



Hearthbreaking

Sébastien Marot

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fireplace

sebastien marot

rem koolhaas

amo

harvard graduate school of design

irma boom

Hearthbreaking

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SMOKING LIKE A CHIMNEY

After the banishment of smokers from cafés, restaurants, workplaces and public buildings in a growing number of countries, the fast spread of the e-cigarette might be one of the most recent developments in the chronicle of the fireplace's exile from architecture. Perhaps the significant expansion of smoking habits in the 19th and 20th centuries was somewhat related to the modernization of the hearth, the transmutation of the fireplace into the stove and then into the radiator, and the progressive expulsion of smoke from the human habitat. The pipe or the cigarette might well have acted first as an individual extension or portable supplement of the fireplace and then as its substitute or surrogate. Enveloped by the smoke he simultaneously inhales, the smoker emanates around himself an evanescent aura, a cloudy prolongation of his self, a home, literally: an atmosphere. And in the rare joints where people may still share an ashtray, the halo that surrounds them is both the shelter of their company and the embodiment of their conversation. Nowadays, the smoker is either confined in the seclusion of his private abode, or out there, under the stars, where the wind swiftly sweeps away his involute. But at night, the faint pulsating glow of his fag – as that of the putative killer in *Rear Window* – still betrays his breathing presence.

I don't know if the philosopher Peter Sloterdijk was ever a smoker or if he indulged in burning joss sticks (though his strong bond with India and eastern spirituality would suggest so), but I don't remember having ever read anything on smoke in his work. Sure enough, his "spherology" does address the issue of heat and temperature. But the fireplace though does not produce just heat; for some time, smoke was probably an essential ingredient in its ability to build up a human sphere. •



Cigarette as substitute for chimney (*Relics*, 2009, by Slinkachu.)



Dying Embers, 2011, Slinkachu.

THERMOTOPIA

¹ Peter Sloterdijk, *Sphères III: Écumes*, Maren Sell Editeurs, Paris 2005, 159 (author's translation).

² cf. *ibid.*, 316–433.

³ cf. *ibid.*, 351: "The most visible sign of the advantage of being at home within the group is the hearth; this symbol, the older one of humanity, is the clearest indication of the fact that men cannot make it without an element of comfort."

⁴ Sloterdijk actually gives in a footnote (*ibid.*, p. 320) an interesting precision as to why he describes those nine aspects of the anthropogenic island as *dimensions*: "We could also say that it has nine strata or layers, if the image of a strata did not suggest successive levels without any point zero; if we prefer the term dimension, it is because it admits the idea that all these branch out from a common interface or zero point (an interlacing of here-now-us)." Indeed, the hearth is the oldest symbol of this zero point.

⁵ *Ibid.*, 319

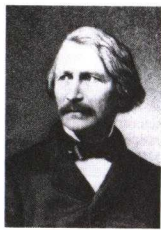
"We are still missing a study that would accomplish for the 20th century what Benjamin's *Arcades Project* intended to do for the 19th century; given what we know today about that period, such a study should be entitled the *Air Conditioning Project*."¹

So says Sloterdijk in *Foams* (2004), the third volume of his spherology, where he describes the "anthropogenic islands"² – the incubators or hothouses of human societies and cultures – as complex spaces combining nine *topoi* or dimensions: the chirotope, an environment of tools and gestures; the phonotope, a sphere of sounds and language; the uterotope, a feeling of common maternal ancestry; the thermotope, a matrix of comfort³; the erototope, an arena of sexual desire; the ergotope, an atmosphere of common ambition and organization: work and war; the alethotope, a theater of memories, wisdom and theories; the theotope, a relation to the dead and the hereafter; and the nomotope, a social architecture of mores, ethos, mutual expectations and obligations. Given that Sloterdijk also describes the anthropogenic island as a local greenhouse effect, it is tempting to introduce a hierarchy and genealogy within these dimensions and to identify the thermotope as both the origin and focal point of human life⁴. "Our basic thesis," writes Sloterdijk, "is that architecture is but a late replica of spontaneous spatial organizations within the body of the group. If the human fact is conditioned by a greenhouse effect, the primary anthropic hothouses have initially no physical walls and roofs but, so to speak, only walls made of distance and roofs made of solidarity."⁵

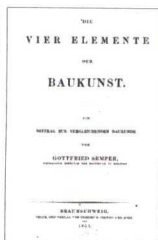
No walls, no roofs – but probably a fire, or something like a *focus*. Indeed, the French saying that expresses the miserable situation of homelessness is rather explicit: "sans feu ni lieu". No fire, no place. No thermos, no topos.

THE FOUR ELEMENTS OF ARCHITECTURE

Fire, together with its counterpart, water, is always an *elemental* component and condition of architecture, as are the earthly solid materials buildings are made of, and the air or "space" which they define, channel or shelter. The basic elements of architecture are still, in other words, the four elements identified by pre-Socratic philosophy: fire, water, earth, air.⁶ In stating this, we follow Gottfried Semper (1803–1879), who explicitly stated, a century before, in his elemental and environmental conception of architecture: "The first sign of human settlement and rest after the hunt, the battle and wandering in the desert is today, as when the first men lost paradise, the setting up of the fireplace and the lighting of the reviving, warming, and food-preparing flame. Around the hearth the first groups assembled; around it the first alliances formed; around it the first rude religious concepts were put into the custom of a cult. Throughout all phases of society the hearth formed that sacred focus around which the whole took order and shape. It is the first and most important, the *moral* element of architecture. Around it were grouped the three other elements: the *roof*, the *enclosure* and the *mound*, the protecting negations or defenders of the hearth's flame against the three hostile elements of nature. According to how different human societies developed under the varied influences of climate, natural surroundings, social relations, and different racial dispositions, the combinations in which the four elements of architecture were arranged also had to change, with some elements becoming more developed while others receded into the background. At the same time the different technical skills of man became organized according to these elements: *ceramics* and afterwards *metal works* around the *hearth*, *water* and *masonry works* around the *mound*, carpentry



Semper, 1803–1879.



1851 Gottfried Semper, *The Four Elements of Architecture*.

⁶ It should come as no surprise then that Gaston Bachelard, the philosopher who initiated the phenomenology of the dwelling (*The Poetics of Space*, 1958) did so only after devoting a series of books to unraveling each of these "elements": *The Psychoanalysis of Fire* (1938), *Water and Dreams* (1942), *Air and Dreams* (1942), *Earth and Reveries of Repose* (1946), and *Earth and Reveries of Will* (1948).

⁷ Gottfried Semper, "The Four Elements of Architecture" (1851), in *The Four Elements of Architecture and Other Writings*, Cambridge University Press 1989, 102–103. In a footnote to the word "mound," Semper describes the close relation of the fireplace and the well: "At first glance the mound or the terrace appears as secondary and as necessary only in the lowlands, where solid dwellings had already been erected; yet the mound joined at once with the hearth and was soon needed to raise it off the ground. Allied with the building of a pit, it may have also served as support for the earliest roofs. Moreover, it is probable that man, not as an individual but certainly as a social being, arose from the plains as the last mud-creation, so to speak. The legends from times immemorial of all nations, which often conceal an idea of natural philosophy, agree on this point."

around the roof and its accessories ... and the art of the *wall fitter*, that is, the weaver of mats and carpets ... around the *enclosure*.⁷

Three things must be emphasized in Semper's elementary anatomy of buildings. First, the elements of architecture identified (and their number) are closely related to the classical components of the environment which they either host, control, or resist: the hearth to fire, the roof to water (and sun), the mound (or floor) to earth (and water), and the enclosure to air (or wind). In other words, this fourfold anatomy of architecture is consistent with (and grounded in) an anatomy of the environment.

Second, a fundamental hierarchy is introduced between those four elements. Whereas the hearth, which hosts or accommodates fire, is unambiguously considered the primal and central element (and almost the origin of architecture, as in Vitruvius), the three others are clearly described as "negations," as defenders sheltering the "focus" from the natural pressures, excesses, and intrusions of what we would nowadays call the pedosphere, the hydrosphere, and the atmosphere. While all four environmental conditions are necessary constituents of the human habitat, fire is singled out by Semper as the most distinctive element of the human biosphere, a fragile one, continuously under threat of being blown out, buried, or swallowed by the three others. This is a striking antithesis to the ecological concerns that characterize our contemporary situation where combustion, in the form of the energy used to power our homes, threatens to dry out a significant part of our natural fresh water supplies, exhaust the resources of the earth's crust and overheat the atmosphere.⁸

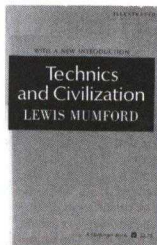
Third, Semper elaborates the different combinations and relative importance of these four elements of architecture – as well as the technologies associated with each – according to the natural and cultural environments where humans have lived and built. He showed for instance how masonry, initially rooted in mound construction, progressively colonized the very structure of the enclosure, where mats and carpets were supplanted by solid load bearing walls.

⁸ On this, see John McNeill, *Something New Under the Sun: An Environmental History of Twentieth Century* (Norton, New York, 2000), an extremely compelling book which precisely proceeds to an elemental study of the damages inflicted upon the lithosphere/pedosphere, the hydrosphere, the atmosphere and the biosphere by human development activities during the last century.

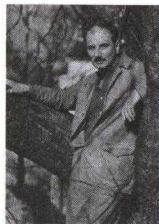
⁹ I want to thank James Westcott for drawing my attention to this proliferation of stove makers in the 1851 Exhibition.

¹⁰ See Kevin Lynch, *Wasting Away: An Exploration of Waste, What it Is, How it happens, Why we Fear it, How to do it Well*, Sierra Club books, San Francisco 1990: "Waste and loss are the dark side of change, a repressed and emotional subject. There is a pornography of waste, just as there is a pornography of sex and death... The accumulation of solid waste, the increasing pollution of water and air, have become our preoccupations. Nothing disposes easily any more; our old poisons return to us... It's all a nasty business." (page 1, our emphasis). Similarly, our huge power plants, with their colossal emissions of less visible wastes, have been located 'out of sight, out of mind,' in a gesture of deliberate (but venereal and shameful) ignorance.

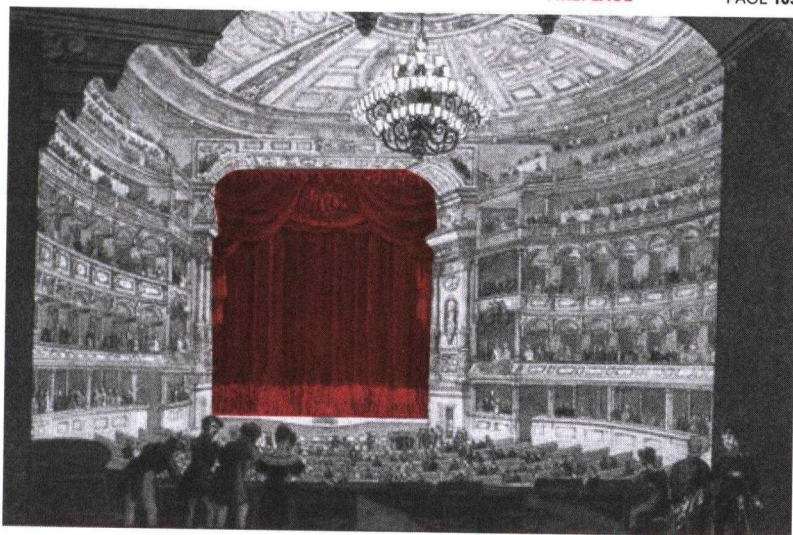
Writing in 1851, after the first decades of the industrial revolution, the very year the Crystal Palace opened in London, Semper couldn't but sense how the technologies deriving from the now visually absent fireplace had undergirded this whole cathedral of glass and iron, while at the same time myriad stove makers, boasting their complex new labor-saving models, dominated the stands of the Great Exhibition.⁹ Since that time, the significance of fire (and fire technics) has continuously increased in the production of architecture while its place as a visible and celebrated element has been almost eradicated. If every building recipe today still includes the four ingredients (or elements) of the environment, the visible presence of each in our built landscape has become inversely proportional to its actual importance and expenditure. Simultaneous with its repression in buildings, fire has been largely ignored in architectural theory in recent decades (seemingly unaffected by the scientific discovery of thermodynamics). Paraphrasing what Kevin Lynch said of waste – when alluding to its paradoxical absence in the discourse on architecture – it could be said that architectural theory has been blinded by a *pornography* of fire.¹⁰



1935 Lewis Mumford, *Technics and Civilization*.



Lewis Mumford (1895–1990)



1841 Fireplace/stage: Gottfried Semper's first built work, the Hoftheater in Dresden, implies a gigantic and collective extrapolation of the hearth.

¹¹ Maybe a blunt and oversimplifying statement, but it seems that, in general, the eviction of the hearth led many authors of architectural treatises, such as Guadet, to relegate the issue of the hearth to footnotes, even while fighting against this eviction: "La cheminée n'est pas encore morte, et il est nécessaire d'y penser." ("The fireplace is not dead, and it is necessary to give it some thought"; Julien Guadet, *Éléments et théorie de l'architecture*, vol. 2, Librairie de la construction moderne, 3e ed., Paris 1902, 155). See Emmanuelle Gallo, "La Réception des nouveaux modes de chauffage domestique en France au XIXe siècle" (2006), who analyzes this reception among users on the one hand, and among professionals – architects and engineers – on the other hand. Gallo shows that the reaction of architects towards new heating technologies was "rather cold and nervous" (with a few exceptions, such as John Soane in England), and that the famous gap between architects and engineers, which emerged in the course of the 19th century notably deepened around the issue of heating and thermal comfort (49). Guadet's *Éléments et Théorie de l'Architecture* marked a significant [cont.] change in the notion of the architectural element after Semper. Guadet distinguishes the basic "elements of architecture," dealt with in the first volume, from the "elements of composition," which are specific to building type (domestic, academic, public, religious, etc.) and are examined in the three subsequent volumes. Significantly, the fireplace does not appear among the basic elements, which are analyzed in the following order: walls, opening in walls (doors and windows), porticoes and orders, roofs and attics, floors and ceilings, vaults, stairs and ramps, and "secondary elements." Whereas the issues of lighting, heating and cooking pop up here and there in the other parts, the issue of the fireplace only appears toward the end of the section on domestic architecture, in two chapters devoted to the "complement of habitations," and to "heating and hygiene," where it is coupled with those of water conveyance and waste disposal.

¹² Lewis Mumford, *Technics and Civilization*, Harcourt Brace & Company, Orlando 1934, reed. Harvest 1963, 110.

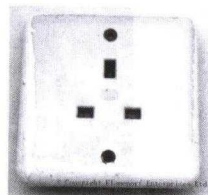
LEWIS MUMFORD: FROM THE FIREPLACE TO THE SOCKET

The fact that Vitruvius – the original theorist of Western architectural values – held the mastery of fire as the origin of human society is in itself a clear indication of the intimate conceptual bond between architecture and fire. But whereas the evolution and metamorphoses of fire technics (the uses, fuels, and control of combustion) had a tremendous and ever-growing influence on architecture in the last two centuries, the corresponding eviction of actual fireplaces from buildings weakened the awareness of this bond, especially among historians and theoreticians of architecture.¹¹ In the past 80 years however, a few authors, swimming against the current, did some work to try restore that consciousness. Four or five books may be considered as milestones.

In *Technics and Civilization* (1934), Lewis Mumford tethered the history of architecture to the history of energy production and distribution. As such he is probably the single most important architectural theorist of the 20th century. Mumford's principal work in his groundbreaking book was to assign new names to historical periods based on their predominant construction mentalities, materials, and capabilities. The centuries that preceded the industrial revolution, which he called the eotechnic era, was for Mumford a "water-and-wood complex." Mumford then divided the industrial revolution into a paleotechnic phase – a "coal-and-iron complex" – and a neotechnic phase – an "electricity-and-alloy-complex."¹² Even though these three phases did overlap and even still coexist within globalization, Mumford's periodization, based on the evolution of major fuels and power distribution techniques, provides a historical framework that allows us to stress the major steps in the progressive displacement of fire from buildings, and the corresponding metamorphoses of architecture.

