

one

Architecture Discovers Fire

Construction and Combustion in the Oven and the Hearth

On matter and energy

architecture between mud and breath

Architecture does not exist as an object of knowledge outside of what physicists call *intermediate* dimensions. At the scale of the very big or the very small, one may speak of the architecture of the cosmos or the intimate architecture of matter, but this involves a metaphorical use of the term. The architecture we refer to here has the scale of the building or the city. It shares with man and his other artifacts an intermediate dimension in which one can rightly speak of matter and energy as different concepts. Of course the distinction would not easily hold in situations belonging to another dimensional field: in high-energy physics, for example, scientists routinely measure the mass of particles in energy units; and, after all, the relativity equation expressing the equivalence between mass and energy is surely the most popular in the history of science. What is important here is that in our immediate environment, in that part of reality that a contemporary of Galileo would have called the sublunar world, the distinction between matter and energy is epistemologically and phenomenologically valid.¹

An important fact about our intermediate world separates matter from energy. Without energy, the movement of matter is reduced to locomotion, trajectories, and elastic collisions; without energy there are no processes or transformations; without it there is no life, which requires a constant flow of energy.² It is precisely this link between energy and life that connects energy theories to vitalistic or animistic philosophies.

Through time, matter and energy are opposed to one another in the same way as the inanimate and the animate, or that which possesses *animus*. In the book of Genesis, matter acquires life—it is animated—through the gust that fills it with spirit, producing the duality between mud and breath

that is best expressed by the Cartesian distinction between *res extensa* and *res cogitans*. When Napoleon wonders about God's place in Laplace's World System and the latter replies "Je n'ai pas besoin de cette hypothèse," we know that it is not only God who is banished from his Celestial Machine: with him go the spirit, final Aristotelian causes; life and energy depart from the material, ordered, and immutable world of trajectories. And it comes as no surprise that the nineteenth century's most radical ideological attempt to place energy at the center of an explanation for the world, Wilhelm Ostwald's theory, clashed head on with the mechanistic reductionism of scientific materialism.³

Thus, energy injects life, processes, and transformations into the inanimate world of matter, and thus into the world of architecture. We are accustomed to thinking of the latter exclusively in terms of physical, mute, immutable objects; architects themselves like to photograph their buildings unfinished, silent and empty. It could be said that architecture is concerned solely with material forms, cold and intangible, situated beyond time.

Partly responsible for this *vision* of architecture, this *image* of it that we conserve (and language and its polysemy betray us here), is precisely the dictatorship of the eye over other organs of perception. But another, perhaps more important factor is the scandalous absence of energy considerations in architectural analysis and criticism.

The irruption of energy in the universe of architecture smashes its crystalline images, shakes its mute silhouette, and gives it a definitive place in the field of processes and life. Architecture can then be thought of as a transformation of the material environment by changing living beings, an artifact continuously altered by use and circumstance, in constant degradation and repair before the aggression of time, permanently perishing and renewing itself.

The building as an exosomatic artifact
a process containing processes

Architecture can be understood as a *material* organization that regulates and brings order to *energy* flows; and, simultaneously and inseparably, as an *energetic* organization that stabilizes and maintains *material* forms.⁴

This leads to a first metaphorical bifurcation: architecture, as an artifact of the human environment, regulates natural energy flows and channels the energy accumulated in combustible substances for the benefit of the living beings who inhabit it; and architecture, as organized matter, is subject to permanent deterioration and needs a continuous supply of materials and energy to enable it to reconstruct its form.

The building accommodates processes but is in itself a process, and both circumstances call for the presence of energy. Thus energy is installed in the heart of architecture in two ways: through the energy consumption of buildings (or more accurately, of the building's users) in thermal regulation, water heating, lighting, etc., and through the energy needed to organize, modify, and repair the built domain. In other words: through the energy consumed by the processes that the building houses, and through the energy consumed by the process that the building itself is. We shall call the former an energy of *maintenance*, and the latter an energy of *construction*.⁵

We must stress the importance of the latter term, often overlooked when energy issues in architecture are tackled. Only through it can we understand the strong bonds that link the degradation of energy to the degradation of matter. Matter and energy, though dichotomized for the sake of methodological convenience,⁶ are as inextricably connected as the warp and the weft.

The building, in effect, as von Bertalanffy wrote of the living cell and the organism, “is not a static organization or a structure resembling a machine made of more or less permanent ‘construction materials’ in which ‘energetic materials’ provided by nutrition decompose to supply the energy needs of vital processes. It is a continuous process in which both construction materials and energetic substances [the *Bau-* and *Betriebsstoffe* of classical physiology] decompose and regenerate.”⁷

How well this description of the organism suits architecture! It might be said to apply only as a biological analogy, but in this case as well as others the metaphor translates into stark reality, revealing some hidden connections that are often more enlightening than mere phenomenological description.

I have mentioned that energy injects life into the world of architecture. More correctly, it is the link between life and architecture—the fact that architecture is created by human beings—that injects energy into the core of architectural practice.

