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Autonomous Housing for "Co-operative Autonomy"

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This paper explores the cultural implications of the theoretical and design reflections of North American and European architectural countercultures on the 'autonomy' of domestic living, within the context of the energy crises that characterized the second half of the twentieth century. In an attempt to provide a unified framework for the heterogeneous and fragmented literature on the various experimental "Autonomous House" projects, this study aims to uncover the deeper motivations that link the reconfiguration of architectural space according to a logic of 'self-sufficiency' with the reimagining of post-industrial models of economic development and social organization. Ultimately, it seeks to evaluate the continuing relevance of these ideas, both historically and in light of today's renewed awareness of the fragile relationship between the environmental context and the built environment shaped by architecture.

Introduction

In the long history of energy crises that have characterized the post-war period of the short twentieth century, the 1973 crisis – triggered by the Yom Kippur conflict between the State of Israel and the Arab countries allied with Egypt and Syria – marks the beginning of a profound reflection on the economic and environmental fragility of the previously consolidated models of management and exploitation of the main energy resources in the Western world[1] (see Figure 1).

Above all, in the field of economic and sociological studies, one observes a deep critique, in particular, of centralized systems of production and distribution of the principal fossil energy sources which, on the one hand, fuels a broader political debate on the forms of control over economic models and, by extension, over the social structures of post-industrial capitalism, and, on the other hand, finds expression in the architectural culture of those years as a broader need to rethink the design practice in light of a renewed awareness of the fragile relationship between different environmental contexts and the space shaped by architecture.

This study retraces much of the heterogeneous and fragmentary historiographical documentation on the research developed by architectural culture, especially in the Anglo-Saxon context, starting from the first half of the 20th century, on the concept of "self-sufficiency" in domestic living. By systematizing the contents of the main experimental projects and the literature published on the subject, the aim is, first and foremost, to shed light on a chapter of architectural history that is still insufficiently explored today, in order to indicate possible horizons and potentials for future research. Secondly, it aims to convey the heterodox cultural contribution that these

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1. Francesco Petrini, "La crisi energetica del 1973. Le multinazionali del petrolio e la fine dell'età dell'oro (nero)," Contemporanea, no. 3 (2012): 445-473.

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architectural reflections express when situated within the context of the construction of new socio-economic paradigms, in order to understand their criticalities and elements of relevance in the current contemporary debate on the forms that the design of architectural space assumes in relation to the multiple theoretical and operational interpretations connected to the broad semantic horizons of the concept of 'sustainability'.

Pioneering Experiments: the 'Solar Houses'

The austerity policies adopted by Western countries to cope with the oil embargo imposed by the Organization of the Petroleum Exporting Countries (OPEC) – initially directed at Canada, the United States, Japan, Netherlands and the United Kingdom and later extended to Portugal, South Africa, and then Rhodesia, now Zimbabwe[2] – constituted, for architecture and urban studies, a favorable condition for the development of intense experimentation.

In fact, during the 1970s, research was concretely developed – through the construction of prototypes, the publication of books, essays, and manuals – to address the 'energy crisis' by proposing 'alternative solutions', ranging from the use of renewable energy sources, to new systems for energy storage, and even to more radical systems of social and economic management and organization and of exploitation of environmental resources – solutions that had already been initiated, especially in the United States, between the two World Wars.[3]

2. Bruno Marcel and Jacques Taïeb, *Les grandes crises: 1873-1929-1973* (Lassay-les-Châteaux: Armand Colin, 2005).

3. Giovanna Borasi and Mirko Zardini (Eds.), *Sorry, out of gas: architecture's response to the 1973 oil crisis* (Montréal: Canadian Centre for Architecture; Mantova: Corraini, 2007).

Figure 1. *Gianni Berengo Gardin, Campeggio sull'autostrada (Camping on the Highway), Switzerland, 1973. Photograph taken during the days of the oil crisis*
Source: Monika Gisler, "Come la Svizzera ha affrontato la crisi petrolifera del 1973 [How Switzerland addressed the 1973 oil crisis]", in *SWI swissinfo.ch*, 2002 [Online]. Available at: https://www.swissinfo.ch/ita/cultura/come-la-svizzera-ha-affrontato-la-crisi-petrolifera-del-1973/47972416 [Accessed: 9 November 2024].

One of the earliest and most ambitious research projects that fits fully within this historical and cultural framework was initiated in 1938 by Hoyt Clarke Hottel (1903-1998) at the Massachusetts Institute of Technology (MIT),[4] and was dedicated to the development of solar energy technologies for the heating of single-family domestic environments. Between 1939 and 1959, Hottel and his research group built a series of 'solar house' prototypes on the MIT campus, equipped with what was then an innovative system for converting solar radiation into thermal energy. Inside 'water-based' collectors made of transparent glass panels installed on the roof, the fluid contained in small pipes was heated by solar radiation and subsequently stored in tanks, to be later used as a heat transfer fluid to deliver the necessary heat for space heating within the dwelling (see Figure 2).

