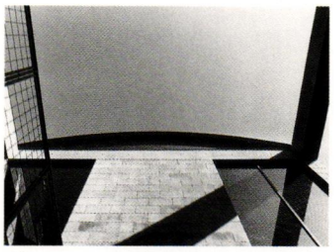
9. West/east building section with detail of steel walkway.



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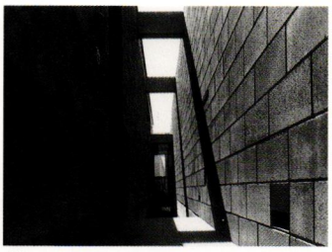

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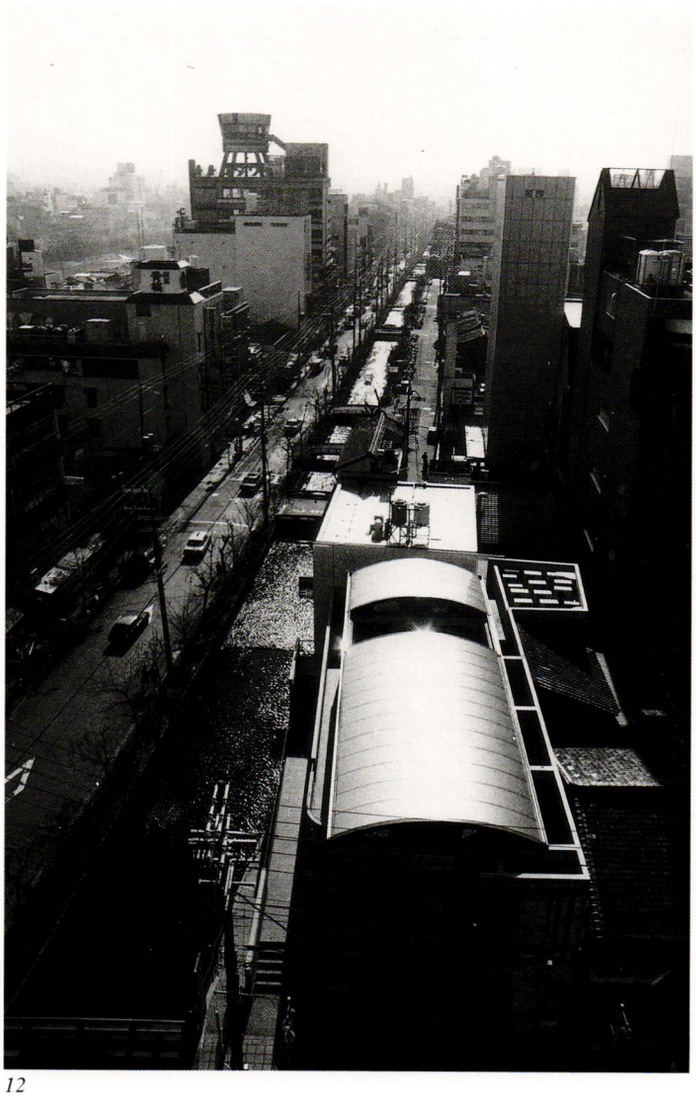

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10. Interior court at third floor shops.

11. Passageway at third floor.

12. View to the south.

Roof: Haus Heinze/Manke, 1988

Rodenkirchen-Köln, West Germany

Heinz Bienefeld

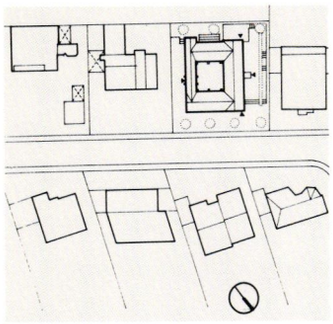
Traditionally, when a wood roof meets a brick wall, the bricks were built up around the rafters, creating a melting or collusion of the two materials. For me this is a very uncomfortable situation: the materials are not compatible. The wood begins to develop uncontrolable cracks. In Haus Heinze/Manke the two materials are separated into building parts: that which is being carried and that which carries the load. The wood rafters that support the roof and ceiling at the courtyard are raised up 15 cm from the brick bearing wall on small steel columns. The slot between the roof and wall is then glazed as much as possible to convey a feeling of transparency. But it is only from the interior that one is able to perceive the separating space, and so a tension is experienced when entering or exiting the building. The intent here is to bring together a suspenseful relationship between the powerful exterior massing and the open bright interior. A means of achieving this effect is by creating the "floating" condition for the roof. I do not try to work in opposition to gravity, but to achieve a balance between lightness and weight.

In my work it is essential to address every change from horizontal to vertical. Each point of transition is illuminated through detail: every wall end and ceiling beginning, staircase end and floor beginning. Nothing is left to chance. In nature it is the same: an insect such as the beetle contains an infinite amount of detail and yet it is still practical in that it is able to maneuver itself. It is beautiful in every aspect: the beetle exists in an endless number of variations, more than any human could ever create.

Translated from the German by Ira M. Hessmer



1. Haus Manke: partial view of north elevation.



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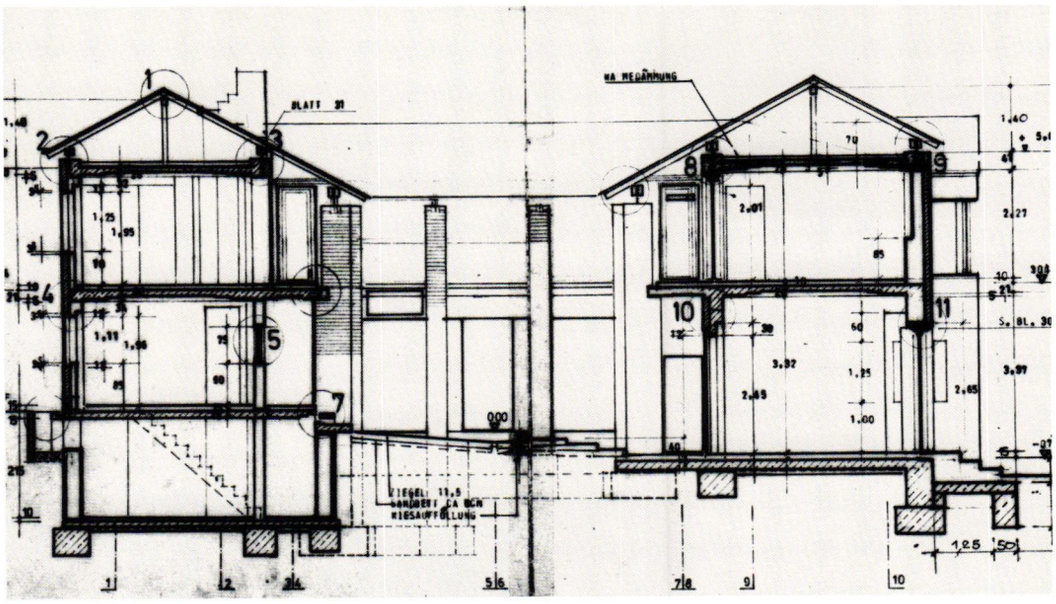

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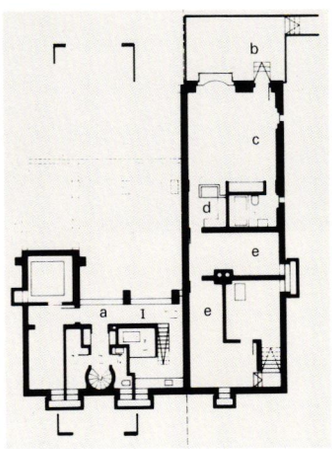

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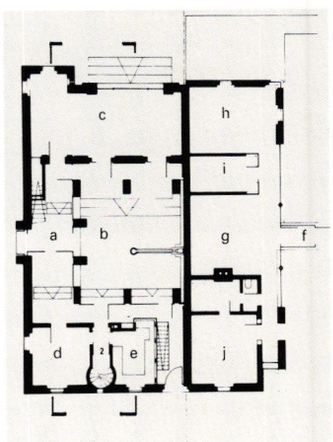

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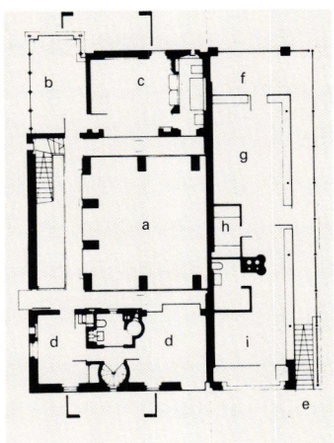

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2. *Site plan.*

3. *Haus Heinze: north/south building section.*

4. *Haus Heinze: lower level plan.*
a. *Mechanical/storage*

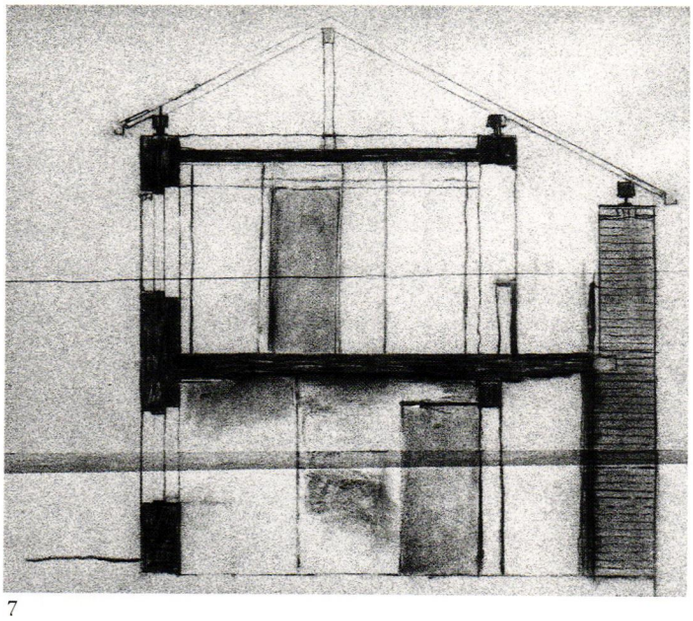
Haus Manke: lower level apartment.
b. *Entry*
c. *Living/sleeping room*
d. *Kitchen*
e. *Mechanical/storage*

5. *Haus Heinze: first floor plan.*
a. *Entry*
b. *Courtyard*
c. *Living room*
d. *Dining room*
e. *Kitchen*

Haus Manke: first floor apartment.
f. *Entry*
g. *Living room*
h. *Dining room*
i. *Kitchen*
j. *Bedroom*

6. *Haus Heinze: second floor plan.*
a. *Courtyard*
b. *Study*
c. *Bedroom*
d. *Children's room*

Haus Manke: second floor apartment.
e. *Entry*
f. *Terrace*
g. *Living/dining room*
h. *Kitchen*
i. *Bedroom*



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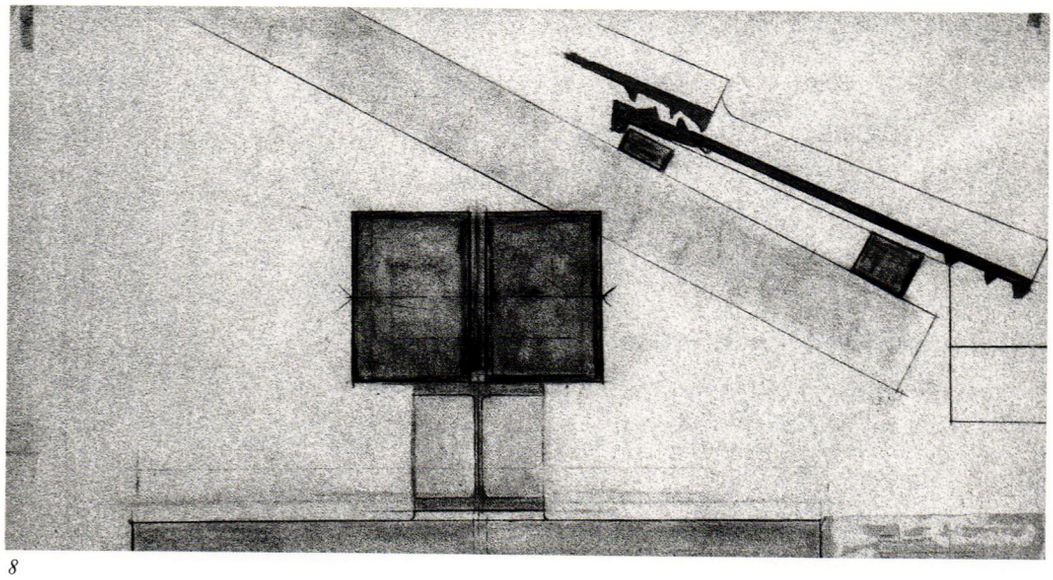

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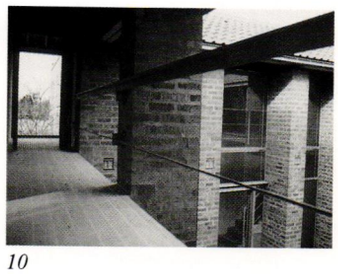

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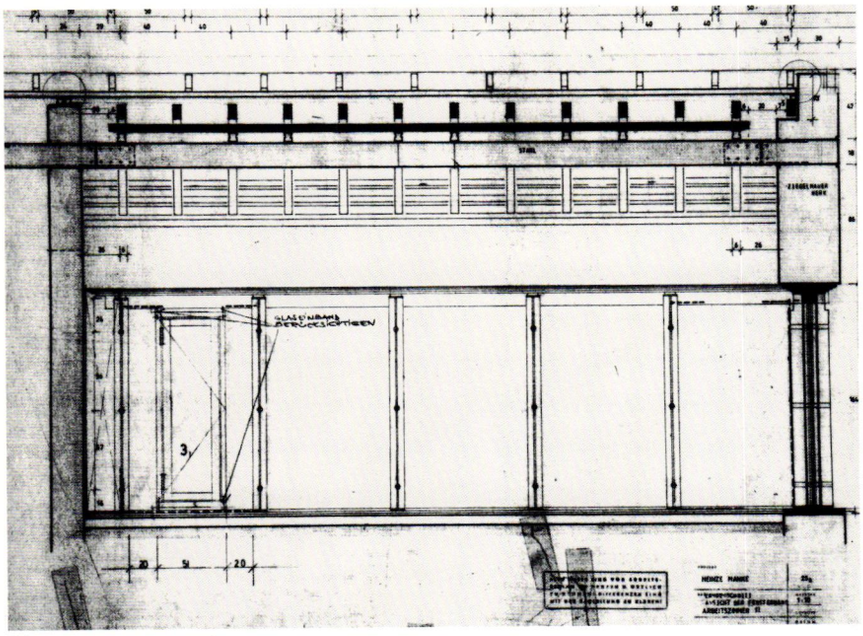
7. *Haus Heinze courtyard: partial north/south building section.*

8. *Haus Heinze courtyard: detail section at brick pier and roof.*

9. *Haus Heinze courtyard: view of detail at brick pier and roof.*

10. *Haus Heinze courtyard: view from second floor.*



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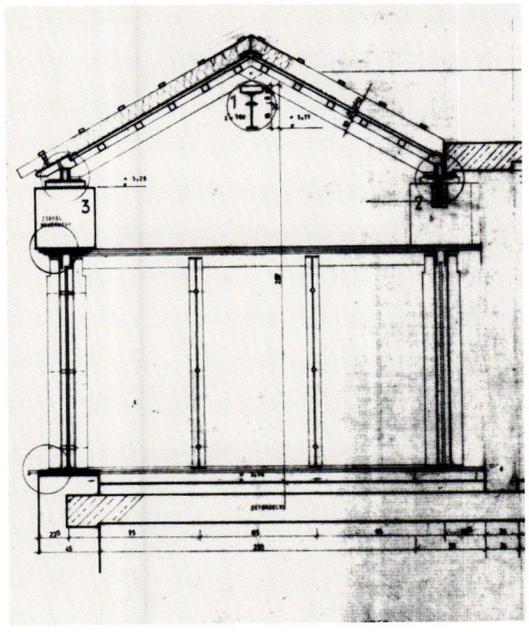

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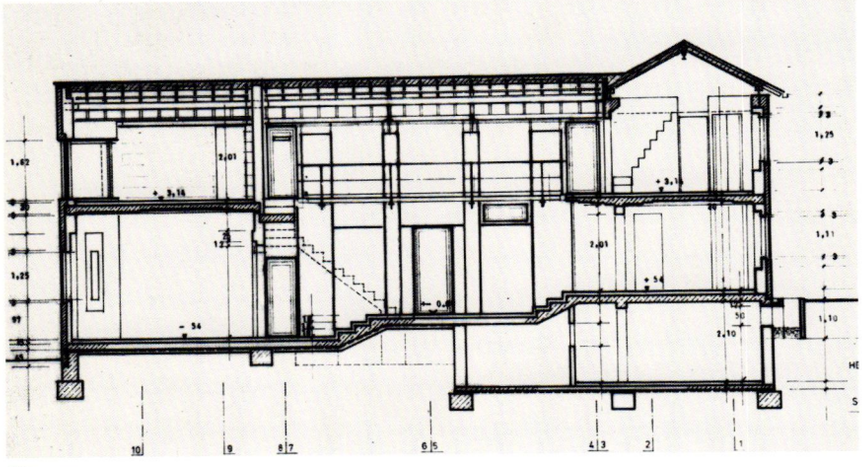

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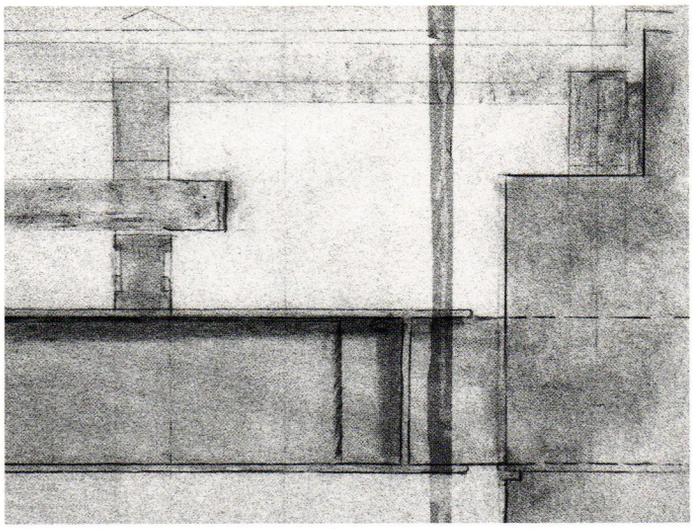
11. Haus Heinze study: north/south section.

12. Haus Heinze study: west/east section.

13. Haus Heinze: south/north building section.



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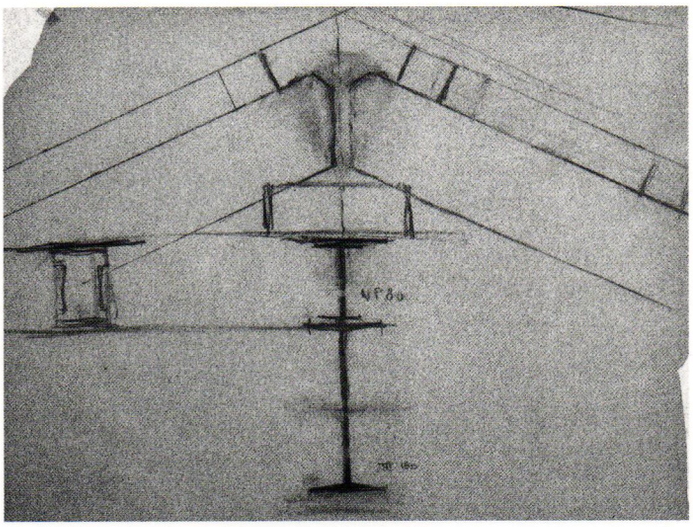

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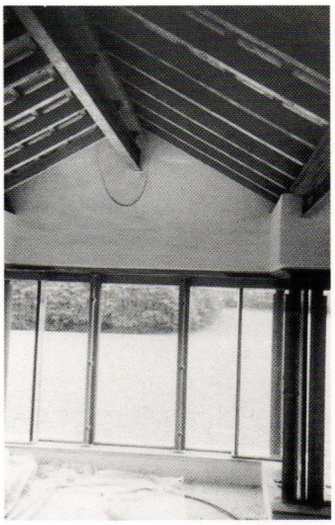

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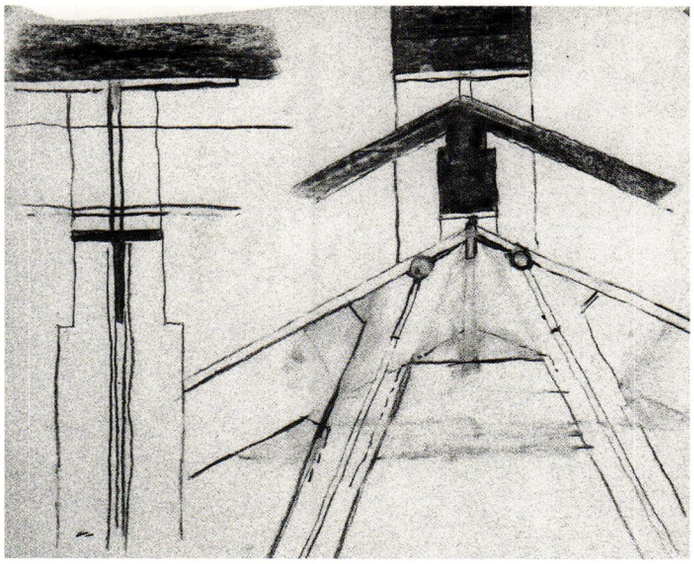
14. Haus Heinze study: detail elevation/section of ridge beam at south wall.