Therefore, architecture can be thought of as an *exosomatic* artifact of man, existing outside of the body,⁸ and the energy used in the building and maintenance of the environment must be included within the general concept of external or exosomatic energy, defined by Margalef as that “which helps maintain life and the organization of ecosystems, but which neither flows through nor gets debased in the channels of somatic metabolism.” He adds: “In today’s human life this label applies to all energy used in heating, transport, food preparation, air conditioning, the building and maintenance of dwellings, and information dissemination.”⁹

At this point a pause and some clarifications are in order. Endosomatic energy—energy that feeds the internal metabolism of organisms—has limited thresholds of variation. The ratio of its biologically possible maximum and

minimum rate of use can never exceed two to one.¹⁰ Not so in the case of exosomatic energy, where the range of variation is virtually limitless, from cultures like the Eskimo tribes, which practically use only endometabolic energy, to the use, by certain groups of individuals in industrial countries, of quantities of exosomatic energy a thousand or more times greater than the metabolic energy they consume in their organisms.¹¹

Hence it is precisely within this latter framework of exosomatic energy, so dramatically and spectacularly variable, that we must present the energetic panorama of architecture.¹² But first we must remember that the *biological* conditioning of endosomatic consumption is one thing, while the *cultural* consumption of exosomatic energy is another. The biological realm of necessity and the cultural realm of choice complement and oppose one another: the fact that architecture belongs to the cultural domain ought to serve as a warning against biologicistic reductionisms, always tempted as they are to formulate the sort of organic analogies that are otherwise enlightening and stimulating on their own terms.

The hut and the bonfire

built order, combustible disorder

A parable attributed to Reyner Banham can be used to illustrate some of the ideas so far presented.¹³ The tale tells of a primitive tribe that has just come across a clearing in the wood where it plans to spend the night—an archetypal tribe that, as the author reminds us, has so many antecedents in architectural criticism, from Laugier to Le Corbusier. There are fallen branches and some wood in the clearing. The tribe has a dilemma: whether to use the wood to build a small shelter or as firewood for a bonfire. An entire theory of architecture is encapsulated in this simple question.

Wood is, of course, a material for both construction and combustion. As such, it meets the potential conditions of both matter and energy and illustrates the close relation between them. The tribe regards the wood, just as the builder regards a natural resource (material or energetic), and considers the two basic strategies of environmental intervention: regulating natural energy flows through the creation of material structures (the hut), or exploiting the energy accumulated in combustible substances (fire); using the climate's free energy through construction, or using its accumulated energies through combustion. Construction is nourished by flows, combustion by deposits. One feeds on our profits, the other on our thermodynamic capital. The two strategies are perfectly differentiated, yet one excludes the other only when they compete for the same resources.

So when faced with our tribe's dilemma, both strategies are feasible. Both present themselves in most cultures and both deserve to be called architecture. Indeed, the thermal space of the bonfire is no less architectural than the visual space of the hut. Only an obstinate fetishism for icons or an object-oriented, hieratic conception of architecture can deny the bonfire the status of *ab ovo* architecture so easily assigned to the hut. What is a house but a hearth?

Moreover, hut and fire, construction and combustion, are inextricably linked in the history of habitation, a unique combination of constructed order and combustible disorder. Energy brings architecture into the world of processes and life. But it also bestows architecture with consumption, fugacity, and irreversible time. Architecture brings together fire and hut, chaos and organization.

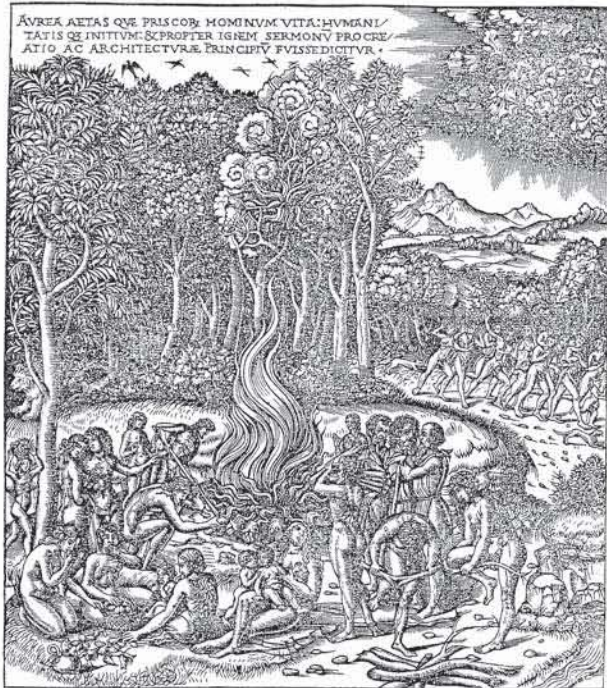
The close bond between construction and fire is clearly reflected when architecture is reduced to its most elemental and primitive form: on one hand, in stories about the origin of architecture and the rituals of urban foundation; on the

other, in the infantile perception and the psychoanalysis of the house. In all beginnings or origins, in myths and rituals as well as in the preconscious or unconscious mind, construction and fire are intermingled and intertwined.¹⁴