Research on what are now more commonly referred to as 'solar collectors' continued even after the experimental phase of the 'MIT Laboratory'. George Löf (1913-2009), a professor in the Department of Engineering at the University of Colorado and a student of Hoyt Clarke Hottel at MIT, focused his research on the development of 'air-based' collectors which, unlike the 'water-based' ones, used air as the heat transfer fluid and stone material for the accumulation and storage of heat.[5] In 1957, the technological system developed by Löf and installed in his

4. Pierre-Édouard Latouche, "Solar in the Laboratory", in *Sorry, out of gas: architecture's response to the 1973 oil crisis*, 78-83.

5. Ken Butti and John Perlin, *A Golden Thread: 2500 Years of Solar Architecture and Technology* (New York: Van Nostrand Reinhold, 1980).

residence in Boulder, Colorado, was able to meet 23% of the heating energy demand. A few years later, Henry Mathew (1938-2002), a self-taught solar energy enthusiast, independently built in his home in Coos Bay, Oregon, a solar thermal plant consisting of 67 square meters of collectors connected to tanks containing 30.000 liters of water. After some modifications made between 1973 and 1974, the system was capable of producing 85% of the energy required to heat the indoor space of the house.[6]

The house designed by architect Eleanor Raymond (1887-1989)[7] for Amelia Peabody (1890-1984) and built in Dover, Massachusetts, in 1949 represents the first architectural work whose internal heat demand was entirely met by the sole energy contribution of solar radiation. The sophisticated technological system, designed by engineer Maria Telkes (1900-1995), nicknamed the 'Sun Queen' and who was a colleague of Hoyt Clarke Hottel at MIT, was composed of 'air-based' collectors placed in the upper portion of the south-facing façade. These consisted of a double-glazed panel detached from the wall surface – painted black to create an air cavity – within which the air was heated by solar radiation. For thermal energy storage, instead of the traditional stone material, a 'eutectic mixture' (a solution of sodium sulfate salts) – previously tested in the second prototype built by Hottel's research group at MIT in 1947 – was used. This was contained within vertical drums between which the pre-heated air circulated, melting the salts in the mixture to store heat and releasing it into the interior through crystallization when the indoor temperature dropped.[8]

The exploitation of thermal energy produced by solar radiation was also a research theme that saw significant development in Europe. Engineer Félix Trombe (1906-1985), within the framework of research promoted by the *Centre national de la recherche scientifique* (CNRS), designed and built in 1967 in Odeillo, France, two houses equipped with a 'passive' thermal storage system integrated into the external wall, more commonly known as the 'Trombe wall'.

By placing a glass panel a few centimeters from the south-facing wall, a greenhouse effect was produced that heated the air inside the cavity thanks to the heat emitted by the stone wall as a result of solar radiation. During daytime hours, vents located at the top and bottom of the wall allowed the heated air to be transferred indoors by exploiting the convective currents generated within the cavity. At night, the thermal energy stored in the masonry radiated directly into the interior, while the openings were closed to prevent the phenomenon of reverse convection.[9]. In 1969, architect Jacques Michel (1920-2014), a longtime collaborator of Trombe, employed this technology in the design of a house in Chauvency-le-Château, further developing its functioning to enable summer cooling by adding openings at the top of the

6. Pierre-Édouard Latouche, "Pioneering Experiments", in *Sorry, out of gas: architecture's response to the 1973 oil crisis*, 84-85.

7. Doris Cole, *Eleanor Raymond, Architect* (Philadelphia: Art Alliance Press; Toronto: Associated University Press, 1981).

8. Pierre-Édouard Latouche, "A Solar First", in *Sorry, out of gas: architecture's response to the 1973 oil crisis*, 86-87.

9. Edward Mazria, *The Solar Passive Energy Book* (Emmaus (PA): Rodale Press, 1979), 43-50.

external glass panels, thereby allowing the heated air within the cavity to escape during the summer months.[10]

Figure 2. *MIT Solar House I, Cambridge, Massachusetts, 1939. Installation of 'Solar Collectors' on the Roof of the First 'Solar House' Prototype, developed by the Research Group Led by Hoyt Clarke Hottel on the Campus of the Massachusetts Institute of Technology (MIT)*
Source: Giovanna Borasi and Mirko Zardini (eds), *Sorry, out of gas: architecture's response to the 1973 oil crisis* (Montréal: Canadian Centre for Architecture; Mantova: Corraini, 2007), 78.

More generally, these studies on the development of 'alternative technologies' capable of harnessing the thermal energy produced by solar radiation in the context of domestic living gave rise to the construction of what are better known as the first prototypes of the 'solar house'. These experimental projects represent the theoretical and cultural premises of that more radical reflection on the concepts of 'self-sufficiency' and 'autonomy' which came to characterize the narratives and experiments of the North American–and, to some extent, European – architectural and artistic counterculture beginning in the 1970s, as a consequence of the first energy crisis of 1973.[11]

10. Pierre-Édouard Latouche, "Innovation: The Trombe Wall," in *Sorry, out of gas: architecture's response to the 1973 oil crisis*, 110-111.

