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Exiting the Grid: Autonomous House Design in the 1970s

This paper explores the 1970s “autonomous house” as a site for the reshaping of relationships between the household and the institutions of broader society. It provides an outline of the autonomous house phenomenon, its historical consideration and the potential for further research. Autonomous houses were conceived as decentralised, systems-independent shelter technologies that would recalibrate the “infrastructuring” of everyday life. There has been limited historical scrutiny of this phenomenon. However, during the 1970s autonomous houses were designed and built across the world, alongside a swathe of projects with corresponding aims, such as “eco-houses,” “arks,” and “integrated life support systems.” The emergence of this fascination with the autonomous house as a distinctive architectural project can be traced to the intense environmental, social and political debates of the late 1960s and the 1970s around the future of “industrial society” – indelibly sharpened by the oil crisis of 1973.

The ideal of autonomous dwelling captured the way that, in the face of a rising anxiety, existing institutional dependencies were questioned and design became considered as a means to achieving “self-sufficiency,” “life-support” and “survival”. Demands were being made for the positive redirection of technological change to take more account of social, environmental and human needs, as well as more accountability and public participation in the shaping of socio-technical processes. Designers of autonomous houses grappled with conflicting understandings of technology as having progressive environmental, social and aesthetic potential, as well as harmful, even destructive consequences. They engaged in a reshaping of architecture’s relationship to technology, environment, and social and economic systems, centred on achieving independence from existing institutions (particularly State utilities). This paper’s initial consideration of a 1970s “autonomy moment” will suggest the possibility of further research, in order to draw together histories of experimental architecture, environmentalism, cultural transformations and post-war technology debates.

In a 1976 editorial, *Architectural Design (AD)* described the autonomous house as “one of the prevailing cult projects among the architectural avant garde.”¹ This paper will convey the initial results of research into that “cult” project – investigating it as a site where relationships between the household and the institutions of broader society were reshaped through the reinvention of the dwelling and its multiple household economies. Around the world, autonomous houses were designed as integrated technological systems able to generate their own energy, collect and recycle water, treat their own wastes, and even grow their own food. They were conceived as a means to recalibrate the “infrastructuring” of everyday life and reshape relationships between the household and interconnected environmental, societal and economic systems.² However, existing accounts of autonomous houses are limited and disconnected. The 1976 *AD* issue’s partial – alternative technology-focused – review of “autonomist” projects provided a rare overview, while subsequent scholarship has tended to scrutinise individual projects.³ The scattered historical accounting is understandable because the autonomous house movement was decentralised and nebulous; the concept of the autonomous house gathered around it a disparate set of designers, scientists, students, activists, funding bodies and research institutions, with sometimes conflicting agendas and approaches. This paper will provide a new introductory overview of the 1970s autonomy moment and its historicisation, suggesting the potential to substantially extend existing scholarship. It will be argued that a collective consideration of the projects can offer productive insight into connections between post-war technological change and its impact on the social, economic and political dimensions of architecture.

The excavation of these historical projects is also timely given the resurgent interest in designing for life “off-the-grid.”⁴ Across the globe, peoples’ connection to infrastructural grids is changing radically. Increasingly, the modern ideal of standardised and ubiquitous water, power, transport and communication matrices across the geographies of the city is no longer seen as sustainable or achievable.⁵ The models for delivering energy, water, health and other infrastructures – both physical (pipes and wires) and metaphorical (planned systems of service provision) – are being rethought, facing particular pressure from phenomena such as financial crises and climate change.⁶ Design experiments that reiterate the autonomous house ideal have emerged – demonstrating current possibilities for a dwelling that operates off-grid.⁷ Reconsidering the 1970s autonomy moment also allows for an historical contextualisation of these experiments in redesigning everyday life – drawing attention to architecture’s place in our collective negotiation of infrastructural needs.

The term “autonomous house” emerged in the early 1970s as a way of describing dwellings designed and constructed with integrated systems to provide self-sufficiency in energy, services and waste disposal. Initial use of the term is attributed to Alexander Pike, who led the Autonomous Housing Research Programme in the Department of Architecture at the University of Cambridge.⁸ It soon came to refer to a range of projects with varying approaches to the modes and extent of systems-independence. Autonomous houses were designed and built across the world, alongside a number of projects with corresponding aims, such as “eco-houses”, “arks” and “integrated life support systems”.⁹ They were model

dwellings, aimed at recalibrating the house in response to factors such as the 1970s energy crisis, demands for technological change to take more account of social, environmental and human needs, increased understanding of ecological systems, and challenges to what was seen as a technocratic and greed-driven society. These experiments in closed-system, ecological architectures adopted concepts, methodologies and representational techniques that reframed architecture as systems of inputs, outputs and flows.