Fire in the childhood of architecture
myths of origin, foundation rites

In what are probably the two paradigmatic treatises on architecture, *De architectura* and *De re aedificatoria*, Vitruvius and Alberti offer symmetrical and significantly opposed accounts of the origin of architecture. In the Roman's colorist narrative about "the beginning of buildings" (book II, chapter I), it is the discovery of fire that gives rise to human society ("the collaboration between men, the communal life and coincidence of many in one place"), and with it, the construction of the first shelters and huts. This explanation by Vitruvius comes from the Epicurean evolutionism crystallized by Lucretius. The idea is not original: the Greek Hephaestus—and later the Roman Vulcan—represented the *ignis elementatus*, the civilizing physical fire that counters the symbolical fire of knowledge in Prometheus; and, starting with Homer, the God of Fire is acknowledged as Arch-artisan and Master of Humanity, who teaches the crafts to men who had lived "in caves like wild beasts."¹⁵ It is this same expression—*ut ferae*, like wild beasts—that Vitruvius uses to describe the life of man before the discovery of fire, the subsequent formation of human society, and the beginning of architecture.

In contrast, Leon Battista Alberti, early on in his prologue, is convinced that "a roof and walls" mark the beginning of the congregation of men, and not, as "some have said," water or fire. Yet a few pages onward, at the start of chapter II of book I, the hearth precedes ceilings and walls in the story of the origin of the house: "In the beginning, men



1.1.

Fire has a privileged place in myths about the origin of architecture, the same leading role it plays in the foundation rites of the city or the house. Combustion precedes and accompanies construction.

- 1.1. *The discovery of fire in Cesariano's Vitruvius (1521).*
- 1.2. *The building of the first shelters and huts in the same edition of Vitruvius.*



1.2.

sought a place of rest in some region safe from danger; having found a place both suitable and agreeable, they settled down and took possession of the site. Not wishing to have all their household and private affairs conducted in the same place, they set aside one space for sleeping, another for the hearth, and allocated other spaces to different uses. After this men began to consider how to build a roof, as a shelter from the sun and the rain. For this purpose they built walls on which a roof could be laid.¹⁶ As we see, early on in what Alberti calls his *partitio* (the distribution of uses in the plan), fire is part and parcel of architecture.

Whether we put emphasis on the structural similarities of the narratives, as Joseph Rykwert has done,¹⁷ or on the differences in their textual organization, for which Françoise Choay has exhaustively argued,¹⁸ fire is intimately associated with construction in the myths of origin; the same is true in the rites of urban or domestic foundation.

In the classical world, for example, fire was of utmost importance in the rites having to do with the city or the house. We must remember that, for both Greeks and Romans, the sacred fire of the city was "its prime altar, the origin of its identity and the fount of religious life." Hestia, the Greek goddess of the hearth, was "the 'focus' of the internal space of the city . . . the 'home you start from.'"¹⁹ Her fire burned in the *prytaneion*, the communal palace-temple, seat of citizen power.²⁰ The Roman Vesta, in turn, "ruled both the household fire of the individual family and the civic hearth of the city. Hers was the fire which warmed and nourished, a benign and fertilizing power."²¹ It is significant to note that the names of both goddesses derived from a common Indo-European root, "perhaps . . . *wes-, to live in, to occupy, but more probably *deu-, to burn."²²

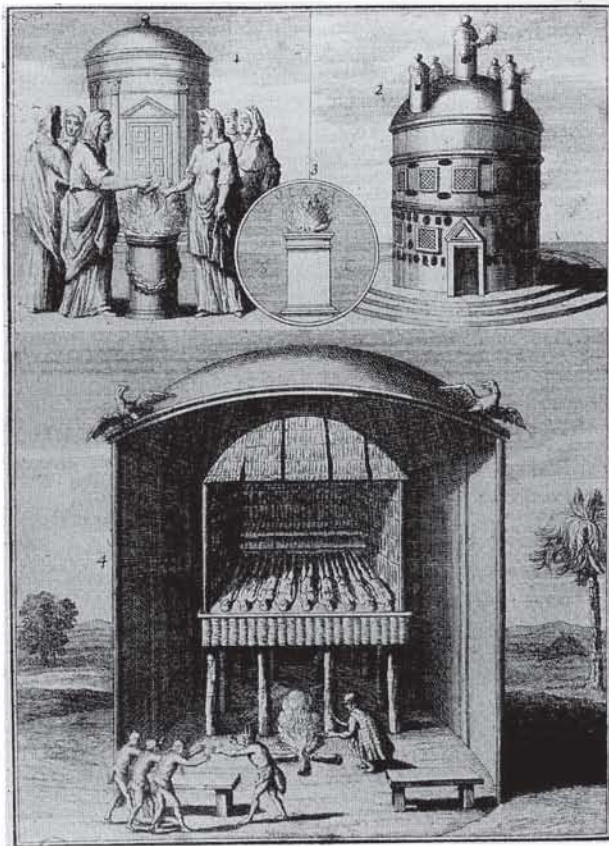
Thus when Rome was erected, its founders—after leaping over the purifying bonfires²³—dug a *mundus* (a round hole representing the mouth of the underworld) in what was to be the heart of the city, placed a stone altar over it, and over the altar lighted a fire: this fire—writes Rykwert—is "the 'focus' of the town. At this point the city may also have received its name."²⁴ This original fire was taken from one city to another, never abandoned; when a colony was founded, the fire came from the original city of the settlers; when the vestal virgins fled from the approaching Gauls, they transported the sacred fire with them in a vessel.