11. Giovanna Borasi and Mirko Zardini (Eds), Sorry, out of gas: architecture's response to the 1973 oil crisis; see also Lee Stickells, "Exiting the Grid: Autonomous House Design in the 1970s", in *Proceedings of the Society of Architectural Historians, Australia and New Zealand: 32, Architecture, Institutions and Change*, edited by Paul Hogben and Judith O'Callaghan (Sydney: SAHANZ, 2015), 652-662.

A New Paradigm: The 'Autonomous Houses'

As observed by Mirko Zardini,[12] the experimental projects of the American research groups: the Farallones Institute at the University of Berkeley in California,[13] the Centre for Alternative Technology (CAT),[14] Integrated Life Support Systems Laboratories (ILS Labs),[15] the Ouroboros Project,[16] and the New Alchemy Institute,[17] adopting the critiques of development models imposed by the capitalist system, particularly those of Ivan Illich (1926-2002)[18] and Ernst Friedrich Schumacher (1911-1977),[19] developed an architectural reflection on the theme of 'self-sufficiency' oriented toward the construction of new and more radical social and economic models. Within the context of this research, the idea of the autonomy of built space from modern structures and economies of production and distribution is not assumed in a mythological sense, aimed at proposing a return to an Edenic condition associated with the Rousseauian figure of the so-called *bon sauvage*, nor at affirming an unconditional supremacy of individual freedom over the collective dimension of existence.

The content of these theoretical and operational experiments, which, as we shall see, develop around the concept of 'autonomous houses', should rather be referred to the intention to construct new paradigms for the functioning of society and alternative lifestyles through the design of architectures and different models of community, capable of repositioning the issue related to the energy autonomy of buildings within a much broader critical and cultural context, centered on an idea of the cyclicality of environmental resources that extends from food production to water use and as far as processes of waste transformation and recovery.

The expression «Autonomous Houses» was first used by Alexander Pike (1924-1979), director of the Autonomous House Research Programme at the Department of Architecture of the University of Cambridge in Massachusetts,[20] to describe a dwelling equipped with a series of integrated technological devices designed to achieve total autonomy in terms of energy needs and services related to domestic functions.

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12. Mirko Zardini, "Think Different", in *Sorry, out of gas: architecture's response to the 1973 oil crisis,* 40-49.

13. Giovanna Borasi, "Farallones Institute", in *Sorry, out of gas: architecture's response to the 1973 oil crisis*, 220-221.

14. Giovanna Borasi, "Centre for Alternative Technology", in *Sorry, out of gas: architecture's response to the 1973 oil crisis*, 202-203.

15. Giovanna Borasi, "Integrated Life Support Systems Laboratories", in *Sorry, out of gas: architecture's response to the 1973 oil crisis*, 207-209

16. Giovanna Borasi, "The Ouroboros Project", in *Sorry, out of gas: architecture's response to the 1973 oil crisis*, 216-219.

17. Adam Bobbette, "New Alchemy Institute", in *Sorry, out of gas: architecture's response to the 1973 oil crisis*, 210-215.

18. Ivan Illich, *Tools for Conviviality* (London: Calder and Boyars, 1973).

19. Ernst Friedrich Schumacher, *Small Is Beautiful: Economics as if People Mattered* (London: Blond and Briggs, 1973).

20. Alexander Pike et al., "The Autonomous Housing Research Program", *Building Science,* Special Supplement: "Energy and Housing" (1975): 119.

The design research and several prototypes developed by the group led by Pike can be understood as an attempt to explore new tools and categories of architectural space design through which to rethink the single-family house as the construction of a completely 'closed system', in which the inflows and outflows of energy, water, and food resources are managed in such a way as to be integrated within a substantially circular operational structure.

What distinguishes Alexander Pike's 'autonomous houses' project from the 'solar house' prototypes developed by Hoyt Clarke Hottel at MIT is the idea of incorporating into architectural space a multifunctional technological infrastructure conceived not only to support the energy needs related to the control of indoor environmental conditions, but above all as a response to the various and multiple levels of self-sufficiency related to domestic functions. It is therefore not merely a technical solution aimed at a more efficient and sustainable use of solar energy, but rather, by exploring new systems of transformation and management of a broader spectrum of renewable resources, including water and food, the concept of the 'autonomous house' represents, on a cultural level, a possible response to the environmental, economic, social, and political issues, then as now urgent, generated by the uncontrolled industrial development of a falsely liberal orientation. This research propose, in fact, a radical paradigm shift toward the self-sufficiency of ways of inhabiting the world, taking as their starting point the foundational element of the built environment: the single-family dwelling.

In March 1976, the Italian magazine *Casabella* (1976)[21] published on its cover the image of *Piece of Nature* [*Stuck Natur*] (1971–1973) (see Figure 3), a work of art by the avant-garde architectural group Haus-Rucker-Co, founded in Vienna in 1967 by Laurids Ortner, Günter Zamp Kelp, and Klaus Pinter, known in the critical literature for the construction of habitable 'bubbles' within urban space, conceived as devices intended to define conditions of existence deliberately separated from physical reality and from the social and collective dimension of the city.