What distinguished autonomous house projects from low-energy demonstration houses of the period, or “solar house” experiments (which stretched back at least as early as the 1930s), was the emphasis on integrating multiple infrastructural systems in the house. The importance of that integration was consistently linked to the adoption of a radically different way of life, encompassing various degrees of self-sufficiency. Experiments in the field of insulation, solar energy, wind power, underground or earth-covered building, tended to have goals such as providing all the conventional energy a house needed for heating or cooling, or reducing that energy requirement. Alongside this, they often sought to minimise mechanical loads for conditioning the internal climate during summer and winter.¹⁰ The autonomous approach went much further in seeking to design a satisfactory living environment from the energy and water falling on the house and its plot – exploring what could be achieved by trying to use only the incoming renewable resources. In doing so, it projected unconventional modes and standards of living, based on what local ecosystems offered. Autonomous house designers believed that more than just a technical fix (such as being efficient in the use of energy) was required to address pressing environmental, economic, social and political problems; rather, a fundamental change – focused on autonomy – was required in how people lived. A new kind of dwelling was to be the instrument for effecting that change.

Another distinction of autonomous house projects was the diversity of their designers, and the way that interest in the concept spanned multiple domains. In the 1970s, there was a search for appropriate architectural responses to the environmental dilemmas projected earlier by publications such as Rachel Carson’s *Silent Spring* (1962), Paul Erlich’s *The Population Bomb* (1968) and The Club of Rome’s *Limits to Growth* (1972): finite resources, nuclear threat, rising population and the explosion of metropolitan regions.¹¹ How the design of buildings could figure in reducing pollution, conserving energy and reshaping settlement patterns became a matter of concern.¹² Questions of how architects might design for, as Buckminster Fuller put it, the challenge of operating “Spaceship Earth and its complex life-supporting and regenerating systems” also overlapped with the interests of the Appropriate Technology (AT) movement.¹³ The AT movement was characterised by serious distrust of the concentration of political and economic power through centralised industrial capitalism, and aspired to develop uses of technology and engineering that would produce less negative impacts on the environment and society.¹⁴ As one AT handbook put it, the purpose was “to make people more self-reliant”; using AT, “you could supply all your energy requirements with largely non-polluting, completely renewable sources of power *that you control* [emphasis in original].”¹⁵ There was further intersection with the living experiments of the counterculture: back-to-the-land communards, outlaw dome-builders, and the ecological design research

of organisations such as the New Alchemy Institute, consistently sought shelter solutions that would be more attuned to the forces of nature, less economically exploitative, and would cultivate people's self-sufficiency and agency.¹⁶ The appeal of the autonomous house idea across these different domains meant that experiments in autonomous dwelling involved individuals as diverse as architects, hippie communards, biologists, and schoolteachers. The projects ranged from government funded, research programs, with highly detailed technical proposals and professionally constructed prototypes, to unauthorised, self-built rural retreats captured in personal diaries and cartoonish sketches. However, amongst all the diversity in participants, networks, sites, funding, forms and discourse, the vision that a dwelling could (and should) be designed as autonomous – as self-sufficient and independent – was consistent.

The proposition made in this paper, about the promise of further research and comparative analysis, largely rests on a preliminary survey of published autonomous house projects (built or unbuilt). It was very much an exploratory, rather than exhaustive, exercise; autonomous house experiments emerged from multiple domains, and involved a diverse set of actors. The survey covered documentation and discussion spread across publications (often obscure and ephemeral) emanating from various fields. The survey also ranged in time from publications contemporary to the autonomous house experiments of the 1970s, through to more recent scholarship on the history of ecological design. The longitudinal aspect of the search was in order to gauge the relative prominence of discourse around the concept of the autonomous house across time (bearing in mind that such projects are now more likely to be discussed as “off-the-grid” houses).

The 1970s publications investigated included architecture journals such as *Architectural Design (AD)*, which engaged with architecture's more radical responses to social and ecological issues during the period (features appeared on shanty towns, squatting, and ecology; with columns called “Eco-tech” and “Recycling” by Colin Moorcraft). The review also included publications associated with the AT movement, such as the journals *Soft Technology* and *Undercurrents*. The *Undercurrents* book spin-off *Radical Technology* included a significant survey of autonomous houses. A further range of books was consulted that tackled questions of energy use in buildings – particularly the development of alternative energy sources in response to issues of resource scarcity and environmental impact. Some of these publications, including Philip Steadman's *Energy, Environment and Building* (1975), Peter Clegg's *New Low-Cost Sources of Energy for the Home* (1975) and Norma Skurka and Jon Naar's *Design for a Limited Planet* (1976), included material on autonomous houses. Lastly, the survey explored a number of journals and newsletters that sprang up during the 1970s as part of the counterculture's expanding network of communes and intentional communities. These included publications such as the *Whole Earth Catalog*, *Rain: A Journal of Appropriate Technology*, and *Mother Earth News*, which all covered autonomous house experiments at some point. Publications specific to the various autonomous house projects were also identified. These included *The Autonomous House* (Brenda and Robert Vale's 1975 proposal for a house design), *The Ecol Operation* (an account of the activities of the