The key presence of fire in foundation rites is of course not exclusive to Greco-Roman culture. Rykwert himself, and others like Frazer or Raglan, have described similar ceremonies—wherein house, fire, and city are associated with one another—in primitive Eastern, African, Amerindian, and European cultures. From the role of the sacred Vedic fire in the founding of Hindu temples to fire's generative func-

tion, as a seed, that always links it to habitational implantation in animistic cultures, construction and combustion are bound together in a close and permanently renewed relation, as occurs in the feast of the new fire among America's Natchez, described by Chateaubriand: "Pieces of oak bark are kindled upon the altar, and this new fire then gives a new seed to the extinguished hearths of the village."²⁵ The same conception of fire as a fertile beginning is present in nuptial ceremonies, as in ancient Greece, with the mother of the bride carrying fire to the new house to signify the continuance of the domestic cult, or in India, where the newlyweds brought to their new home a part of the sacred fire that had witnessed their marriage, to be used in the future in all domestic ceremonies, according to Raglan.²⁶

Fire is thus associated with the house and the city in foundation rites—the establishment of the city, the creation of the home—and in subsequent civic and domestic ceremonies requiring the continuity of the flame, but it is so by virtue of its role as an image of fertility and a metaphor of life. This identification between fire and life, notoriously present among alchemists,²⁷ comes as no surprise. As Lisa Heschong points out, "The fire was certainly the most life-like element of the house: it consumed food and left behind waste; it could grow and move seemingly by its own will; and it could exhaust itself and die. And most important it was warm, one of the most fundamental qualities that we associate with our own lives. When the fire dies, its remains become cold, just as the body becomes cold when a person dies. Drawing a parallel to the concept of the soul that animates the physical body of the person, the fire, then, is the animating spirit for the body of the house."²⁸

Matter and energy, architecture and fire, construction and combustion are once again placed in relation to one



1.3. *The cult of Vesta and of the sacred fire compared with a similar cult of fire at the temple of Louisiana's Natchez Indians. Joseph-François Lafitau, Moeurs des sauvages américains comparées aux mœurs des premiers temps (Paris, 1724).*

another through the thin thread of life, processes, and transformation, which links them together in an inextricable tangle.

Fire in the architecture of childhood
nostalgias and dreams

The house and fire come together and complement each other also in the mind of the child and the poet, in the state of consciousness at the moment of awaking and in that which inhabits the threshold of sleep. Children's drawings and poetry weave the part of the subconscious that ties together the cave and the bonfire, the fireplace and the house.

Gaston Bachelard, who knows that "the house, even more than a landscape, is a 'psychic state,'" has described studies that have been carried out on children's drawings of houses: "In certain drawings, quite obviously, to quote Mme. Balif, 'it is warm indoors, and there is a fire burning, such a big fire, in fact, that it can be seen coming out of the chimney.' When the house is happy, soft smoke rises in gay rings above the roof. If the child is unhappy, however, the house bears traces of his distress. In this connection, Françoise Minkowska organized an unusually moving exhibition of drawings by Polish and Jewish children who had suffered the cruelties of the German occupation during the last war. One child, who had been hidden in a closet every time there was an alert, continued to draw narrow, cold, closed houses."²⁹

The warm house, like the maternal womb, expresses the joy of the protective shelter; the more inclement the season, the more intense the joy; the colder it is outside, the more intimate the warmth becomes. This identity between the mother and the house has been expressed by Milosz in two tense lines:

I say Mother. And my thoughts are of you, oh, House.
House of the lovely dark summers of my childhood.³⁰

The nostalgia of childhood, the protective nostalgia of the mother, and the melancholic nostalgia of the house are fused and lost into one another.

Kent C. Bloomer and Charles W. Moore have recalled the old association between the cave and the womb of Mother Earth,³¹ but failed to mention that in it fire represents the fecund masculine beginning. Without this sexualized fire described by Bachelard,³² the cave is a barren womb. The cave needs fire as much as the child's house needs the smoky chimney. Only then do they express and contain life, only then do they become a desirable architecture.

The nostalgia of the primitive gesture of inhabitation is a tepid, round nostalgia for the womb and the nest. This is not a merely spatial sentiment; it is also—and above all—a thermal sentiment.