15. Haus Heinze study: detail section at ridge beam.

16. Haus Heinze study: view to the south.

17. Haus Heinze study: view of ceiling detail at interior wall.



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18. Haus Manke second floor apartment: detail elevation of column and detail section at ridge.

19. Haus Manke second floor apartment: column/truss connection showing terrace ceiling at left.

20. Haus Manke second floor apartment: view to the south showing entry terrace at right (under construction).



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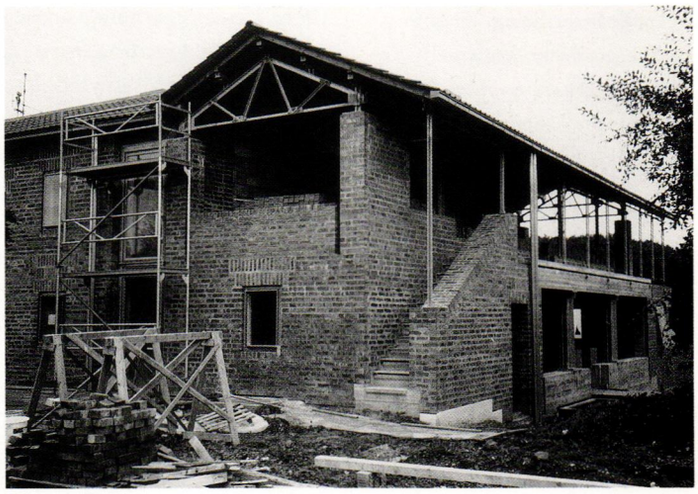

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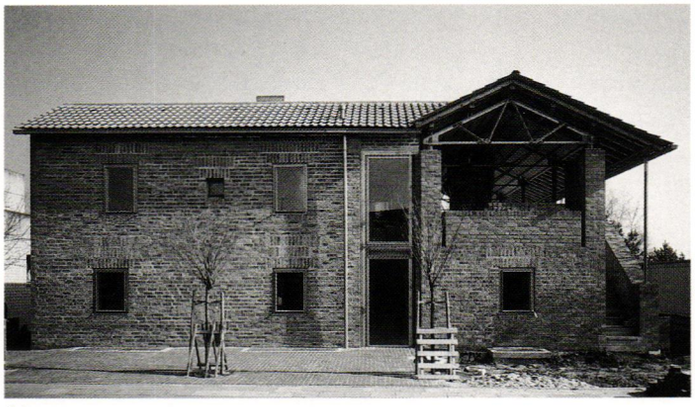

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21. View of south elevation: Haus Heinze at right showing second floor study and Haus Manke at left.

22. Exterior view: Haus Heinze study at far left and Haus Manke at far right.

23. Exterior view: Haus Manke second floor apartment entry stair at right (under construction).

24. View of north (street) elevation: Haus Heinze at left and Haus Manke at right showing entry stairs to second floor apartment at far right (under construction).

The Archaeology of Section

Jacques Guillerme and Hélène Vérin

Originally, the Lacanian mythologists tell us, there was *lack*, whence arose *representation*, which is the germinal form and precondition of all activity of knowledge and planning.[1]

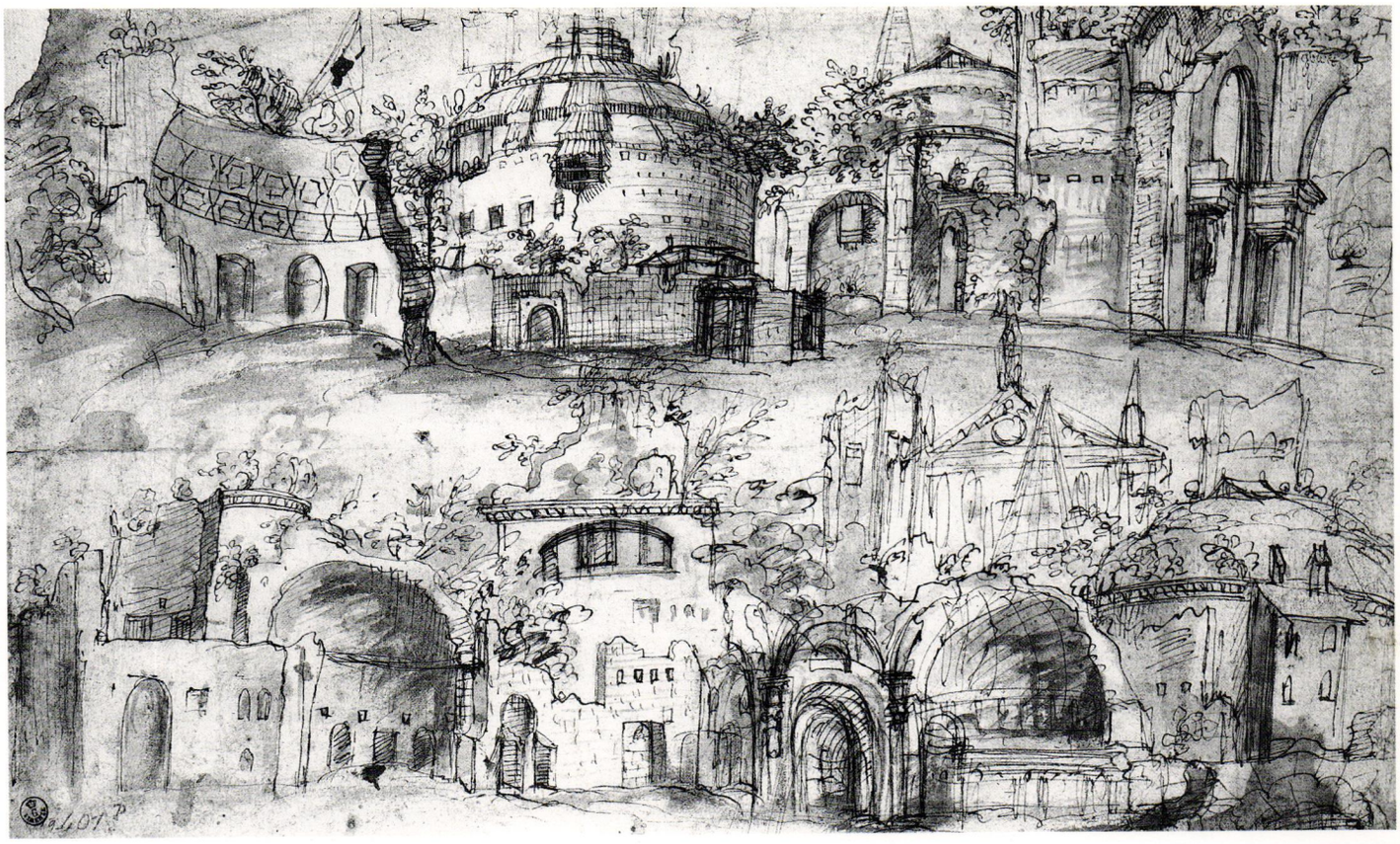
In the beginning, as concerns the architectural section, was the *ruin*, more specifically, the Roman ruin: the ensemble of the ruins of the *Urbs* which displays to the magnetized gaze of humanist nostalgia all the stages of the vestiges' decline and all the breaches that time has wrought on the outer shells of edifices extolled by scholars. Ruins are, in short, the traces of decay's ravages and *lack* on the resistant mass, and hence the contours and aspect of structures which constitute the very bodies of monuments. It is to the hands of time that we owe the bringing to light of the frameworks that architectural *technê* conceived, worked, erected and finally dissimulated in the temporarily completed appearance of perfect construction.

The problem we would like to address here is that of retracing the steps by which inventive citizens, from the reasoning artisan to the curious philologist, were able to translate the "natural" images of breaks in ancient ruins into stable schemata of sectional contours in the documents made by the traveler as well as the projects made by the artist. To put it another way, we would like to glimpse the many stages where the acute and questioning gaze of technicians paused to contemplate in order to transform the observation of archaeological remains (*traces*) into the observance of architectural diagrams (*tracés*)

Of the countless but often unrecognizable vestiges of ancient Rome, three stand out for the charismatic effect they have on the minds of archaeologists; these are three monuments which have particularly fostered the objectification of sections. On the one hand, we have the amphitheater of Flavius, better known as the Coliseum, and the baths of Caracalla; on the other, the rotunda of the Pantheon. All were abundantly contemplated, admired, observed and drawn. The first two greeted one's eyes with the gaping breaks in their structures and with the semi-preserved arrangement of their vaulting systems. The Pantheon, on the other hand, had come down through the centuries nearly intact, with its interior disposition visible and easily represented but its internal structure remaining hidden. Its constructional apparatus remained hypothetical and provoked a vast range of divergent conjectures. The joining of the orthogonal structure of the peristyle with the incurvation of the main body was especially titillating to the imaginations of archaeologists. Already in Leonardo's work a hastily executed sketch poses this question without insisting on one particular solution; hesitation is a meaningful symptom of this "visionary" who nevertheless worked rigorously and carefully at outlining the details of arches (as in the *tiburio* of the Milan cathedral).[2]

1. The term "lack" or *manque* in Lacanian mythology refers to "a presence made of absence." Jacques Lacan, *Écrits: A Selection*, translated by A. Sheridan (New York: Norton, 1977), p. 65.

2. *Codex Atlanticus* (Milan: Biblioteca Ambrosiana), folio 850, previously 310 recto, b.



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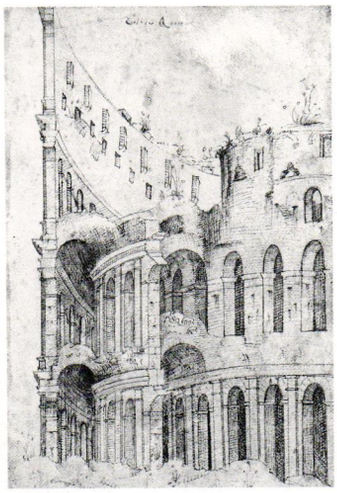

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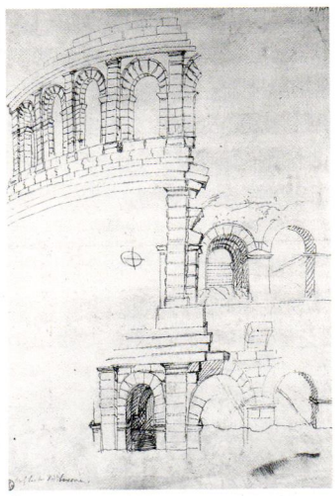

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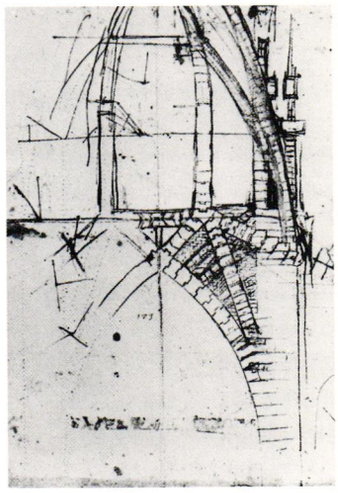

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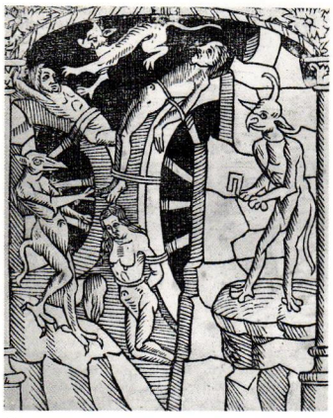
1. Attributed to Bramante, sheet of drawings of ancient ruins.

2. Anonymous, partial view of the Roman Coliseum, late 15th century.

3. Sangallo il Gobbo, external structure of the amphitheater of Verona.

4. Leonardo da Vinci, sketch of the tiburio *at the Milan Cathedral.*



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The fact is that the rotunda is the emblematic monument on which speculators in matters of architectonics have long and insistently expended their energies. They go so far as to impose on its form the imaginary and vivid breaking up of the outside onto the inside, and thereby contribute to the teaching and justification of the art of *spaccato*, or vertical section. One of the most noteworthy of such examples is found in the Chlumčzanský Codex, which presents side by side two drawings by the same anonymous hand, dated circa 1500.[3] The first is a simple and crude elevation; the second one looks like a primitive *spaccato*. The positioning and stroke of the *spaccato* are rather awkward compared to current standards. Yet its merit, indeed its purpose, lies in presenting a drawing of the mental operation which embraces, all at once, the interior and exterior of the edifice as well as the thickness that separates them. Here we have indeed a "tectonic" cut-out whose pattern seeks to show the structure or "inner workings." It is thus a diagram (*tracé*) more thought-out and more elaborate than the traditional images of breaches which give a glimpse of scenes belonging to such unusual compartments of the universe as Hell or the Empyrean.[4] The elaborated type exemplified in this drawing from the Chlumčzanský Codex also stands apart from such imagery which revives mystical fables and whose figurative means, whether naive or mannered, tend to express an encounter between Revelation and History.[5]

But here one must recall one of the most audacious strokes of genius of the Renaissance, that of representing the cosmos through the double correlation of the concave and the convex by the use of globes. Compared to this, the twofold figuration of the Pantheon seems little more than a timid application of the same principle. Imagining the antipodes was an act of conceptual invention that made it possible to represent the earth as a distinct object of our sensible, immediately intuitive rootedness.[6] It was also the condition for being able to configure, in plastically identical and similarly manipulable ball-shapes, the miniaturization of the two spheres of the natural macrocosm, the globe of the earth and that of the concave celestial sphere. Thus one became accustomed to considering side by side, as it were, simultaneously, the inside and outside of things, within hand's reach; within the reach of that "instrument of instruments,"[7] the sign and means of a rationality that analyzes and synthesizes, breaks down and reassembles modifications of scale. The cosmological artifice of the spheres of the world was de jure the expression of a conceptual bravado that henceforth authorized the enterprising advancement of the artifices of architectural graphic figuration.

3. *Codex Chlumčzanský* (Prague: Library of Czech National Museum), folio 71; W. Juřen, in the manuscript *Mémoires et monuments Piot*, vol. 68 (Paris: 1987), p. 161, points out that "the two views . . . are copies, probably the only ones, of a lost model that probably dates from the same period as Giuliano's drawings and comes from his entourage"; he refers to folios 37 recto and 38 recto of the *Codex Barberini*, Lat. 4424.

4. Among the many examples, see folio F3 recto of the *Grant Kalendrier et compost des bergiers* published at Troyes in 1529 by Nicolas Le Rouge. It is, of course, but one example; the artifice of representing the break in a wall can be found as early as in the decorations adorning Greek vases when they illustrate an episode taking place inside a dwelling or cave.

5. Often cited in this connection is the convention whereby the Nativity is represented in Renaissance art within a decor of ruins.

6. ". . . today, under the round machine / New lands and diverse peoples / have been found by dint of great effort," one reads in the "Foreword" of the *Description of Geography* attributed to Marco Polo and published in Paris in 1556.

7. Aristotle referred to the hand as the "instrument of instruments" in *Parts of Animals*, 687 a-sq.



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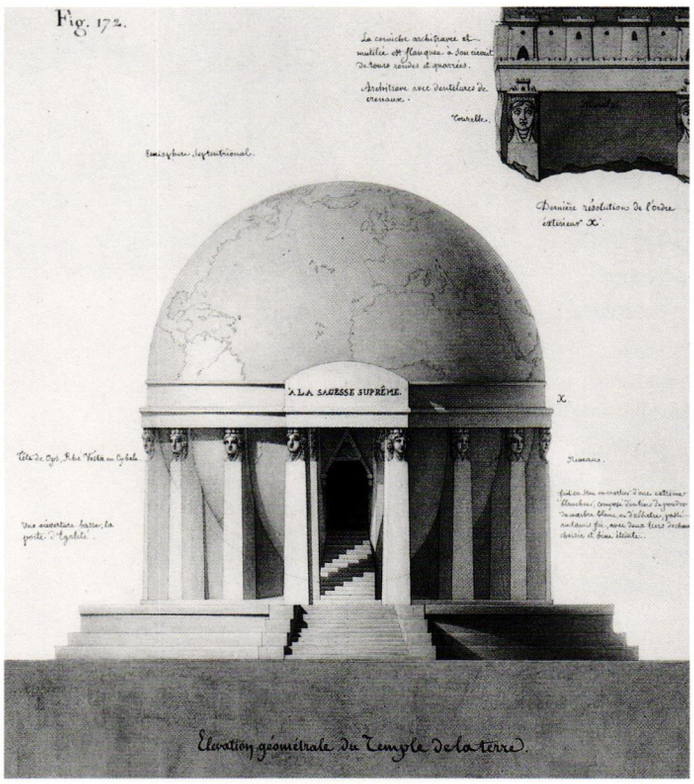

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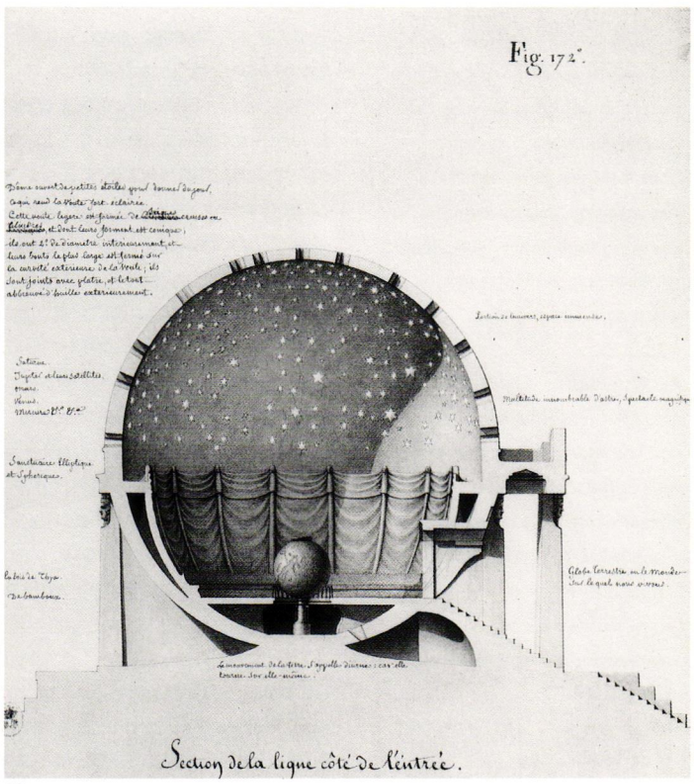

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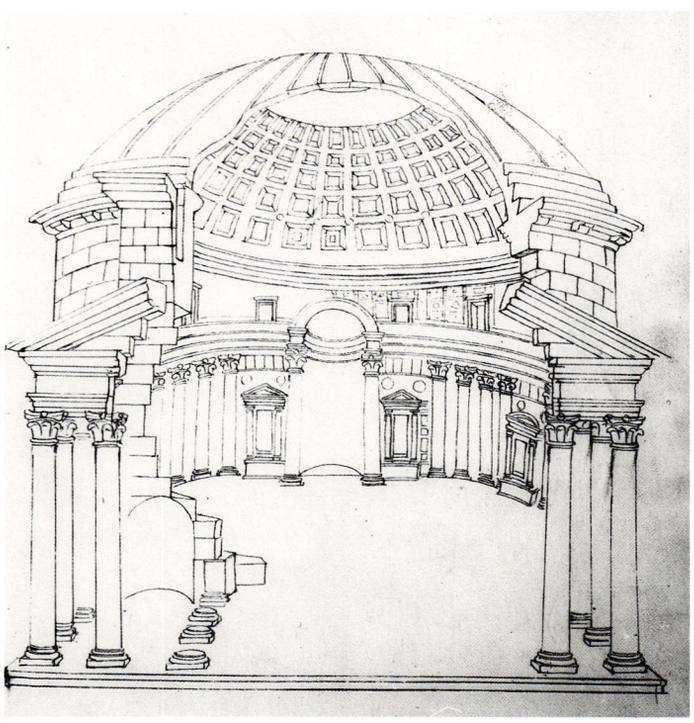

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5. *From* Le Grant Kalendrier et compost des bergiers, *view of a part of hell, 1529.*

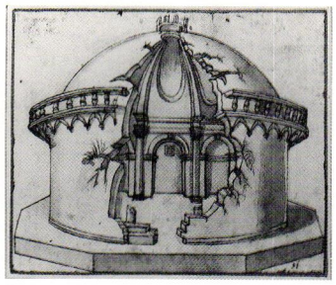
6. *P. Baltens, allegory of the "ruin," ca. 1550.*

7a, b. *J. J. Lequeu, elevation and section of* Temple of the Earth, *ca. 1792.*

8. *Anonymous, exploded section of the Pantheon in Rome, Chlumčzanský Codex, ca. 1500.*

Let us return momentarily, however, to the figure in the Chlumčzanský Codex. It is emblematic, we said, of the questioning gaze cast on the structures of edifices whose appearance is reconstructed artificially in two dimensions. This gaze is instructive for the questions it poses and for the answers it provides beyond a merely playful attitude to a truly pioneering one. This attitude is expressed in a famous drawing in the Royal Collection at Windsor of the so-called temple of Portumnus, which is apparently an imitation of a drawing by Giuliano da Sangallo.[8] This drawing and others embellish upon the theme of the ruin and mark a decisive step in the importance of sections. Indeed, the comparison and seriation of those drawings which present aspects of the architectural section, whether they correspond to documentary or creative intentions, bear witness to a surprising diversity of manners and points of view. These varied approaches quickly rise from a merely experimental stage to take flight. Once archaeological curiosity arms itself with the demands of proportion, the diagrammatic illustration tends to become uniform and the protocol of the section begins to submit to academic conventions.

