2. Environmental management

The surviving archaeological evidence appears to suggest that mankind can exist, unassisted, on practically all those parts of the earth that are at present inhabited, except for the most arid and the most cold. The operative word is 'exist'; a naked man armed only with hands, teeth, legs and native cunning appears to be a viable organism everywhere on land, except in snowfields and deserts. But only just; in order to flourish, rather than merely survive, mankind needs more ease and leisure than a barefisted, and barebacked, single-handed struggle to exist could permit.

A large part of that ease and leisure comes from the deployment of technical resources and social organisations, in order to control the immediate environment: to produce dryness in rainstorms, heat in winter, chill in summer, to enjoy acoustic and visual privacy, to have convenient surfaces on which to arrange one's belongings and sociable activities. For all but the last dozen decades or so, mankind has only disposed of one convincing method for achieving these environmental improvements; to erect massive and apparently permanent structures.

Partial solutions to these problems have always been offered by alternative methods such as wearing a coat in the rain; getting in a tent out of the sun, or gathering around a camp-fire in the cool of evening. But a coat is an unsociable solution, a tent is short on acoustic privacy even though it may be adequate to keep off prying eyes, and a camp fire, while it can provide heat and light enough to make a useful area of ground habitable, is short on all sorts of privacy and offers no protection against rain.

But, over and above considerations of this kind, one must observe a fundamental difference between environmental aids of the structural type (including clothes) and those of which the camp-
fire is the archetype. Let the difference be expressed in a form of parable, in which a savage tribe (of the sort that exists only in parables) arrives at an evening camp-site and finds it well supplied with fallen timber. Two basic methods of exploiting the environmental potential of that timber exist: either it may be used to construct a wind-break or rain-shed—the structural solution—or it may be used to build a fire—the power-operated solution. An ideal tribe\(^1\) of noble rationalists would consider the amount of wood available, make an estimate of the probable weather for the night—wet, windy, or cold—and dispose of its timber resources accordingly. A real tribe, being the inheritors of ancestral cultural predispositions would do nothing of the sort, of course, and would either make fire or build a shelter according to prescribed custom—and that, as will emerge from this study, is what Western, civilised nations still do, in most cases.

The acquisition of such predisposing cultural habits depends, obviously, on the previous experience of the tribe or civilisation, and this experience could have been painful. In terms of capital expenditure, a structural solution will usually involve a large, and probably hurtful, single investment, while the power-operated solution may represent a steady and possibly debilitating drain on resources that are difficult to replenish. Most ‘pre-technological’ societies have little choice in this matter, since they are usually short of combustibles or other sources of usable power. For this reason, all the major civilisations to date, those that have shaped world architecture, have demonstrably, and demonstratively, relied on the construction of massive buildings to fulfill their environmental needs, both physical and psychological.

The consequence is that architects, critics, historians and everyone else concerned with environmental management in civilised countries, lack a range of spatial experience and cultural responses that nomad people have always enjoyed. Cultures whose members organise their environment by means of massive structures tend to visualise space as they have lived in it, that is bounded

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\(^1\) This tribe, though unknown to scientific anthropology, has been a good friend to architectural theorists, and its history may be traced back through Le Corbusier’s *Vers une Architecture* to Laugier’s *Essai* and beyond, reflecting in every age the current preoccupations of architects.
and contained, limited by walls, floors and ceilings. There are, obviously, reservations and quibbles that can be raised against this proposition, but its general truth may be observed in many things, such as the persistent manner in which architects and designers visualise ‘free’ or ‘unlimited’ space as retaining the rectangular format of walled rooms—Frederick Kiesler’s *Cité dans l’Espace* of 1924 is an obvious instance.

Against this, societies who do not build substantial structures tend to group their activities around some central focus—a water hole, a shade tree, a fire, a great teacher—and inhabit a space whose external boundaries are vague, adjustable according to functional need, and rarely regular. The output of heat and light from a camp fire is effectively zoned in concentric rings, brightest and hottest close to the fire, coolest and darkest away from it, so that sleeping is an outer-ring activity, and pursuits requiring vision belong to the inner rings. But at the same time, the distribution of heat is biased by the wind, and the trail of smoke renders the downwind side of the fire unappetising, so that the concentric zoning is interrupted by other considerations of comfort or need.