This intention to signify a voluntary detachment from the physical and sociological contexts of urban settlements is expressed in many of Haus-Rucker-Co's projects, for example, in *Environment Transformer* (1968), where transparent helmets are worn by the members of the group to alter optical and acoustic perceptions of the external environment; or in *Oase No. 7* (1972), in which a fragment of nature is reproduced and enclosed within a transparent sphere eight meters in diameter, suspended from the main façade of the Fridericianum in Kassel.

Placed within the context of the research initiated by Alexander Pike on the concept of the 'autonomous house', the image of the house sealed inside a jar may be read as a model of a single-family residence completely isolated from the natural context that conventionally surrounds it, in order to define a fully closed and independent microcosm that reproduces a fragment of nature conceived as a duplication of nature in its entirety.

21. *Casabella*, no. 411 (1976).

Figure 3. *Haus-Rucker-Co (Laurids Ortner, Günter Zamp Kelp and Klaus Pinter), Stuck Natur (Piece of Nature), 1971-1973*
Source: Heinrich Klotz (ed.), *Postmodern Visions: Drawings, Paintings and Models by Contemporary Architects* (New York: Abbeville Press, 1985), 85.

Piece of Nature represents a genuine new paradigm of domestic space conceived to function as a completely synthetic environment through the continuous transformation and regeneration of its own material and energetic resources. To use the words of Lydia Kallipoliti: "The canned domestic cosmos depicts a transformation in

the field of ecology, from the purity of nature as a realm outside the human-made to a technologically mediated science of instrumentation".[22]

The new domestic space circumscribes a fragment of the natural environment within its own boundaries by engineering the functioning of nature. The house is conceived as a perfectly closed system where every transformation takes place internally in order to control its environmental conditions solely by utilizing what is available within its systematic boundaries and operational structures.

Also in 1976, the English magazine *Architectural Design* (1976) published a special issue curated by Martin Spring and Haig Beck, entitled "Autonomous Houses".[23] On the cover, an illustration by Clifford Harper (see Figure 4) – British illustrator and militant anarchist, known for his numerous drawings published in the magazine *Undercurrents* – depicts a rural domestic environment in color, fully equipped with all the technologies necessary to render it autonomous relative to a desolate and gray urban industrial cityscape placed in the background. Inside, the eponymous section curated by Peter Harper (trained as a biologist and later director of the Centre for Alternative Technology in Machynlleth, United Kingdom) gathers some reflections on the political, economic, and cultural implications connected to research on the autonomy of space and residential functions at the scale of the single-family house and the city, a brief review of 'alternative technologies' for its concrete realization, and a collection of nineteen projects of self-sufficient houses,[24] as part of a broader monographic study published the same year entitled *Radical Technology* (1976),[25] written together with Godfrey Boyle (1945-2019) and the editors of *Undercurrents*.

22. Lydia Kallipoliti, *The Architecture of Closed Worlds, or, What is the Power of Shit?* (Zurich: Lars Müller, 2018), 13-14.

23. *Architectural Design*, Special Issue: "Autonomous Houses", no. 1 (1976).

24. Peter Harper, "The Autonomous Houses", *Architectural Design*, Special Issue: "Autonomous Houses", no.1 (1976): 19-49.

25. Peter Harper and Godfrey Boyle, *Radical Technology* (London: Windowood House Limited; New York: Pantheon Books; Melbourne: Penguin Books Australia, 1976).