There is a beautiful fragment from Bachelard that illustrates this admirably, through a page of Henri Bachelin. Bachelin writes in *Le serviteur*: "I delighted in imagining (although I kept my feelings to myself) that we were living in the heart of the woods, in the well-heated hut of charcoal-burners; I even hoped to hear wolves sharpening their claws on the heavy granite slab that formed our doorstep. But our house replaced the hut for me, it sheltered me from hunger and cold; and if I shivered, it was merely from well-being." Bachelard comments: "Bachelin is more fortunate than dreamers of distant escape, in that he finds the root of the hut dream in the house itself. He has only to give a few touches to the spectacle of the family sitting-room, only to listen to the stove roaring in the evening stillness, while an icy wind blows against the house, to know that at the house's center, in the circle of light shed by the lamp, he is living in the round house, the primitive hut, of prehistoric man."³³

As in the primitive hut of treatise writers, fire is present in the hut imagined by the child Bachelin. In both the writer's

text and the philosopher's commentary, thermal sensations come before others. The dream of the "well-heated hut . . . sheltered from cold" is inspired by "the stove roaring in the evening stillness, while an icy wind blows against the house." The only spatial definition of the hut is provided by a sheaf of light, and the feeling of comfort is manifested by a shiver.

The primitive hut and the primitive fire are revealed to be inseparable. The protoarchitectural fire of the treatise writers, the sacred flame of the city and the house, and the smoky chimney of the child's drawing all show the close identity of house and fire in the luminous furnace that is the origin, the singular and unrepeatable moment, in which architecture is born in myth, in rite, or in consciousness. The warm hut of the imagination manifests this in the even more far-reaching moment in which architecture is reborn in dream.

Besides the fire that dwells in buildings, the fire that builds the dwelling

The story of the primitive tribe confronted with the dilemma of the hut and the bonfire has led us to review other origins that eloquently speak of the link between construction and fire. But there is more to it than the mere beneficent presence of energy in the building, by which it is rendered habitable or sacred, intimate or joyful; to stop here would be to limit the matter to what we have called energy of *maintenance*, that which feeds the processes contained by the building. More than the energy that nourishes the *processes of the building*, it is important to consider the energy that nourishes the actual *building as process*, which we have named energy of *construction*.

With night about to fall, our undecided tribe could well decide to follow both strategies of environmental intervention put forward earlier: use part of the wood to build a small

shelter and light a fire with the rest of it. Up to this point we have been thinking only in terms of the complementary relationship between the primitive hut and the primitive fire: a material component and an energetic one forming an inhabitable environment. But the tribe could also choose to build a larger hut with all the wood available, or to do away with a hut altogether and surrender the wood to the flames. In the first case the strategy of environmental intervention is exclusively material; in the second, exclusively energetic.

There is a certain commutability between matter and energy that resides in the fact that wood is potentially as much a construction material as a combustible substance. This is precisely our concern now. If previously the emphasis was on the *complementarity* and *simultaneity* of the material and energetic strategies, now emphasis goes to the *commutability* and *interchangeability* of the two. Construction and fire, matter and energy are complementary *and* interchangeable.

Energy comes from the combustion of a material, and the material can be expressed in energy units: in such permeability rests the possibility of comparing the two by reducing them to a common denominator. Thus so much emphasis on the fact that if the processes of the building need maintenance energy, the building as a process needs construction energy.

In the case of the tribe, this energy is accumulated in the material itself, wood, in which solar radiation has gathered and concentrated; metabolic energy will be needed to transport, prepare, and assemble it. In our society, energy is similarly accumulated in materials, formed in the heat of ovens for ceramics, glass, cement, or metal; mechanical and metabolic energy will have to be used in order to transport them to and install them in the building site.

Energy, present in the principle and foundation of every process, is present as well in the process—of construction, of



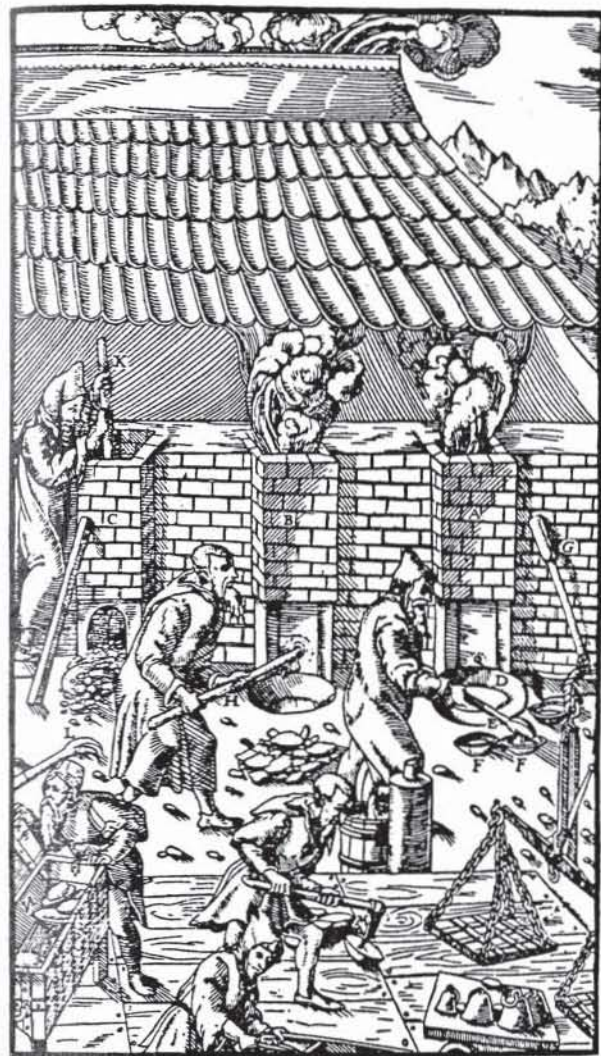
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The fire of the hearth dwells in the building; the fires of the oven build up the dwelling. The energy necessary to maintain a house is as important as the energy needed to build it: architecture and fire are linked to one another as much by the hearth as by the ovens that produce brick, glass, and metal.