The terminology would follow far behind and was not always rigorous, as we can see for example in French, where the terms *coupe*, *section*, and *profil* have long been interchangeable. This vacillation can probably be ascribed to the original transgression of Daniele Barbaro, who in his 1556 Venetian edition of Vitruvius, read *sciographia* for *scenographia* in the definition of the three types of drawing appropriate for architecture. This contradicted the authoritative opinion of Hermolao Barbaro, a relation of Daniele, who in 1492 in his *Castigationes* of Pliny's *Natural History* had pointed out that *scenographia* corresponded correctly to the acceptable idea of *tecti universi scena*.[9] Nevertheless, the 1547 edition of Vitruvius by Jean Martin did not fail to identify *scenographia* with perspective.[10] In 1612, however, Baldo's explanation of Vitruvius' vocabulary was content to bring together a great range of diverse opinions and did not choose, for *sciographia*, between the shaded image of an edifice put into perspective and the drawing of a profile.[11] Forty



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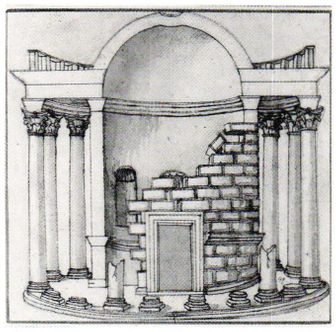

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9, 10. Anonymous, drawing from the Royal Library at Windsor.

11. S. Peruzzi, elevation /section of the facade of the S. Elogio Church, Rome.

12. A. San Gallo, study sheet of the Tempietto, *section of the building and various detail studies.*

8. See Wolfgang Lotz, *Studies in Italian Renaissance Architecture* (Cambridge, Mass.: 1977), pp. 18-21. The important point here is the reference to a view of Hagia Sofia, copied from a model by Ciriaco d'Ancona from the first quarter of the fifteenth century.

9. See Hermolao Barbaro et al., *C. Plini Naturalis Historiae libros Castigationes*, (Basel: 1534), p. 507: ". . . ex Vitruvii libro primo quanquam scenographia fortasse rectius apud eum scribitur, quoniam pictura sit non solum areae, ut ichnographia, nec frontis tantum, ut orthographia: nec tecti universi quod scenam, hoc est, tabernaculum vocare mos Graecum est."

10. One reads: "The adumbration and receding of the background, with the shortening of the front and sides of the edifices effected by lines all correspond to a center and so is commonly called perspective. . . ."

11. B. Baldo, *De Verborum vitruvianorum significatione* (Augusta: 1612), p. 153.

12. Micraelius, *Lexicon Philosophicum* (Iena: 1653), V° "Sciographia."

13. Ozanam, *Dictionnaire de mathématique* (Paris: 1691). This is more or less the definition of "profile" given by the *Encyclopaedia Britannica* in the 1771 Edinburgh edition.

14. C. Rieger, *Universae Architecturae civilis Elementa . . .* (Vinderborn: 1756).

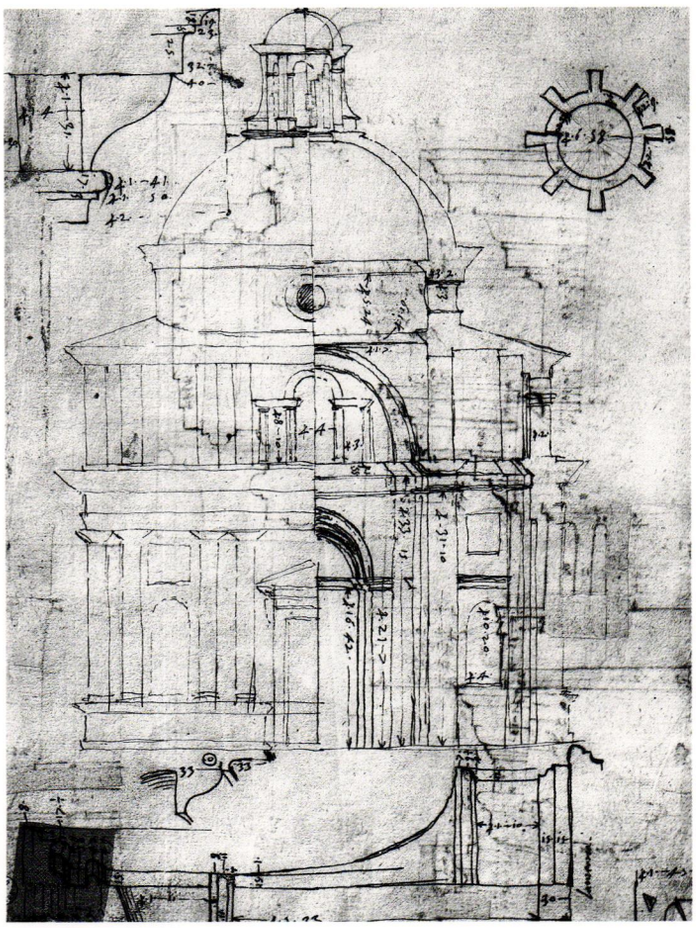
15. C. Wolff, *Elementa Matheseos universae*, ed. nova, vol. 4 (Halle: 1738), p. 487.

16. The "Lettere a Papa Leone X" is reprinted in the collection *Tutti gli Scritti di Raphael*, edited by E. Camesasca (Milan: 1956), p. 63.

years later the *Lexicon Philosophicum* of Micraelius defines the term *sciographia* as an ordered representation of the facade and sides of an edifice. As synonyms he posits the terms *modellum*, *profilum*, *protypum*, *proplasma*.[12] And it is probably not until the end of that century that one finds a clear identifi-cation between *sciographie* and *profil*, in Ozanam, who defines the latter as the "geometric and orthographic elevation that lets one see the inside of a building."[13] Henceforth, the etymology invoking shadow refers to the object described (the insides of which are in shadow by definition) and no longer to the manner of representation and image alone. Such an interpretation is affirmed in the various usages of the French word *coupe*. Essentially, in civil architecture the term *coupe* designates the area of a portion of an edifice, already built or yet to be built, by means of a vertical plane between the outlines of which the interior elevation is represented. Such a figure is still called *intersectio* by C. Rieger, who in 1756 defined it thus: *Delineatio aedificii, quale apparitum esset, si murus primarius externus removeretur*, or "the delineation of an edifice, as it would appear if the primary outer wall were removed."[14] This delineation may be either a flat or perspective view. The former case was termed *Orthographia interna* by Christian Wolff in his *Elementa* of 1738;[15] yet this method was designated as early as 1519 by Raphael, in his famous letter to the Pope, by the denomination *parete di dentro* (inner wall).[16] There are a great number of images that correspond to this prescription and Daniele Barbaro gives an example of one in his *Practica della prospettiva* of 1568, where the model of a central plan *tempietto* is represented with an acute sense of the economic codification of graphic information. The same representation connects, by rabattment of the half-plane, the orthographic ensemble of section plus elevation. This is achieved by revolving the half-plane around its line of intersection with the other plane until the two planes coincide. This type of delineation would become the fashion and we should not be surprised to see it adopted with diverse and ingenious variations by Palladio in his celebrated *Quattro libri*, as well as in many of his original designs.[17]

The *parete di dentro* is termed much later, by Guarino Guarini, as *interna facies*, which is a section on a flat background or section elevation.

17. Palladio practiced the rabattment of the profiles of members onto the figures of their elevations; the rabattment implied a logical disjunction in the reading of diagrams and their conceptual recombination, just as in Barbaro, who had introduced superimpositions of transparent plans. For a long time the drawing of the dimensioned perspectival section of the "Tempietto alle Fonti di Clitumno," no. 22 in the collection of the Civic Museum of Vicenza has been attributed to Palladio; now scholars tend to think that it is one of those drawings of antiquities that humanist architects used to exchange in their keen hunger to appropriate ancient models.



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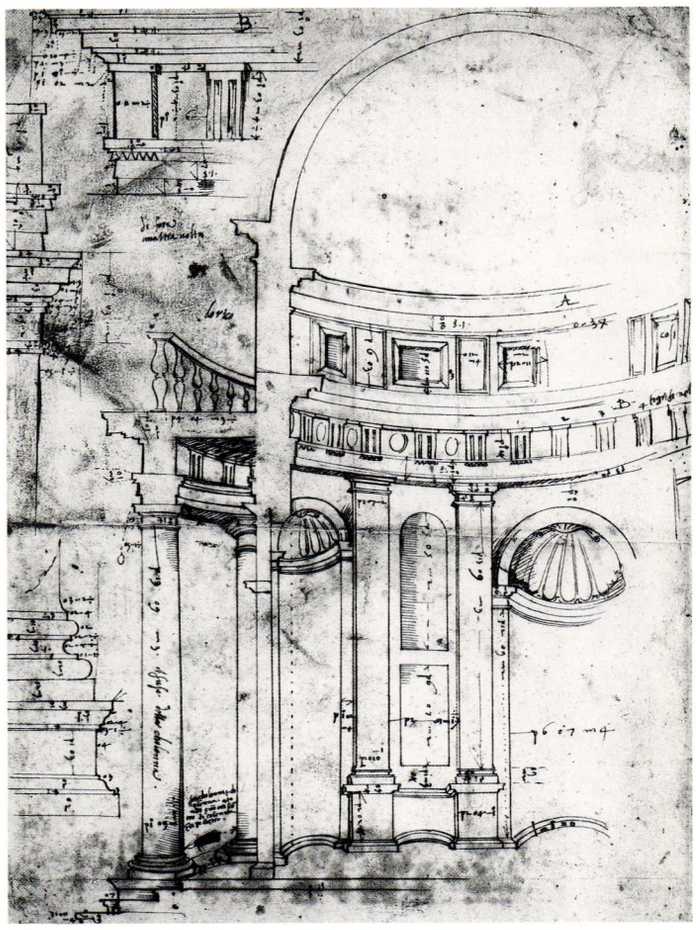

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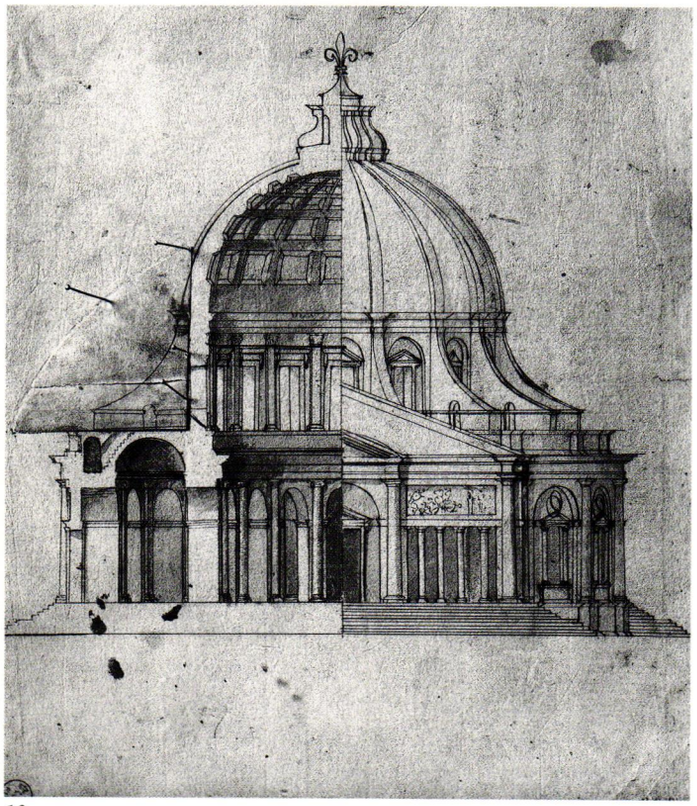

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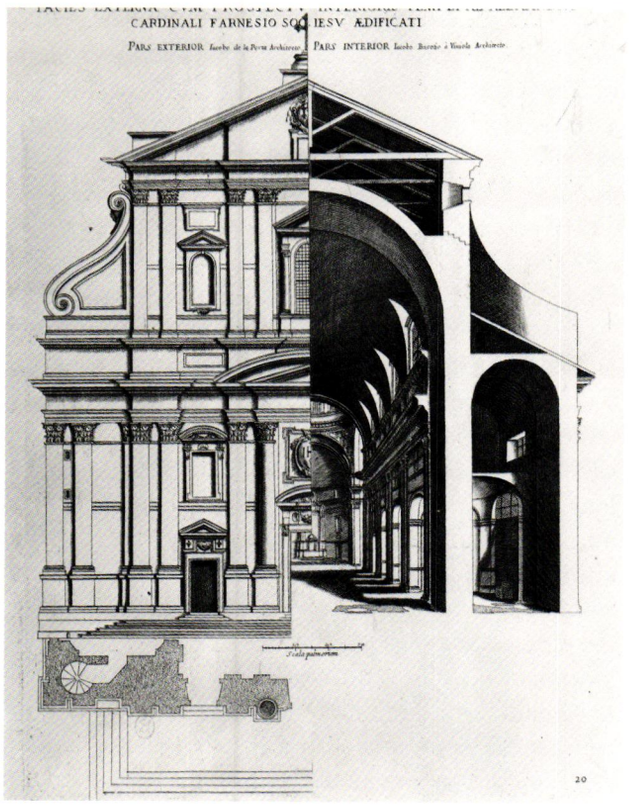

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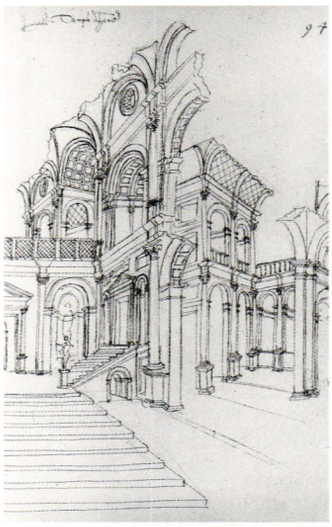
18. Although we know that two programs had been given for a *Grand Prix* in 1701. See the excellent study of J.-M. Pérouse de Monclos on the *Concours de l'Académie royale d'architecture au XVIIIe siècle* (Paris: Berger-Leuorault, 1984).

19. See the two imposing volumes of *Disegni di architettura dell'Archivio storico dell'Accademia di San Luca*, edited by P. Marconi, A. Cipriani, and E. Valeriani (Rome: De Luca, 1974).

However, around the same time one witnesses the development of the equally ingenious practice of juxtaposing flat or diminished semi-elevations with perspective views of the corresponding interiors, or even with actual sections from which issues the entire perspective disposed in the background. Such is the case with the famous "Desseing du dedans de la chappelle dans le logis" of Anet, engraved for the *Premier volume des plus excellents bastiments de France* by Jacques-Androuet du Cerceau of 1579. To him we are indebted for his great cleverness in the graphic representation of complex edifices, and it is no accident that to him have been attributed the astonishing architectural fantasies of the Fitzwilliam Museum.

In these drawings the designer plays, in more or less accelerated perspectives, with a capricious variety of architectonic milieus. This formal effervescence, however, so typical of the Renaissance, would gradually be sobered under the weight of scholastic conventions in the so-called "classical" and "baroque" eras. The collections of the Académie d'architecture de Paris, founded in 1671 but not regularly holding competitions until 1720,[18] as well as those of the renderings of the competitions of the Accademia di S. Luca in Rome beginning in 1677,[19] show the canonical usage of section/elevation drawings in the exercises given to students. The programs most often prescribed a cross section or longitudinal section, but



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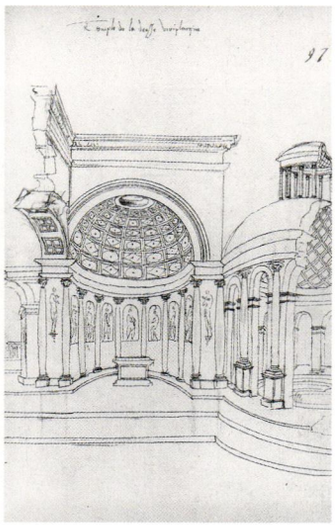

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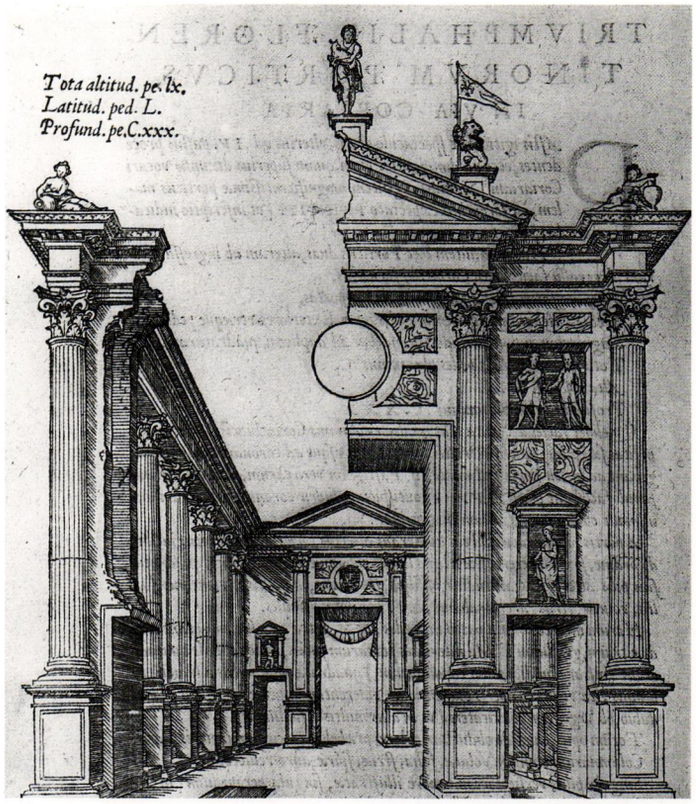

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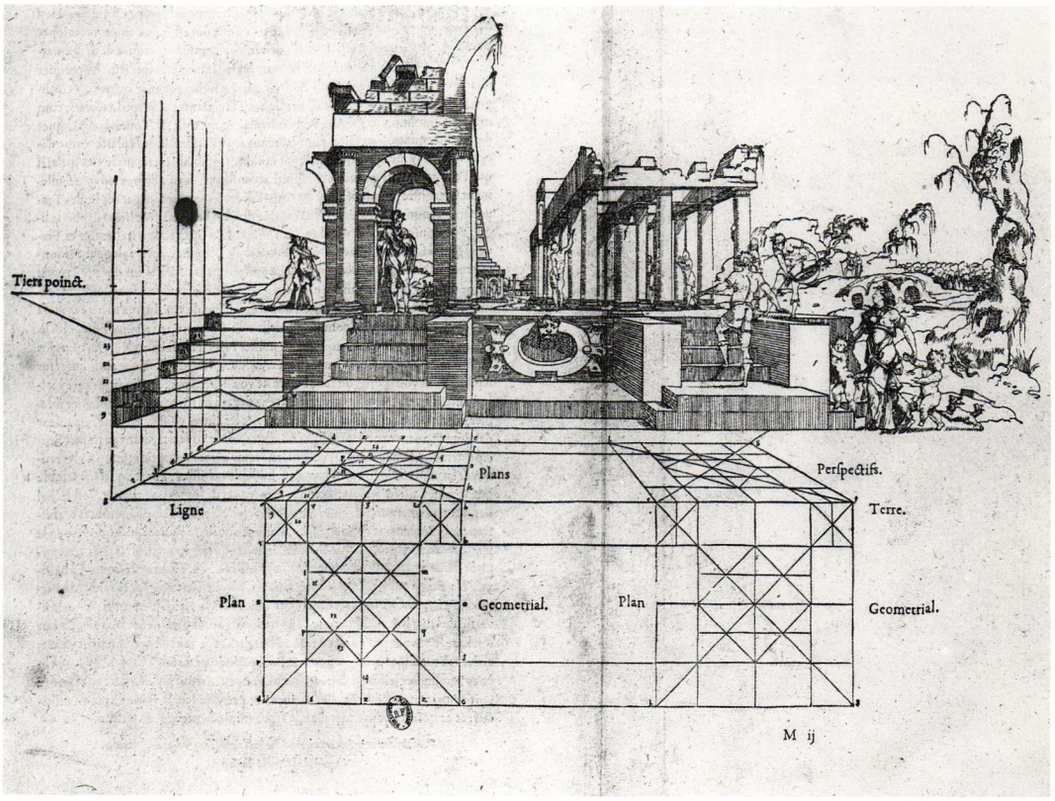