Without pursuing the consequences of these experiences, which may prove to be of fundamental relevance to power-operated environments, further than the exiguous anthropological information warrants, one can still observe that they are experiences that do not enter into the traditions of architecture, even those of modern architecture which is largely concerned with power-operated environments. The traditions of architecture, as we commonly understand the concept, have been forged in societies and cultures that are committed to massively structural methods of environmental management. Furthermore, the accumulation of capital goods and equipment needed to produce even a moderate level of civilised culture in pre-technological societies, required that building materials be treated as if valuable and permanent. It was necessary not only to create habitable environments, but to conserve them. There was rarely any shortage of physically or

—see the observations of Paul Scheerbart in chapter 7.
culturally necessary functions queueing up for the available stock of roofed spaces. Buildings were made to last, and had to be, in order to produce a sufficient return in terms of shelter performance over the years to justify the expenditure of labour and materials that went into them.

Architecture came to be seen as the conscious art of creating these massive and perdurable structures, and came to see itself professionally as no more than that art, which is one of the reasons for its present problems and uncertainties. Societies—through whatever organs they see fit, such as state patronage or the operation of the market—prescribe the creation of fit environments for human activities; the architectural profession responds, reflexively, by proposing enclosed spaces framed by massive structures, because that is what architects have been taught to do, and what society has been taught to expect of architects.

But such structures may be open to objection on a number of grounds; culturally they may be over-emphatic, economically they may be too expensive, functionally they may be intractable to alteration, environmentally they may be incapable of delivering the performance for which society had hoped. All these objections have grown in force as more technological societies have emerged in the northern hemisphere and sought to establish outposts nearer the equator. But the architectural profession has had little to offer beyond further variations upon massive structure, and has normally responded as if these constituted the unique and unavoidable technique for dealing with environmental problems.

In truth, they never had been the unique and unavoidable technique. A suitable structure may keep a man cool in summer, but no structure will make him warmer in sub-zero temperatures. A suitable structure may defend him from the effects of glaring sunlight, but there is no structure that can help him to see after dark. Even while architectural theory, history, and teaching have proceeded on the apparent assumption that structure is sufficient for necessary environmental management, the human race at large
has always known from experience that unaider structure is inadequate. Power has always had to be consumed for some part of every year, some part of every day. Fires have had to be burned in winter, lamps lit in the evening, muscle power for fans, water power for fountains used in the heat of the day.

The design of buildings has always had to make some provision in plan and section, for these marginal consumptions of environmental power—chimneys for smoke, channels for water. Some architects, like the Adam brothers, made ingenious use of ‘left spaces’ in plan to provide concealed access for servants to light lamps and candles. In general, however, such provisions were of little consequence either in outlay or visible bulk; architecture could continue to treat them as matter for footnotes and appendices (Alberti’s generous views on chimneys notwithstanding) and cleave to the massive structure of walls and roofs as its real business.

The word ‘massive’ deserves to be emphasised. In the Mediterranean tradition, from which most Western architecture is directly descended, the need to render society’s shelter-investment permanent—or, at least, perdurable—was normally answered by making it massive. Thick and weighty structures are less easily overthrown by storm or earthquake, less maimed by fire or flood. But such constructions bring with them environmental advantages that had become so customary in three millennia of European civilisation, that they were falsely supposed to be inherent in all structural techniques, and there were baffled complaints when they were found to be absent from light-weight methods promoted out of futuristic enthusiasm for the ‘Machine Age.’

The outstanding advantages are acoustic and thermal. A thick and weighty structure offers better sound-insulation, better thermal insulation and—equally important—better heat storage capacity. This last quality of massive structure has probably played a larger part in rendering European architecture habitable than is commonly acknowledged. The ability of massive structure to
more conservative from those that are more selective, and an equally crucial historical distinction that separates our present period, which has the option of being primarily regenerative, from all previous periods.