- 1.4. *Assaying laboratory.* Lazarus Ercker, *Beschreibung allerfurnemisten mineralischen Ertzt und Berckwercksarten* (Prague, 1574).
- 1.5. *A glass-blowing workshop.* Agricola, *De re metallica* (1556).
- 1.6. *Ovens for refining copper ore.* Agricola, *De re metallica* (1556).



1.5.



1.6.

repair—that constitutes building. There is no transformation, irreversible change, or mutation without energy; without it there is neither construction nor destruction, neither animation nor time. Only energy transforms matter; only fire transforms material. As the insignia of old chemists said, *ignis mutat res*. Fire creates alterations and metamorphoses in the furnace of the blacksmith and the crucible of the alchemist; in the oven of the manufacturer, fire converts mineral into material. Fire bakes clay, generates metal, makes glass. In the hearth, fire dwells in the building; in the oven, fire builds the dwelling.

The clockwork sun and the unpredictable fire

cosmologies and cosmogonies

The two basic methods of environmental intervention have already been presented: on one hand is the regulation of free energy³⁴ through construction; on the other is the exploitation of accumulated energy³⁵ through combustion. We have seen how construction needs energy in order to be carried out; combustion, in turn, tends to need the help of material contrivances (fireplaces, stoves, boilers, tanks) which in themselves are manufactured with energy. Both methods thus require energy, but in very different amounts and consumed through time in very different proportions; and though they tend to be presented together, each has a very separate identity. Between the two strategies lies a broad conceptual and philosophical void.

Construction involves a passive availing of the orderly world of trajectories; fire, an active availing of the chaotic world of combustion. Constructed order is opposed to combustible disorder, celestial mechanics to terrestrial thermodynamics, the clockwork sun to the unpredictable fire.

This formidable ontological and existential opposition between sun and fire, which feeds and devours our entire culture—and which is also present, as we shall later see, in our architectural culture—has been admirably described by Michel Serres in a paper about Zola's work.

The century that was ending when the novel appeared had begun under the ruling stability of the solar system, but now, with the implacable degradations of fire, it was possessed by anguish. Thus the dilemma, positive and savage: a perfect cycle, without residues, reversible, eternal and revalorized, the cosmology of the sun; or a frustrated cycle, which loses its difference, irreversible, historic and devalued, a cosmogony, a thermogony of fire that must be extinguished or destroyed, and inevitably so.³⁶

The confrontation between the cosmogony of fire and the cosmology of the sun, between Chaos and Logos, between the Heraclitan fire and the regularity of the trajectories that filled Kant's heart with reverence, is an opposition but equally a hidden identity. After all, the universe as we know it today is a gigantic combustion, a multiple, catastrophic, historic fire, whereas fire, for all its aleatory agitation, is a creator of order, a Hesiodic, genetic, constructive fire. As Edgar Morin has shown, there is an essential link between the star-sun, the *arch-machine*, and the earthly fire, the *wild engine*, which brings together disorder and organization, Chaos and Logos.³⁷

Despite this link, or perhaps precisely by virtue of this subterranean identity, the opposition of sun and fire provides a wonderful metaphor through which to interpret some architectural polarities in the field of environmental intervention. These will be discussed in the terms of a philosophical architecture and two architectural philosophies.

A philosophical building and two building philosophies

Solar Le Corbusier, igneous Wright

The philosophical building, appropriately, is in itself a metaphor, since Robert Misrahi fabricates a *Treatise of Happiness* through the story of the building of an imaginary castle. Here are but two quotes from it that can exemplify the solar conception and the igneous conception of architecture.

The visible must be built in such a way that, with the rising sun and summer solstice, the sun invades the tallest and longest room in all its splendor, and this room shall therefore be at once the center of the building and its most elevated place.³⁸

The central foyer . . . like the fire that is at once punctual and cosmic, from which all these movements and all these beginnings emanate, will be created by reflection, that is, the optic and reflective interaction that the visitors work out among and in themselves, nourished as they will be by their respective, common and mutual affirmation.³⁹