In the eotechnic phase, houses and buildings are indeed the places of fire, altars of combustion for heating, cooking, and lighting alike. While the mastery of glass – another major fire technic of that phase – gradually allowed them to function as heliotechnical boxes, capturing more light and storing more heat from the outside, they are also Chinese lanterns, sanctuaries hosting discrete burning sources and niches (from fireplaces to candles) which punctuate visually, thermally, and olfactively, their internal space, organization, and atmosphere. From the first decades of the 19th century on, the “paleotechnical” shift to coal and iron encourages the encapsulation of domestic fires within cast-iron stoves, and the progressive relegation of combustion to central heating apparatuses and boilers located away from the living spaces, in underground or concealed rooms. In this technological complex, based on the mining of coal, fire, with its soot and fumes, is ostracized in the basement and, thanks to steam ducts and pipes, gradually divorced from the services it performs: heating, lighting, and cooking. Each of these functions develops its own paths and systems through buildings, which are thereby able to expand in size and height: hence the notice seen in fin de siècle European buildings, “Eau et Gaz à tous les étages” (“water and gas to all floors”).

Finally, around the turn of the 20th century, the “neotechnic” advent of electricity completes the process by freeing wired buildings, in principle, from having to host any primary combustion facility at all. Henceforth, every building is potentially a pure consumer of secondary energy rather than a producer, the leaf end of an arborescence of power lines and cables permanently conveying and instantaneously providing voltage wherever needed: the city is indeed a tree, and could become more so if buildings, like real leaves, would capture or synthesize energy and feed it back into the grid. Each neotechnic building is a secondary network of wires plugged into an infrastructural grid fed by coal, gas, nuclear, biomass, and hydroelectric power plants – the huge freestanding fireplaces of our era. Cleared of smoke and fumes, houses, apartments and offices are homogeneous thermostatic spaces providing an array of sockets for lamps, radiators, boilers, fridges, TVs, computers... Buildings function less and less as internal combustion engines, and more and more as switchboards, sockets, and chargers. Basically, neotechnic architecture is about the design of output terminals and charging points.



Fireplace.

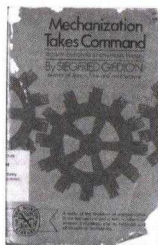


Well.

SIGFRIED GIEDION: FROM THE CAST-IRON STOVE TO THE MECHNICORE

The next landmark study exploring the technical evolution of “machines for living” is Sigfried Giedion’s *Mechanization Takes Command* (1948).¹³ Here, Giedion analyzed the ways in which machines and mechanization had progressively transformed organic processes (the cultivation of soil, the production of food, and the processes of plant or animal reproduction), but also the human surroundings (comfort and furniture), the household, and bodily hygiene (the bath). In doing so, Giedion called attention to the increasing influence that tools, prostheses, fixtures, and appliances were having on architecture, which emerged as a discipline responsible for little more than the design and furnishing of environmental equipment. A building was no longer a construction attended by servants, but a construction providing services.

So vast was the program of “anonymous history” that Giedion was opening up that he had to focus on just a few significant examples. Unsurprisingly, the “mechanization of the hearth” is one of them, and it introduces the whole section of the book devoted to the transformation of the household (essentially



1948 Sigfried Giedion, *Mechanization Takes Command*.



Giedion, 1888–1968.

¹³ Sigfried Giedion, *Mechanization Takes Command: A Contribution to Anonymous History*, Oxford University Press 1948, reed. Norton & Company 1969.

¹⁴ *Ibid.*, 527–548.

¹⁵ *Ibid.*, 625.

¹⁶ *Ibid.*

¹⁷ *Ibid.*, 626.

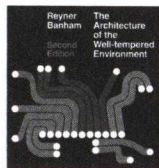
¹⁸ *Ibid.*, 627.

¹⁹ Reyner Banham, *The Architecture of the Well-tempered Environment* (The Architectural Press, London 1969; second and augmented edition in 1984). For a detailed study of the background of Banham's book, I cannot but refer the reader to the excellent introduction Luc Baboulet gave to its recent translation in French: "Paysage avec artefacts" in Banham, *L'Architecture de l'environnement bien tempéré*, HYX 2011. Baboulet insists on several previous authors which Banham barely mentions, even though he was well aware of their works, such as James Marston Fitch, Ellis Aronin, Victor Olgyay, Ralph Knowles, Maxwell Fry and Jane Drew. If our focus wasn't here on the metamorphoses of the hearth, but on the broader issue of architecture, environment and energy, the present overview should necessarily include these major books, especially James Marston Fitch, *American Building: The Forces that Shape It* (1948), and *Architecture and the Esthetics of Plenty* (1961).

²⁰ Banham, *op. cit.*, 19.

focused on the functions of cooking and cleaning).¹⁴ Tracking the successive means of "concentrating the heat source" while getting rid of the nuisances of direct combustion, Giedion follows the metamorphoses of the cast-iron stove (Franklin, Rumford, etc.) into the gas range and the electric range up to the fully equipped kitchens of the 1940s, teeming with mobile electrical appliances and designed as the cockpits of domestic life.

Giedion did not explicitly draw out the consequences of these transformations, and of the dis-integration of the fireplace, on architecture, except in the final chapter of this section, entitled "The House and the Mechanical Core." The *mechanicore*, "embracing the kitchen, bath, laundry, heating, wiring and plumbing"¹⁵ – the modern equivalent of both the well and the chimney – was clearly, in his view, the central issue around which the future of architecture revolved: "Mechanization brought with it difficulties of its own: there was on one hand the wish to use rooms as flexibly as possible and to enjoy the utmost freedom of groundplan; on the other hand, mechanization conflicted with this by seeking the utmost concentration of all installations."¹⁶ Though Bucky Fuller had explicitly tackled the problem of the mechanicore, his chimney-like solution "incorporating the core within a mast, which carries the weight of his house" nevertheless left Giedion rather perplexed: "Circular or polygonal houses resulted, whose closed ground plan is in contradiction with the inherent trend of contemporary architecture."¹⁷ The future of this trunk of wires and pipes (and the elevator shaft and mechanics), both rooting and holding the building up, seemed quite uncertain: "Whether the mechanical core will be dissected into its components or gathered into a single unit has not yet become clear. And it is not certain whether the mechanical core will find its use in one-family houses or in large apartment buildings, the design of which, in America, is still in the hands of routiniers."¹⁸ Giedion concluded: "what matters is to domesticate mechanization, rather than to let the mechanical core tyrannize the house."



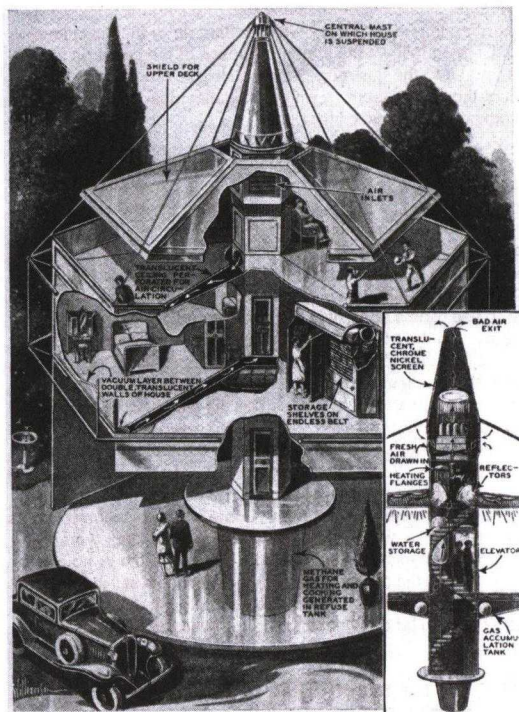
Banham, 1922–1988.

1969 Reyner Banham, *The Architecture of the Well-Tempered Environment*.

REYNER BANHAM: FROM THE STRUCTURAL TO THE REGENERATIVE

In 1969, four years before the first oil crisis, Reyner Banham published *The Architecture of the Well-Tempered Environment*, the first comprehensive attempt to embrace the issue Giedion had started to analyze 20 years earlier.¹⁹ But whereas Giedion had busied himself with some of the major mechanical appliances and fixtures that had invaded humanity's surroundings and indoor habitat, Banham would attempt to portray architecture itself as a matter of "environmental management."

The critical and alternative history of modern architecture presented in Banham's book amounted to a manifesto: whereas architects had always more or less considered architecture as the design of structures, the ordering of forms, and the assemblage of materials, it was in fact fundamentally a matter of environmental and thermal control, the provision of an enclosed set of atmospheric conditions and processes suited to human comfort and activities. For Banham, the design of material structures was only one of the possible ways to achieve that end. Architecture was not just about "forms assembled in light," as Le Corbusier would have it, but also about actually producing and distributing light, heat, and convenient climatic conditions. The architectural cell did not just have an envelope or membrane, but also a nucleus. In other words, architecture was basically a matter of energy, and this called for an in-depth reassessment of its history and present achievements.



Giedion on Buckminster Fuller's Dymaxion House "...incorporating the core within a mast, which carries the weight of his house."

Banham introduced his argument with the parable of a "savage" tribe that arrives at a camp-site 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*."²⁰ Stressing that a real tribe would choose one or the other solution purely according to custom rather than a rational estimate of the situation, Banham explained that this was exactly the case of Western nations, where architects typically respond by "enclosing 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."²¹

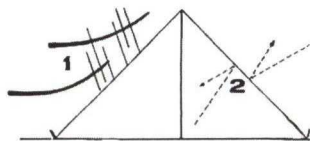
For Banham, the architectural profession was addicted to the structural solution for environmental management. He broke this down further into two complementary modes: the *Conservative* ("the ingrained norm of European culture"), where massive and durable structures absorb, store, and return heat, and the *Selective*, which "operates to expel unwanted conditions from within and to admit desirable conditions from outside." Traditional construction had always combined those two modes, but complemented both with a third, power-operated solution: "the *Regenerative* mode of applied energy, whether from the combustion of fuel or the exercise of human and animal muscle power."²² As Banham puts it, indicating the historical relation between the three:

"The proverbial phrase 'Hearth and Home' recognizes this interrelationship. But if these three modes should not be too strictly distinguished in traditional building, there is still a crucial climatic distinction that separates practices that are more conservative from those that are more selective, and

²¹ *Ibid.*, 21.

²² *Ibid.*, 23.

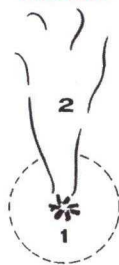
²³ *Ibid.*, 23–24.



Environmental behaviour of a tent.

1. Tent membrane deflects wind and excludes rain
2. Reflects most radiation, retaining internal heat, excluding solar heat, maintaining privacy

Build or burn: Banham's parable of the choices available to a "savage tribe."



Environmental conditions around a camp fire.

1. Zone of radiant heat and light
2. Downwind trail of warmed air and smoke

*an equally crucial historical distinction that separates our present period, which has the option of being primarily regenerative, from all previous periods.*²³ [editor's emphasis]

A revolution had occurred in 1882 with the domestication of electricity, which boosted the regenerative mode from the status of a "modest hand-maiden" to that of a "serious rival" to the Conservative and Selective modes. Yet almost a century later, architectural theory, history, and practice were still focused on "unaided structure" and continued to treat regenerative issues (heating, cooling, ventilating, distributing light and power) as if they were just "a matter for footnotes and appendices". In fact, Banham argued, architectural design was entirely – though unconsciously – dictated by these regenerative issues.

The Architecture of the Well-Tempered Environment thus presented itself as a counter-history of architecture, describing the major technical innovations that transformed the metabolism and nervous system of buildings, drastically improving their performance in terms of power-operated environmental control: the gradual elimination of smoke and the open flame; the distribution of heat from steam engine, gas, or electric boilers through pipes and radiators; the breakthrough of air-conditioning systems and "man-made weather" (led by American engineer Willis Carrier); the emergence and evolution of technical floors or suspended ceilings (combined with the curtain wall) for both the even distribution and concealment of ducts, pipes, wires, and cables; the correlate horizontal expansion of Giedion's mechanore in power mats or grids servicing homogeneous space layers; etc.

In parallel, Banham described a number of buildings that could be considered milestones in that counter history, where architects not only took advantage of these regenerative innovations but integrated them architecturally and expressed them in their design. Frank Lloyd Wright was portrayed as "the first master of the architecture of the well-tempered environment" both for his Larkin building (1906), a masterpiece of ventilation framed by its four chimney-like brick stair towers and duct-boxes at corners, and for his Prairie Houses, where the symbolic staging of the fireplace was completed by an elaborate interplay of heating, lighting and ventilating systems.

As if announcing the imminent triumph of the architecture of the well tempered environment, Banham presented a host of more recent exemplary buildings, among them William Lescaze and George Howe's Philadelphia Savings Fund Society (1932), for its ventilation system and prefiguration of the suspended ceiling; Philip Johnson's Glass House (1949), for its fireplace/bathroom mechanical core linking the electric heating, floor and roof slabs; and Louis Kahn's Richards Laboratories (1965), for their impressive staging of the service shafts in brick towers surrounding and holding the labs.

In the second edition of the book, in 1984, Banham would naturally celebrate the "breath of intelligence" that its first edition had contributed to a new generation of high tech buildings, such as the Willis, Faber, Dumas offices in Ipswich by Norman Foster (1975), the archigram-esque ex-plumbing and ductwork of the Pompidou Center in Paris (1977), and, last but not least, the Inmos factory by Richard Rogers (1982) where pipes and air handling machinery had been seized as "a modern opportunity to extend the expressive vocabulary of art."²⁴ In Banham's eyes, all these were instances where "the application of radical intelligence to our problems" had triggered "the displacement of habit by experiment, and of accepted custom by informed innovation," and where regenerative technologies had dissolved "what architecture has been made of to date: customary forms." Hence Banham's ultimate conclusion: "The position of these upstart technologies seems as secure as ever, in spite of the predictions of their disappearance along with fossil fuel, and the art of making fit environments for human activities must now accept their claim to be a permanent part of the craft of architecture."²⁵

INTERMISSION

The Architecture of the Well-Tempered Environment had all the ingredients of a powerful manifesto, suggesting a whole new way to judge architecture based on the evolution of combustion and regenerative technologies. But it so happens that its publication almost coincided with the first energy crisis in the 1970s, and a sudden spike in concern about the "Limits to Growth" (Club of Rome, 1972) and the environmental externalities linked to the exploitation of fossil fuels. Despite its claim to take a stand against the "tone of panic" which characterized "all such responses to the energy crisis, masquerading as a moral crusade,"²⁶ the second edition of Banham's book registered a certain theoretical unease, and discreetly added a number of buildings that actually resorted to the presumably more ecological "selective" mode of building.²⁷ Obviously, and for all its intelligence, the way Banham had framed the issue of thermodynamics in architecture left something to be desired.

In the wake of the energy crisis, a number of authors attempted to recast the problem. One of them was Lisa Heschong, in her short, dense, and elegant book, *Thermal Delight in Architecture* (1979): a vivid evocation of the thermal experiences provided by various pre-modern architectures, ranging from the hearth-centered home to the Roman bath, the Japanese house, the Islamic garden, the Finnish sauna, the igloo, the Hindu temple, the veranda, inglenook, gazebo or the outdoor swing.²⁸ She contrasted this bounty of thermal delights with the prevailing modern ambition to achieve what James Marston Fitch had called "a thermal 'steady-state' across time and a thermal equilibrium across space."²⁹ Against the "high-energy-consuming mechanical methods of neutralizing the thermal environment" and "the modern emphasis on central heating systems, air conditioning and hermetically sealed buildings which has actually damaged our thermal coping and sensing mechanisms," Heschong pleaded for a passive architecture, based on solar energy, that would revalidate that panoply of thermal qualities. Evoking a couple of solar houses recently built at the time, notably by architect David Wright, she wrote:

"A solar house, geared to both the people who live in it and the cycles of the sun is seen to exemplify the human relationship to the natural world. Such an attitude is quite reminiscent of the ancient's fire worship as a celebration of the death and rebirth of the sun. It suggests a parallel between the symbolism of the hearth and of solar buildings. They both domesticate an elemental force to provide for pragmatic thermal needs. They both bring a primal phenomenon into the realm of everyday experience."³⁰

²⁴ *Ibid.*, 299.

²⁵ *Ibid.*, 312.

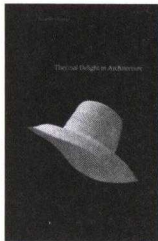
²⁶ *Ibid.*, 278.