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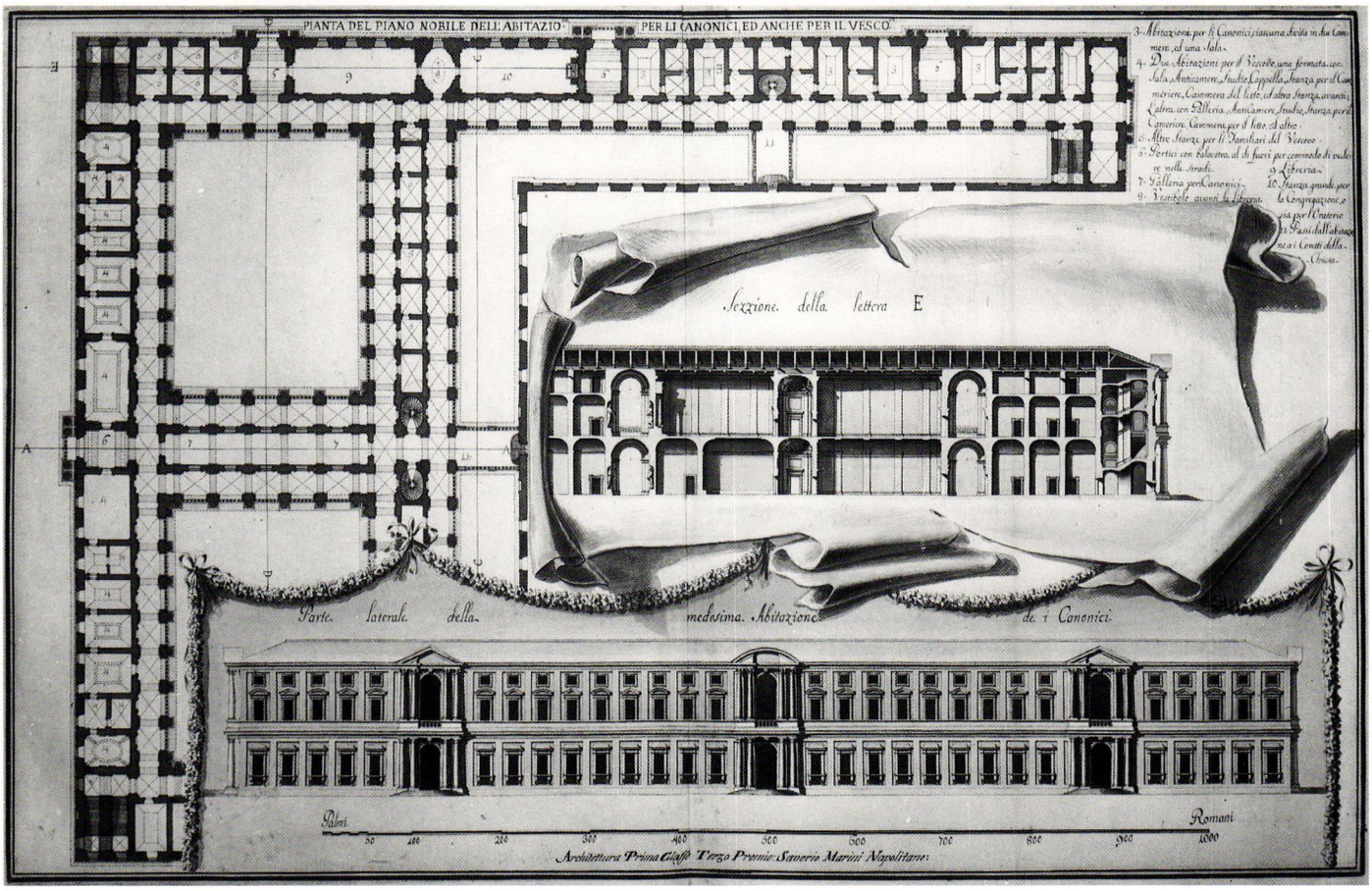
13. G. A. Dosio, project for circular temple, section/elevation.

14. J. Rossi, Insignium Romae Templorum prospectus . . . , *1684, elevation/section perspective with plan.*

15, 16. J.-A. du Cerceau, from The Book of Architectural Inventions.

17. C. Schriver, "Triumphalis Florentinorum Porticus . . . ," from La très admirable, très magnifique et triomphante entrée . . . , *1550, section perspective/elevation.*

18. J. Cousin, "Paysage," from Livre de Perspective, *1560.*



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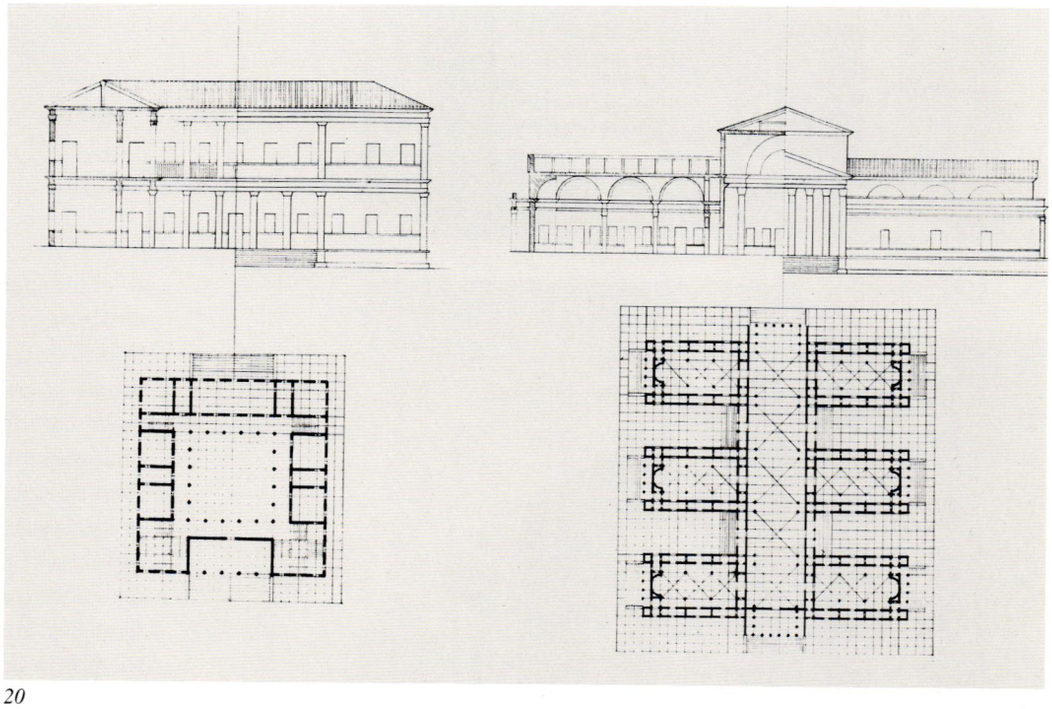
rarely two sections. Almost always, however, in the important tests, these sections were sumptuously washed by the competitors, who rivaled one another with their brilliance in pleasurably bringing out images of imaginary structures, the constructibility of which was often problematic. Against this same lure of graphic virtuosity would rise up, with good reason, such doctrinarians of the so-called "neo-classical" period as Quatremère de Quincy and, to an even greater degree, J. N. L. Durand, professor of architecture at the Ecole Polytechnique, who militantly fought for a severe economy of graphic practices and a rationalization of the process of conception. This method favored the section for the deduction of the elevations of facades and their correlation with the plan. In so doing he was only providing the means for an enlightened functionalism which matched, combined and arranged the required functions of an edifice, outlined their volumetric dispositions and subordinated therefore all decorative intentions.



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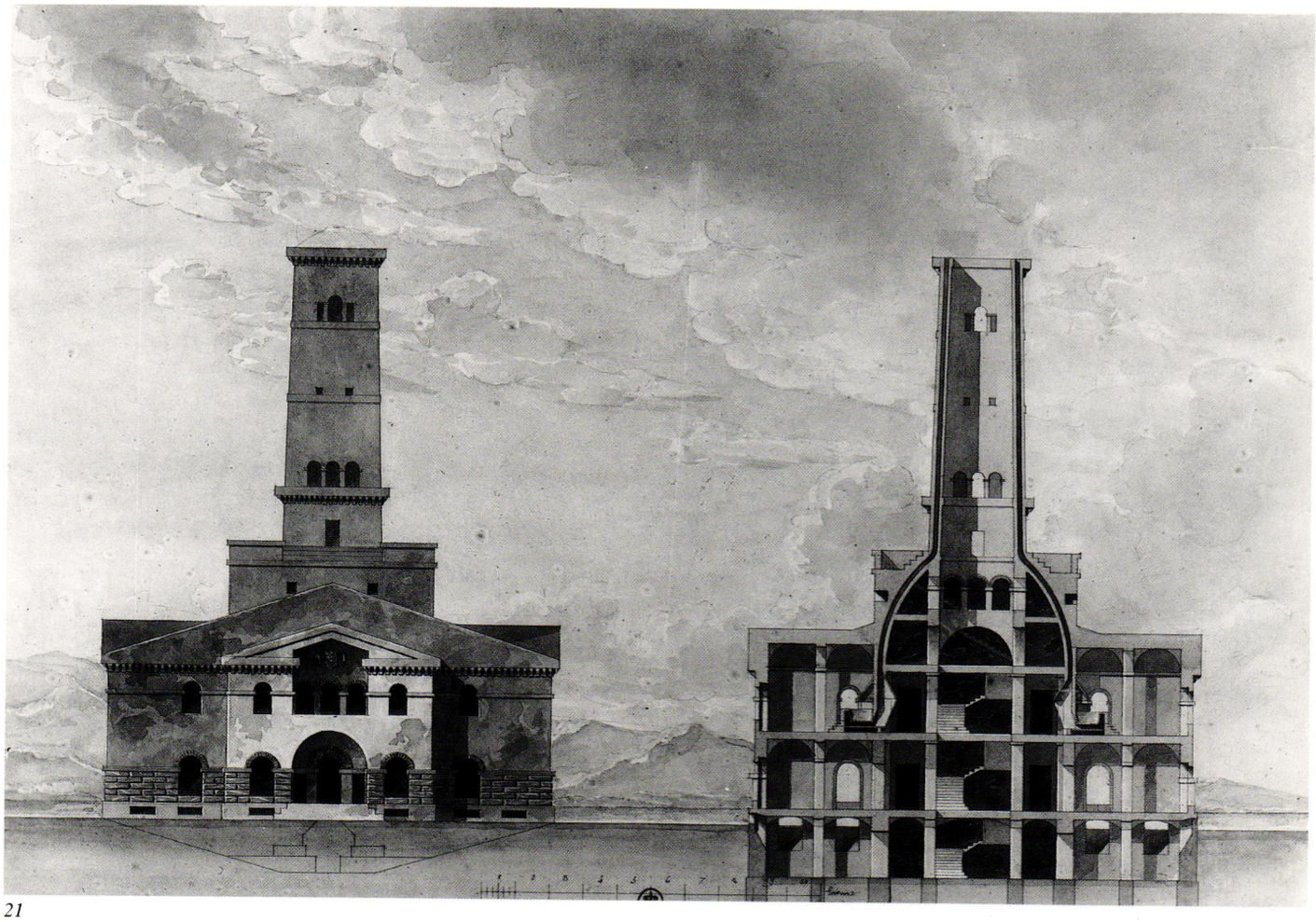

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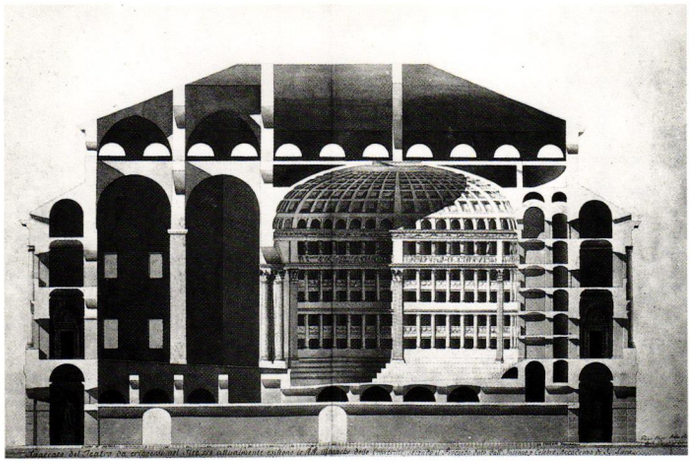

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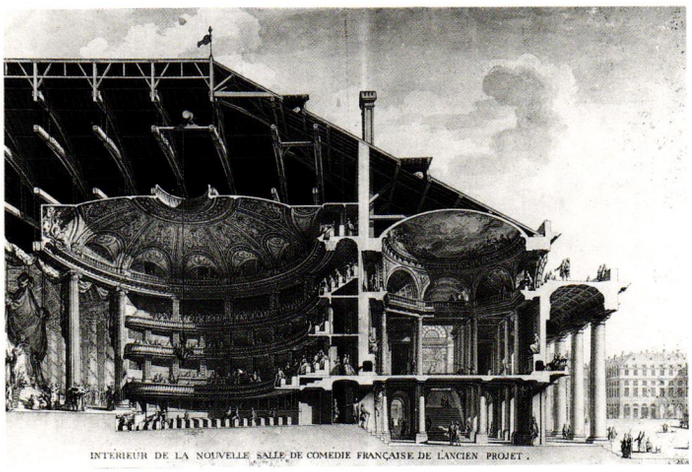

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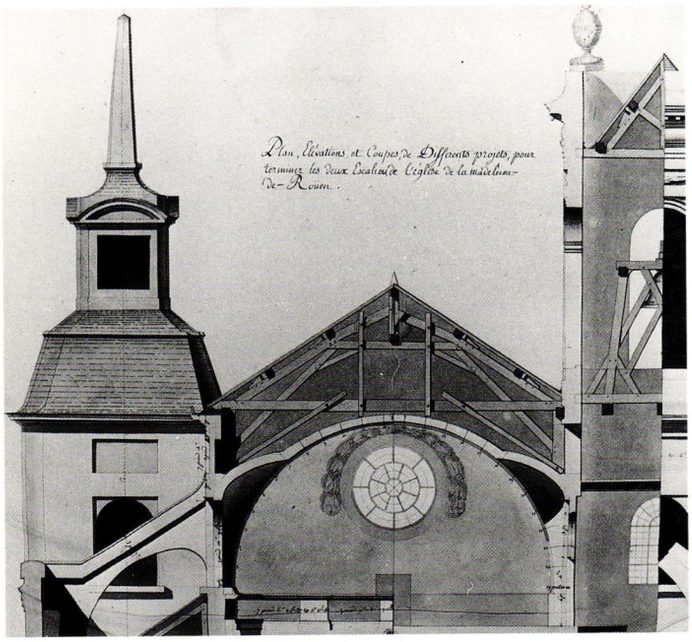

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It is clear, furthermore, that many a complex structure is defined first and foremost in relation to its section. This is true for theaters whose exteriors give little indication of the machinery inside. It is even more true for buildings established on inclined sites, where even though advantages could be gained in such locations, one had to deal with the problem of the structure's foundations and avoid interference to the line of view. Concern with the line of view was one of the primordial parameters of fortification. In this regard, the project for the cenotaph of Lapérouse by Labrouste is exemplary, as it shows, all at once, how a section design can be a means of controlling compositions and an occasion for aestheticizing the rendering of the project. This use of the section merits closer examination. In this case precisely, the section brings to light properties of the composition that would otherwise remain unnoticed upon first consideration of the constructed monument. One imagines that here the eyes would be taken up with the ingenious scenography of the sensible qualities of the elevation's surfaces. The epidermal contrast between formless roughness and formal rigor expresses the opposition between two temperaments of the universe, that of natural chaos and that of cultural memory. At the heart of the boulders – the raw material in front of the cenotaph – the alignment of the inscriptions on the polished cylindrical cut-out which winds perfectly around the model of the terraqueous globe centered on the pedestal, completes the allegory by suggesting that history prepares the time of the finite world even as it separates man from nature. Erected facing the sea, the elevation, with its display of inscriptions, dissembles all signs of the depth



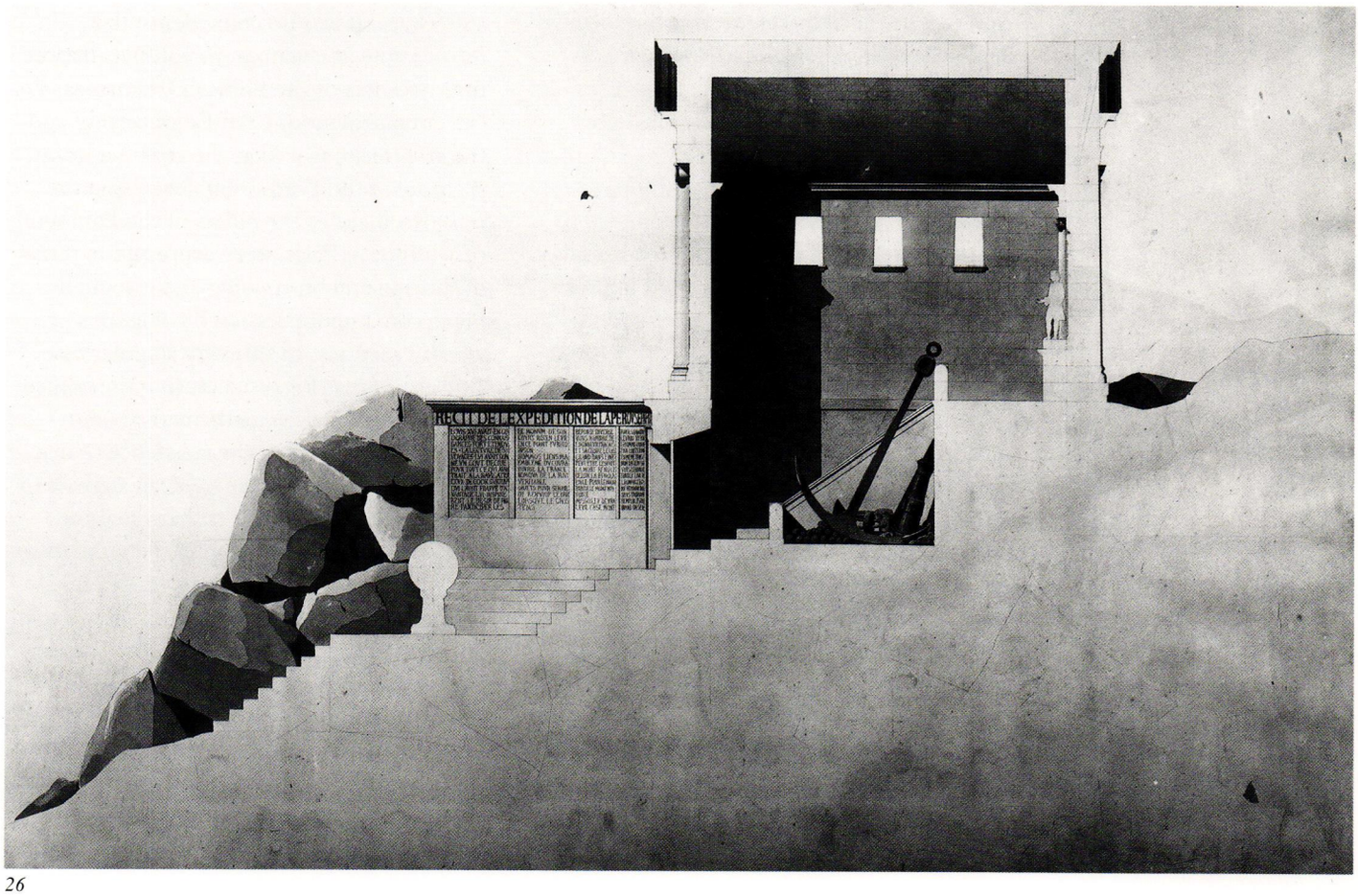
25

22. C. Barabino, Clementino Competition, 1789, Accademia di S. Luca, Rome, longitudinal section of a theater project.

23. C. de Wailly, perspective section of project for a performance hall, 1771.

24. J. J. Lequeu, from Différents projets pour terminer les deux escaliers de l'eglise de la Madeleine de Roüen, *1779, section/elevations.*