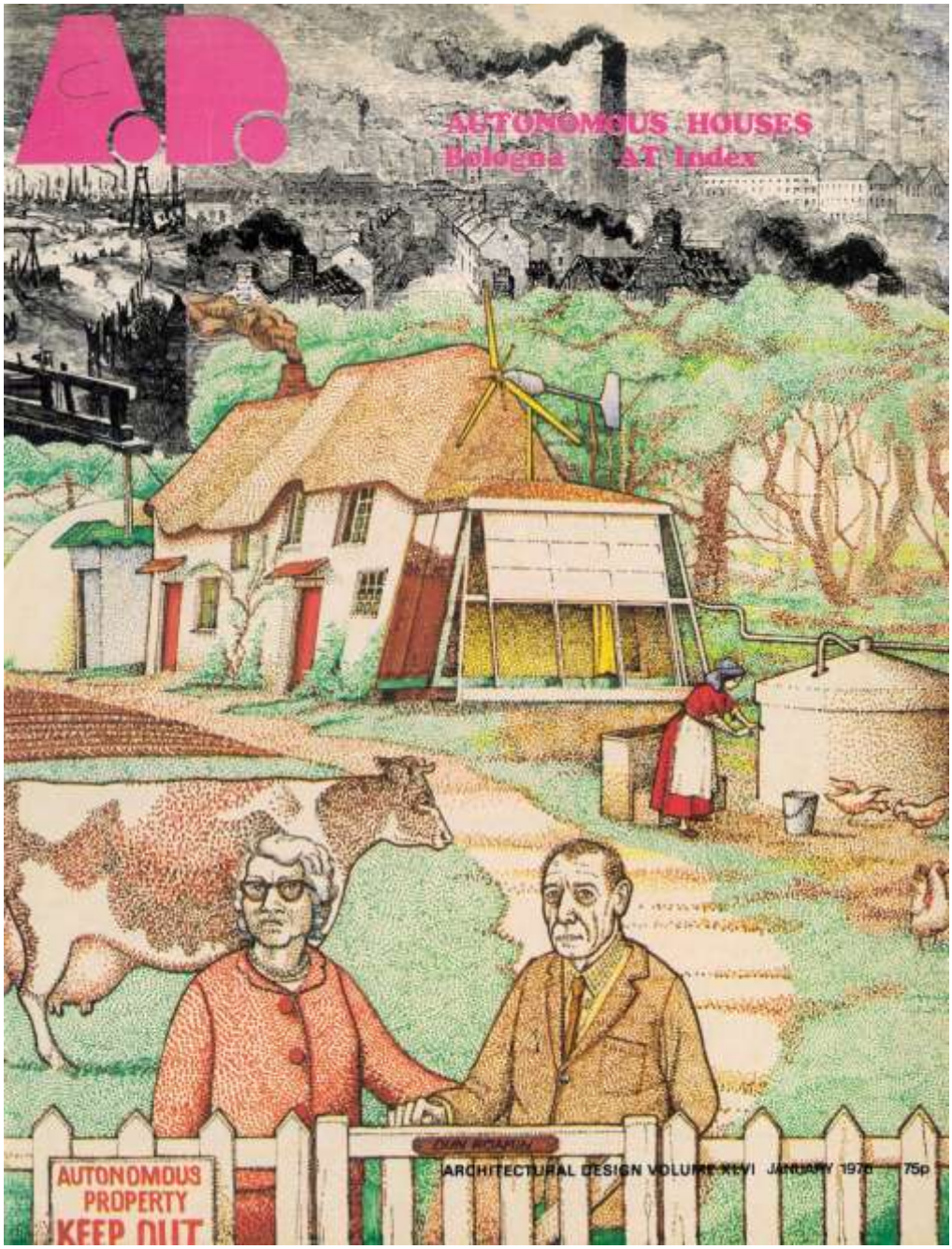

Figure 4. *Clifford Harper, Illustration drawn for the Cover of the Special Issue titled "The Autonomous House", Published in the Journal Architectural Design, no. 1, 1976*

The section curated by Harper in the monographic issue of *Architectural Design* offers a broad overview of research and projects, partly attributable to the experience of the *Alternative Technology* movement that took root in the United Kingdom starting in the 1970s[26] and to some publications by representatives of the American

26. Witold Rybczynski, *Paper Heroes* (New York: Doubleday, 1980).

counterculture released during those years, on the theme of the 'autonomy' of the single-family house.[27]

As in the image of the sealed house *Piece of Nature* by the Austrian collective Haus-Rucker-Co, the archetype of the 'ecological house' proposed by Harper, differently articulated in the prototypes of 'Autonomous Houses' published therein, adopts the concept of 'self-sufficiency' with a fundamentally 'biological' connotation, which finds expression in the design of architectural space as the construction of a technologically 'closed' organic ecosystem, defining a functional structure of domestic life completely independent from the various environmental contexts.

"Some units [Peter Harper writes] are designed for specific locations; others for a specific kind of location (e.g., city or countryside); others for a specific climate. Most of those discussed are intended for temperate climates without any particular location in mind [...]".[28]

For Harper, giving architectural form to the concept of autonomy in dwelling translates operationally into equipping the functional structures of the house with integrated systems of alternative technologies for the exploitation of environmental resources and the recycling of those produced within it. More precisely, the design of the dwelling is oriented exclusively toward the construction of a perfectly functioning technological structure for the transformation of solar radiation into heat, the conversion of wind energy into electricity, the storage and purification of rainwater, and the transformation of organic waste into methane and fertilizers for food cultivation and animal husbandry.

However, manipulating organic and ecological processes in order to construct an artificial space that is closed in itself, in which the design of architectural space sets itself the objective of imitating the functioning of nature in order to reproduce it, implicitly means decreeing the supremacy of technological solutions over the formal questions of architecture. An approach that, paradoxically, effectively nullifies the 'dialectic' that has always existed between the design of architectural space and the historical, geographical, and cultural specificities that distinguish the different places of a territory. A circumstance that, according to Reyner Banham (1922-1988) – a reference already particularly significant in itself – was the primary cause of the interruption of the original and centuries-old relationship between 'architecture' and 'environment'.[29]

27. See Brenda Vale and Robert James Dennis, *The Autonomous House: Design and Planning for Self-Sufficiency* (London: Thames and Hudson, 1975); Alfonso Ortega and Witold Rybczynski (eds.), *The Ecol Operation: Ecology, Building and Common Sense* (Montreal: Minimum Cost Housing McGill University, 1975); Helga Olkowski, William Bill Olkowski, Tom Javits and The Farallones Institute staff, *The Integral Urban House* (San Francisco: Sierra Club Books, 1979); James B. DeKorne, *The Survival Greenhouse: An Eco-System Approach to Home Food Production* (New York, Walden Foundation, 1975).