²⁷ Particularly telling in this respect is the last example published in the second edition: a house in Santa Cruz, California, by Thacher and Thompson (1982), which Banham praises for the subtle adaptation of its gable and solar orient window to both winter and summer airflows (*ibid.*, 309). But the St George School, Wallasey, Cheshire, 1961, by Ensley Morgan and the Zome house, New Mexico, 1972, by Steve Baer, are other examples, basically selective, which Banham also introduced.

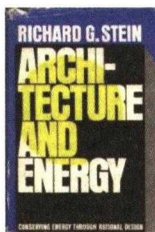
²⁸ Lisa Heschong, *Thermal Delight in Architecture*, MIT Press 1979.

²⁹ James Marston Fitch, *American Building: The Environmental Forces that Shape It*, Houghton Mifflin, Boston 1972, 46, quoted in Heschong, *op. cit.*, 20.

³⁰ *Ibid.*, 57.



1979 Lisa Heschong, *Thermal Delight in Architecture*.



1977 Richard Stein, *Architecture and Energy*, Conserving Energy through Rational Design.

But for all its eloquence on the many lost thermal delights, the book was rather short on evidence of the way that such varied climatic experiences could actually be recovered by a solar architecture.

Much more ambitious in its attempt to tackle the whole issue of energy in buildings was a book published two years previously by New York architect Richard Stein. Soberly titled *Architecture and Energy* (1977), it endeavored to portray architecture as a wholly energetic issue.³¹ Stein evaluated the energy costs of both the maintenance and production of modern buildings (operating as well as embodied energy), and identified the many ways in which these high power expenditures could be reduced, thereby making architecture more efficient, adjusted, and functional: "The lack of self-imposed or socially required constraints and the unwillingness to recognize the imperatives of building with care, precision and economy was defeating and enslaving," Stein wrote. "Conversely, the recognition today of the limitations of building in a finite world can reintroduce the meaning and interconnections that have been abandoned. The skill, mastery, and style can return."³²

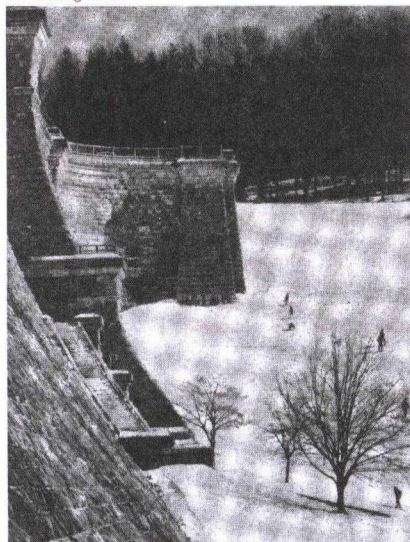
Based on research into energy accounting (inspired by Wassily Leontieff³³) and a thorough analysis of the mechanisms and power games at play in the U.S. building industry, *Architecture and Energy* performed a grim accounting of the various energy systems and standards that had colonized the scene of architecture and construction: "this cast is wandering around the stage, each largely unaware of the others, moving with a Beckettlike isolation, except for occasional interaction. The dialogue is sparse. The spectators realize how interdependent the performers really are, but there is no way to convey this obvious truth to the characters."³⁴

Stein's book paid due reverence to renewable energies borrowed from the environment, such as solar and wind. But it was essentially a plea for the reduction of energy use that would come from the rescaling of power

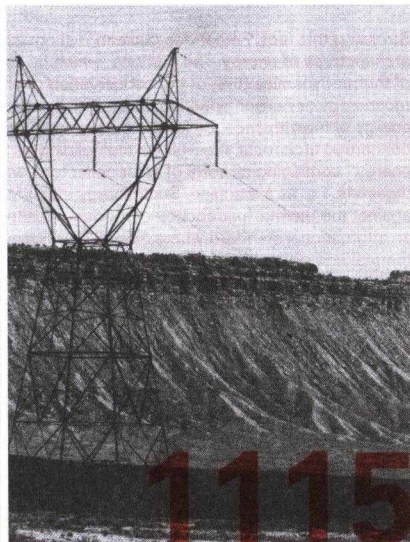
³¹ Charles G. Stein, *Architecture and Energy*, Anchor Press/Doubleday, Garden City, New York 1977.

³² *Ibid.*, 237.
³³ Wassily Leontieff (1906–1999) is the economist who developed the use of input-output tables to analyze the flows between different sectors of industry, or between different countries. A strong advocate of the use of quantitative data in economics, and a fierce critic of economists who were reluctant to "get their hand dirty" by working with empirical facts, he was awarded the Nobel Prize in 1973 for this specific and major contribution to the field. Many methods of accounting the flows of specific data, including energy, are based on his model.

Stein, landscapes of energy: "The Croton Dam in Westchester County, New York, is a granite dam that maintains an easy scale relationship with the surrounding terrain."



"The power transmission tower challenges the mesa near Cortez, Colorado."



generation and grids, from embracing "differentiated spaces, contrast, and lowered ambient levels," from individually controlled energy and, most of all, from a recalculation of all the conservative, selective, and regenerative features of buildings. For Stein, the challenges of the environmental crisis required no less than reconnecting with the spirit of the modern movement (as well as with the lessons of vernacular architecture):

"The environmental responsibility of architecture, the aspect that introduces many architects into the whole interconnected examination of the ecosystem and its components, broadens architectural practice. The comfortable avoidance of controversial issues; the concentration on the formal aspects of aesthetics; the absence of communication with the scientific community, the groups concerned with the future of the world, and other broad humanistic philosophers;³⁵ the compartmentalization of the architectural process through which technical matters are taken care of by engineers – all these are no longer tolerable in view of the critical nature of our entire world ecological balance. In a word, there is an urgent need to relearn the way to build buildings that function simply and without a complete surrender to energy-dependent systems."³⁶

LUIS FERNANDEZ-GALIANO: ON THE THERMODYNAMICS OF ARCHITECTURE

If Banham's name does not even appear in *Architecture and Energy*, the specter of "the most eloquent defender of West Coast hypertechnological society" is, on the contrary, omnipresent in the background of Luis Fernandez-Galiano's *Fire and Memory: On Architecture and Energy* (1991), but as a kind of foe.³⁷ Published three years after Banham's untimely death and shortly after the first report of the Intergovernmental Panel on Climate Change, this book may be considered a counterpoint to *The Architecture of the Well-Tempered Environment*.³⁸ Drawing on physics (Prigogine), economics (Georgescu-Roegen), biology and ecology (von Bertalanffy, Lotka, Odum, Margalef), Fernandez-Galiano intended (like Stein) to consider architecture as basically a matter of energy, and, hence, from the point of view of thermodynamics. Indeed, a building is an exosomatic artifact which "accommodates processes but is also, in itself, a process, and both circumstances call for the presence of energy," including "grey" or "embodied" 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."³⁹

Stressing this fact, Fernandez-Galiano distinguished three different *architectures of energy*. The first one, which he associated with the first law of thermodynamics (that of the conservation of energy), and called *heliotechnology* or *heliotechnology*, is essentially mechanistic and focused on the energy of maintenance. By far the most popular among environmentally concerned architects, it envisions the building as "a domestic factory of energy" combining all sorts of solar collectors, wind generators, and methane digesters, i.e. as a machine. Such energy efficient *heliotechnology* is a reaction against the thermal inadequacy of modern architecture and its promotion of an international standard where "visual homogeneity went hand in hand with thermal homogeneity." Yet Fernandez-Galiano considers high performance, energy producing buildings as subject to exactly the same critique: "Obsessed as it is with maximizing gains, minimizing losses, and optimizing output, this kind of architecture is a living example of the mechanistic, reductive, unidirectional and monofunctional approach to design."⁴⁰

Hence, Fernandez-Galiano stressed two additional approaches associated with the second law of thermodynamics (entropy), which he differentiated into an

³⁴ *Ibid.*, 116. At the other end of the chain, Stein also inquired into "the aesthetics of energy-producing facilities," describing how bigger and bigger powerplants, always more remote from the end users, with their transmission corridors, and the transportation infrastructures, were jeopardizing the scale and meaning of landscapes.

³⁵ Stein's research was actually instigated and encouraged by American biologist and politician Barry Commoner (1917-2012), who was among the founders of the modern environmental movement, and ran for the presidency of the United States in 1980. His famous Four Laws of Ecology as exposed in *The Closing Circle* (1971) – everything is connected to everything else; everything must go somewhere; nature knows best; and there is no such thing as free lunch – have their specific relevance in architecture.



2000 Luis Fernandez-Galiano, *Fire and Memory: On Architecture and Energy*.



³⁷ Luis Fernandez-Galiano, *Fire and Memory: On Architecture and Energy*, MIT Press 2000. The work originally appeared in Spanish under the title *El fuego y la memoria. Sobre Arquitectura y energía*, Alianza Editorial, Madrid 1991.

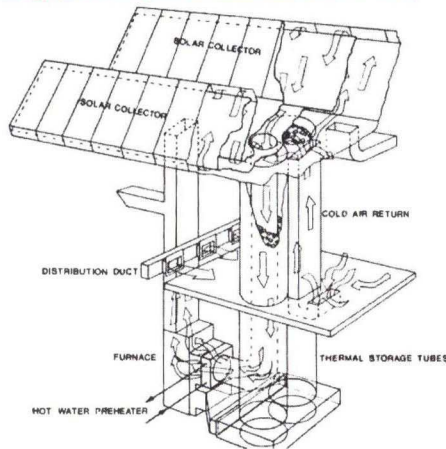
³⁸ Luis Fernandez-Galiano is explicit in a footnote to the first chapter: "It seems paradoxical to be quoting Banham in this context, because the conclusions we arrive at here are almost diametrically opposed to those he upholds in that book, so exuberantly charged as it is with technological optimism. Nevertheless, in my opinion, the value of Banham's work lies more in his undeniably innovative point of view than in the actual view he propounds, which after all is conditioned by the great expectations of the 1960s."

³⁶ Ibid., 247.
³⁹ Ibid., 5.
⁴⁰ Ibid., 107.
⁴¹ Ibid., 119.
⁴² Ibid.

optimistic and a pessimistic version. The first of these "architectures of the second principle" he dubbed bioclimatism, since it is fundamentally organicist, preoccupied with climatic adaptation, materials endowed with symbolic biological connotations, and integration into nature. It considers the building as an organism which, like every living structure, aims at performing its functions with the least input or expenditure of energy: essentially what we call passive architecture, an approach "more concerned with controlling than with maximizing the capture of natural energy, nourished by fluctuating energy flows, self regulated by processes similar to metabolic ones."⁴¹

As to the last approach, the one corresponding to the "pessimistic" version of the law of entropy law, Fernandez-Galiano dubbed it the architecture of *rehabilitation*. It views matter, and thus existing or inherited buildings, as captured energy, accumulations of information and memory that should be spared, treasured, attended to and transmitted. This "pessimistic" approach was for him "only one that fully deserves to be considered 'architecture of the second principle.'" It is indeed "as attentive to the process of entropic degradation of matter as to that which affects energy, dedicated to the recuperation and recycling of both the existing material support and the information it contains, and concerned first and foremost with rehabilitating what is fabricated and used, recuperating what has been learned and forgotten."⁴² In other words, rehabilitation – the repairing, restoration and reuse of already built structures – was presented as the most serious and responsible way to deal, in the field of architecture, with the problem of energy and the inescapable predicament of entropy. What was most needed was to slow down the course of civilization towards thermal death, by preserving captured energy and the heritage of already informed matter, conceived as a fragile but precious genetic pool of information, culture and memory.

Despite the fact that the three approaches – heliotechnology, bioclimatism, and rehabilitation – were not presented as mutually exclusive, no more than the conservative, the selective and the regenerative had been considered incompatible by Banham, it is clear that by emphasizing rehabilitation (the conservation of material information and memory), Fernandez-Galiano inverted the hierarchy proposed by Banham between his own three modes. Instead of calling for the "displacement of accepted custom by informed innovation," and for the replacement of existing structures by more efficient regenerative systems, the concern for entropy and for a more sustainable environment required first and foremost the careful preservation of the energy (and the capital of information and memory) accumulated in our inheritance of extant



Heliotechnology:
 "a living example of
 the mechanistic...and
 monofunctional
 approach to design"
 (LF Galiano, op. cit.,
 105 & 109)

When architecture is designed based on energy priorities, the resulting image is not always organic. Many constructions using solar energy, for example, are displays of extreme mechanicism; heliotechnology is a branch of heating and ventilation engineering that yields intricate machines full of tubes, valves, and pumps.

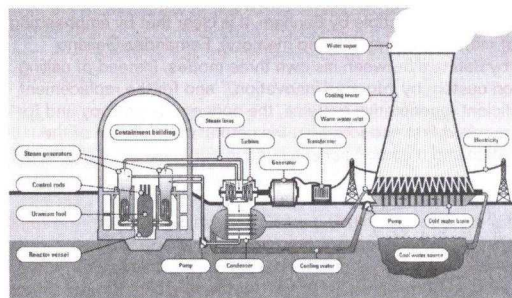
4.2. System of solar heating through collectors (Watson).

buildings. Tradition was not an obstacle to the management of a well tempered environment, but the most precious resource for slowing down its degradation.

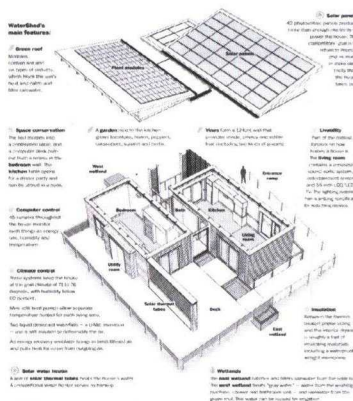
THE ELEMENT OF FIRE

A broader overview of the literature would single out several other references, and since the escalation of concerns about climate change and the "peak all" in fossil fuels, studies on the role of energy in buildings and cities have been piling up. But the four or five books I have just leafed through represent major milestones in the evolution of the fire's place in buildings and the theory of architecture.

Clearly, things have dramatically changed since Semper's time. While heating, ventilation and climate control systems have invaded the interior of buildings, and whereas combustion techniques have become everywhere essential in the production of the materials, components and structures of all the other elements of architecture (well beyond the arts of ceramics and metallurgy), fire itself has lost its focus, and almost disappeared as a distinct element. It looks as if its overwhelming expansion and distribution through built structures has gone hand in hand with the elimination of its local and phenomenal presence (flame and smoke) from their core. Semper's elementary anatomy of architecture seems a bit anachronistic today. The hearth no longer stands out as the primary, most important and *moral* element of architecture, which the three others (the roof, the enclosure and the mound) were charged with protecting from the threat of wind, rain and mud (or dust). After the modern phase, where the fireplace was progressively erased by the free plan, and where the other three



elements projected from the inside out, so as to conquer the surrounding conditions (pilots, roof terrace, glazed façades, etc.), the logic of Semper's elementary anatomy of architecture now seems completely reversed. With the proliferation of green roofs and façades, the plunging roots of geothermia, the multiplication of solar panels, wind turbines and water-retention systems, it seems as if the six façades (the three peripheral elements) are now displayed as "protecting negations" defending not the hearth's flame against the environment, but the environment itself against the dire effects of global combustion, of which buildings are still, and more than ever, among the major end products. Protecting negations or, in many cases, protecting denials: the weird politeness of predators who apologize for not being able, or not really willing, to change their diet.



2011 Synchronized realities?
Explanatory model of a nuclear plant (by Frederic Gaspoz, University of Maryland entry for the Solar Decathlon).

⁴³ Simondon's first and most important book in this field, *Du Mode d'existence des objets techniques* (Aubier, Paris: 1958), was originally written as a complementary thesis to his doctoral dissertation, *L'Individuation à la lumière des notions de forme et d'information* (Millon, Paris: 2005).

⁴⁴ See Jacques Lafitte, *Réflexions sur la science des machines* (Vrin, Paris: 1935). Although Simondon criticizes several aspects of Lafitte's classification, and generally prefers the notation of technical objects to that of machines, he basically endorses (and considerably deepens) Lafitte's evolutionary analysis in three phases (particularly in the texts gathered in *L'invention dans les techniques: cours et conférences* (Seuil, Paris: 2005).