H. Labrouste, project for the Lapérouse mausoleum, 1829.
25. Frontal section
26. Sagittal section



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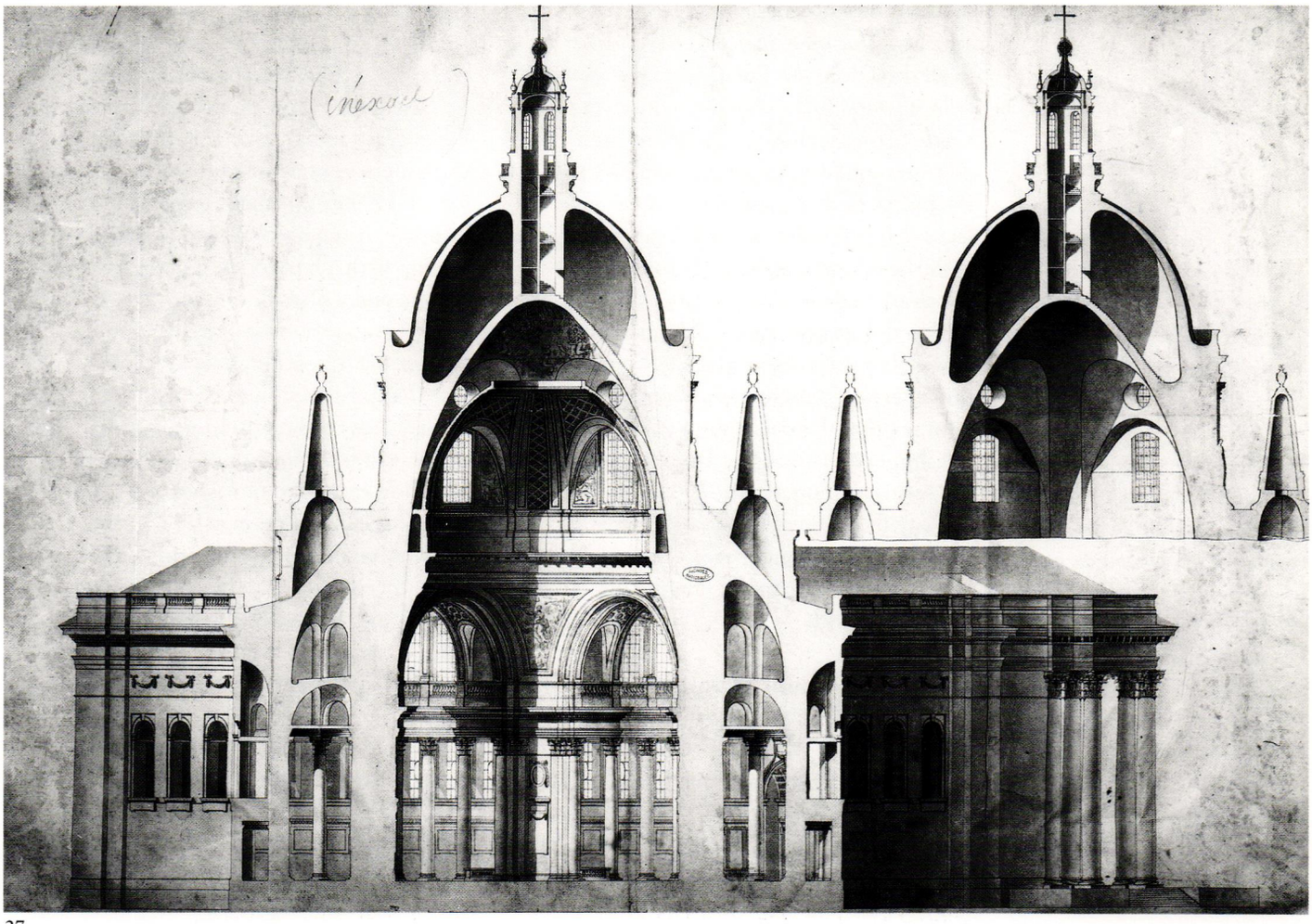
of its crypt and conceals the disposition of its secret organization. Only the sagittal section can annul the masking screen that when analyzed proves to be nothing less than a palliative. Labrouste has here brought together the signifying details of an apparatus whose primary function is to preserve the relics of a scientific expedition and to honor the political order that made it possible. The section, indeed the two sections, sagittal and frontal, enable one to see a complex cryptal volume whose visible apertures, laterally arranged, afford a bird's-eye view onto the open reliquary and the simulacrum of Lapérouse which seems, in this instance, deliberately reduced in size. Shaped by an experienced master of heroic statuary, the figure of the navigator, standing at the back of the crypt, gives orders by virtue of the *volumen*, or rolled documents, he holds in his right hand. This hand, the ring of the anchor and the center of the globe are all rigorously aligned, while the hero's creative gaze, if it were not interrupted by the bronze door, would extend without end into the ocean lapping at the foot of the structure. In other words, the architectural composition, so controlled as it is, is evidently subordinated to an intangible axis which links, on both sides of a closed door, two miniaturized figures: those of the sailor and the sea represented in the globe. These figures rest meanwhile on two "real" objects: the stock of the anchor saved from the waters and the waters themselves. It is easy to see that the forms of the project are not limited to uniting indiscriminately the necessary parts of a commemorative program, but consciously shape games of scale distortion from which emanates the semantic cluster of the composition. The mark of this relationship of scale is even more evident in the relationship uniting the rolled-up writings of the King's orders, placed in the figure's hand, with the historical text unrolled in the light of day, over the hollowed-out cylinder of polished granite; this makes sentient the doctrine that architecture, as an art conscious of its means, consists in giving meaning to artifices by relativizing their dimensions.

The case described above further instructs us that the section is, by its very essence, associated in architecture with verticality; although one can conceive of choosing a sectional plane variously inclined on the horizon, as one desires. Yet from an essentially tectonic point of view, the vertical is imperative in that it defines and divides the forces of weight, weight being an invariant parameter of all constructive practice, par excellence. If sections in architecture have diverse functions for the choices of building elements' disposition, they are *also* the necessary referent of all anticipation of construction; they determine in the most immediately visible way the relationship between forms and forces. It was no coincidence that, for example, the venomous conflicts between the engineers of the Ponts et Chaussées (the Department of Civil Engineering) and the architects, as well as the contractors, at the time of the 1796-1800 debates on the reinforcement of the pillars of the Pantheon of Soufflot in Paris, were expressed in terms of shoring and buttressing and essentially given concrete expression by diagrams of vertical sections. In this very singular case study, the ideas for restructuring the edifice bear resemblance to mathematical treatments of problems of the resistance of materials. They prefigure the modern analysis of structures for they have as their goal the conformation of supplementary members to be bonded with a masonry in danger of collapsing onto itself. Moreover, in a case as complicated as the Paris Pantheon, sections are inevitable documents of the analysis of the masonry blocks, and they affect the study of structures as well as the making of transactions. More generally speaking, from this perspective we must consider the section



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27. J. G. Soufflot, Ste. Geneviève, studies for the cupola structure.

as a sort of contractual document which the architect addresses to the commissioner and to the contractor, if not implicitly to himself as well. We would do well to recognize at this point in our historical survey that the architectural section steadily gained in theoretical and practical importance as the complexity of the projects increased and the terms of the social division of labor were established. These two components of the practice of civil architecture are well illustrated in the history of the development of naval architecture during the very same period that we have just examined, from the Italian Renaissance to the end of the French Revolution.

To give the ship's hull a regular surface which will assume lines that curve differently in all directions, and to achieve this with the help of wood that is not curved except in a single plane: such is the nature of the work of marine carpentry. From the very fact that the pieces have at least one of their many surfaces that is rectilinear, forming a right angle with the adjacent surfaces, it follows that the ship's body is entirely composed of "right angles and straight lines."[20] It also follows that elaborating the sections is a traditional procedure of construction. One might even say that the conception of the forms of the ship takes its bearing from these sections; the forms are engendered in succession, starting from the two first and principal vertical sections, and traverse the ship's body at its points of maximum length and maximum width.

These two sections are the first ones chronologically and the principal ones in as much as all the others are deduced from them with the aid of arithmetic ratios that guide the ruler and compass. A section is the shape that *must* be assumed by the combination of parts that make up the "spine" and the "ribs" of the ship, its "skeleton": that is to say, the ensemble of keel, stem and stern, in the longitudinal section, and floor timbers, stanchions and futtocks in the transverse section. The latter section, and the others derived from it, are nothing but the representations of the chief frames of the vessel, designed full-size in the template room and cut up into thin or cardboard planks. These frames are then arranged at precise intervals across the keel; the wood pieces that constitute them have been patterned after these models. At the same time, the master carpenter makes projections on the ground with the help of a plumb line and rulers graduated according to certain heights taken from the frames, which allow him to regularize the outlines of the horizontal planes and particularly the "water line" that descends along the ship's hull at a pre-established angle.[21] Thus the builder's "plan" is only a means for controlling the regularity of the vessel's profiles. It is rendered precise during the course of construction.

It was not at all the same for those who, starting around the 1640s, had a hand in naval architecture. One might even say that the rift between architecture and construction was expressed in the manner in which one used the terms "plans" and "sections." The royal ordinance of 1683 obligated carpenters to represent on paper the vessels for which they are about to present an estimate; it required "a plan in vertical section with a horizontal section," that is, a section and a plan. Several years later, Father Paul Hoste, professor of hydrography at the L'ecole d'hydrographie at Toulon,[22] added a third section to the list which would be taken along the water line, and specified the reason for this requirement: "As the plans [or drawings] of vessels must provide an exact representation of all the vessel's parts, three different projections will be made thereof."[23] The word was spread: the section is but a projection according to a plan; at the court, it is called "plan in section," or as we know it, a sectional drawing.

In 1746, Pierre Bouguer, in his *Traité du navire* describes various methods for "projecting the whole vessel onto a plane perpendicular to its length," that is, in section/elevation.[24] This design practice, which appeared in the 1670s, became widespread at the start of the eighteenth century. It consists of representing in a single figure the exterior curves of all the chief frames,[25] which start to narrow at the midship beam, and arranging the frames of the stern and stem on either side of a median, or the line of vertical symmetry. "This sort of projection suffices to let one know the form of the ship and to enable the builders to start construction," and "if one wishes to project the ship onto any other plane, it will be easy to deduce this new projection from the first one."[26] However, the same Bouguer points out that "the word 'section' in shipbuilding is applied particularly to those sections that are made perpendicular to the ship's length and the first one is the largest of all, the one that indicates the master model or the midship frame."[27] These observations by Hoste and Bouguer are indicative in more than one way of the complex connections existing between the knowledge and practice of shipbuilders and that of the "geometers and physicists" who strove to rationalize building practices according to their own models and principles.

20. Hobier, Counsellor to the King and Treasurer General of the Eastern Navy, *De la construction d'une gallaire et de son equipage* (Paris: 1622), p. 4.

21. This incline corresponds to what the carpenters called "pitching by stern," that is, the ship's tendency to sink towards the back.

22. Father Paul Hoste was a Jesuit and originally from Bresse – two reasons for Colbert to doubt the validity of his teaching. He was thus sent to sea, and accompanied D' Estrée and Tourville on expeditions. His *Hydrographie*, reprinted numerous times, shows a concern, rare among educated men at the time, for practical usefulness.

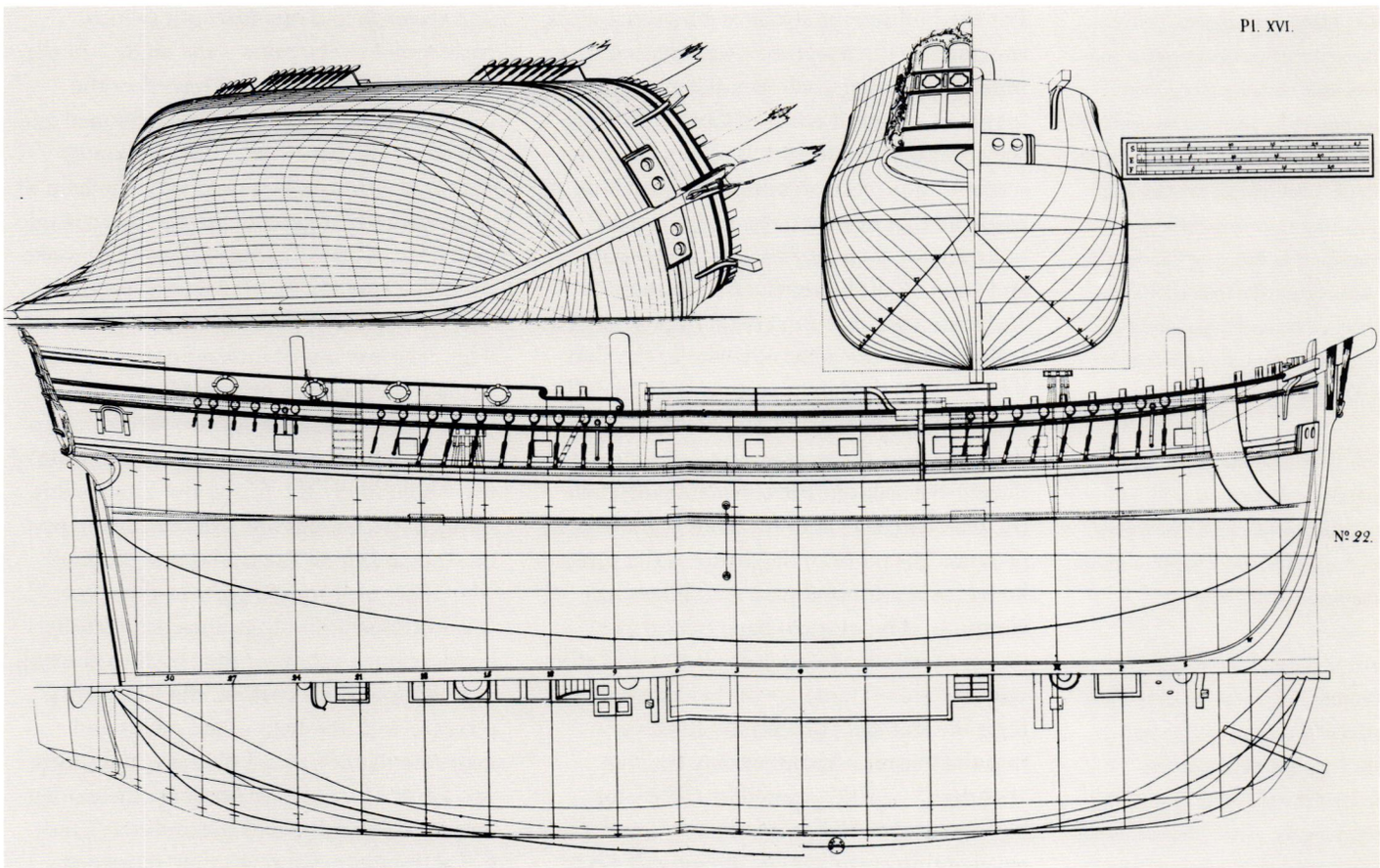
23. Father Paul Hoste, *Théorie de la construction des vaisseaux* (Lyon: 1697).

24. Pierre Bouguer, *Traité du navire* (Paris: 1746). Pierre Bouguer, mathematician, physicist, astronomer and geographer, taught hydrography in the western ports.

25. These are the frames arranged according to the models and templates; the other frames, filling frames, have been traced from the beginning with the aid of ribbands (horizontally placed planks) which served as references for establishing dimensions.

26. Bouguer, *Traité du navire*, p. 56.

27. Bouguer, *Traité du navire*, p. 27.



28. F. E. Chapmann, Architectura navalis mercatoria, *1775*.

For the builder, the *section* is a material work instrument: the *template*, a wooden mold or millboard pattern, full-size; the *plan* is only a means of practical control. Conversely, for the architect, the section is only a "plan in section," a projection onto a plane that might easily be that of paper: the projection of one section, then quickly of several sections, and soon of all the transverse sections. As Hoste says: it is a question of providing a form with all the parts of a whole, the ship. The architect's plan in section is an analytic process that starts from the whole to get to the parts. For the master carpenter, producing the section (the template) and then the plan (the checking method) is a synthetic process. His point of departure is the timbers he has at his disposal with which he must compose. If he cannot shape the proper pieces of wood, can he prepare to build with only the aid of drawings of the curves that limit the frames? It is certain, however, that the master carpenters only became "builders" – a title granted in 1689 – for having adopted the point of view that defines naval architecture: taking the intended purpose of the work as the point of departure rather than using the parts as a point of departure. François Coulomb, master builder of the vessels of the King at the shipbuilding school in Toulon, begins his *Livre de construction des vaisseaux* by declaring that "it is necessary to show the reasons which are the basis for giving proportions to the keel of a vessel touching the earth"; that is, "one must proceed according to the quantity of cannons the vessel is to carry," which makes it possible to calculate the total length, from stem to stern.[28] This length, reduced by one eleventh and one fifteenth (which correspond to the rakes – the angle – of the stern-post and stem-post) furnishes the keel's length. Once the keel is fashioned and placed on the land-line,[29] the stern-post and stem-post can be raised with the help of apparatuses that geometrize the space inside which the vessel is being erected. The same would be true for the transverse sections.

This requirement of interpreting the sizes of parts on the basis of dimensions represented on the plans in section forces one to go back to working with the configuration of the whole to get the forms and dimensions of the parts, so that one can once again proceed according to the traditional method which moves from the parts to the whole.[30] It is to this arithmetic gymnastics that the builders must submit if they wish to control, according to their custom, the forms they produce with the help of the tables and instruments they use. There are, therefore, two kinds of transverse sections: the carpenter's frame drawing and the architect's sectional drawing. Although they represent, based on the same divisions, the same bodies of the same vessels, they differ from each other in that they belong to two different modes of intelligibility of the tangible, whether we are talking about the material and form or the time and space with which one is working.

One may interpret the history of shipbuilding in this era as a constantly renewed attempt to make the two kinds of sections coincide. In this respect the construction of warships made of wood and propelled by

28. François Coulomb, "Livre de construction des vaisseaux contenans le nom des pièces, leurs liaisons et les proportions générales de la masture, comm'aussy pour les fluttes et chaloupes par Coulomb fils, Maistre-constructeur des vaisseaux du Roy dans l'Escolle de construction de Toulon," Bibliothèque Nationale, Manuscrits, nouvelles acquisitions françaises, ms 4070.