28. Peter Harper, "The Autonomous Houses", 27.

29. Reyner Banham, *The Architecture of the Well-Tempered Environment* (The Architectural Press, London, 1969).

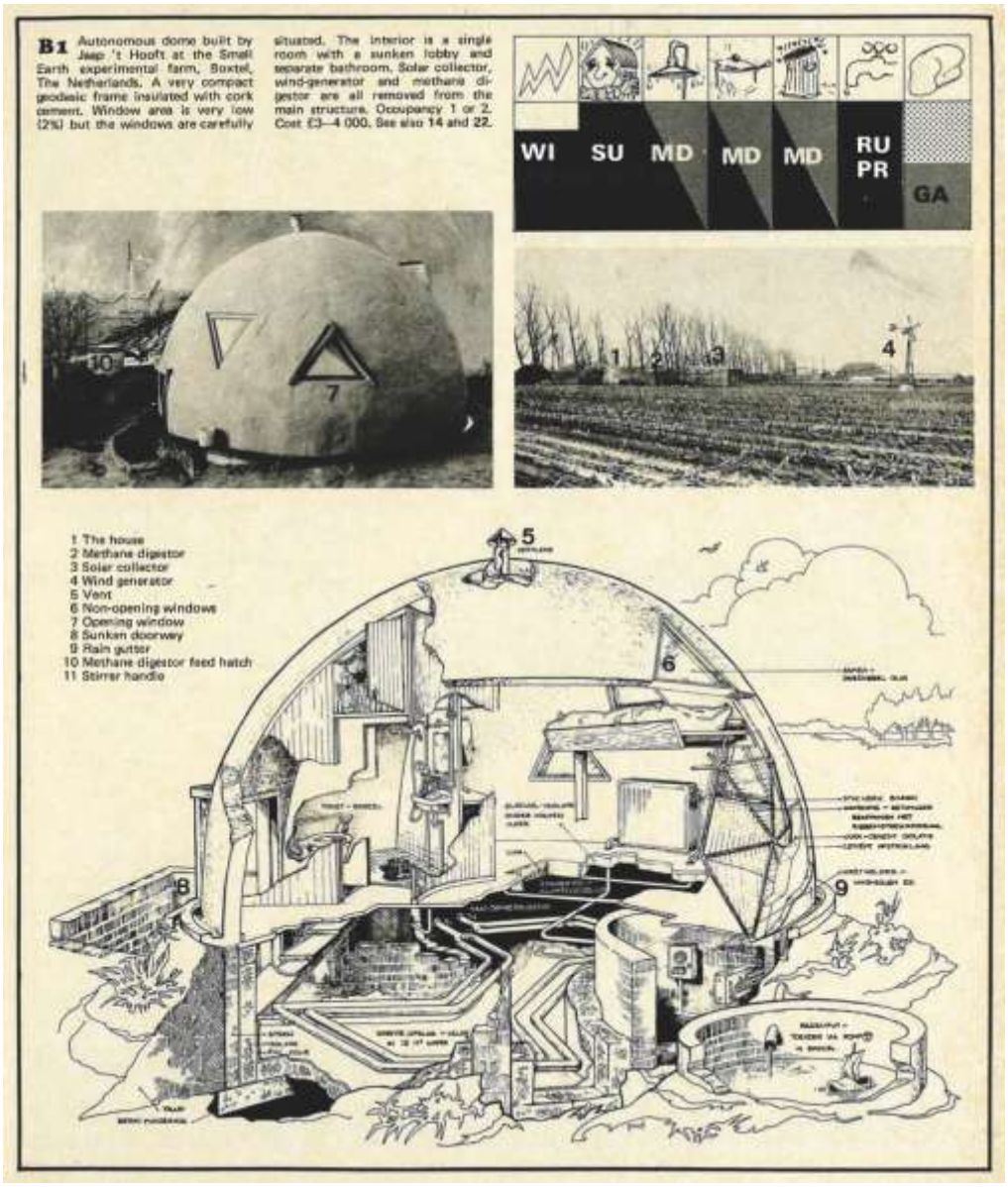

Figure 5. *Jaap't Hooft, "Autonomous Dome" Built at the Experimental Farm Small Earth, Boxtel, the Netherlands, 1975*
Source: Peter Harper, "The Autonomous Houses", *Architectural Design*, Special Issue: "Autonomous Houses", no. 1 (1976): 33.

Conclusions

If one refers to the then-new awareness of the necessity to rethink the relationship between the built space and the social, environmental, and material contexts that the history of energy crises has brought to light since the post-World War II period and which reemerges, updated, even in the contemporary moment, the merit of these research developed, above all by the British and American counterculture, on the self-sufficiency of domestic living has been, in our opinion, to situate architecture

within the ecological question, while adopting a cultural perspective much broader than that confined solely to a critique of the tools and procedures inherent to architectural design.

Reconfiguring the functional structures of architectural space by exploring the intersection between ecological systems and technological innovation within a logic of autonomy meant, for architects, engineers, and intellectuals of the radical counterculture, paradoxically assuming architectural design as a tool for the revision and re-foundation of the social and economic models governing the collective life of a community.