⁴⁵ Simondon's classification also echoes Mumford's threefold history of technics, and could be seen as both a deepening and explication of its internal logic.

⁴⁶ "L'invention dans les techniques" (1971) in Gilbert Simondon, *L'invention dans les techniques: cours et conférences*, Seuil, Paris 2005, 234.

TOWARDS AN ORGANOLOGY OF ARCHITECTURE

The extraordinary situation we are now in, where huge combustion processes and massive power plants have multiplied everywhere (but generally out of sight) in order to supply the insatiable energy demands of an exploding global population and its relentless urbanization, has dramatically changed the conditions of architecture. This situation of a ubiquitous thermotope (*a contradictio in adjecto*), coupled with the energy/climate predicament, calls for a renewed inquiry into the "mode of existence" of architectural objects.

A serious attempt at that would find a strong impetus in a careful study of the works of French philosopher Gilbert Simondon, which have been, so far, only marginally considered by architects.⁴³ Following a distinction introduced in 1935 by engineer and architect Jacques Lafitte, Simondon divided the domain of technical objects (complementary to the mineral, vegetable and animal kingdoms) into three classes, which he also considered, somehow, as three stages in their evolution.⁴⁴ The first one was "passive machines", i.e. those which are independent from an external input of energy and, as Lafitte said, "have no other useful properties for men than those which they draw from their fixed position in space, their mass, and the strength of the materials they are made of." Simondon considered buildings and architecture as pertaining to the upper range of this class. Then came "active machines," operated through an input of external energy that they transform, thanks to an elaborate system of *elements* – the technical equivalents of biological *organs* – that enables them to transmit the effects of this energy flow (a lamp, an automobile, etc). And finally came "reflexive machines," i.e. those which, in addition to being "active" (but not always: think of an old mousetrap) are also equipped with organs that allow them to "perceive" variations in their relations with their milieu and to adjust or modify their operation accordingly: all the machines which receive, amplify, transmit and display information.

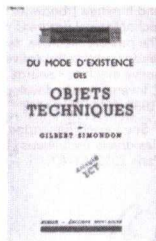
Of course, buildings and constructions have evolved and cannot be entirely confined within the category of passive machines. One immediately notices that Simondon and Lafitte's categories (passive, active, reflexive) are somewhat close to Banham's conservative, regenerative and selective modes, but in that hierarchical order, with the reflexive/selective (and not the active/regenerative) as the most recent evolutionary step.⁴⁵ But whatever their active or reflexive components, Simondon still considered most architectural objects as globally passive machines because, in them, *adaptation* generally prevails over *auto-correlation* or internal consistency:

"Buildings insert themselves between Man and the geographical milieu by producing a microclimate; on the inside, they are adapted to Man by the shape and disposition of the rooms, the stairs, the contrast between the different places or areas, the possibility of heating and lighting, the absence of rain or wind; on the outside, they are adapted to the milieu, in terms of stability and balance, by their foundations, the way their materials are assembled; they are also adapted to their milieu by their roof cover, whose type depends on climate, so as to resist to wind and rain or snow... Despite this double adaptation inside and outside, buildings have a certain auto-correlation, because one cannot reconcile any overall structure, visible from the outside, with a given distribution inside; this minimum of auto-correlation results in the fact that the external appearance reveals and sometimes even manifests the building's vocation, the social standing or the profession of its users. But this correlation is not tight enough to forbid reconversions or reuses..."⁴⁶

In other words, the adaptation of architectural objects is not focused on a highly specific end or function. And their potential *soliditas* or auto-correlation – which mediates (and compromises) between two sets of conditions – is less complete than that of active or reflexive machines, which, narrowly adjusted to a specific kind of operation, are also more mobile, more autonomous, and detachable from their geographical environment.⁴⁷ As *individuals*, architectural



Simondon, 1924–1989.



1958 Gilbert Simondon, *Du mode d'existence des objets techniques*.

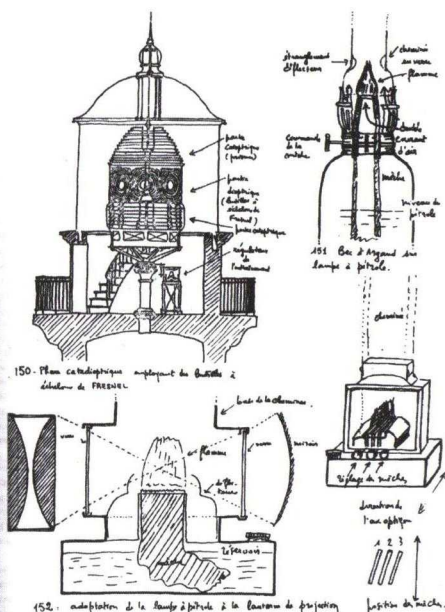
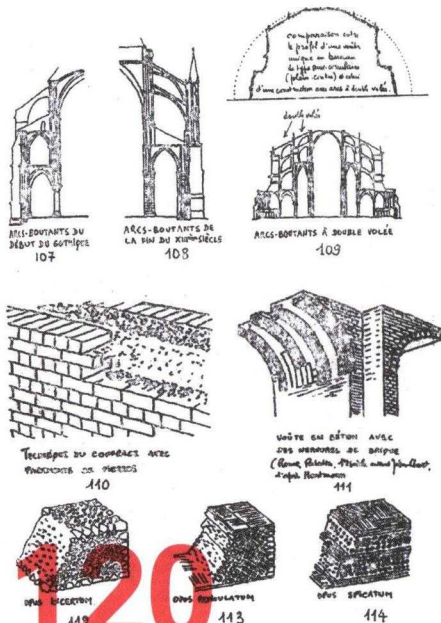
objects cannot reach the same kind or degree of "concretization" that other and more specialised machines may attain.

But again – and this is one of Simondon's central theses – technical "individuals" (and consequently architectural objects) are always made of infra-individual components, or organs – the technical *elements* – and inserted into broader assemblages or networks – the technical *ensembles* – which largely define their "associated milieu." This distinction defines the "mode of existence" of technical objects, and allows Simondon to explicate the specific mechanism of their evolution.

Strictly speaking, it is individual machines which men deal with, live with, operate and manipulate: cars, buildings, phones, tools, computers, pianos, televisions, etc. Only these metastable objects are real protagonists on the stage of everyday life, whereas the infra-individual (or shared) elements they are made of and the supra-individual (or collective) contexts they are plugged into (or emerge from), tend to slip "out of sight, out of mind," either because these conditions are embedded or sublimated. And this condition of individual machines is concerning because it occludes their meaning and the processes by which they evolve. Indeed, as Simondon explains, technical objects, unlike humans, animals and biological beings in general, do not directly reproduce. Instead, their evolution is subjected to a cyclical process of relaxation,⁴⁸ which tends to synchronize the phases of historical development: gradually, the given individual machines of an epoch, by being interconnected and combined, form a technical *ensemble* which, at a certain moment, produces new infra-individual elements or organs that capture, crystallize or synthesize the specific technology of that ensemble. In turn, these new elements are incorporated in other individual machines, which end up forming a new technical ensemble, etc.

⁴⁷ But Simondon, witnessing the progress of prefabrication, questioned the degree of passivity of architecture and its possible evolution: "In order to assess the extent to which a given construction is a more or less perfect "passive machine," it might be possible to introduce, beyond the criteria of functionality and synergy of its different elements, that of the temporal reversibility of the assembly and disassembly. Some contemporary buildings are designed so that they may be enlarged or prolonged without discontinuity (such as the Dominican convent built near L'Arbresle by Le Corbusier); but very rare are the buildings that could be disassembled without destruction; in this respect, the passive machine is before all a machine irreversibly constituted of elements that stick and adhere to one another; the immovable nature of the building [immeuble] lays first and foremost in the irreversibility of its genesis; if buildings became movable and dismantlable, they would have the basic characteristics of active machines, which are open, admit repairs and replacement of parts. The major postulate of architecture is the immovability of its products, which implies the irreversibility of the genesis, and therefore also the irreversibility of the degradation in time, the impossibility of total recycling and transfer. But in this sense, architecture integrates and spreads a cultural barrier (the distinction between real estate and furniture [*fancier et mobilier*]) that a further technological progress might lead to revoke. The passive machine, by its very development, tends towards the active machine, and the active machine towards the reflexive machine." (*L'invention et le développement des techniques*" (1968–69) in *Ibid.*, 182.

⁴⁸ See Gilbert Simondon, *Du mode d'existence des objets techniques* (1958), re-issued Aubier Paris 2012, 81–87.

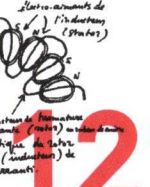
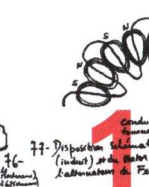
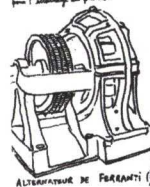
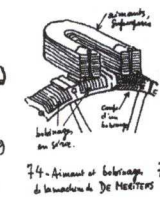
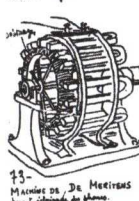
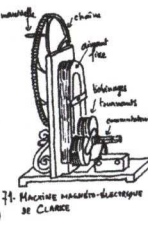
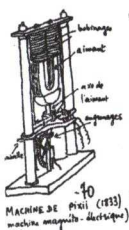
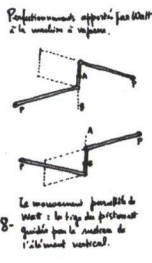
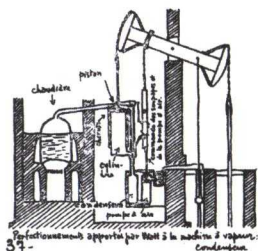
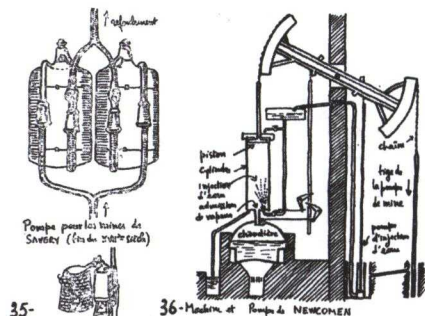


The paradigmatic example that Simondon gives is that of the evolution of power sources: in the 18th century most of the energy used came from running water, wind and animal power. These types of power corresponded to relatively small artisan ensembles located along rivers. But from these ensembles emerged thermodynamic elements such as the tubular boiler or Stephenson's *coulisse*, which were engaged in new "individuals" such as the locomotive and the railway engine. Because freight transportation was thus liberated from its previous reliance on waterways or contour lines, larger industrial concentrations, which were not only composed of thermodynamic individuals but were also thermodynamic in their structures, could develop around coal mines and steel factories (while the railway transportation of passengers also favored urban concentration). In the same way, it is within these thermodynamic ensembles that the first electrotechnical elements (copper cables, isolators, etc) started to emerge as easier means of transporting energy from one place to another, giving birth to new individuals such as turbines or alternators.

And these, in turn, were integrated within new ensembles of power production, distribution and use whose structures were very different from that of thermodynamic concentrations. The role played by railways in the thermodynamic ensemble was thus taken over, in the electrotechnic one, by power-lines, which stimulated an industrial decentralization that went hand in hand with the development of the car. "The automobile and the high power-line are parallel technical structures, synchronized, but not identical": indeed, automobile technology, even if it increasingly uses electric power, is still largely thermodynamic in its principle.

Architecture among machines and technical objects: drawings by Gilbert Simondon illustrating his course on *L'invention et le développement des techniques* (1968-1969).

At the time he was writing his stunning thesis, almost 60 years ago, Simondon already saw that the fully developed electrotechnic ensemble had produced new elements and schemes that were about to spark a new phase of "relaxation": first, with the acceleration of particles, the possibility of exploiting nuclear



energy, and, second, with electrometallurgy and the extraction of pure silicon, the possibility of developing photoelectric systems. In his view, those two very different technologies were also essentially parallel and likely to synchronize (i.e. to mutually encourage their simultaneous and complementary developments): "Nuclear energy will probably long stay inapplicable, in direct form, to small uses such as those which consume only a few watts; on the contrary photoelectric power may be easily decentralized; it is essentially decentralized in its production, whereas nuclear energy is essentially centralized. The relationship which existed between electric energy and energy drawn from oil combustion still exists, though maybe more accentuated, between nuclear energy and photoelectric energy."⁴⁹

What is extremely interesting here is not only the background that this condensed history gives to the evolution of the fireplace in architecture over the past centuries, but also the profound insight Simondon provides into the elemental process of architectural evolution itself. Indeed, as Simondon said, "elements have a transductive quality which makes them the true carriers of technicity, as the seeds which transport the properties of the species and produce new individuals. It is therefore in the elements that technicity exists in its purest form... whereas it emerges, in individuals and ensembles, only as combination."⁵⁰ Architectural invention and imagination thus presuppose, on the part of architects, an intuitive notion of the technicity involved in the elements, and the ability to incorporate them into new metastable assemblages. Hence the importance of the *organology* of architecture which is attempted in this volume, and of the correlative study of the technical but partly invisible ensembles of which buildings appear to be the terminals and outcrops. This inquiry into the genesis and metamorphoses of these realities, which both undermine and *overmine*⁵¹ individual buildings, is all the more urgent at a time when the environmental predicament exacerbates a hysteria of technolatriy and a corresponding delirium of technophobia. Nowadays, too many architectural objects are closed machines which, instead of subsuming their elements and sublimating their associated milieu, seem anxious to attain some kind of fake autonomy, by denying both, thereby ruining their intelligibility, durability and legacy.

BURNING LIKE HELL

Buildings are today pulled apart and disintegrated by the antagonistic forces that have deprived them of the physical presence of the fireplace. On the one hand, they are more and more dependent on an expansive infrastructure of power lines, pipes, cables, sewers, and networks, fueled by those more and more remote but bigger and bigger combustion plants of fossil energies. Plugged like bulbs of different sizes and voltages onto this messy grid, they emerge as pure consumers in a landscape configured by the giant equivalents of their classic elements (corridor/highway, floor/runway, etc.). As pure consumers, receivers, or terminals, more and more made of components produced by this regenerative system, they cannot but represent their fragile and dubious condition. Either subdued or monumental, self-conscious or self-contained, they do not look metastable nor resilient. Let's be honest, they don't look good: the newer they are, the sicker they seem. As Robert Smithson once said: these buildings don't fall into ruins like their elders, but *raise* into ruins.

On the other hand, haunted by some kind of generic bad conscience, these same buildings tend to display and even to project out, at the cost of consistency, all the exterior signs of goodwill and of a no less generic concern for "sustainability," often imposed onto them, from without, by an arsenal

⁴⁹ *Ibid.*, 86-87.

⁵⁰ *Ibid.*, 91.

⁵¹ I am borrowing this neologism from philosopher Graham Harman, who distinguishes two ways of questioning and devaluating the import and consistency of objects. The one undermines or disintegrates them into their elements, while the other overmines or dissolves them in the network of their relations with other objects. See for instance *L'Objet quadruple: une métaphysique des choses après Heidegger* (Puf Paris 2010), 14-26.



Si: Silicon, raw material for photovoltaics (and semi-conductors), crucial in a new "electrotechnic ensemble," according to Simondon.



2014 TV-illuminated
apartment, Rotterdam.

of regulations. But for all their display of photovoltaic surfaces, green façades, double glazing, passive ventilation, etc., they rarely achieve the consistency of quasi-worlds whose elements would selectively capture, resist, and express the conditions of their local environment (the Elements), and be intimately correlated so as to produce balanced thermotopes in which fire itself would regain a more modest, but also much more precious and enjoyable presence. Obviously, fire needs to be redomesticated.