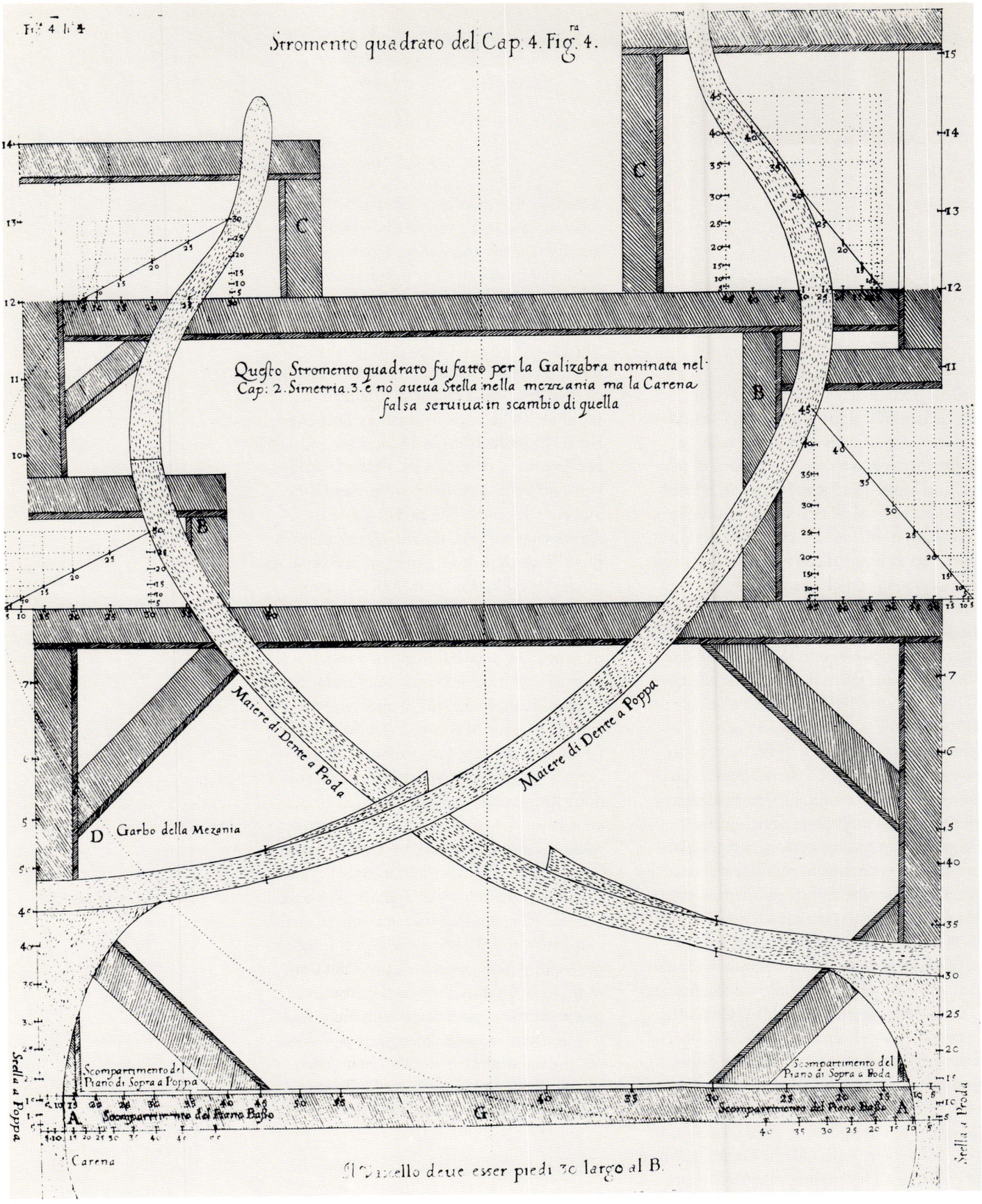
29. The land-line is the line traced on the ground at the outset of construction upon which part of the keel is placed when forming the shape of the ship.

30. In the mid-seventeenth century and in most cases into the start of the eighteenth century, the length of the vessel was defined by the length of the "keel touching the earth"; the keel being "the basis and foundation from which all the other parts take their dimensions." See Dassié, *L'architecture navale* (Paris: 1677), p. 15, and Aubin, *Dictionnaire de la marine* (Amsterdam: 1702).

sails is particularly interesting. Such construction began to spread in the mid-seventeenth century and in the late eighteenth century reached a level of perfection as the product of plans calculated by engineers. Although limited in terms of duration, the construction of warships gave rise to innovations and was subjected to normative constraints. An object of concern to governments, it inspired a broad literature: memoirs, inquiries and statutes that make it possible to follow the history. One can distinguish three phases: the first was around the 1640s, and the work by Robert Dudley, *Dell'arcano del mare*, gives one a good outline of it. This work represents a great effort to control the design of frame models according to the tradition of the master carpenters. The second stage corresponds to generalized concern among governments to regulate the vessels according to rank and to geometrize their forms. This period is characterized by cross-sectional drawings which present all the sections in a single representation and indicate only the exterior profiles of the frames. This holds true until the mid-eighteenth century, at which time the builders, who were becoming engineer builders, began to grapple with the internal structure of the vessels and with the disposition of the parts designed to strengthen it. One witnesses in this third stage, especially in France, an orgy of minutiae. The engineer builders form assemblages of parts and no longer merely assembled parts. The advantages of systems of reinforcement made visible in sections were the result of "calculations" that aimed to optimize the diverse and contradictory functions of a *machine* of this sort. Such a machine was to be supple and strong, solid and light, swift and stable. The vessel is henceforth conceived as a physical object, subject to calculable forces. Its forms and structures must result from the application of physics to the arrangement of its parts. The "builders," formerly "master carpenters of the navy," have become "engineer builders." The royal ordinances ratifying these denominations in 1623, 1689 and 1765 also institute, correlatively, certain relationships between conception, representation and construction. The result is that the approaches adopted for the representation of sections show how, during this period, the modes of *application* were opposed, combined and transformed in shipbuilding: the application of a tangible body onto another, of a tool to a material form, of a theory to matter. These modes of application correspond respectively to the practice, the art and the science of construction, which, far from being mutually exclusive, never cease to assist and support one another, and not without certain confusions.

Most assuredly the work by Dudley marks an important moment in the transition from the first of these sorts of application to the second. His ambition was not only to enable carpenters to *fabricare in simmetria i vascelli*, or "build vessels symmetrically," but even more to be able to do so in the absence of the inventor who claims to wish to find *il remedio per redurgli in maggiore perfezione*, or "the method for reducing them [the vessels] to greater perfection."[31] To these ends, Dudley puts forward his "invention":

31. Roberto Dudleo, *Dell'arcano del mare* (Florence: 1646). Dudley was known as Dudleo when he wrote his book.


Stromento quadrato del Cap. 4. Fig.ra 4.
Questo Stromento quadrato fu fatto per la Galizabra nominata nel Cap. 2. Simetria 3. è nō aueua Stella nella mezzania ma la Carena falsa seruiua in scambio di quella
Matere di Dente a Proda
Matere di Dente a Poppa
D Garbo della Mezania
Scompartimento del Piano di Sopra a Poppa
Scompartimento del Piano Basso
Scompartimento del Piano di Sopra a Proda
Scompartimento del Piano Basso
Stella a Poppa
Stella a Proda
Carena
Vascello deue esser piedi 30 largo al B.

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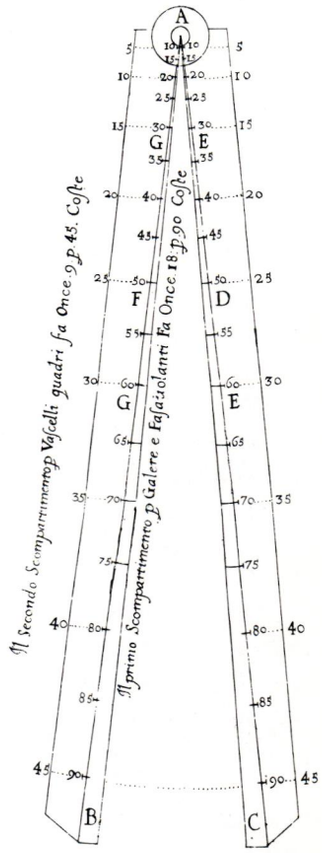
an ensemble of instruments conceived to design the templates of different kinds of ships. Once one knows the main dimensions customarily used, it is a matter here of adjusting the proportions and forms of all the chief frames. Four instruments make this possible: two *tables*, one of principal measures, the other of proportions; a *compass* to relate the former to the latter at full scale on the templates, which is done with the aid of the fourth instrument, a quadrangular *wooden model* whose parts are arranged and calibrated so that the measurements can be easily converted into regular curves. The references are letters and numerical progressions corresponding to the tables, compass and model. The sections are defined on the basis of the largest dimensions. The vessel whose timbers are here being constructed must be twenty feet wide in B along the section corresponding to the point of greatest width (*Garbo della Mezania*), which is indicated by the dotted line.

When Dudley, in his *Dell'arcano del mare*, presents his "invention," we should understand this word in the sense of discovering, bringing to light and divulging a practice kept silent as a trade secret. Nevertheless, he is not content merely to describe the steps of construction, but furnishes as well the means to realize them in accordance with his intentions. His intentions require working according to such a method as that by which the master carpenter produces an object, in keeping with the prescribed dimensions and the plans and sections that he has designed and wishes to apply. However, in Dudley's work these plans are presented *after* the instruments that are supposed to make their realization possible. This is certainly no accident. On the contrary, everything leads one to conclude that this order (instruments, then plans and sections) expresses the relationship that is established between the general and the particular. It is the instrument that is mathematical. As such, it *must* be universal. Thus we must start with it, and follow an order similar to that of strict deduction: from principles to their application to the tangibly diverse.

Still, these instruments, by their very conception, manifest a concern for generalizing and mastering traditional procedures, as well as for synthesizing know-how. This is evident, first of all, in the comparisons made between the dimensions of different ships and the vessels of different nations (first instrument), then in the progression of proportions characterizing them (second instrument), together with the compass which can be used for numerous kinds of ships (third instrument). The third instrument bears on the outer faces of its "legs" the calibrations corresponding to the proportions of one kind of vessel; on the inside faces, are those corresponding to galleys and *passavolantes*. Lastly, the fourth instrument applies to all the sections of one same ship. Although the latter instrument indicates a concern for synthesis, one that submits to constructional considerations, the same is not the case for the third instrument. What could be the usefulness, in designing the forms of a galley, of employing at the same time calibrations used in the design of a vessel? Might this



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29. R. Dudleo, Dell'arcano del mare, *1646, third instrument.*

30. R. Dudleo, Dell'arcano del mare, *1646, fourth instrument.*

double calibration be the manifestation not of any considerations of usefulness but of the contemporary wavering between generalizing synthesis and universalizing abstraction? We know that in this period a great number of new instruments were invented and each time declared as the *universal* instrument for measuring *every sort* of vessel. Such a claim by itself contains the contradictions of this ambition.

The fact remains that the ensemble of instruments presented by Dudley reveals an order of conception in which the forming of the material is no longer dictated by the chronology of the acts of construction, which used to start from the available materials. It now becomes possible to follow the architect's intentions: to start from the dimensions and the sectional drawings, or better yet, to move indiscriminately from one determination to another. At least such is the claim made by Dudley. That it took a century to come close to this ideal should come as no surprise.[32]

Colbert, and after him Seignelay, Minister of the Navy and State Secretary, had to rebuild the French fleet and together they made decisions to obtain the best vessels possible. In following their correspondence, one notices that they give their attention first to the dimensions of the vessels, then to their proportions.[33] Regulating the relation between the principal dimensions and those of the parts is essential when it is a matter of reproducing the same vessels. In handicraft production, identical reproduction presents the greatest of difficulties. It is in this connection that one finds expressed in the correspondence the need to obtain the "*true* proportions." They come to realize that knowing the dimensions is not enough to construct the proper forms, entrusting this task to the good will of the carpenters. One must also direct their "manners," (*maiere* in Dudley), that is, the "sweeps," the methods and the forms.[34] At this point we enter a second phase, starting in 1670, where it is a question of applying oneself to the "manner" of forms, and in particular to that of the cross-sections.[35] In 1671, Colbert envisages the creation of building councils that will bring together, in the ports, the representatives of the administration, officers and master carpenters. It is a question of conducting "the constructions in such a way that one is assured that in building according to the established proportions and dimensions the vessels will be successful."[36]

In 1681, the schools of construction were founded[37] and, in 1683, the ordinance for the Navy is promulgated whereby the carpenters are required to make sectional drawings of vessels before construction. From this period on, carpenters are subjected to new obligations concerning the disclosure of their knowledge. They must teach what they know in the schools, which does not come about without difficulties, and they must write memoirs and books on building.[38] The same, however, was also asked of officers such as Duquesne and Tourville, and of the engineer Renau. Inspectors of construction were sent into the ports to get the carpenters to talk and to compare, and even to correct, their practices.[39]

32. In 1681, in a memoir sent to the court, de Viniers, a captain, cites *Dell'arcano del mare* as one of the rarest of books "in the hands of the curious" and requests that a new one be made "which His Majesty would have printed and would sell cheaply in seaports" (Archives Nationales, Marine G 86). This book represented a veritable summary of all related knowledge at the time in Europe. *L'Hydrographie* by P. G. Fournier, printed in 1643 and more scholarly than scientific, proposed on the other hand a geometric method for drawing sections.

33. This was during the 1660s, a period marked by much espionage, the purchase of foreign vessels and the arrival and acceptance of Dutch carpenters.

34. See the January 28, 1660 letter by Colbert to Hubac the younger, a carpenter sent to Holland who was later to pass through England: "Beyond the general observations you make, you must, if possible, inform yourself as to the detail of the proportions, as it is essential to know how many feet of keel a vessel with 100 cannons has." In P. Clement, *Lettres . . . de Colbert*, vol. 3 (Paris: 1864), p. 234. A "sweep" in shipbuilding terms refers to a method of tracing the curves of the ship's main members.

35. See the letter from Colbert to Colbert de Terron, March 5, 1671: "I beg you to consider very carefully what I wrote you on the modes of construction in England and Holland." In Clement, *Lettres . . . de Colbert*, p. 346.

36. Letter from Colbert to Duquesne, September 18, 1678, Bibliothèque Nationale, Manuscrits, nouvelles acquisitions francaises, ms 9481.

37. Archives Nationales, Marine G 86.

In 1679, the engineer and mathematician Renau invents a machine that is supposed to make it possible to copy frames. In 1680, Tourville has the templates used at Toulon reproduced, "in order to send them to every port."[40] Blaise, a carpenter, constructs a demountable model of a vessel that is dispatched to the court where it will serve, at a colloquium including Tourville, Duquesne, Renau, Blaise and Hoste, "to regulate once and for all the proportions of all the ribs of every vessel."[41] Renau there presented his machine and a manuscript, "Mémoire sur la construction des vaisseaux dans lequel il y a une méthode pour en conduire les façons" ("Memoir on the Building of Vessels: In Which is Contained a Method for Managing the Sweeps").[42] The "machine" tried out during 1680 is sent to the ports in January of 1681. In the meantime Seignelay tempers Renau's geometrical ardor because his instrument cannot determine sections: "You must not delude yourself that you have already reached such a level of perfection," but only rectify profiles and, he writes, "above all, you should remember that it is not up to you to determine the proportions, but to follow with your machine those determined by the master carpenters."[43]

Renau's method eliminates the traditional combination of circle arcs, arithmetic progressions and reductions. It creates an ellipse, with the aid of a single mechanism made up only of a square, over which one moves a ruler. It is the extremity of this ruler which, by its movement, describes the elliptical line. In his memoir, Renau proceeds at first to a "demonstration" of his machine, which is "entirely geometric and presupposes many principles thereof," and he then arrives at "the manner of forming all the templates."[44] A single example of such a diagram suffices for the instruction of all, since the "manner" is always the same. This single "manner" ensures the regularity of the forms engendered and confirms the geometric – hence universal – character of his method, which replaces the "depression of the line of vaults" of which Hobier spoke, and which he claimed was traced by rough estimation. To read Dudley, or the *Livre de construction* by Coulomb, whom Renau had seen working in Toulon, one realizes that these "depressions" were in fact rigorously regulated with the help of a number of instruments of various sorts, manufactured with the help of dimensions obtained in the course of construction and above all regulated according to different dimensions. The regularity of the forms depended on a number of maneuvers and calculations that allowed for a margin of error. This multitude of different operations and this fragmentation of calculations are, like the "reductions" of one series of shapes to another, properly the work of the craftsman. With Renau's machine every vertical section outlines an ellipse and every horizontal section (that is, plan), outlines a parabola. The mechanical generation of lines obeys the principles of geometry. The vessel should therefore be a geometric figure. It is nothing of the sort, Vial du Clairbois would declare one century later.[45] Once the initial enthusiasm for geometry had subsided, Renau's machine was hardly used again, and ellipses and parabolas continued to be created from triangles and circle arcs.

38. See Coulomb, "Livre de construction."

39. See Archives Nationales, Marine C7 164, "Instructions sur le rôle des inspecteurs de construction."

40. Letter from Seignelay to Tourville, September 1, 1680, Clement, *Lettres . . . de Colbert*, p. 198. In 1681, Renau went about studying, gathering and comparing instruments used to design vessels, in order to make copies of them. "Do not forget," writes Seignelay, "to have the master carpenters of Le Havre make the same models that you made from the one from Brest." Letter of September 22, 1681, Bibliothèque Nationale, Manuscrits, nouvelles acquisitions françaises, ms 9481.

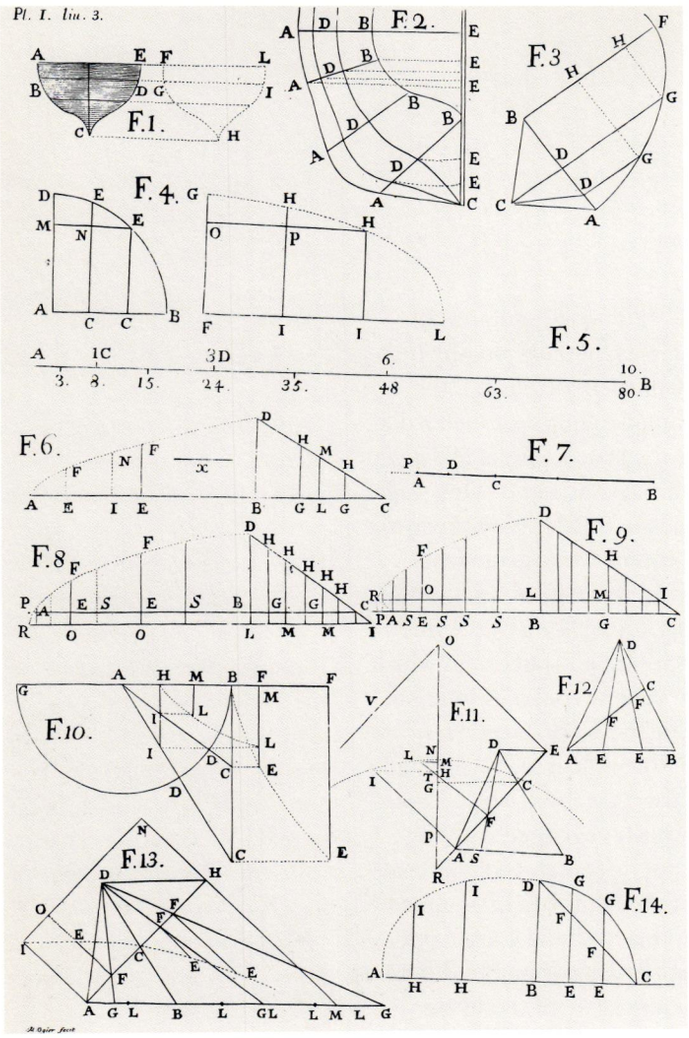
41. Clement, *Lettres . . . de Colbert*, p. 198.

42. Bibliothèque Nationale, Manuscrits, nouvelles acquisitions françaises, ms 9481.

43. Letter from Seignelay to Renau, June 26, 1681, Bibliothèque Nationale, Manuscrits, nouvelles acquisitions françaises, ms 9481.

44. Letter from Seignelay to Renau, June 26, 1681.

45. The practice of shipbuilding is "based on geometric operations, even though the body of the vessel is not a geometric figure," in "L'art de la construction. Discours préliminaire," in *Encyclopédie méthodique*, Marine, vol. 1, (Paris: 1784), p. iv. H. Pitot, *La théorie de la manoeuvre des vaisseaux* (Paris: 1731), preface, n.p.