"Autonomy [Peter Harper writes] does not necessarily mean *private*. What we really need is a new model of autonomy/collectivity",[30] further specifying, together with Boyle, that: "For many people, autonomous houses represented the technical realization of the political or existential autonomy that is one of the basic themes of this book: not just having legal or social control over one's destiny but having one's hands directly on the hardware".[31]

The problems of the post-industrial capitalist organization related, above all, to the social context of existence – which still today retain an indisputable character of relevance and urgency – find a possible solution, for Harper and Boyle, by assuming a notion of self-sufficiency understood as a 'dialectic' between 'self-management' and 'sharing'. The realization of a concrete "*co-operative autonomy*"[32] should have allowed, through the design of the smallest element of the built environment: the single-family domestic space, a broader process of 'decentralization' aimed at dismantling the centralized authority of higher institutions by exercising 'bottom-up' control over the systems of production and management of natural resources within a logic of sustainability that is not only environmental but also, and above all, economic and social (see Figure 6).

30. Ibid, 20.
31. Ibid, also in Peter Harper and Godfrey Boyle, *Radical Technology*, 136.
32. Peter Harper, "The Autonomous Houses", 20.

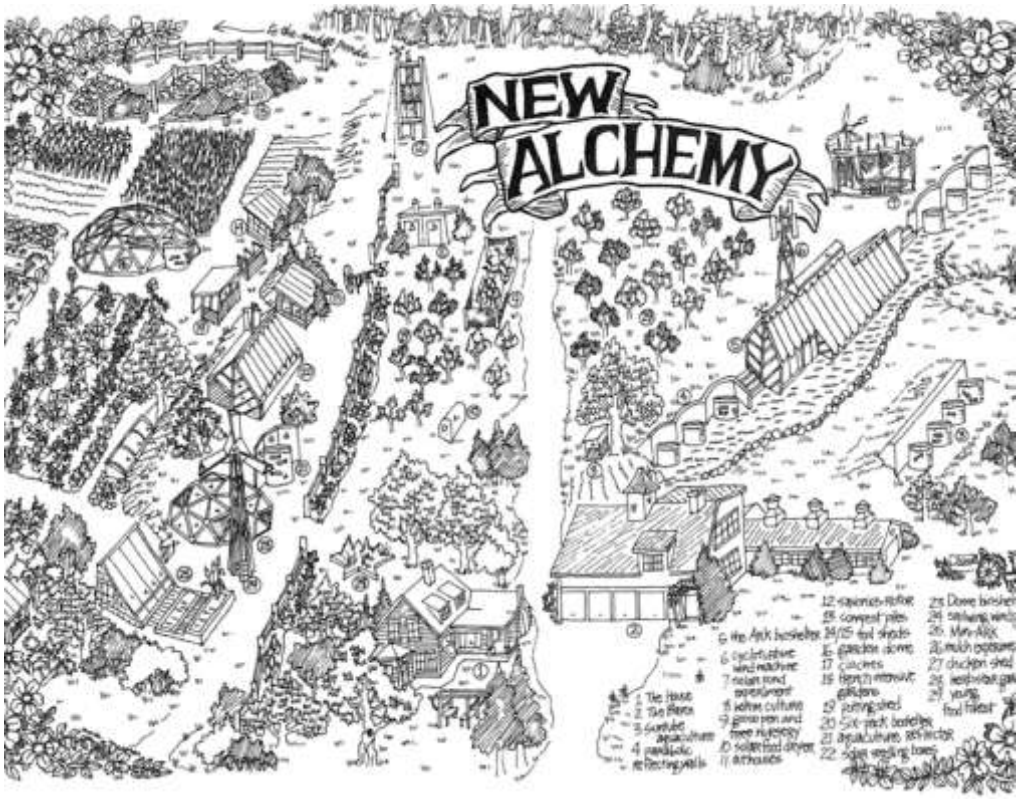

Figure 6. *Drawing of a New Radical Model of Self-sufficient Living Developed by the New Alchemy Institute, Woods Hole, Massachusetts, 1979*
Source: Nancy Jack Todd, "Overview", *The Journal of New Alchemists*, no. 5 (1979): 7.

More precisely, in the chapter of the volume *Radical Technology* (1976) entitled "Autonomy," written by Peter Harper and later republished almost in its entirety in the special issue of *Architectural Design* (1976), the author, referring to the research conducted by Richard Merrill within the New Alchemy Institute, emphasizes the need to rethink the separation imposed by industrial development between the "public production" and "private consumption"[33] of the essential components of dwelling: communication and social services, domestic goods, utility services, and food, assessing their potential for self-production and self-consumption within collectively functioning and self-sufficient social and economic structures called "local communities".[34]

The author distinguishes the 'rural' context from the 'urban' one, recognizing in the countryside more suitable conditions for the construction of newly founded self-sufficient communities, where individual dwellings collaborate in resource production, making them available to the entire community. In cities, instead, interventions should focus primarily on the peripheries, directing the restructuring of pre-existing architecture toward the configuration of self-sufficient housing units, according to a principle of sharing domestic functions within collective spaces and

33. Peter Harper, "Autonomy", in Peter Harper and Godfrey Boyle, *Radical Technology*, 136-169.
34. Ibid.

self-producing energy, water, and food resources through a different use of the dwelling's external areas.