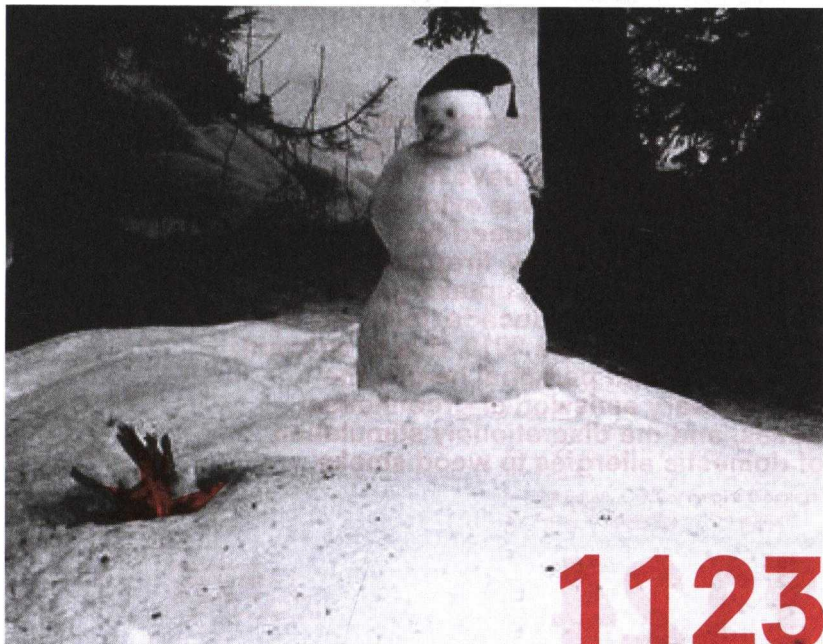
An easy conclusion on a threatening issue. But while windows at night are flickering with blue reflections from television and computer screens, disheathered smokers are out there, freezing.

The most perfect palindrome ever composed, also referred to as Hell's Verse, is sometimes attributed to Virgilus. It supposedly referred to moths (or stars), but the seven billions which nowadays compose humanity (smokers and non-smokers alike) may find it more and more consonant with their global situation. And it is no coincidence if Guy Debord chose it as the title of his most heartrending film. There it goes:

**in girum imus nocte
et consumimur igni**

**we turn around in the night
and we are consumed by fire**

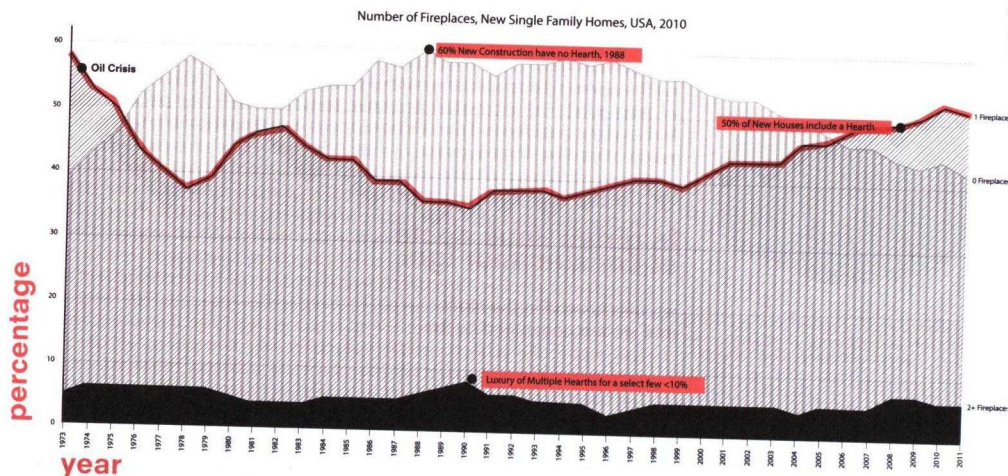
1990 Fischli & Weiss,
Snowman.



1123

functionally extinct? fireplace in the 21st century

...since 1991, the
fireplace is on the rise

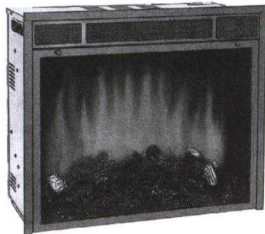


...decline: american fireplace trends already by the 1980s, the majority of new-build homes in the us have no fireplace. By 1990 a luxury trend is evident: a growing percentage of homes need two or more fireplaces. in the 2000s, fireplace nostalgia kicks in, and fireplace uptake grows by 10 percent over the decade, followed by a small decline since 2010, due to concerns over global and personal health: the unnecessary emission of greenhouse gases, and the discretionally stimulation of domestic allergies to wood smoke...



HOMEOWNER'S INSTALLATION AND OPERATING INSTRUCTIONS

PLEASANT HEARTH ELECTRIC FIREPLACE INSERT
 FR-PLEASANT HEARTH ELECTRIC FIREPLACE INSERT (page 19)
 SP-PLEASANT HEARTH ELECTRIC FIREPLACE INSERT (page 37)
 MODEL/MODELO #18-600-310 / GCE-1803 / GCE18TRG13 /
 23-600-320 / GCE-2303 / GCE23TRG13



For installation with
 Pleasant Hearth
 Fireplace Mantel

IMPORTANT INSTRUCTIONS

PLEASE READ THIS MANUAL BEFORE INSTALLING AND USING APPLIANCE

WARNING!

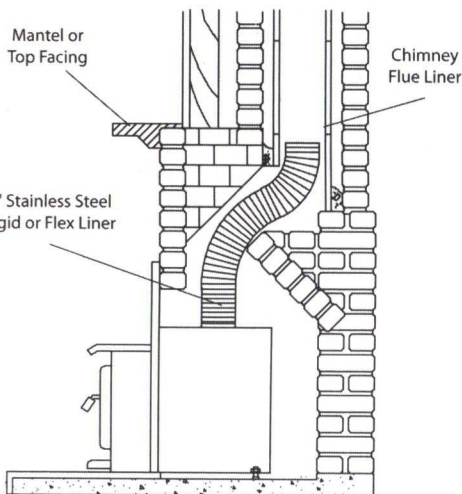
IF THE INFORMATION IN THIS MANUAL IS NOT FOLLOWED EXACTLY,
 AN ELECTRICAL SHOCK OR FIRE MAY RESULT
 CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

INSTALLER: Leave this manual with the appliance.
 CONSUMER: Retain this manual for future reference.

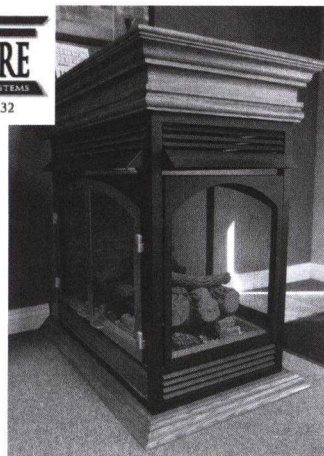
Questions, problems, missing parts? Before returning to your retailer, call our customer service department at 877-447-4768, 9:30 a.m. - 4:30 p.m. CST, Monday - Friday, or email us at customerservice@gagroupinc.com.



Pleasant Hearth:
 "If the information
 in this manual is not
 followed exactly,
 an electrical shock
 or fire may result."



Pacific Energy:
 Following Franklin's
 innovation, an electric
 insert for real fireplaces.



2011 Fireplace by Empire Comfort Systems,
 jutting out from the wall for maximum visibility,
 including imitation logs. Transparent walls display
 the naked flame.

"...in the last couple of years houses have gotten smaller and the price points have become more competitive. Its one of the profit centers - like how the wife pays attention to granite counter tops in the kitchen, they just expect that fireplaces are expensive. As houses have become smaller, the fireplace has become an option instead of a norm. I feel that as the market recovers, the fireplace usage rate will stabilize if not grow. It can be, and it should be, the focal point of the home. It's where your Christmas tree is next to; it's where you open presents; it's where you have your coffee. I'm pretty confident that moving forward the fireplace will regain ground. You may not have four fireplaces in each house, like in some McMansions. It may only have one or two. Basically the builder buys the fireplace for \$500, sells it for like \$5,000, then adds \$7,000 worth of value to the home. I think because of that added value they will keep the market there moving forward."

—Nick Bauer, CEO of Empire Comfort Systems, interviewed by the editors.

1125

REJECTION: BODILY AND GLOBAL HEALTH

Those attempting to resurrect their fireplace are faced with the health risks and the stigma of visibly contributing to climate change. The Environmental Protection Agency, in a 2013 report titled "Health Effects of Breathing Woodsmoke," lists "irritation of the airways, coughing ... aggravated asthma ... bronchitis ... irregular heartbeat" as effects of prolonged exposure to fine particle pollution exposure in the home.

spare the air

EXPLORE BY: Topics Visitor Type What's New RSS

Spare the Air Status

Saturday, 11/16

No Spare the Air Alert in Effect

Sunday, 11/17

No Spare the Air Alert in Effect

Spare the Air

Air Quality Alerts | BAY AREA

5 Day Forecast

Air Quality Forecast

Friday, November 15 at 9:52 AM

	PM	Sun
Northern Zone	68	76
Coast and Central Bay	49	66
Eastern Zone	58	69
South Central Bay	45	64
Santa Clara Valley	64	70

Read an explanation of the color-coded AQI scale categories used in the air quality forecast.

View the extended [San Diego Air Quality Forecast](#).

Find out which [weather zone](#) your city is located in.

PM AQI Forecast

Winter 2013-14

Winter Spare the Air Alerts	0
National 24-hour PM2.5	1



Spare the Air in the San Francisco Bay Area



The 2013/2014 Winter Spare the Air season runs from November 1 through February 28.

Each day by early afternoon, the Air District will issue an [air quality forecast](#) for the next day. If air quality is forecast to be [unhealthy](#), a Winter Spare the Air Alert will be called. The alert will be in effect the entire next day, for a full 24 hours.

When a Winter Spare the Air Alert is in effect, it is illegal to burn wood, manufactured fire logs, pellets, or any other solid fuels in your fireplace, woodstove, or outdoor fire pit.

During the winter season, wood smoke is the largest source of harmful [airborne pollutants](#). On this website, residents can find information about the [health effects of woodsmoke](#), as well as detailed information about the [Wood Burning Ban](#) and how to [comply](#) with it. Here are answers to some [frequently asked questions](#) about the Winter Spare the Air program.

You can also file a [wood stove complaint](#) online.

The Love Affair With the Fireplace Cools



Winsome Brown and Claude Arpels use a wood stove at their country house.

By CHRISTINA S. N. LEWIS

Published January 19, 2011

WINSOME BROWN, an actress and writer, and her husband, Claude Arpels, own an enviable apartment in TriBeCa worthy of a spread in an interior design magazine. The apartment — which is, in fact, being considered for an issue of *Elle Décor* — has maple floors, casement windows and all the character one would expect to find in a building that was once a factory.

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Brand New Images/Getty Images

But one of the features that many people in the city would pay a premium for is something the owners don't like: the fireplace.

"A wood-burning fire in the city is a ridiculous luxury — we would never have put it in ourselves," said Mr. Arpels, grandson of one of the founders of Van Cleef & Arpels and the former managing partner of Netto Collection, a baby furniture company bought by Maclaren. "In the city, it doesn't make sense to burn fires, because it's inefficient and it's polluting."

Hard as it may be to believe, the fireplace — long considered a trophy, particularly in a city like New York — is acquiring a social stigma. Among those who aspire to be environmentally responsible, it is joining the ranks of bottled water and big houses.

"The smoke from a fire smells very nice," said Diane Bailey, a senior scientist with the [Natural Resources Defense Council](#) in San Francisco. "But it can cause a lot of harm." The tiny particles, she said, "can cause inflammation and illness, and can cross into the bloodstream, triggering heart attacks" as well as worsening other conditions.



Tony Carosca/The New York Times
Winsome Brown and her husband,
Claude Arpels, use a woodstove at their country house.

Enlarge This Image

2008 Wood smoke fires are banned in the Bay Area on "Spare the Air" days, when climatic conditions make lingering pollution more likely. Fireplace users can check on an app if they can light up on any given day. In 2011, 2,316 smoke complaints are filed and 178 citations issued for violation of the ban. "I resent it when I don't have the choice whether to light a fire on Christmas," said Bruce Griffing, a longtime Livermore resident. "It's another example of nanny-government telling people what to do." ("Has The Wood Burning Ban Actually Worked?") *Contra Costa Times*, 4 January 2013.)

2011 "Every time [Sue Duncan, a 52-year-old landscaper in Austin, Tex.] builds a fire, it causes 'inner conflict,' she said. 'It's a guilty pleasure.'" "The Love Affair With the Fireplace Cools," *New York Times*, 19 January 2011.

Build or burn: "I've been told if you plan to heat your house with a fireplace, you need a stack of wood equivalent to the size of your house. Which is just a way to say it's ridiculous." Ashley Eldridge, director of education for the Chimney Safety Institute of America, *New York Times*, January 11, 2008

Men's Health News

MAIN

FITNESS

SEX

HEALTH

NUTRITION

WEIGHT LOSS

THE BEST L



**Run off Your
Cancer Risk**

1 of 7



**Can Your Diet
Derail Your
Relationship?**

2 of 7



**The B.
Happi**

man-sniffing-barbecue

by **Andrew Daniels** January 26, 2012, 08:31 am EDT



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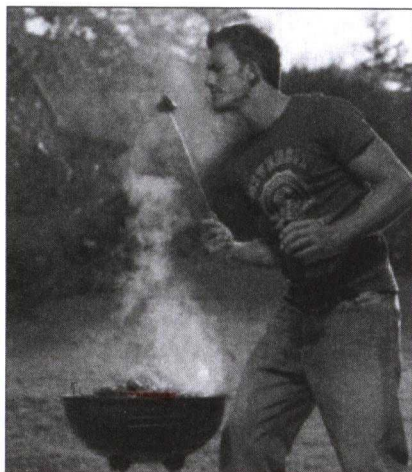
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6



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...western males increasingly attempt to seize control of the flame ... in the semi-exiled form of the backyard barbecue...

THE MACHO BARBECUE

In an inversion of ancient, even primordial gender roles, the woman is no longer the keeper of the domestic fireplace (c.f. Hestia): western males increasingly attempt to seize control of the flame – from the stifling domestic forces of technology, comfort, and convenience – in the semi-exiled form of the backyard barbecue. No text is offered by Men's Health Magazine in explanation of this urge, except the heading, "man-sniffing-barbecue."

1127

EVOCATION: CREATING A FAUX FIREPLACE

eHow, the arts and crafts website, offers a guide to the fabrication not of real fireplaces (as seen in 1970s magazines) but of faux fireplaces – skipping the period when the “fireplace” is actually used...

How to Create a Faux Fireplace

By Nickey Ronacher, eHow Contributor

Fireplaces create a main focal point in a room. They are pleasing to the eye with their warm glow and dramatic architecture. If a fireplace is not present, one can easily create a faux fireplace to achieve the same pleasing and aesthetic affects. Another benefit of having a faux fireplace is that it is easier to maintain than a real fireplace, because there is no chimney that has to be kept clean. Creating a faux fireplace will help to transform a room into a cozier and more inviting space. Does this Spark an idea?



Other People Are Reading



How to Build a Faux Fireplace on a Blank Wall



How to Build a Faux Fireplace Out of Wood

Instructions

- 1 Measure the available wall space to decide where to place the new faux fireplace. Write down the measurements on a sheet of paper. Use the pencil to draw markings on the wall's area that will be designated for the faux fireplace.
- 2 Find a mantel that fits the recorded measurements. An old vintage mantel can be found at a salvage yard or a new and stylish fireplace mantel may be purchased at a home improvement store.
- 3 Place a piece of precut fiberboard on the floor where the faux fireplace will be set. This board will become the new faux fireplace's hearth.

Things You'll Need

- ☐ Measuring Tape
- ☐ Precut fiberboard
- ☐ Tiles

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CONVERSION: HOW TO DESTROY YOUR FIREPLACE

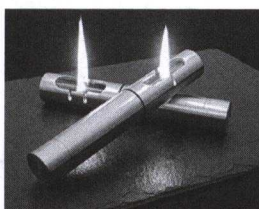
Typical fate of the unused fireplace: gutting its platform, niche, and flue, enlarging the floor, replacement with flat screen TV.



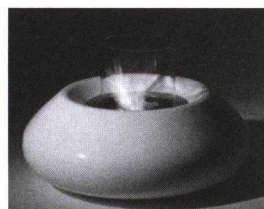
Designer fires: instead of a piece of architecture, the fireplace becomes an ultra-clean, often table-top object...



Portable Gel Fireplace



Tabletop Frieplace
by Gido Wahrmann
for Carl Mertens



Planila by Serge Atallah



1130

...exile of the flame: At Le Corbusier's Maison La Roche, Paris, the original fireplace (1925) – still present in a house otherwise heated by radiators – has been gutted. A fire extinguisher nestles in an adjacent niche, poised to tackle any attempted return of the flame...