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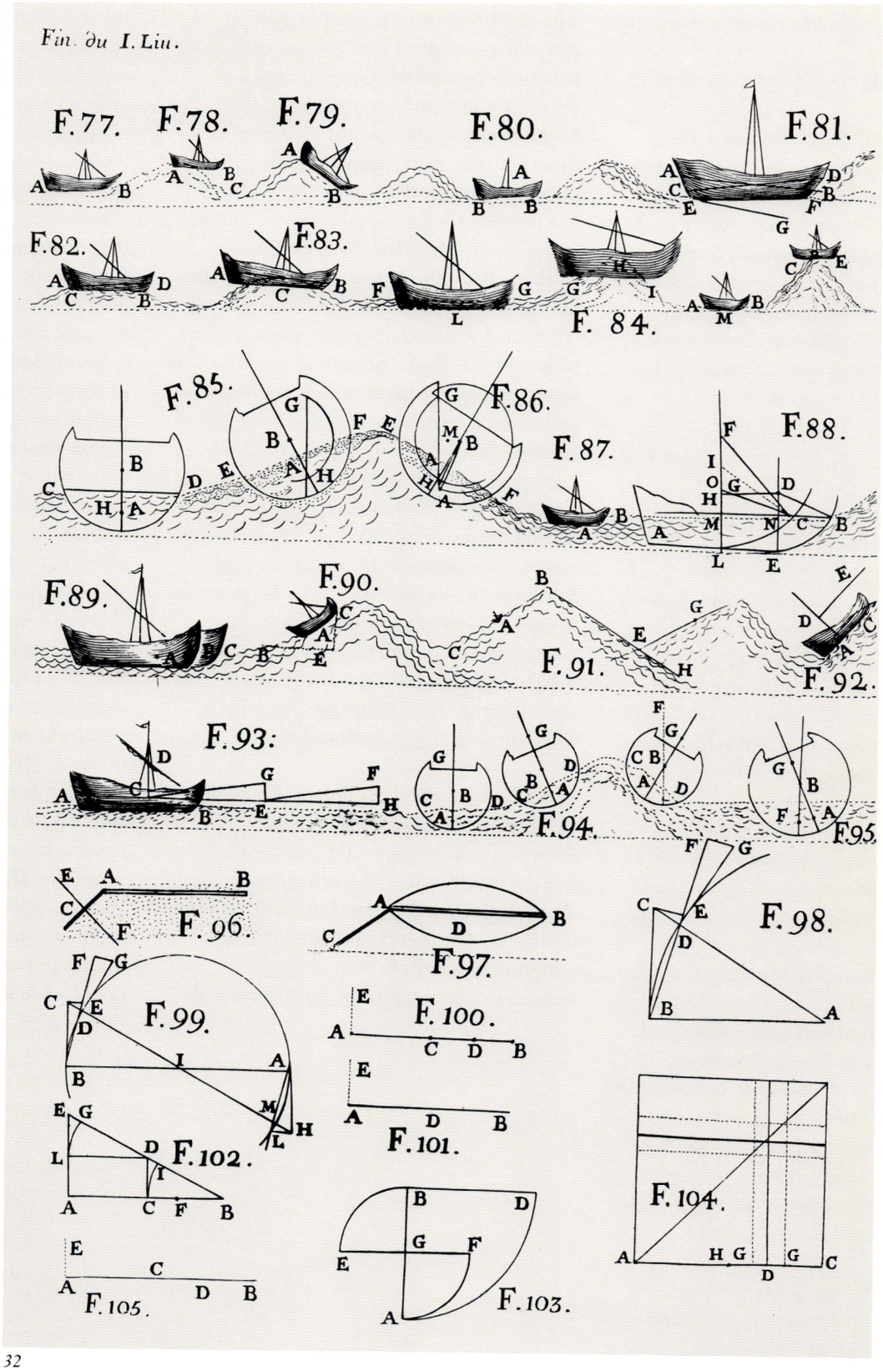
In Renau's machine we have an excellent example of the pretensions of the sort of mechanical geometry to which one aspired in the seventeenth century – and of its limits as well. The geometrization of existing forms was certainly desirable and feasible. Geometry by itself, however, cannot alone justify necessity: why choose one form instead of another? If among possible forms there exists an optimum model, it is not geometry but physics that can determine what this might be.

Certainly many great minds – such as Newton, the Bernoullis, Leibniz, Huygens, Euler, Clairaut – had been enthusiastic about applying analysis to the physics of fluids in order to determine the forms of a ship. However, when the *Théorie des évolutions navales* by Hoste was commented upon by Jean Bernoulli and Leibniz, the latter declared his own incompetency regarding the book by Hoste, *Théorie de la construction des vaisseaux*. Newton brought to the attention of shipbuilders the figure of the solid of least resistance, which he examines in his *Principle*; yet his essential interest, like that of all theoreticians, remains devoting himself to exercises of virtuosity in computation. At best, these theories only lead to an examination of the "supposed forms" of the hull. They all recoil before the complexity of "opposites" that link together forms and dispositions which the physics of fluids alone cannot justify – even if it were carried, thanks to the new methods of calculation, so far as to determine "the curve whose revolution about a straight line forms the curved surface that must be given to that part of the vessel that is in water."[46] Such calculations, in fact, only aim to "find on the part of the water the least resistance possible," and do not take into consideration the other "necessities" to which vessels variously loaded with artillery are subject.[47] So sublime and subtle a geometry applies only to itself, using the ship merely as a pretext.

46. H. Pitot, *La théorie de la manoeuvre des vaisseaux* (Paris: 1731), preface, n.p.

47. Pitot, *La théorie de la manoeuvre*, preface, n.p.



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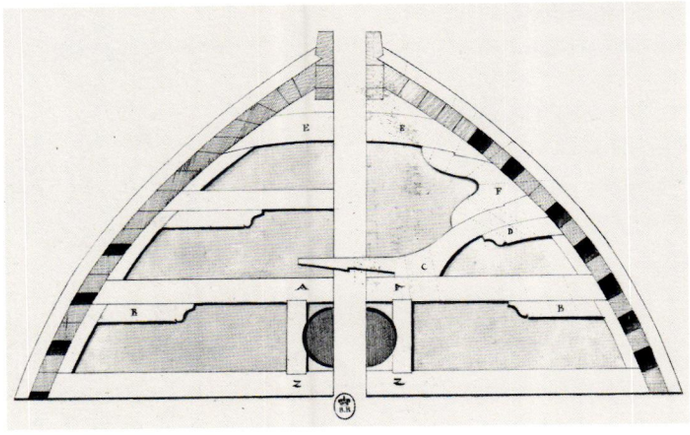
31. P. P. Hoste, Théorie de la construction des vaisseaux, *1697*, *plan in perpendicular section.*

32. P. P. Hoste, Théorie de la construction des vaisseaux, *1697*, *the image of vessels relative to their rolling and pitching.*

The section drawings, reduced to their profiles, show a stage of the "science of the ship" to which one aspired. Bouguer explains: the dimensions and dispositions of the internal reinforcements "are not subject to the strict laws of mechanics." Hence he undertakes to speak of shipbuilding "only as a mathematician and physicist."[48] These "details" are left to the discretion of the workers. It would appear that no progress has been made since Dudley, who was only concerned with the diagrams of the profiles of sections, and who refused to go into *l'altre circostanze dell'abbatimento delle coste, e della grossezza e fortificazione di quelle, con le late, e fasciame*: "the other circumstances of the cutting of the ribs, and of the width and fortification of [the] same [ribs] with deck plating beams and planking." These are *cose comuni e ben'intese da' Capimaestri, e però si tralasciano; non volento l'Autore in questo suo Arcano trattare delle cose ordinarie, e volgari* : "common things well understood by the master builders, and thus can be omitted, as the author in this *Arcano* does not wish to dwell on ordinary, common things."[49]

Actually, from Dudley's time to Bouguer's, the attitude changed. It is no longer the sufficiency of the geometry that is affirmed, but the insufficiency of mechanical physics.[50] The field has been opened to investigations of interior frameworks founded first on common knowledge, then on physical concepts. Obtaining from mathematics all the insight necessary for "creating balance among so great a number of forces" presupposes that one is making the long and difficult effort of treating vessels "like physical and heterogeneous bodies."[51] The builders, meanwhile, find in the "invention" and the divulging of new couplings the chance to advance their own careers. Thus the case of Salinoc, assistant builder at Le Havre in 1734, whose section drawings have survived to this day.[52] Here one sees how the internal "fortifications" of different types of vessels aspire to be the application of an entirely empirical notion of "work" guided solely by the theory of the lever and a great deal of emphasis on the play of materials. It is necessary to "buttress, bind, brace" in order to unite all the forces being exerted like so many levers "in one same effort that will serve as node to the machine and will impede its deterioration," demands Pierre Train, former carpenter turned assistant engineer of La Rochelle.[53] By creating in 1741 in Paris his Petite Ecole, intended to complete instruction for builders, Duhamel du Monceau encouraged this new state of mind. His *Elémens d'architecture navale*, intended for instruction, are in the tradition begun by Colbert and Seignelay. The approach he adopts is at once rhapsodic and synthetic. He presents the different methods used by builders – the section he proposes is almost identical to that of Salinoc – and formulates several general principles which could serve as the subject for a physical



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48. Bouguer, *Traité du navire*, p. 25.

49. Dudleo, *Dell'arcano del mare*, p. 9.

50. It is nevertheless used to measure a vessel's tonnage, establish its center of gravity, estimate the effects of its displacements (see figure 32), and determine the optimum placement of the masts, and also to cast doubt, without arriving at any sufficiently justified counter proposals, on the carpenter's rules of proportions.

51. Bouguer, *Traité du navire*, p. ix.

52. Bibliothèque Nationale, Estampes I C3 fol.

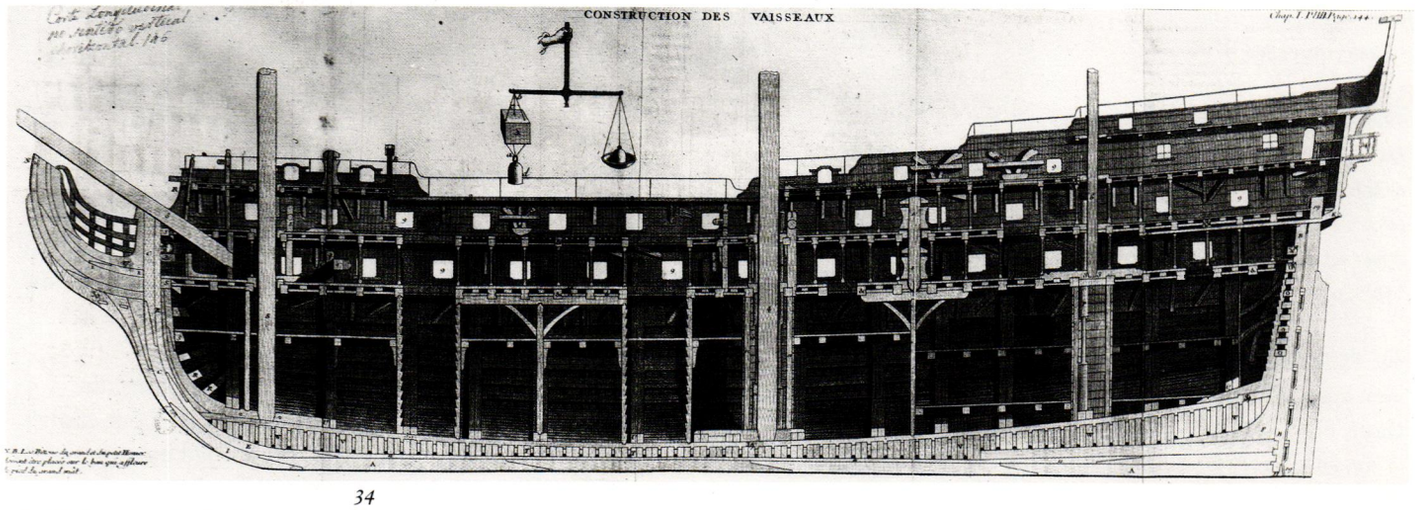
53. "Essai sur l'architecture navale ou traité abrégé de la construction, proportion des pièces de bois et de fer qui composent le corps du vaisseau ainsi que les mâtures" (Brest: 1782), Archives Nationales, Marine D1 25.

54. La Touche, "Résponse" (Rochefort, November 9, 1775). Frigates with twenty-six cannons would have to carry two cannons of eighteen of cast iron at the bow; "It will be necessary to adjust the forecastle to this, and to increase the width of the beams, deck-beams and planks in that part." For less than twenty cannons, it will be necessary to "sacrifice everything for speed," and hence to lighten the ship by lessening the reinforcements. Archives Nationales, Marine D1 26.

55. See Vial du Clairbois, "Architecture navale," in *Encyclopédie méthodique*, Marine, vol. 1, p. 67. The difficulty of building warships "is due to the considerable weight of the artillery placed on the topsides and at the highest possible point of the vessel, which makes for what is called a fine battery:

and mathematical study. The essential part of his pedagogical effort consists in having introduced doubt, by means of such comparisons, into the minds of his students. The joining of parts can henceforth serve as the object of evaluations. Indeed, a great effort is made to perfect reinforcements by adapting them more strictly to the particular intended purpose of the ship in question. Thus for commerce raiders, for example, swiftness, hence lightness, is preferable to solidity and safety. This sort of evaluation of advantages is improved upon until the end of the century. When an inquiry by the ministry in 1775 asks for the "forces to be established for the ranks of frigates," in other words their artillery, the responses are accompanied by considerations on the importance of reinforcements for each rank. The evaluations concern relationships between force (number of cannons), swiftness, solidity, expense."[54] Each of these terms can be coupled with the others according to a hierarchy of preference proper to specific situations.[55] One can see that the structural section is an integral part of the instruments of preliminary verification and the choices made by the engineer responsible for the construction of the ship in question.

> the bases, moreover, or the upper works will of course be rather heavy in themselves, since their structure must be proportionate to the weight of the artillery that they must support [on each side], and the bottom [which must be] as impenetrable as possible to the enemy's fire. One could partially sacrifice the safety and solidity of the structure, to give greater quality to the ship: such is commonly done with commerce-raiders."



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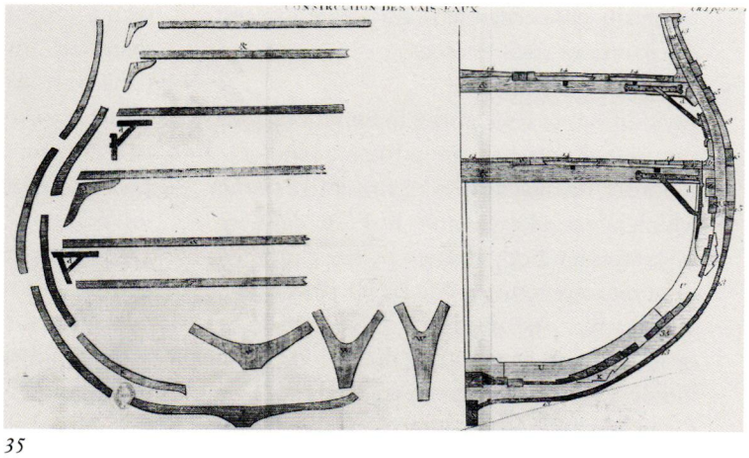
33. *Salinoc*, Plan representant l'avant du vaisseau l'Orox . . . , *1734, comparison of two modes of connection.*

34. *Duhamel du Monceau*, Elémens de l'architecture navale . . . , *1758, longitudinal section.*

35. *Duhamel du Monceau*, Elémens de l'architecture navale . . . , *1758, cross section.*

36. *Salinoc*, Coupe verticalle de la flutte du Roi, l'Orox, *1734, description of a reinforcement device and its assembly.*



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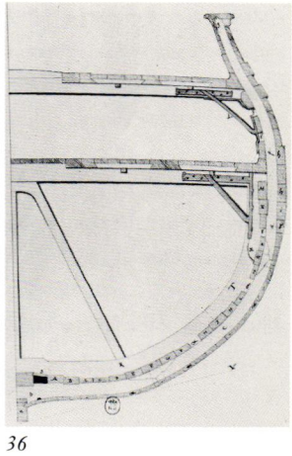

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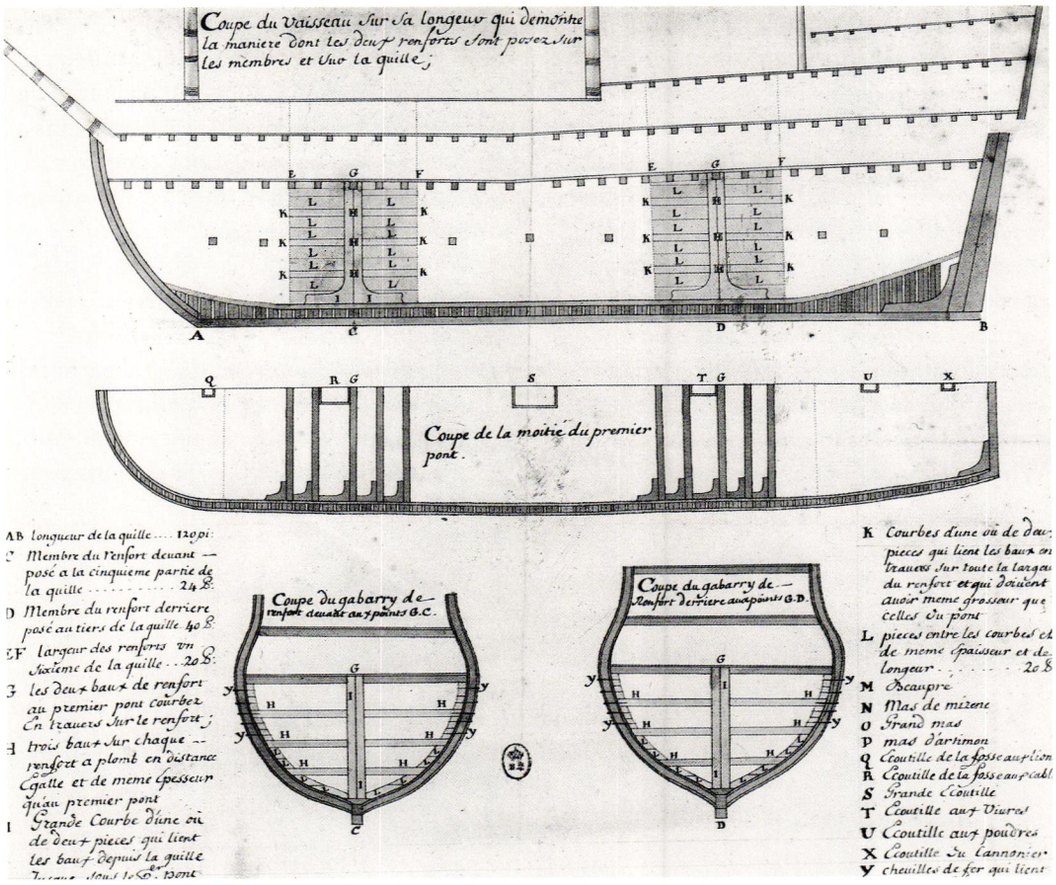

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56. "Notte sur les bois de chêne" (1776), Archives Nationales, Marine G 141.

57. Proceedings of the building council of Toulon (1678), in the Archives of the port of Toulon 3 A1 1.

58. Deck-beams are small cross-beams fixed to the ribs and support the planks of the deck.

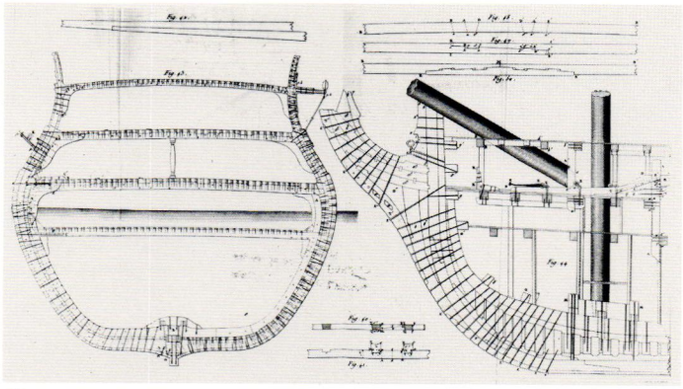
59. Duhamel du Monceau, *Du transport, de la conservation et de la force des bois . . . formés de pièces d'assemblage pour suppléer au défaut des pièces simples* (Paris: 1767), p. 532.

60. The mechanisms of the experiments made in 1811 by Charles Dupin, then captain of the Corps of Naval Engineers, are indistinguishable in their principles from the tests conducted in the ports during the eighteenth century to study the flexibility of timbers: various weights were hung from the ends of beams different in length and width, and with a variety of types of wood. Dupin's apparatus, however, made it possible to measure the flexion – the "descension" – of the timbers, whereas the others only had the point of breakage as a criterion. Dupin's stated objective was to "establish the dimensions of the parts (of the ship) in a less arbitrary manner." See "Expériences sur la flexibilité, la force et l'élasticité des bois," *Journal de l'Ecole Polytechnique*, 17e cahier, vol. 10 (Paris: January 1815).

It was in connection with the masts and spars that these evaluations were soon conducted by precise and rigorously calculated applications of the physical qualities specific to the materials used. The sectional models of masts which Forfait presented in 1788 to his students at the naval academy bear witness to the extraordinary sophistication of the coupling methods being practiced in France at the time. Unknown to other nations, these methods might well be a result of the system of emulation that encouraged the advancement of artisans who were primarily concerned with the invention and disclosure of trade secrets.

In addition, to look at the indentations, one cannot fail to recognize in them a kind of imitative reconstruction of the entire timber which a marine carpenter, in 1776, defined as "a wooden body formed by the coupling of numerous cones, some larger than others, which cover one another."[56] Is it artifice or nature that dictates this definition? As the builders slowly divulged the secrets of forms, they never ceased to be spokesmen – often haughty – of material. The contempt in which the builders were often held is connected to the function imputed to them, whereby their own manners of behavior are likened to this rude material which is multiple and disorderly in its rebelliousness.