Minimum Cost Housing Group at McGill University), *The Integral Urban House* (detailing a project connected to the Farallones Institute), and *The Survival Greenhouse* (an account by Jim DeKorne of his family's back-to-the-land project).¹⁷

This initial review identified 54 published autonomous house projects in the period from 1972 to 2000. The projects were located across the world – in the UK, USA, Canada, Australia, Netherlands and Japan – although concentrated in the UK and USA. Around half of the projects were built (although, due to the lack of published information, it was sometimes difficult to confirm this). There was a clear concentration of published autonomous house projects in the early-to-mid 1970s: 43 of the 54 identified projects were designed and/or constructed in the period 1972-79. It is a concentration that prompts questions about its historical dimensions. Why the fascination with the project of the autonomous house? What are the connections between the designs, the technical systems, the locations, the designers, and the institutions involved? Why the decay in interest? Some of the projects, such as the Integral Urban House or the “arks” of the New Alchemy Institute, are familiar reference points in ecological design histories. However, many are obscure and little documented – houses such as Jaap't Hooft's self-built autonomous dome in Boxtel, Netherlands, or Andrew Mackillop, Ian Hogan and Low Impact Technology's plans for a house built of “junk technology”. While in the mid-1970s there were some reviews undertaken of activity in the area of autonomous housing (Steadman's overview in *Energy, Environment and Building* and Peter Harper's analysis in *Radical Technology* are the most prominent) there is little scholarship that addresses the historical dimensions of the broader autonomous housing phenomenon.

The autonomy trend seemingly peaked by 1976, with the book *The Autonomous House: Design and Planning for Self-Sufficiency* (1975); *Architectural Design's* special issue on autonomous houses; and the *Radical Technology* survey of autonomous projects.¹⁸ From that point onward, wider interest in autonomous housing appears to have significantly waned. Experiments in domestic self-sufficiency certainly continued, but the autonomous house as a self-conscious living experiment and model dwelling largely disappeared from view. For example, the 1983 publication *Australian Solar Houses* included a number of private houses (of the late 1970s and early 1980s) that pursued some level of autonomous servicing, however, none were documented, analysed or publicised in the way the earlier, more ambitious projects had been. In 1992, a paper in the *International Journal of Solar Energy* detailed a Japanese project for an exemplar autonomous dwelling.¹⁹ Reprinted from the *Journal of Japan Solar Energy Society*, the paper is interesting as it points to a localised strand of autonomous house experimentation that had not been discussed previously in the predominantly Anglo-American autonomous housing literature. It is also significant in that, by the 1990s, this kind of documented autonomous house project had become relatively rare.²⁰

However, within the continuously expanding field of publications related to sustainability in architecture – ranging from technical manuals for energy efficient buildings through to the critical theorisation of sustainable architecture's aesthetics – there has been a resurgence

of interest in housing experiments that are, effectively, autonomous dwellings. These are now more likely to be referred to as “off-the-grid” houses. Lori Ryker’s books *Off The Grid: Modern Homes + Alternative Energy* (2005) and *Off The Grid Homes: Case Studies for Sustainable Living* (2007) are prominent examples, and include a small number of projects that fit the autonomous house definition. In Australia, Michael Mobbs’ renovation (with his family) of an inner-city terrace house to become self-sufficient was documented in the book *Sustainable House: Living for Our Future* – first published in 1998, reprinted nine times and producing a second edition in 2010. The family’s aim was “to obtain our own water and energy from our own house, from the land on which we live, our 5 x 35 m inner-city block of land. We also wished to ensure that none of our waste water left the site.”²¹ Despite the obvious correlation with the aspirations of the 1970s autonomous house movement, these recent examples make almost no reference to the history of this kind of self-conscious domestic living experiment.²²

Turning to the field of architectural history does not provide much more in the way of contextualisation for such projects; the autonomous house project very rarely surfaces. The experimental ecological design of the 1960s and 1970s is not a focus of the enduring major histories of modern architecture, such as Frampton’s *Modern Architecture: A Critical History*, Tafuri and Dal Co’s *Modern Architecture*, Curtis’ *Modern Architecture Since 1900*, or Colquhoun’s *Modern Architecture*, let alone strands as specific as the autonomous house phenomenon.²³ Interest in radical work of the two decades between 1960 and 1980 has certainly grown during the early twenty-first century; however, it has tended toward coverage of aesthetic avant-garde theory and practices. The attention to the autonomous house suggested within this paper sits in coordinate with historical perspectives on architecture that take in the technological, cultural, political, and especially social revolutions materialising in the 1960s.²⁴