Referring to the experience of the "rural utopian communities",[35] theorized and supported by the Irish economist William Thompson (1775–1833), Peter Harper recognizes the historical failure of these forms of collective dwelling organization as highlighted by Jos Kingston (1948–2007),[36] attributing the cause not so much to the ineffectiveness of the proposed economic and social models, but rather to the backwardness of the technological systems used to implement such projects. Consequently, Harper acknowledges the relevance of the sociological and economic horizon outlined by these 'utopias' in terms of the relationship between self-production and sharing, believing that technological progress, and more specifically the use of 'alternative technologies', now allows their utopian status to take concrete form.

Operationalizing the concept of autonomy in architecture does not mean reconfiguring domestic space with a view to total self-sufficiency, since, as Richard Merrill reminds us, this would constitute a "logical extension of the 'privatization'" that characterizes the logics of capitalist economies.[37] The most authentic meaning of the idea of autonomy proposed by Harper and the British and American counterculture lies in its various social, economic, and political implications, referring to the need to achieve independence from dominant centralized networks through new localized systems of self-production and sharing, built to sustain the original 'dialectic' between the 'public' and 'private' dimensions of existence, without either dimension prevailing over the other.

After all, as Harper writes: "It is a seeming paradox that each extension of the scope of economic and material autonomy, if it is to remain honest and non-exploiting, requires commensurate measures of collective participation. If healthy autonomy can only grow, think of no better moral on which to end".[38]

Excluding the work on the documentation of the main self-sufficient housing prototypes published by Lidia Kallipoliti and her research group in 2018,[39] the special issue of the journal *Architectural Design* (1976) and the volume *Radical Technology* (1976), both edited by Peter Harper – the latter together with Godfrey Boyle – represent the first attempt to systematize research on the theme of autonomy in dwelling, which has not been the subject of subsequent in-depth studies.

In this regard, a more complete and structured reconstruction of the theoretical content and design experiments on this topic can be developed starting from the study of archival materials preserved at the Canadian Centre for Architecture in Montreal, which include experimental projects of prototypes and 'alternative technologies', a wide and significant photographic documentation, and a considerable portion of volumes and major sector journals published in those years, partially organized on the occasion of the exhibition curated by Giovanna Borasi and Mirko

35. Ibid, 165.

36. Jos Kingston, "It's Been Said Before – and Where Did That Get Us?", in Peter Harper and Godfrey Boyle, *Radical Technology*, 238-248.

37. Peter Harper, "Autonomy", 161.

38. Ibid, 167.

39. Lydia Kallipoliti, The Architecture of Closed Worlds, or, What is the Power of Shit?

Zardini in 2007 at the Canadian institute and published in the exhibition catalogue.[40] Considering also the study more specifically dedicated to the theoretical framing of the content of this research, supported by a valuable bibliographic reconstruction, which was carried out by Lee Stickells on the occasion of the *Architecture, Institute and Change* conference held in Sydney in 2015.[41]

Unfortunately, these are still studies that remain too fragmented and distant in time, providing only a partial account of the broad cultural significance of these theoretical reflections and design experiments. However, taken together, they constitute an isolated yet highly valuable scientific contribution in indicating the content and possible directions of a research path aimed at overcoming a significant gap, through the restitution of an important chapter of architectural culture that is still today inadequately integrated and problematized within the main literature dedicated to the history and theory of architecture.

The research and projects developed by architects and engineers: Steve Baer (1938-2024), Edward Mazria, Jacques Michel, Félix Trombe, Michael Jantzen, Michael Reynolds, John Barnard (1932-2021), Malcolm Wells (1926-2009) and by the research groups Underground Space Center, Windworks, Farallones, Ouroboros, Ecol Operation, New Alchemy Institute, ILS Labs, and CAT, deserve recognition for having proposed, for the first time, reflections on 'alternative' models that seek to interrogate the complex meaning and the multiple nuances that the concept of 'sustainability' assumes within the broad disciplinary field of architectural design.

Although, in some cases, an excessive emphasis on the technological dimension can be noted, it is our conviction that the most significant contribution offered to the theory and practice of architecture by these studies and design experiences, beyond the concrete formal outcomes, lies in the construction of a wide and irreplaceable panorama of reflections and experiments. By interrogating the relationships between architectural design and new socio-economic paradigms for the 'dialectical' structuring of the 'individual' and 'collective' dimensions of dwelling, in our opinion, these works reveal their broadest and deepest cultural significance when interpreted in the form, to conclude with the words of Ernst Friedrich Schumacher, "of a repertoire of ideas, with which, thanks to which, and through which, we experiment and interpret the world".[42]

Acknowledgments

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40. Giovanna Borasi and Mirko Zardini (Eds), *Sorry, out of gas: architecture's response to the 1973 oil crisis*.

41. Lee Stickells, "Exiting the Grid: Autonomous House Design in the 1970s".

42. Ernst Friedrich Schumacher, *Small Is Beautiful: Economics as if People Mattered*, 91.

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