The Conservative mode suits mostly dry climates, hot or cold. The Selective mode predominates wherever humidity is a problem, as can be seen in the ‘White-Man’s’ architecture of the East Indies or the hot, humid Southeastern parts of the United States. There the traditional house form, according to James Marston Fitch, has the following:

1. elevated living floors . . . offering maximum exposure to prevailing breezes;
2. huge, light-mass parasol-type roofs to shed subtropic sun and rain;
3. continuous porches and balconies to protect walls from slanting sun and blowing rain;
4. large floor-to-ceiling doors and windows for maximum ventilation;
5. tall ceilings, central halls, ventilated attics for warm weather comfort;
6. the louvered jalousie, providing any combination of ventilation and privacy . . . etc.³

This is the classic characterisation of the Selective mode, obsessed with admitting one aspect of the total environment (in this case, moving air), while excluding all others. The Conservative mode that prevailed in the equally hot, but dry, Southwestern United States has yet to find so masterly a summation, but its characteristics have begun to come into sharper focus through the work of Ralph Knowles at the University of Southern California. Applying a formidable body of theory and laboratory simulations to field observations of classic Indian pueblos like Pueblo Bonito, he showed not only that the massive adobe walls store daytime sun-heat with commendable effectiveness, but that the forms of the building-section, with terraces and flat roofs, seem contrived to capture a greater useful percentage of solar heat in winter, when it is needed, than in high summer, when it is not. Simple as they may appear, these pueblos may be among the most rewarding environmental investments that any vernacular society has ever devised, but they do not have to cope with high humidity.⁴

And of all the factors involved in environmental management,³ in his essay ‘The Uses of History,’ in Architecture and the Aesthetics of Plenty, New York, 1961, pp 244–245.

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humidity has, for most of architectural history, been the most pestiferous, subtle and elusive of control. While the deficient humidity of an overdried climate can be crudely made good by splashing water about and using shade to reduce evaporative loss, the removal of excess water from the atmosphere has so effectively defied all pre-technological efforts, that it has usually made better sense for those who could afford it to move elsewhere—the British in India retiring to hill-stations like Simla, New York business men with lung complaints to Colorado.

For excess moisture, only a regenerative solution, consuming power, has so far proven effective. Hence the historical, rather than geographical, division between the two main methods of dealing with humid climates. Structural solutions of the Louisiana type discussed above could only be replaced when certain crucial advances in power technology and its control had been achieved.

These advances were part of a general revolution of environmental technology in which humidity control was a late development, and if there is a critical year in that revolution, it is 1882, the year of the domestication of electric power, an achievement that confirmed previous crude environmental advances, and laid the essential foundations for more sophisticated later ones, such as the control of humidity on which air-conditioning depends. It was this revolution that first posed the problem of alternatives to structure as prime controller of environment, and introduced the regenerative mode as a serious rival to the Conservative and Selective modes, rather than their modest hand-maiden.

It is a fact—though not an easy one to interpret—that the most vital advances into the regenerative mode were made in that area of ‘European’ architecture that was least devoted to massive construction—North America. This may have depended on the simple coincidence that the abundant timber of which lightweight American houses were built, also provided abundant fuel for the high performance Franklin stoves and Rumford fireplaces that heated them, or it may be that there is a more directly causal connection, and the skimpy thermal performance of these timber
heated them, or it may be that there is a more directly causal connection, and the skimpy thermal performance of these timber buildings made the invention of high-performance, quick-heating stoves environmentally necessary. Or it may have been something even more coincidental than either of these propositions—that these ingenious devices were almost invented for the sake of inventing something or improving an existing device, without any specific reference to the context in which they were to perform.