"...the fire, the hearth, that is to say something ancestral, that eternal thing which is the very key to everything"

ca. late 1940s Le Corbusier describes the kitchens of Unite d'habitation, Marseilles; the apartments do not have fireplaces. (F. Pottecher, 'Que le Fauve soit libre dans sa cage', L'Architecture d'Aujourd'hui, 252 (1987), p. 62.

Return to the radiant: Kiel Moe on the myths of convective heating

Launched by Benjamin Franklin and the smoke doctors' investigations of the fireplace, and later enshrined by Willis Carrier's air conditioning systems, convection in the form of forced air has been the dominant principle for heating and cooling buildings for nearly 100 years – despite its manifest inefficiency compared with radiant heating. Kiel Moe, professor of architecture at Harvard Graduate School of Design, asks: Why would we want to heat and cool buildings with air?

AMO How did you become interested in the architectural technology of heating and cooling?

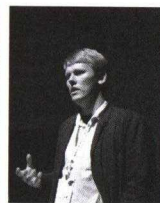
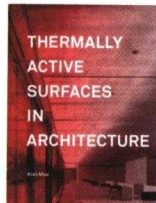
Kiel Moe From a thermodynamic and physiological perspective, air is peculiar medium for heat transfer. There are other paradigms for thinking about human occupation with very different assumptions and parameters. The heating and cooling apparatus, especially as it evolved in North America in the twentieth century, ultimately served to fragment not only buildings but architectural practices as well. Part of my research focuses on many of the most routine – and unquestioned – assumptions about contemporary buildings. The predominance of air is one example. Its co-determinant is insulation. Architects consented, without much reflection, to fundamentally transform how buildings are designed, how they are built and how they persist, or not, as thermodynamic systems. I am deeply motivated to discern far less acquiescent alternatives that amplify the architectural thermodynamic power of buildings.

AMO So you're advocating a practice of architecture that is more cohesive in terms of its disciplinary relationship with heating and cooling?

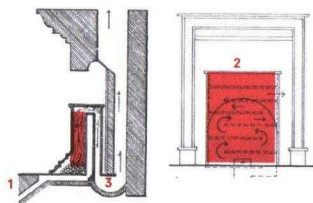
KM My point of view is that modern architecture has never really had a coherent agenda for energy that amplified the ambitions of architects. It has always applied received engineering and building products from outside concerns. If you're thinking specifically about buildings and matter and energy, you will come to very different conclusions as an architect than you would as an engineer or an insulation salesman. We have radically different obligations and opportunities. This requires a more convergent architect who can swerve form, matter, and energy towards robust architectural and ecological outcomes.

AMO In *The Architecture of the Well-Tempered Environment*, Reyner Banham describes the dilemma of choosing endosomatic or exosomatic* energy, conservation vs construction. In architectural discourse of the last 2,000 years, the optical practice of architecture has dominated the haptic. Is there an opportunity for reconciliation between the two?

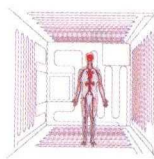
KM Yes I think there is an opportunity for architects today. A fundamental part of architecture's agenda could be to design both exosomatic and endosomatic compositions of a building. Very different outcomes in building and practices emerge out of that. It's critical to have some kind of recursive process between the endosomatic and the exosomatic.



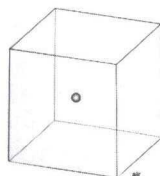
"How did a thermodynamically and physiologically irrational medium of heat transfer – air – become the dominant method of heating and cooling buildings?" Kiel Moe, *Thermally Active Surfaces in Architecture*, (Princeton Architectural Press, 2010).



Precursor of HVAC: Benjamin Franklin's Pennsylvania Fireplace, 1742. "With increasingly convoluted channels of combustion exhaust air contained inside a box, [convective fireplaces] were the prototypical logic for later centralized heating systems. Their miniaturized system of thermal source and ducted distribution systems in many ways prepared the logic of later HVAC systems."



* **Endosomatic:** Energy used inside the body
Exosomatic: Energy used under human control outside the body. In Moe's manifesto, the two systems will be combined.



Hydronic efficiency: water is 832 times denser than air. "Air is a poor medium for transferring heat energy and it unnecessarily absorbs a disproportionate amount of a building's budget and energy use."

AMO What might an exosomatic design look like? And an endosomatic? What different techniques and features do they mobilize?

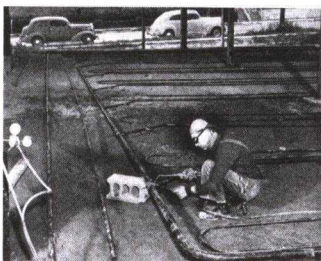
KM Unlike Banham, architects could explore both the endosomatic possibilities of our physiology as well as the endosomatic reality of our buildings. These relatively unconsidered domains are absolutely sublime in their latent capacity. I am excited to say that I have few prefigured ideas about what an endosomatic/exosomatic design would like, only what its necessarily recursive design process might look like. I also know very well the thermodynamic indicators that would help guide that process. But as for the resulting object and its attachments, this is perhaps the most tantalizing and wide open horizon of design inquiry today.

AMO The fireplace has undergone a radical transformation in the history of architecture. At first it began as a radiant core, forming the social locus both on the scale of the house and the scale of the city. It was a place to communicate, keep warm, and to cook. The fireplace was both utilitarian and highly symbolic. Fast forward to the 18th century, the flame is concealed by the stove, the stove is exiled to the basement, and the iron pipe is the new heating apparatus of choice. Quite quickly the fireplace became invisible in order to sustain a thermally homogenous, increasingly sanitary interior environment. The radiant core is now a convective system delegated to the "impure" zones of the plan. In your book *Thermally Active Surfaces in Architecture*, you discuss the evolution of convective heating and cooling. Can you talk about this evolution and who you think the critical players or moments were?

KM Certainly for me the central agent is Willis Carrier. His foremost interest was in conditioning air, not human bodies. He mechanized heat transfer and our expectations for comfort, and decoupled thermal modulation from architecture. From that point all the architectural potential of heat is pretty much evacuated from the practice of architecture. If the mass of the building – the great weight of a building – is no longer accounted for in climate control – its equations, and systems – then all that matters is air, which is only marginally interesting from an architectural point of view. Carrier shifted heat transfer to a convective practice from a predominantly a radiant practice – a huge transformation. I think that's a really big singularity. I am deeply interested in the non-modern thermodynamic disposition of architecture that you refer to in your question. Indeed, the cannon of architecture is replete with examples of buildings whose utility, symbolic program and social habitus are totally convergent, inextricable, as any non-modern thermodynamic history of architecture would reveal. I am not interested in these precedents as some sort of recidivistic exercise but rather to articulate for myself the architectural terms by which extremely rich and varied thermodynamic architectures emerged, outside of the reductive, divergent terms of modern building science and formal sensibilities. The Chinese Kang, Korean Ondol, Roman Bath, the Igloo, etc., are all profound thermodynamic architectures in endosomatic and exosomatic ways. We need a way to see around our own, self-selected corners that we adopted, unreflexively, in modernity.

AMO What kind of political – lobbying – power does the forced air industry have, and is it changing today? And is convection primarily an American preference, when it comes to heating and cooling?

KM I am more familiar with the historical emergence of the air-conditioning apparatus. It is easy to characterize it as a sinister endeavour but any apparatus, of course, emerges through a huge network of very willing and generally well-intended individuals. I think the effect of the apparatus is rather sinister when you at the total mangle of practices. As a result, yes, convection has considerable technological momentum, even if it is has negligible thermodynamic impact.



Road not taken: coiled pipes prepared for radiant heating slabs, Levittown, 1947. Their failure, due to poor materials and poor installation, "contributed significantly to the demise of post-war interest in thermally active surfaces ... As building industry confidence in radiant systems sank, air-based conditioning continued to acquire more momentum and better marketing compared with hydronic systems."

AMO It's ironic that with this transformation architects were proclaiming a new flexibility. Now we're in a situation where the exact "flexibility" has cost us agency and led to mechanical systems becoming drivers of building production, especially in terms of cost.

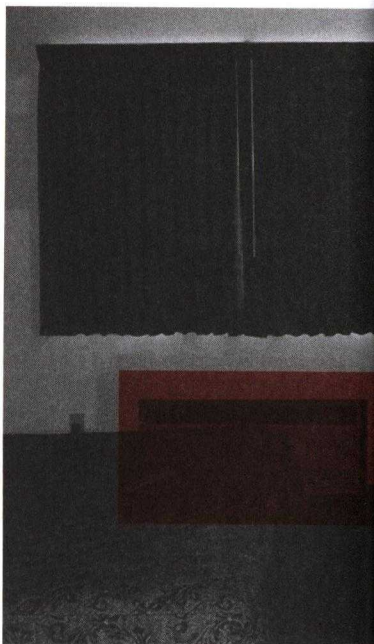
KM I'm very interested in how we lose or gain agency as architects through our history of practices. By unreflectively adopting both the rhetoric and implements of technological escalation, architects have again and again ceded agency to non-architectural interests. This tawdry stairmaster of technological escalation is routinely seen as the sponsor of "new" architectures in naive, early modern ideologies of progress. I think young architects engaged in questions of technology have a sense that we must design these practices, rather than just capitulate and receive imposed agendas. It is a totally different, much less cynical paradigm for practice.

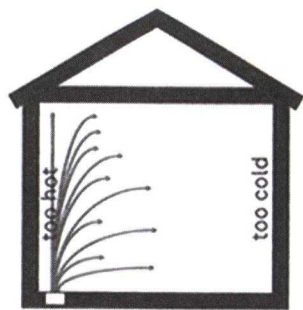
AMO What has struck me the most about the fireplace is its persistence in architecture. Despite its apparent redundancy in providing heat or cooking these days, the fireplace persists. Over 50 percent of new single-family homes constructed in the US includes a fireplace. Each fireplace is manufactured like an appliance but somehow the builder adds 1,000 percent value; in other words, he may buy the fireplace for \$500 but adds \$5,000 value to the house. Why do you think this is? Is it simply nostalgia or is there a physiological explanation?

KM I think for a new suburban house in Florida there is no energy or physiological argument to be made. It is purely nostalgia, or some association of "home." I think something like a fireplace only matters if the rest of the architecture goes along with it. If it is just an element or "feature" of the design, it is trivial from an architectural and thermodynamic perspective. But it is nonetheless a powerful human thing. Have you read Wrangham's *Cooking with Fire*? It's about the role fire has in the course of human development over the last million years. One hundred years of air conditioning and bad fireplaces is a really insignificant part of that history. There's an extremely deep physiological, biological response to fire in buildings that is extremely non-trivial. And I think it goes beyond the kind of nostalgia or these ideas of home. It's extremely biological and fundamental to the co-evolution of bodies and buildings in the last thousands of years.

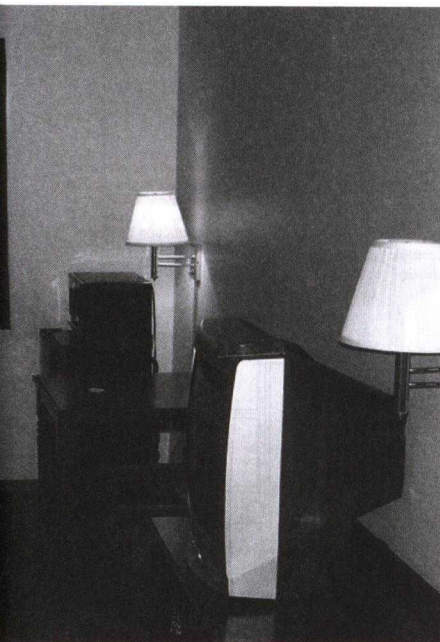
...how did a thermodynamically and physiologically irrational medium of heat transfer – air – become the dominant method of heating and cooling buildings...

The force of forced air: at a generic 1970s Motel 6, the ubiquitous American heating system, descendent of Benjamin Franklin's convective fireplace, nestles under the window. Because of the fluidity of air and the ease of the fan-operated system, room temperature is easy to manipulate, enabling instant gratification. Give another blast of hot air. Radiant systems on the other hand are slow and powerful; like an oil tanker, they cannot be easily reversed...





Forced warm air:
Too local, too hot, too fast



AMO Your research focuses on both buildings as discrete thermal entities but also as large scale energy systems. What is the difference between the two?

Does the architect have influence over both scales?

KM Absolutely. Architects routinely specify not only the endosomatic of a building but, far more unwittingly, the exosomatics of its very becoming. Modern architects have been explicitly trained to externalize the exosomatic reality of their practices and buildings. This is but a modern aberration in the history of architecture. The early treatises on architecture, if just turned slightly off their normative art-historical axis, are manuals for a more complete thermodynamic architecture that includes all scales of the energy hierarchy of a building. The only way to achieve the latent thermodynamic of buildings and urbanization is to recursively consider, and design, all the simultaneous spatial and temporal scales of any thermodynamic entity. I think closing that metabolic rift and internalizing its modern externalities in architecture is an important task today.

AMO What does a building with thermally active surfaces feel like, compared with one dependent on convection? In other words, can you describe the difference from a user's as well as an architect's point of view? In my limited experience with radiant heating surfaces, like a heated kitchen floor, it's incredibly powerful but also incredibly hard to control.

KM First, architects should check their mania for control. Generations of architects were trained through "Environmental Control Systems." This nomenclature itself set up an unbelievably false posture regarding thermodynamics. If you wish to engage thermodynamics in architecture, a totally different posture and political economy is necessary. Think of Kwinter's article on "Politics and Pastoralism" Rather than control, the task is one of modulation of mass, velocity, and accumulation through design. That is already a radically different aesthetic position. But, yes, if you begin to sensitize yourself to radiant transfer and the effects of thermal symmetry and asymmetries, a whole formal universe is available.

AMO One reason convection took command might be that it is instantly responsive and instantly gratifying? The problem is that the change it brings on is hard to maintain. Do you think we can change our expectations and behaviors towards heating and cooling?

KM Air conditioning conditioned far more than air. Foremost, it conditioned expectations for a certain idea of comfort, an idea, to be sure, that is not universal or even physiologically desirable. Modern architecture no doubt created a new human subject. Unfortunately, in the construal of that subject much thermodynamic vitality and delight gets sacrificed. If it is instant responses you seek, buy a hat or sweater, or take your clothes off. Do expectations and behaviours change regarding thermal milieux?

Constantly. Expectations and codes for "human comfort" are constantly negotiated, socially constructed entities. As Michelle Addington has documented, the requirements for ventilation has shifted pretty continuously over the past hundred years, totally in sync with various economic, ecological, and health factors modulate the requirements. Architects are trained to accept these realities rather than design more astute or powerful realities. I can never quite discern why we are so acquiescent in this regard.

AMO What kind of technology is necessary to make a building into a radiator, basically? Is it already available, and cheap?

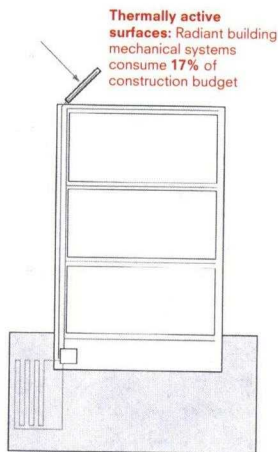
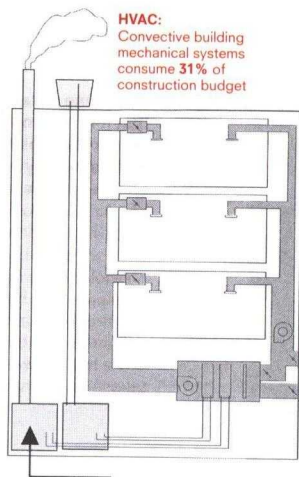
KM All buildings have thermally active surfaces. All spaces are responsive environments. Architects and engineers just assume the mass of a building to be neutral. So, first, the full, but latent thermodynamic reality of the most rudimentary material sitting in the sun next to a body needs to be grasped. From there, a thermally active surface might get more intricate as a technological apparatus. But the most compelling examples of thermally active surface architectures are surprisingly monolithic in their endosomatic and exosomatic design. Gilles Perraudin is perhaps one the best examples.