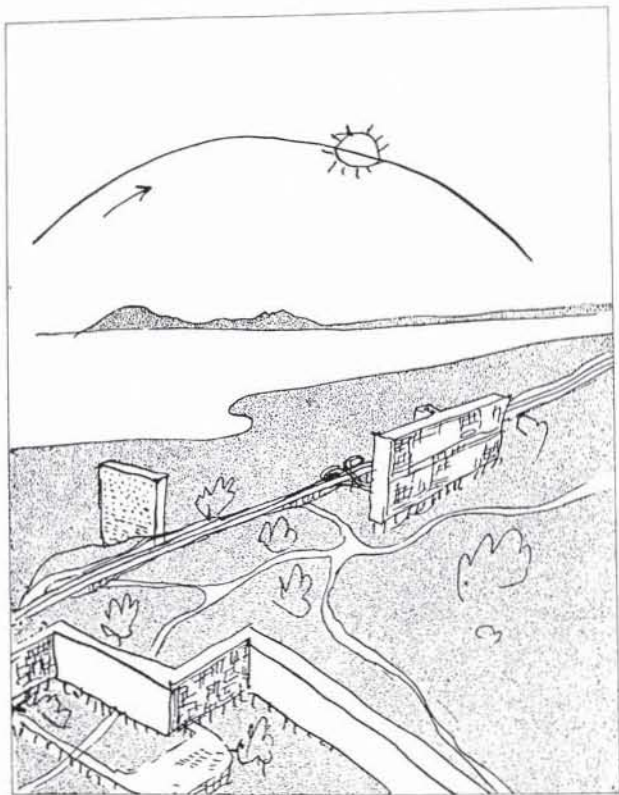
Observe how the solar and astronomic references situate architecture in the orderly world of trajectories, of necessary and predictable occurrences, whereas the mention of fire introduces agitation and interchange, movements and beginnings, interaction and unpredictability. The rising sun, removed from the world of men and changes, in its full splendor more luminous than warm, is opposed to fire, the source of transformations, made up of the reflection of the subjects.

This same opposition of sun and fire can be found in the works and writings of two architects of the century, perhaps the two greatest, definitely among the most controversial and passionate interpreters of the role and function of architecture. They are Le Corbusier and Frank Lloyd Wright.

Le Corbusier is, indeed, a splendid example of the necessary and orderly, Apollonian, solar conception of architecture. His sun is a perfect cycle, logical and closed, and a testimony to this is the obsessive omnipresence in his notebooks of the sinusoidal curve representing the 24 solar hours, “événement fondamental qui rythme la vie des hommes.” His is a sun of mathematical trajectories, of certitude and precision, of equinoxes and solstices: a Cartesian, Laplacian, indispensable sun. His *brise-soleil*, as at the *unité* of Briey-en-Forêt, are designed in such a way that no ray of sun touches the glass during the warmest hours of the day, “between the spring equinox and the autumn equinox.” In the huge hyperboloid of the assembly hall at Chandigarh, the lighting of the ceiling “rejects the summer sun, receives the winter sun and sends the equinox sun over the interior edges of the hyperboloid.”⁴⁰ The sun designs the architecture, univocally and obligatorily, through the regular and orderly cycles of its daily rotation and annual revolution. Below the drawing of the solar cycle (the cycle that runs from *un soleil se lève* to *un soleil se lève à nouveau*), Le Corbusier writes: “If not all the necessary and sufficient conditions are achieved, the result is disequilibrium, insufficiency—disgrace all day and . . . all one’s life!”⁴¹

Happiness is the perfect and serene equilibrium under the logical empire of the solar cycle. Environmental design rests in submission to the immutable and necessary laws of the movement of the stars.

Wright, in contrast, represents the igneous, organic, agitated, and emotive view that is diametrically opposed to solar rationalism. Even when he does refer to the sun, he does so in terms having little to do with Le Corbusier’s clocklike star. Cosmic laws are not the laws of trajectories but the laws of change (which “sing in unison with cosmic law”). Rhythm does not reside in orbital cycles, but “dances in sentient



1.7.

Les 24 heures Solaires

un soleil
se
lève

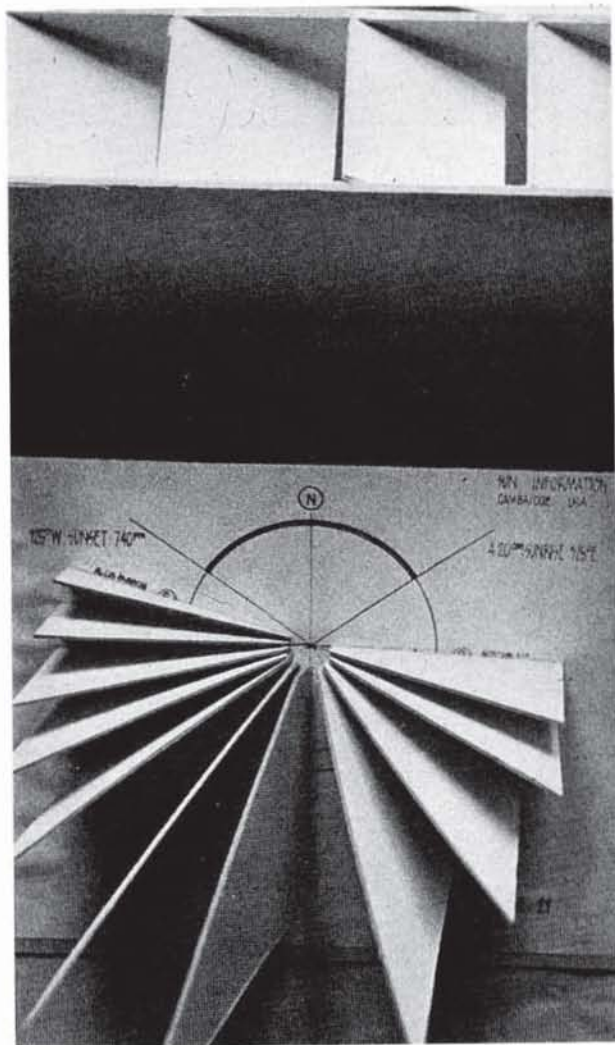


Si la totalité des conditions
nécessaires et suffisantes n'est
pas acquise, il y a déséquilibre,
insuffisance — malheur chaque
jour et ... toute la vie !