Whatever happened, it is clear that by the later nineteenth century, the North Americans had acquired habits and skills in the deployment of regenerative environmental aids that were beginning to add up to an alternative tradition. The importance of this developing regenerative tradition can be seen in the shifting centre of environmental invention as the century proceeded. Coal-gas as a source of domestic environmental power for light and heat is a purely European development, its founding fathers being Philippe Lebon in France, F. A. Winzer in Germany and England, William Murdock in England. But at the other end of the nineteenth century, there can be no doubt that Edison was the true father of the electric light, and Carrier of air-conditioning. Many European inventors, of course, contributed key devices to these regenerative aids, but their development into practicable systems is a purely American story in both cases.

The history of environmental management by the consumption of power in regenerative installations, rather than by simple reliance on conservative and selective structures, is thus a predominantly American history, at least in its pioneering phases. This is in no way a judgement upon the ingenuity or determination of European architects and inventors; it is more a reflection of the unusual problems and advantages of US conditions. The problems were those of lightweight structures in extreme climates wherever Americans built in wood, and the advantages were those of the relatively lightweight culture that many Americans took westward with them into a zone of abundant power.
Of all these considerations, the lack of the encumbrances of a massive culture (physically or figuratively speaking), may have been the most important. It is striking how often events in the USA are not so far in advance of Europe technically, but the Americans appear to have been more aware of what they were doing, and thus to make a better job of it. To anticipate a comparison to be made in a later chapter, one may cite again that masterpiece of the architecture of the well-tempered environment, the Larkin building. In physical and physiological fact it was less advanced than the Royal Victoria Hospital, Belfast, completed some two years earlier, but the advances achieved at the RVH seem rather accidental, and its quality as architecture is barely to be mentioned in the same breath as the Larkin building’s.

Doubtless, Wright’s towering genius had a great deal to do with this difference in quality, but that genius fed upon a far greater experience in the handling of regenerative tackle than any of his European contemporaries could boast, within the context of a culture that was far more convinced of the need for their exploitation. Familiarity is the key, without a shadow of doubt. There is normally a time-lag—sometimes of decades—between a mechanical device becoming available, and its full-blooded exploitation by architects.

This has less to do, directly, with problems of development in the device itself, than with the need for architects to make themselves acquainted with it. In their role as creators of actual physical environments, architects have to be both cautious and practical. They have to see something in use, sometimes for as much as a generation, before they feel the confidence to extrapolate new and radical uses for it, knowing that their clients will never forgive nor forget if anything goes wrong, even if it is the inexperience or improvidence of the client himself that causes the malfunctioning.

So, technological potential continuously runs ahead of architectural performance. The gap between the two is commonly occupied by environmental experimentation in fields not com-
monly regarded as architecture—greenhouses, factories, transportation. Almost four decades separate the first industrial uses of air-conditioning from its confident employment in the kind of architecture that is designed by famous architects, but these long intervals involve not only physical experimentation, but much speculation and brainstorming as well, in which a climate of ideas is generated that makes the eventual architectural exploitation of the particular technology become thinkable.

These speculations do not take place in a philosophical or professional vacuum. Commercial and personal interests are deeply involved, axes are ground, factions are served. Thus most of what emerges from the technical side proves to be overt or covert sales-promotion literature, what emerges from the architectural side is often propaganda directed at clients, professional self-criticism or attempts to twist the future development of the art.

Even where a visionary without a professional interest emerges, as in the case of Paul Scheerbart and his book *Glasarchitektur*, the propaganda aim remains clear, the intention to mould the world nearer to heart's desire is manifest. For the environment touches man where it hurts—and it hurt Scheerbart deeply—so that the literature of the subject is very closely entangled indeed with practicalities. Much of that literature is of such quality and interest that it could probably stand being discussed in isolation as a separate branch of architectural writing, but to do so would be to deprive it of its reality. None of the chapters that follow is concerned solely with theory, none solely with practice. The words uttered, like the buildings erected, are exchanges in the close dialogue of technology and architecture, a dialogue that has become closer and more involved throughout the period covered by this book the period in which the possibility of a purely regenerative architecture has emerged for the first time in human history.

^ see chapter 7 again.