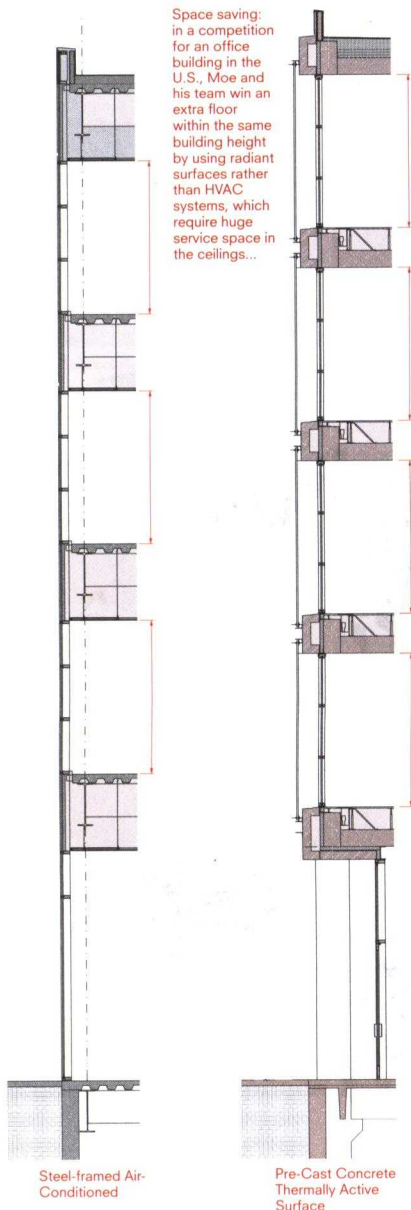
AMO If surfaces become thermally active, it's plausible that we could do away with the drop ceiling eventually, liberating a lot of space within architecture. What other repercussions do you see for the elements of architecture, like the window, the roof etc.?

KM I worked on a competition for a pair of office buildings in Denver. The massing was pre-determined by various zoning, historic, and masterplan criteria. Our proposal was selected because it had 5 stories in the same envelope as the other architects' 4 story, air-conditioned proposals. The thermally active surface approach in this case added an extra floor of leasable square footage. It was a Trojan Horse strategy for getting a more comfortable, more powerful, and more durable scheme to prevail in a market-driven context. But some more space here or there is but the tip of a far more powerful, convergent paradigm for a thermodynamic architecture.

AMO How has the diversification of energy resources affected architectural production? Is there more or less room today for reinventing the relationship between architecture and energy?

Relative systems space required for convective HVAC system (left) and radiant system (right): "By obviating the need for drop ceilings and increasingly complex, multilayered wall assemblies, thermally active surfaces collapse the physical and organizational layers of contemporary construction systems and structure into one robust and integrated layer of architecture."





KM It's a slightly tricky question because there is only one form of energy that we tap into. We get 99.97 percent of our inputs from the sun. All those processes – wind, biomass – are solar energy. Once architects fundamentally understand that and understand that's the start of the energy hierarchy, then they'll make radically different choices about systems or buildings.

AMO How do you think architectural education should shift to embrace some of these ideas?

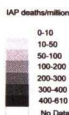
KM I don't think most schools of architecture have any interest in shifting from a modern paradigm for energy in architecture. Faculties generally thrive on the separation of design from construction, the separation of construction and energy courses. The administrative, tenure dossier-driven idea of specialization in architecture is pretty absurd once you look at it as a generalist endeavor. The generalist expertise of architecture simply strains against the phantom culture of expertise that emerged both in the profession and in the academy of architecture during the twentieth century. If you want tenure, you strategically tend to deny the generalist expertise of the architect in favor of a more specific or autonomous agenda. But if you remove those curricular/administrative assumptions and are intellectually supple enough to incorporate, and design, architecture's basic contingencies rather than dossiers alone, I think a lot of things would significantly change in both the academy and practice. If not, as William Gibson noted in the 1990s, architecture will go the way of symphony orchestras, which are interesting, but not protagonists or culture in a major way.

DEADLY PERSISTENCE OF THE FIREPLACE: 45 PERCENT OF THE WORLD STILL COOKS WITH SOLID FUEL

One and a half million years after the first deliberate use, fire is still not entirely under control. Despite the apparent domination of electric and gas stoves for cooking, and of boilers, radiators, and HVAC systems for heating, about 3 billion people – 45 percent of the world's population – still rely on solid fuel and unventilated stoves for household cooking.* While the fireplace may be more or less functionally obsolete in the West, in the developing world the cookstove still plays a critical role in the survival of the family and the home. At the same time, cooking with wood, coal, and biomass causes 4.3 million deaths in 2012 through household air pollution. According to a 2010 report by the International Energy Agency, by 2030, over 1.5 million will die every year due to toxic smoke and indoor fires, more than the premature deaths estimated for malaria, tuberculosis, or HIV/AIDS. A sentimental symbol in the West, the fireplace is deadly elsewhere: 99 percent of the fatalities from indoor pollution occur in developing countries in generally warm climates. This begs the hypothesis: needing to keep warm forces innovation in the faster than the need to cook efficiently...

Deaths from Indoor Air Pollution, 2000

An almost perfect overlap between solid fuel usage, deaths from indoor air pollution, and the warmer parts of the global south.



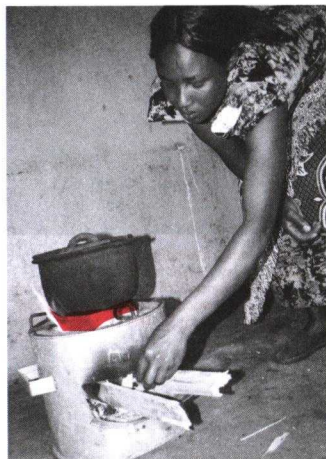
...a sentimental symbol in the West, the fireplace is deadly elsewhere: 99 percent of the fatalities from indoor pollution occur in developing countries in generally warm climates...

Solid fuel cooking as percentage of population, 2000

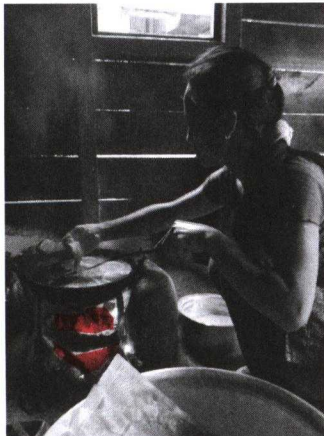
Source: World
Health Organization

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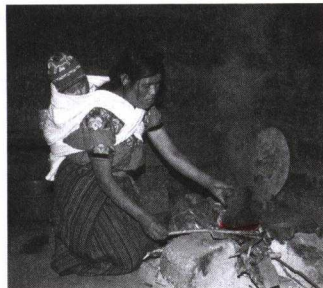
Over 75%
56-75%
25-50%
0-25%



'Rocket Jiko' cookstove, Kenya.



Cooking Roti over an open flame, with no ventilation except through the walls, Nepal.



Chimney-free, Guatemala.

2011 Below: central fireplace keeps burning in chimney-less dwelling, Sappo, Vietnam.



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FEEDING THE FLAMES: ADDIS ABABA

Fireplaces, where they are still used on a daily basis, are insatiable – the only architectural element that requires constant refuelling. In Addis Ababa, large sections of the population today are almost enslaved by the fireplace; and the city itself was planned in its service. For centuries, the capitals of Ethiopia are, for the most part, not permanent physical entities but the transient camps of a nomadic Emperor and his enormous retinue and army. When firewood in the area surrounding the camp runs out, as it inevitably does, they must decamp to a new location: the demands of fireplaces have, in essence, the power to move an entire city. In the late 19th century, the mountain capital of Entoto was abandoned due to the exhaustion of wood supplies for building and burning. When Emperor Menelik II moved down the mountain to set up court in Addis Ababa in 1891, and built the city around it, the same pattern of consumption started over again. In 1901 the English traveller Herbert Vivian recorded that “there was scarcely a tree to be seen ... every shrub that could possibly be used for firing has been cleared ... Such is the scarcity of fuel about here that the peasants are in the habit of collecting cow’s dung.”¹ The shortage of firewood was so drastic, writes Richard Pankhurst, that Menelik II is almost forced to abandon Addis Ababa. But with the population rising (from 50,000 in 1900 to 70,000 in 1910), Menelik II decides, in 1904 to start importing a renewable fuel resource: first turpentine, then eucalyptus trees, (a paradigm shift that belies Banham’s allegory of fire and cultural planning). Treeless in 1901, a decade later the city could be re-named “Town of Eucalyptus Trees,” so thick was the coverage. By 1981 though, demand for firewood exceeds supply by 75 percent.² Governmental agencies and enterprises supply 20 percent of the city’s requirement, while the bulk of the remainder is supplied by women firewood carriers.

1. Vivian, H., Abyssinia, 1901, in “Menelik and the Foundation of Addis Ababa,” Richard Pankhurst, *Journal of African History*, II, I (1961), 103–117.
2. Haile, F., “Women Fuelwood Carriers,” 1989.



In 2006, a woman named Amarech reports to the BBC: “Today, I spent from 03:00 to 15:00 collecting the branches of eucalyptus trees which people use as firewood. I will sell this big bundle at the market for about \$2. This will feed my family for a couple of days.”



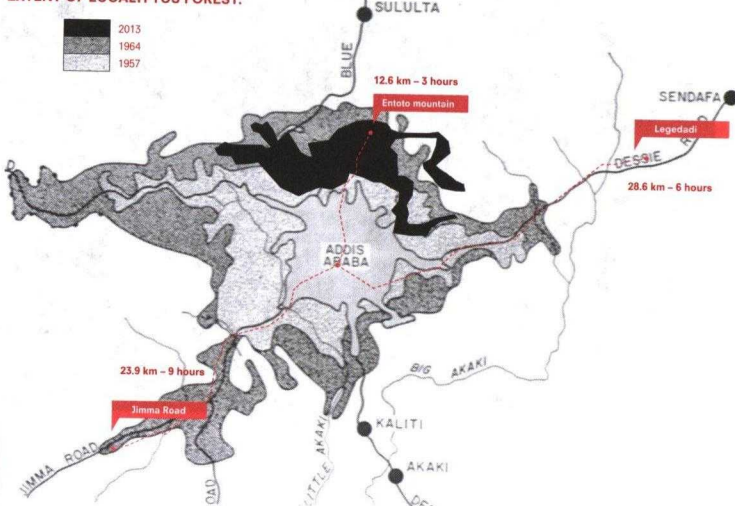
“Driving out of Addis Ababa [I pass an] endless line of women and girls ... marching ... into the city” with firewood. William Easterly, *The White Man’s Burden* (Oxford University Press, 2006.)

Forest extent in 2013 (black) based on Google satellite image. Forest extent in 1957 (light grey) and 1964 (dark grey), and base drawing from Ronald J. Horvath, Von Thunen’s “Isolated State and the Area around Addis Ababa, Ethiopia,” *Annals of the Association of American Geographers*, Vol. 59, No. 2 (Jun., 1969).

Routes taken by women of Addis Ababa to find firewood to sell in the city.

1941: 20 square miles
1957: 68 square miles
1964: 95 square miles

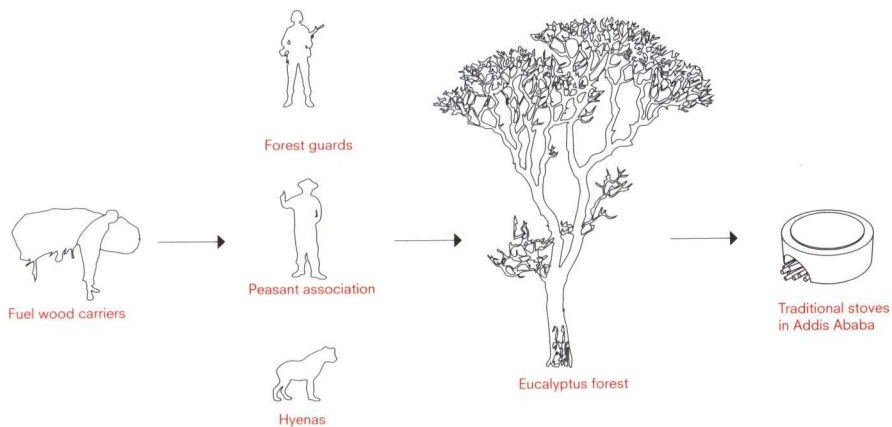
EXTENT OF EUCALYPTUS FOREST:



1140



1830 Europe experiences its deforestation and fuel crises hundreds of years earlier, also triggered by the use of solid-fuel fireplaces. Germany: Woman apprehended for collecting firewood.

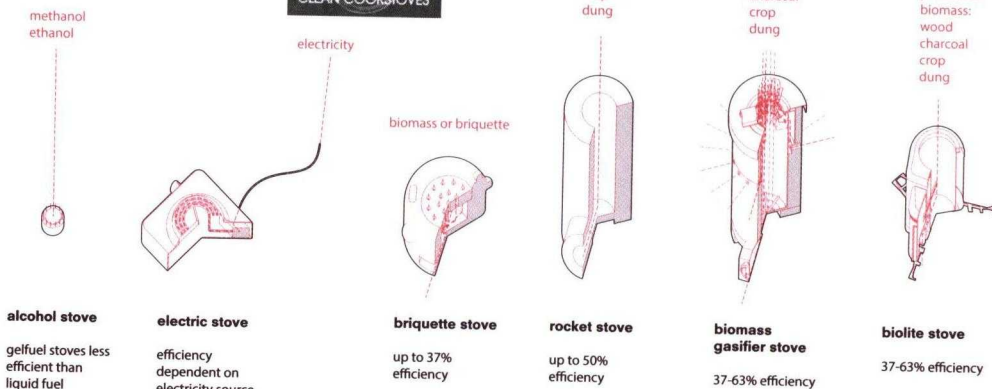


Fireplace obstacle course: collecting wood in forests that are now protected, women are often extorted by forest rangers and peasants. Hyenas along the road are also a threat.

ENERGY POVERTY AND THE CLEAN COOKSTOVE

The fireplace/stove is a prime target in the UN's fight against global poverty, of which "energy poverty" plays a decisive role. UN secretary general Ban Ki Moon hopes to achieve universal energy access by 2030, meaning that the 1.4 billion people without electricity and the 3 billion cooking with solid fuel will have access to electric alternatives. Unventilated stoves based on solid fuel and open fires will be eradicated. The exile of the flame that happened in the West in the 19th century must be completed around the world in order to eradicate disease and poverty. Led by the Global Alliance for Clean Cookstoves, there is a new wave of stove design, reminiscent of the explosion in the U.S. in the 19th century, but now in portable, low-cost forms...

21st Century clean cookstoves



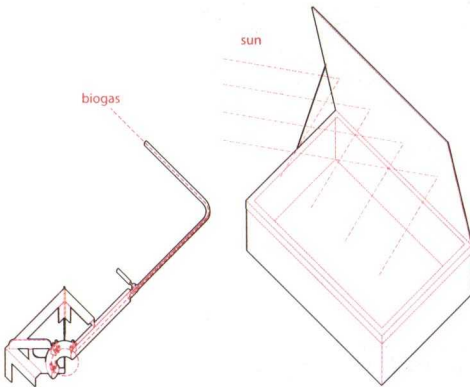
Alcohol cookstoves are pressurized or non-pressurized and can burn ethanol in liquid or in gelled or waxy forms. Ethanol and methanol burn very cleanly. Reducing indoor air pollution as compared to wood, charcoal and kerosene stoves. Alcohol stoves tend to produce significantly less CO (carbon monoxide) than stoves using kerosene or solid fuels.

Limited to areas that have access to electricity, usually cities in the developed world.

Insulated, L-shaped combustion chamber allows partial combustion of gases and smoke inside the stove. Flow of hot gases are channeled closer to the pot or griddle. Some rocket stoves reduce emissions by 40-70 percent or more for carbon monoxide, and over 50 percent for particulates in a laboratory setting.

Gasifier stoves force the gases and smoke from incomplete combustion back into the flame, for a second round of combustion, resulting in very few if any emissions.