1.8.

Le Corbusier under the empire of the orbits: the sun designs architecture, which is subjected to the logic of the cardinal points and the inexorable law of astral movement.

- 1.7. *The law of the place, Le Corbusier, 1946.*
- 1.8. *The solar cycle, Le Corbusier, 1954.*
- 1.9. *Brise-soleil of the Carpenter Center, Le Corbusier, 1961.*



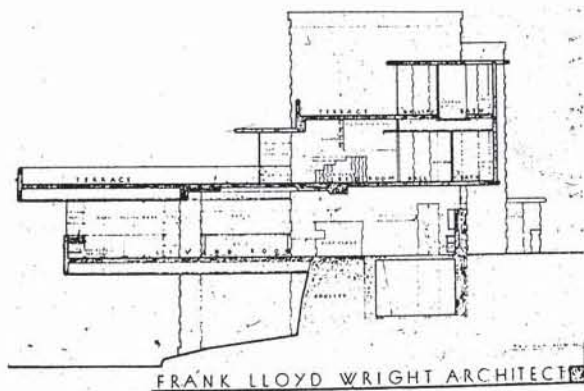
1.9.

beings." And the sun, more than a celestial body, is the beginning of life and growth, impeller of changes, seed of the earth, which "becomes more and more the creative creature of the sun. It is a womb quickened by the passions of the master sun."⁴²

To Le Corbusier, the sun is a luminous and regular sign that normalizes and organizes the life of human beings. To Wright, the sun is heat more than it is light, a beginning more than a regulator, a factor of change rather than of stability. His is a warm, chaotic, igneous sun: a cosmic fire.

And fire is precisely where the keystone of Wright's environmental vision resides. Remember his Prairie Houses and the leading role played in them by the hearth, the thermal and compositional focus around which the architectural space and the life of its inhabitants is elaborated. The architect described his intentions in a revealing statement: "At that time a real fireplace was very rare. In its place were 'mantels'. A 'mantel' was a marble frame for a few pieces of coal, or a wooden furniture with tiles and a grille, attached to the wall. The 'mantel' was an insult to comfort, but the *integral* fireplace became an important part of the building itself in the houses I got to build on the prairie. I found it refreshing to see a fire burning deep in the masonry of the house itself."⁴³

The link between construction and fire goes beyond the conventional association between the *hearth* and the *heart* of the house. The fire is not only present in the center of the house, but burns "deep in the masonry of the house itself." In Fallingwater, his most famous house and one of the fetish images of this century's architecture, the fireplace rises precisely over the large rock on which the building sits, so that it has been said to be, more than a house over a cascade, a fire over a rock.⁴⁴ It might be more than mere irony



1.10.



1.11.

that the rock, before its igneous consecration by Wright, was the client E. J. Kaufmann's favorite place for sun-bathing.

Needless to say, in the case of both Le Corbusier and Wright, the use of sun or fire is more symbolic than functional. Behind the *brise-soleil* and around the fireplaces are sophisticated climate control systems; nevertheless the role of *signifying* climate control is attributed to the screen and the hearth, most likely because they fall within the range of wider symbolic systems.

Thus, the careful astronomical determination of their inclinations links Le Corbusier's *brise-soleil* to a respectable architectural tradition of buildings governed by the stars, a tradition ranging from megalithic alignments to the Arc de Triomphe in Paris, the pyramid of Cheops, the Chartres cathedral, and the monastery of the Escorial. In all of these the calendar of the stars has left a mark. And there is little doubt that Wright's chimneys invoke a no less archaic tradition in which fire is the soul of the house and the city, a symbol of fertility and life, a sacred and beneficent flame.

In the prologue to his eighth book, Vitruvius writes that "the sun and the fire, meant to be fostered naturally, make life more secure." If the examples cited are convincing, then to

Frank Lloyd Wright at the service of fire: the hearth is the heart of the home, and the ceremonies of domestic life are celebrated around its sacred and changing flame.

1.10. *Fallingwater, a fire on a rock, Frank Lloyd Wright, 1935.*

1.11. *Interior of the second Jacobs House, Frank Lloyd Wright, 1946.*

the Roman's narrow interpretation of *utilitas* we would have to add that sun and fire *also* make life more significant. In this way we would better understand the double role—functional and symbolic—played by sun and fire, the world of orbits and that of combustion, celestial mechanics and terrestrial thermodynamics, which constitutes the axis of the relation between architecture and energy.