The object of conflicting opinions, the timber, the essential material, is not easily accommodated to prescribed measurements and pre-established plans. Its shaping can only be appreciated for "reasons that are only sensed and cannot be written down on paper," assert the carpenters of Toulon in 1678, in a document declaring their own prerogatives as well as those of the material.[57] In the eighteenth century they consent to disclosing these "reasons." It is difficult to know exactly what is attributable to them and what are the results of the first tests of the resistance of materials in the following statement by Duhamel: "The assemblage of masts of several pieces is comparable to the assemblage of trussed deck beams,[58] as the finishes (of the mast) are skillfully joined to the spindle by coak-indentations. . . . In one piece being loaded, one part of the fibers is in dilation, another in condensation. . . . With our deck beams we have always taken great care that the



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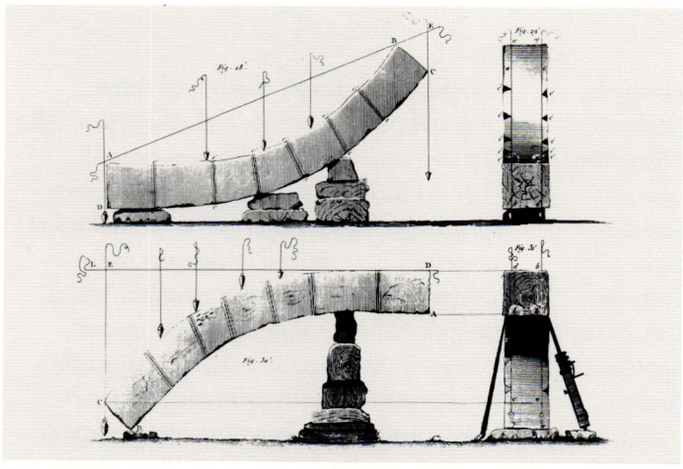

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37. *Salinoc*, Coupe verticalle de la flutte du Roi, l'Orox, *1734, sections describing means of reinforcement.*

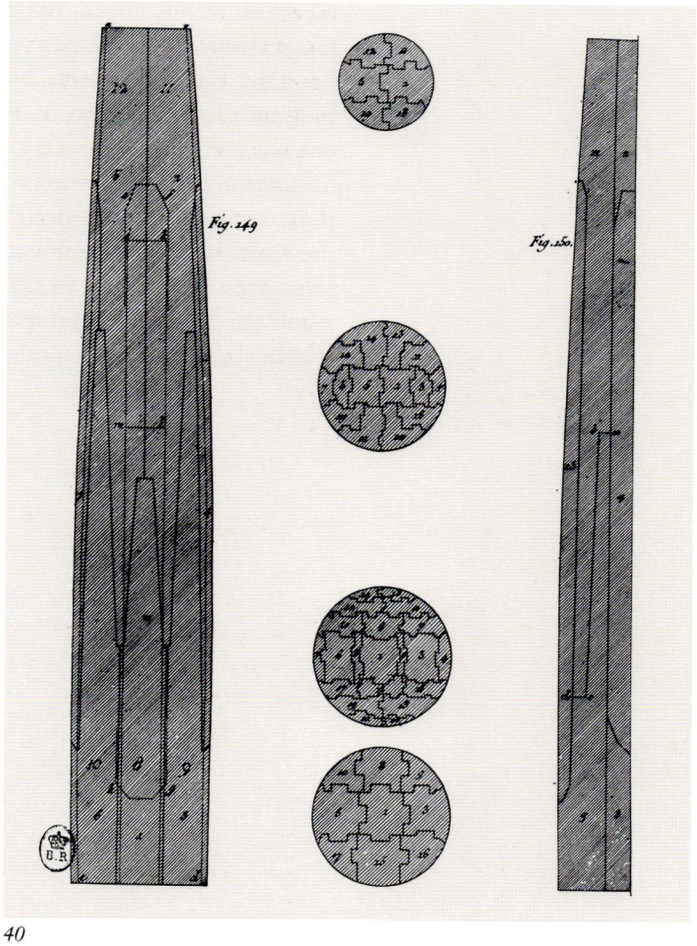
38. *Vial de Clairbois*, Traité élémentaire de la construction des vaisseaux de guerre, *1805, section of the web-frames.*

39. *Vial de Clairbois*, Traité élémentaire de la construction des vaisseaux de guerre, *1805.*

40. *Forfait*, Traité de la mâture des vaisseaux . . . , *1788, sections describing structure of mast.*

indents of the reinforcements should be disposed in such a manner as to resist compression; and those of the spindles and tie beams, in such a manner as to be able to resist tension. It is upon this principle alone that the entire theory of reinforced parts rests."[59]

In following the experiments on the resistance of wood up to the beginning of the nineteenth century, one begins to appreciate the "theoretical" quality of the general principle formulated by Duhamel.[60] The transition from the terms "dilation" and "condensation" to "tension" and "compression," in the physical science of what wooden bodies would sustain, leads one to think that Duhamel is proceeding according to the method mentioned above, attempting to make the synthesis of know-how coincide with the application of principles. This "theory of transition" is typical of the theories one finds in his works in general. It illustrates the determining role played by the "inspectors" in the technical progress of the eighteenth century.



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In Forfait's propositions mentioned above, one can well admire the careful detail of the indentations imagined for the construction of compound masts. But at this point one may question the validity and the extent of such exercises of virtuosity. The hand is free to invent as long as it has room for its diagrams and as long as it does not have to test, *in medias res*, the good will of the material to be assembled. It is the feasibility of the project that is in question here, as well as the estimation of economic advantage. In contemplating Forfait's combinations, one begins to sense the complacency that the sectional design so readily affords the conceiving imagination. The arbitrary begins to creep in naturally, though one may, however, attempt to limit it in its audacity. In other words, once one has recognized the section's capability of sustaining an indefinite variety of propositions one must make a special effort to know the limits within which this spontaneity, this serendipity is at leisure to function. One would think that these limits have some relation to the gnoseological properties of sections which break down into three categories: *scale*, *analogy*, and *abstraction*. The first two categories are interconnected. There is little need to point out the limits within which the conservation of analogical properties is restricted in matters of the resistance of materials, for example, when the scales of critical dimensions are not corrected. As a result, in architecture often the section represents nothing but established customs! Abstraction, for its part, at first finds itself present in analogy when, following Alberti, edifices are metaphorically likened to animal organisms.[61] A graphic description, in this case, is an efficient means for this conversion; one need only recall Leonardo's studies representing architecturally the open structure of the brain-pan and his schematic reductions of the osteo-muscular machinery, which abstract a functional order from the confusion of a dissected corpse. One would have to wait until the time of Le Gendre and his homolographic sections to see the image of a supposedly precise topography of the organic machine.

61. Such as in the following passage, which is just one of many, in the J. Martin edition of *De re aedificatoria: L'Architecture et Art de bien bastir du Sr. Leon-Baptiste Albert* (Paris: 1553) p. 56. "For this reason, in whatever case, we shall imitate nature, which fits bones to bones, blends flesh, fibers, nerves and other connectives lengthwise, widthwise, upward, downward, inward and backward, even (in short) in all directions and diameters. . . ."



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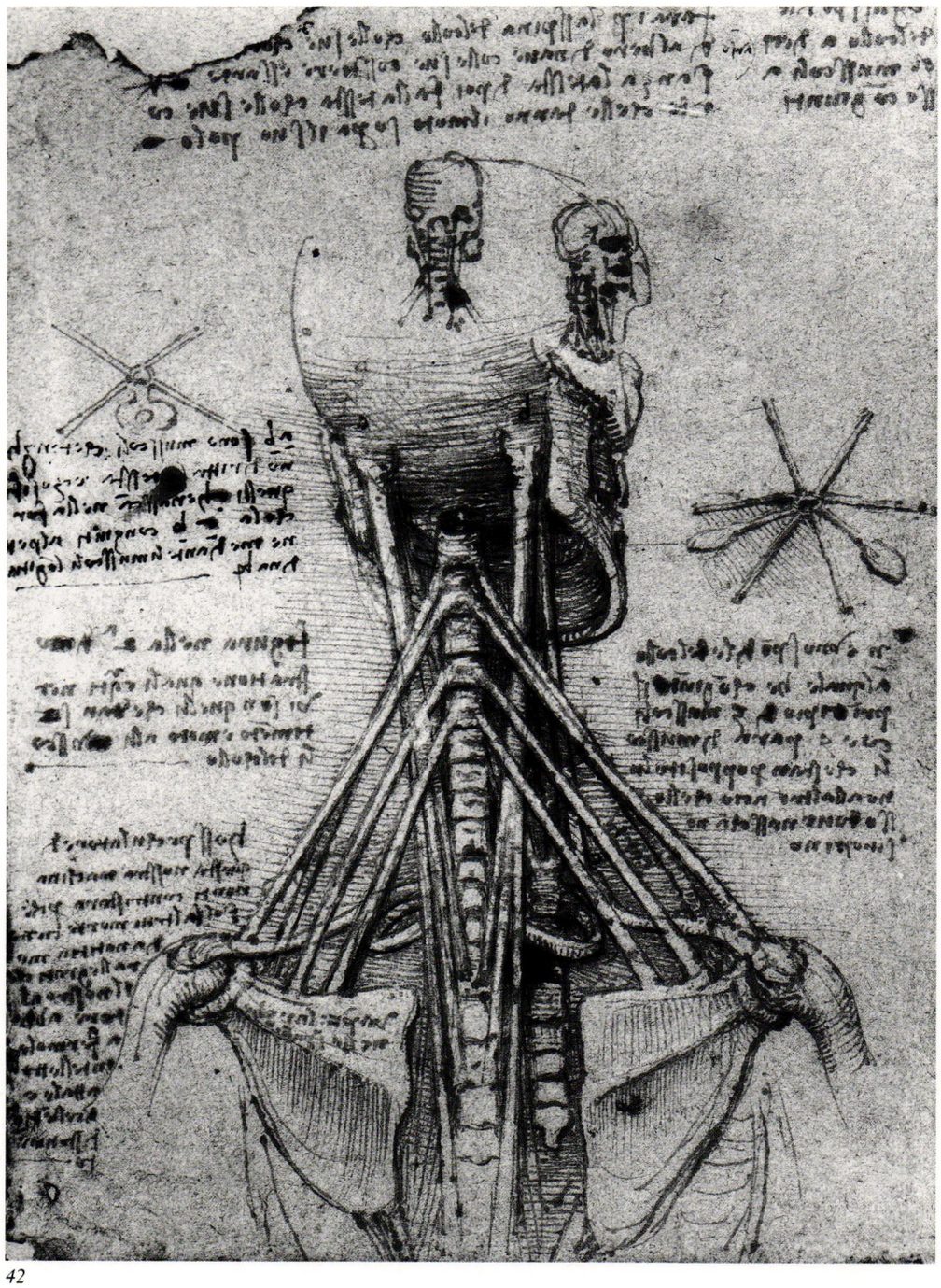

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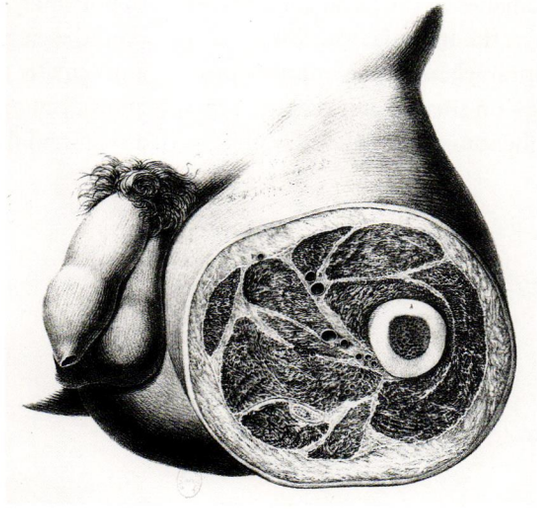
41. Anonymous, Fascicolo di Medicina, *1494, anatomy class at Padua, the professor reads his text from the chair while a* prosecutor *performs the cut directed by a* demonstrator.

42. Leonardo da Vinci, drawing of a schematic dissection of the posterior cervical region, 1513.

43. Le Gendre, from L'Anatomie homalographique, *1853, transverse section of the upper thigh of a man at the height of the femur's apophysis.*



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Except for those manipulations that harden and in some way petrify the organic composite, it is only at the cost of an incessant oscillation between the imprecise object of dissection and its careful representation that anatomy can hope to come close to the necessarily abstract typology of the living organism. Yet the validity of this abstraction has its limits depending on the range of the field it has in mind and the scale of the instruments involved. If we address a larger scale, such as that which nature offers directly in the form of a cliff, an all-inclusive observation will not dwell on details. The painter might intervene with his psycho-sensorially synthetic equipment, but only the gaze of the geologist, indeed the quarrier, is capable in its questioning of identifying and understanding the significant details, those it recognizes at the end of a long education nourished with schemata and abstract categories. And in this case the broadening of our field of vision to include all details is comparable to the cosmic emission of background noise. And in fact it is only the anomalies in the background noise which beckon to the investigator. It is a different situation when, in the opposite case, the gaze focuses on smaller and smaller objects. The phenomena registered in the sections change in nature, perceptually and structually, even while the technical and conceptual instruments of representations become more refined. A section is always the image of a surface. However strong the effort of abrasion on the fragment of nature in question, the dissecting instrument and the graphic device, hypothetically linked to it, will still always encounter other abstract arrangements of surfaces.

Meditating in 1873 on the divisibility of organized matter, Liard, whose mere name evokes the derisory ostentations of the republican Sorbonne, was astonished that "thought pursues the irreducible element without ever attaining it," even though "observation had stopped long before." From this he inferred that "we are in the presence of the infinite," an infinite that leads oddly to "an infinite raised to an infinite power."[62] In so saying he prefigured all at once the more modern notion of layers of "levels of organization." He recalls to mind, quite opportunely, that the idea of the section, doubtless a primordial one ontologically, has a pragmatic consistency that justifies the appropriateness of theoretical reasoning at a clear and distinct level of questioning.

62. L. Liard, *Des définitions géométriques et des définitions empiriques* (Paris: 1873), pp. 140-41.

Translated from the French by Stephen Sartarelli



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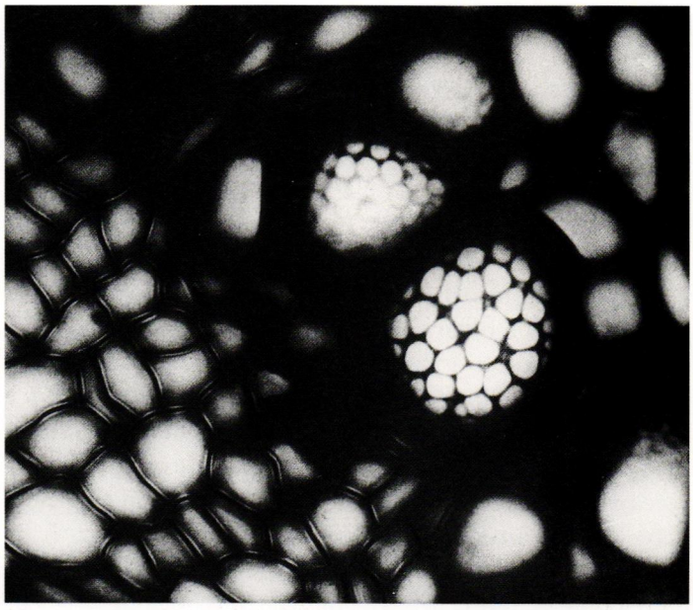

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44. Excavation in a marble quarry, Carrara, Italy.

45. Section of a liliaceous parenchyma.

Contributors

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David Woodward was born in England in 1942, and studied and received his doctorate at the University of Wisconsin. He then served as Director of the Hermon Dunlap Smith Center for the History of Cartography at the Newberry Library, Chicago. In 1980 he returned to the University of Wisconsin, where he is now professor of geography. He was also the Director of the University of Wisconsin Cartographic Laboratory from 1983 to 1986. His publications include *The All-American Map*, *Five Centuries of Map Printing*, and *Art and Cartography*. He is currently co-editor of the six volume *History of Cartography*, of which volume 1 was published in 1987.

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Charles B. McClendon received his M.A. and Ph.D. in art history from New York University. He has lived and worked in Rome for many years, specializing in the art, architecture and archaeology of the periods from late antiquity to the Renaissance. His most recent book is *The Imperial Abbey of Farfa: Architectural Currents of the Early Middle Ages.* He has taught at the University of California, Berkeley and at Yale University, and he is now associate professor of fine arts at Brandeis University.

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David Lowenthal was Secretary of the American Geographical Society in New York until 1972, when he became professor of geography at University College, London; he retired from that post in 1985. Currently adjunct professor in landscape architecture and geography at the University of California, Berkeley, and chairman of the Landscape Research Group in Britain, he writes and lectures on heritage and museum matters world-wide. His recent books include *Our Past Before Us: Why Do We Save It?* with Marcus Binney, *The Past is a Foreign Country*, *Landscape Meanings and Values* edited with Edmund Penning-Rowsell, and *The Politics of the Past* edited with Peter Gathercole.

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Tom F. Peters was born in 1941 in Berkeley, California, but spent most of his life in India and Europe. He was educated at the ETH in Zurich and only returned to this country in 1982. He has taught in the architecture departments of the ETH, the University of California, Berkeley and Cornell University. He is currently the director of the Institute for the Study of High-rise Habitat at Lehigh University and adjunct professor at the Technical University of Nova Scotia in Halifax. Peters has chaired the annual national ACSA Conference on Technology since 1985.

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Mark A. Hewitt, born in Chicago in 1953, is a practicing architect, writer and teacher. Educated at Yale University and the University of Pennsylvania, he currently holds academic posts in the Historic Preservation Program at Columbia University and at the New Jersey Institute of Technology. In 1985 he was the editor of *CITE: The Architecture and Design Review of Houston*, and he has published articles on architectural history and criticism in journals such as *The Journal of Architectural Education*, *VIA* and *Texas Architect*. He recently completed a book on the American country house in the twentieth century, for which he received a Graham Foundation Fellowship.

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Francesco Venezia was born in Lauro, Italy in 1944. He received his architectural degree in 1970 from the Faculties of Architecture in Naples. Since then he has practiced architecture in Naples, and has taught at Harvard University and the Faculties of Architecture in Naples. His recent projects include a competition for the town of San Leucio near Naples and the square and gardens for the new town of Salaparuta, Sicily. He is also the author of a book entitled *La Torre d'Ombre*.

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Tadao Ando was born in Osaka, Japan. After directing his own studies in architecture he established an architectural practice in Osaka. His work has been exhibited throughout the world and most recently published in *GA Architect: Tadao Ando*. Ando is the recipient of the 1988 Isoya Yoshida Award for the Kidosaki House. He has taught at Yale University and Columbia University, and his recent projects include the Fukuhara Clinic and the Karaza Theater.

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Heinz Bienefeld is a practicing architect in West Germany. Born in 1926 in Krefeld, he studied with Dominikus Böhm in Cologne, becoming his assistant in 1952. After the death of Dominikus Böhm, he worked with Gottfried Böhm, and in 1958 he associated with Emil Steffann. Since 1963 he has had his own practice in Swisstal-Ollheim and has focused on residential and ecclesiastical architecture. His projects include the Nagel House, St. Bonifatius Parsonage, the St. Willibrord Church, and his own home, Derkum House.

JACQUES GUILLERME

Jacques Guillerme began his professional career as a chemist in the French navy. Currently, he is a researcher at the National Center for Scientific Research in France. His first archaeological publication discussed a model of an ancient vessel at the Metropolitan Museum of Art in New York. He received a Focillon fellowship at Yale University and has published numerous articles on the history of science and technology, as well as contributions to *Table Ronde*, a journal of short stories. He has written several books, among them *L'Atelier du temps* and *La figurazione in architettura*. He founded and now directs the journal *Amphion*.

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Hélène Vérin's thesis, part of which was published by the University Press of France under the title *Entrepreneurs, entreprise, histoire d'une idée*, began her career at the National Center for Scientific Research in France. She has published articles on the history of technology and a novel, *Chaque pierre fait son ombre*, recently translated into German. She collaborated with Jacques Guillerme on the restoration of the work of A. Raucourt, an inventor of maritime constructions.

Illustration notes and credits

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16. Musée Guimet, Paris.

17. *The Defense Mapping Agency . . . Putting the World on the Map* (Washington, D. C.: DMA [no date]).

THE CULTURE OF DESCRIPTION/ THE RELIEF OF THE CITY
These illustrations are chosen from *La identitat del territori català: les comarques*, an atlas compiled in 1977. Each map measures 250 cm x 100 cm and was drawn at a scale of 1:10,000. This investigation took place at the Laboratorio de Urbanismo de Barcelona (Laboratory of Urban Planning of Barcelona) at the University of Barcelona School of Architecture under the direction of Manuel de Solà-Morales. The thirteen plans which comprise the atlas were created by a group of architects that includes the following: R. Barba, J. Blanch, J. Busquets, J. Carné, I. Castiñeira, O. Clos, M. Domingo, A. Font, J. L. Gómez Ordóñez, M. Hosta, P. Mas, V. Mas, F. Mestres, J. L. Oyón, J. Parcerisa, R. Pié, P. J. Ravetllat, C. Ribas, M. Rubert, M. Roa, J. Vayreda and J. M. Vilanova. All drawings courtesy of the Laboratorio de Urbanismo de Barcelona.

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25. *Architectural Forum* 57 (December 1932).

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