...the exile of the flame that happened in the West in the 19th century must be completed around the world in order to eradicate disease and poverty...



biogas stove

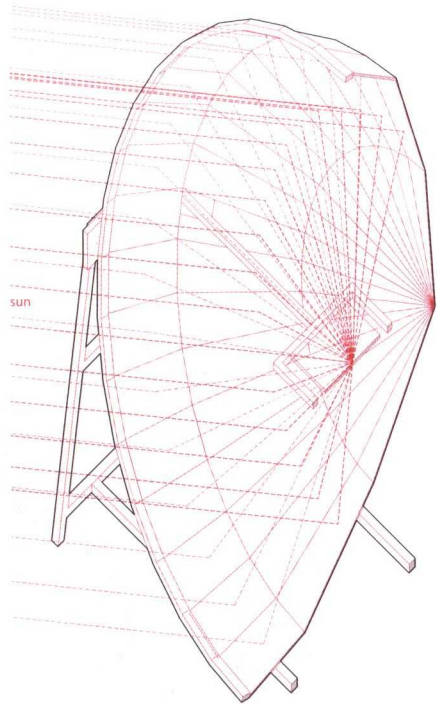
50-65% efficiency

In a merger of toilet and fireplace, this biogas stove can convert manure and human waste into combustible methane. Reduces respiratory diseases, eye infection, asthma and lung problems.

solar box stove

100% (fuel is available at no cost)

Solar box cookers reach temperatures between 177–204°C and present no fire danger.



parabolic solar stove

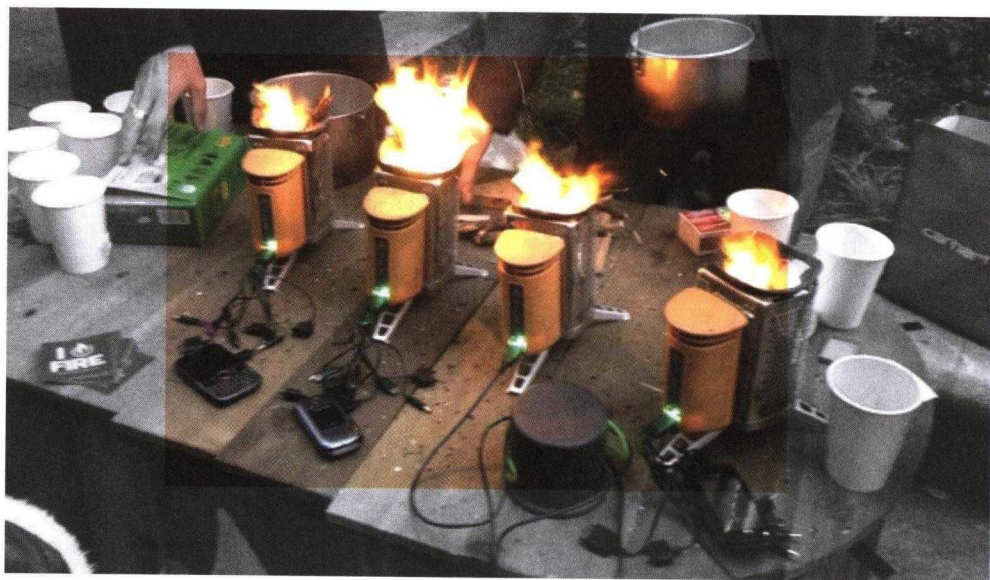
100% (fuel is available at no cost)

Resembling satellite dishes, parabolic solar stoves cook as fast as an open fire by concentrating sunlight on the bottom of a cooking pot, generating temperatures above 232°C even in sub-zero weather.

sources

"Energy Poverty: How to make modern energy access universal?" International Energy Agency (IEA), UN Development Program, (UNDP) UN Industrial Development Organization (UNIDO), 21 September 2010
<http://climate-l.iisd.org/news/iea-undp-and-unido-release-energy-poverty-report/>
 "The Solvable Problem of Energy Poverty," *National Geographic*, 21 September 2010:
<http://news.nationalgeographic.com/news/2010/09/100921-energy-poverty-cookstoves/> (accessed November 17, 2013).
 Sources for cookstove information: cleancookstoves.org

fireplace vs. phone



...fireplace's last stand: miniaturized,
used solely for powering a charging
device for smartphones...

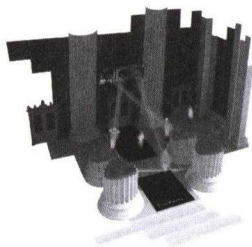


...2012 Chinese authorities
confiscate 681 iPhone-branded
stoves...

1145

PROTECTIVE BUBBLE: "LOCAL WARMING"

One possible future for the fireplace is being prepared at MIT's SENSEable Cities Lab. Inverting at least 200,000 years of history, they propose that, instead of people going to the source of heat, and instead of trying to maintain the temperature of entire spaces, heat will now be programmed to follow individuals. A sensor detects motion, and a series of infrared beams encapsulates the beneficiary in a moving bubble of warmth, leaving the rest of the space in the cold, and no escape for the warmed person...



2012 Motion-detecting mobile heat beams warm people on the steps of MIT.

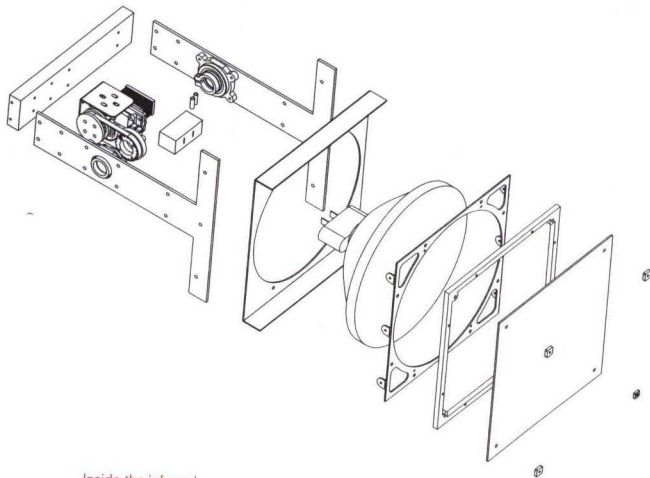
Carlo Ratti, director of SENSEable Cities, explains, in an interview with the editors:

There is an alarming asymmetry between people and energy use: we heat our office buildings during the day when people are there, but also during the night when they are empty. We heat every corner of a house even if only one room is being used. Imagine a system that creates personalized climatic bubbles – energy consumption could be reduced by orders of magnitude. Local Warming aims to achieve that. Motion tracking technology is now sophisticated enough to tell us where people are, and how they move through space, at an incredibly fine-grained resolution. Using that spatial data, we can dynamically control a bank of infrared lenses and cast personalized bubbles of heat around people. The *Nuvola di Fantozzi* comes to mind – an Italian story from the 1970s of an unfortunate man who is followed by a rain cloud over his head – except this system provides warmth...



1975 Fantozzi, Italian movie about a man followed everywhere by a rain cloud...

OUTSMART THE SYSTEM: The first prototype of Local Warming was installed at the main entrance of MIT during the cold months of winter 2012. Three lenses welcomed students with heat as they approached the building and stepped on an activation mat. The installation got incredibly positive feedback – people gathered around the front steps, tried to outsmart the system, dragged their friends into the beam...



Inside the infrared warming laser lens.



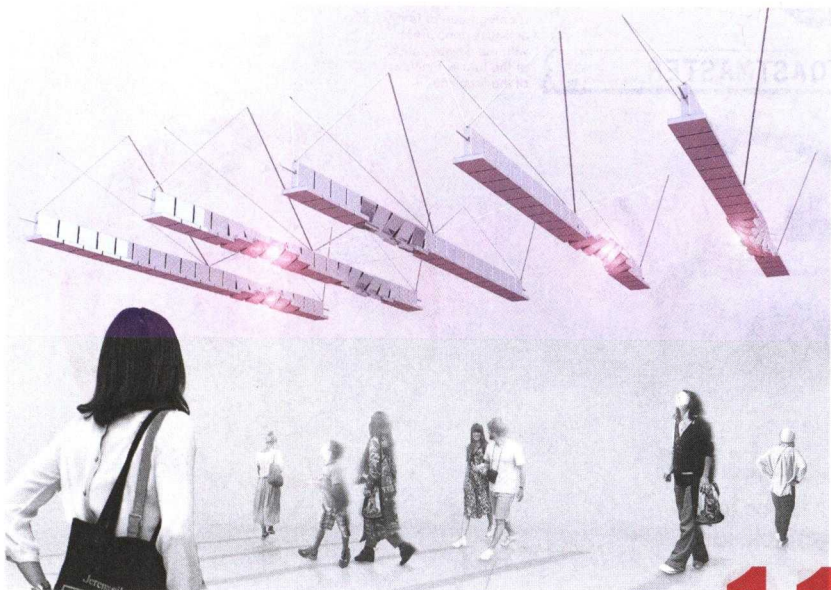
21st century fireplace.

HEATING DRONE: This same principle can be applied to multiple situations and spaces: from ceiling fixtures in interior public spaces to responsive surfaces in the home to heating poles in outdoors parks – not to mention drones that walk with you through the icy winter. We're even working on a parallel system called the Spritz – for warmer climates – that would use the same tracking principles but follow people with a cloud of refreshing mist.

YOUR SMARTPHONE: Future iterations of the system will allow you to log in with your smartphone and set a personal temperature or share heat in various ways. The motion tracking systems might even gather usage patterns to then tailor comfort levels based on behavior or group dynamics, moving from the diagnostic to the predictive. We also envision a tighter integration with other building systems, such as light, sound, or even delivery of data.

EVOLUTION OF THE GROTTO: If you want to explore tomorrow, you also have to consider possible dystopian futures: the first thing we reacted to was the possibility of disconnection and isolation. As humans become increasingly networked in digital space, there is a corresponding physical alienation. With Local Warming, the evolution of the grotto is complete: the fireplace has become entirely atomized and mobile, and its decentralization risks fragmenting social structures. The hearth is no longer the locus of domestic life (reduced to nostalgia or a glorified knickknack shelf), and with its disappearance, an entire social fabric might unravel – something that Bill Mitchell hypothesized unsettlingly in e-topia. The hermetic environment of a personal climate seems to be the final death toll of human interaction – digitally connected and spatially isolated.

NEO-NOMADIC: Instead we respond by finding potent ways of infusing Local Warming with a strong connective energy. Man is a social creature. Although we no longer need to share space, we still yearn to, and digital networks can provide a powerful antidote to the blight of modern alienation. An asset-light, neo-nomadic and digitally-integrated mode of living may yet be compatible with (and even augment) human interaction. The value of a ubiquitous digital overlay like Local Warming will be proven in its capacity to enact new forms of sociability – sparking our mobilized heart(h)s to vibrant encounters in physical space.

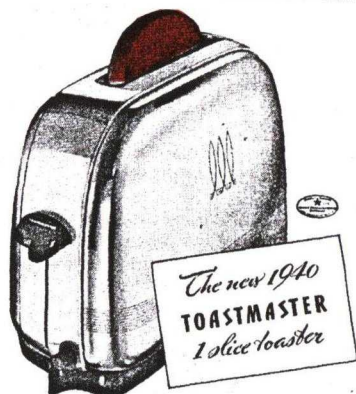


"Ubiquitous digital overlay": in a collage of the system's predicted use, lasers detect passersby and swivel to encapsulate them in a moving heat beam.

EXTINCTION

After (hundreds of) thousands of years of service to architecture and civilization, the fireplace has mutated beyond recognition. Going incognito, hiding inside various modern devices, its primal Promethean drive is no longer expressed directly in flames but through apparently inexorable technological and social progress. As the most blatant symbol of entropy – a fire burning out before our eyes, its exhaust suffusing the room – the fireplace has been the victim of expanded scales, and intensifying demands on our energy systems, to fuel relentless progress. Other devices can easily outperform the fireplace. Its memory might be preserved by UNESCO as the first architectural element to become extinct.

AUTOMATIC TOASTERS =



= BY TOASTMASTER

the end of Prometheus?

...fire as an element is too erratic, out of control, and dangerous for a mankind of consumers ... while half of mankind is still using open fire each day, out of dire necessity, the other half has evolved apparatus and sophisticated devices that in their design try to efface their remote heritage, denying their relationship with the real thing...

1940 The toastmaster toasts one slice at a time, mimicking the disintegration of family activities concurrent with the disintegration of the former functions of the fireplace.



Electric kettle.



Russell Hobbs had an unforgettable idea.

1148

Leftover fireplace and
chimney, Purse State
Park, Maryland, U.S.



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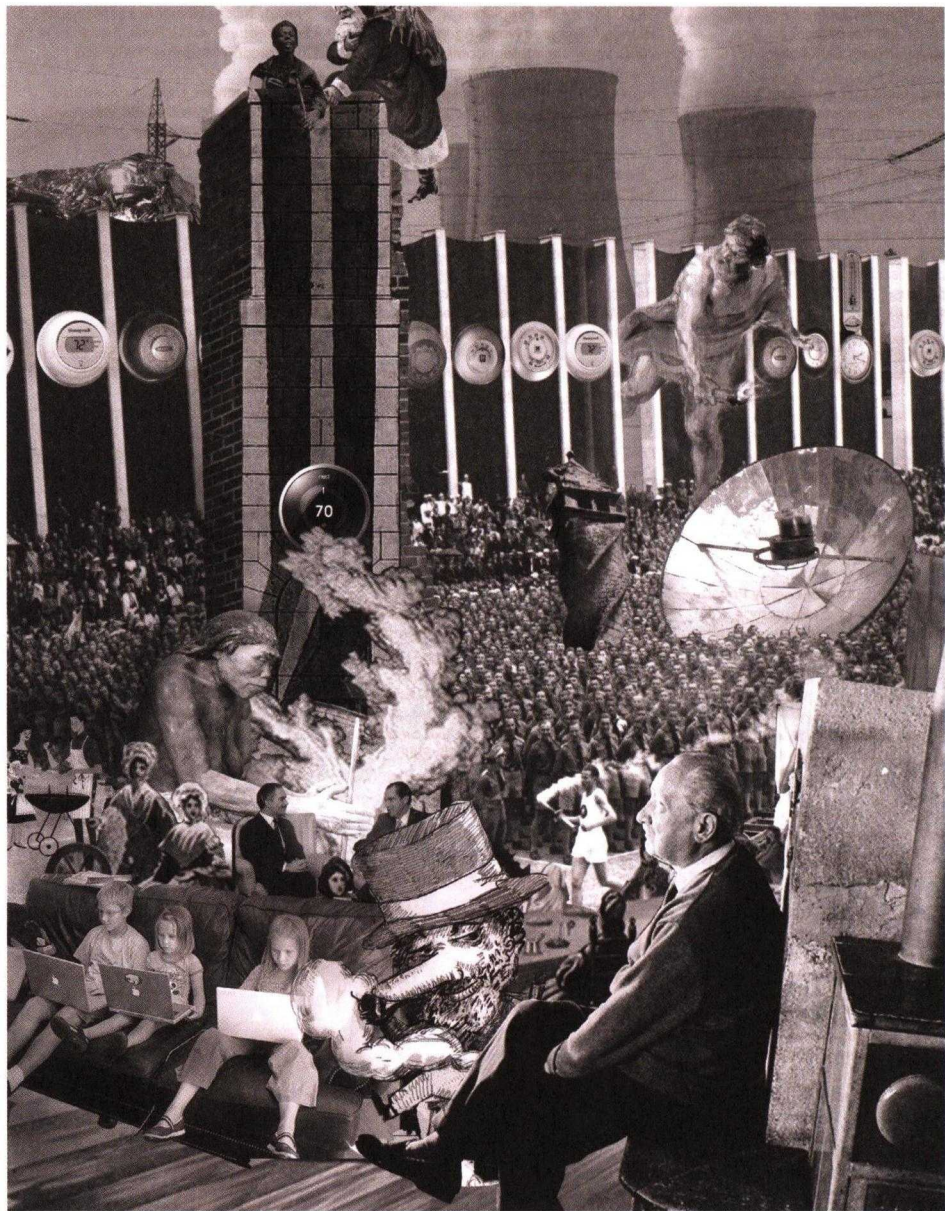
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2012 Participants in Doha's TEDx event gather around the firepit specially built on the beach for the conference.



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