Recent historical surveys of ecological design and sustainable architecture have also been limited in their scrutiny of the autonomous house phenomenon. James Steele’s *Ecological Architecture: A Critical History* involves very little discussion of the 1970s experiments that rethought architectural design through the socio-politics of energy, technology and ecology.²⁵ Despite discussing Ken Yeang’s work at length, Steele makes no mention of the doctoral research that Yeang undertook as part of Pike’s autonomous housing group (research that was foundational to Yeang’s theories of bioclimatic design). Colin Porteous’ *The New Eco-Architecture: Alternatives from the Modern Movement* does discuss the concept of autonomous living, but refers only to the work of the New Alchemy Institute.²⁶ The publication accompanying the Canadian Centre for Architecture’s 2007 exhibition *Sorry, Out of Gas: Architecture’s Response to the 1970s Oil Crisis* also recognised the phenomenon. However, the curators made little examination of the autonomous house, and posited that, as a “mythical” ideal, it made no lasting contribution to architecture’s ability to articulate alternative, sustainable lifestyles.²⁷ The most thorough recent reflection on the autonomous house appears in Peder Anker’s *From Bauhaus to Eco-House: A History of Ecological Design*. Anker includes a number of the key projects – such as the Integral Urban House and the

Cambridge Autonomous Housing Research Group – in a chapter on the “closed world” of ecological architecture. However, the emphasis of Anker’s account is on the connections between ecological design experiments and the USA’s space research program – for example the borrowing of terms such as “life-support system.”²⁸ More thorough research has been done on a small number of individual autonomous house projects. For example, Lydia Kallipoliti has published a series of papers examining Street Farmer’s Eco-House. Similarly to Anker, her focus is on connections between NASA’s exploration of closed re-circulatory systems and the subsequent transfer of ideas and technologies to experiments in ecological design.²⁹ The scholarship focusing on individual autonomous house projects is valuable, but leaves an historical lacuna in terms of understanding the dimensions and implications of the 1970s autonomous house phenomenon as a whole.

In order to understand why it would be profitable to pursue a deeper historical understanding of the 1970s autonomy moment, it is worth briefly retouching on some of the ways in which autonomous house projects attempted to reshape architecture’s technological, environment, and social agency. Peter Harper, surveying the autonomous house movement in 1976, observed that while concerns with “autonomous servicing” were ostensibly associated with responding to ecological problems associated with conventional housing, they had further implications:

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 [*Radical Technology*]; not just having legal or social control over one’s destiny but having one’s hands directly on the hardware.³⁰

Alexander Pike described the objective of the Cambridge autonomous housing research programme, which was funded by the Science Research Council (SRC – a UK government funded research body), as facilitating the decentralisation of society, through “an alternative planning strategy to relieve the spatial pressure now being experienced in most of our cities and towns.”³¹ From a more radical environmental perspective, through the Ark for Prince Edward Island the New Alchemy Institute developed a prototype for what they called “living machines.” Biologist John Todd, co-founder of the New Alchemy Institute, outlined the intention that the Ark:

be productive enough to provide its resident with a new economic base. Such structures might conceivably initiate new concepts of household economics, income and self-sufficiency ... it would not impinge heavily on the external world, by polluting neighboring ecosystems, consuming scarce and expensive fuels or utilizing nuclear power.³²

Meanwhile, in Berkeley, California, the creators of the “integral urban house” were seeking a model for ecological living in an urban environment. They argued that “people need to believe in their own ability to create and maintain their basic life support systems in order to feel at least somewhat in control.”³³ Understandings of autonomy and its significance

differed. The Street Farmer group were critical of the Cambridge autonomous housing research, arguing that its prototypes were “not autonomous to build” and avoided necessity to “twice a week ... get elbow-deep in shit.”³⁴ By contrast, the Vales contended that the kind of “dropping out” engaged in by radicals such as Street Farmer (whose project was called the “Eco-House”) was “a game for those with private means.” Rather than a romantic vision of voluntary poverty, the Vales saw the autonomous house autonomous as a key to the “survival of mankind” when environmental disaster struck.³⁵

As touched on above, the varied entanglements of environmental, institutional and personal autonomy – or agency – in the autonomous house projects also played out in the way they were materialised, documented and disseminated. Some were government funded research projects, often located within university architecture schools, such as the Cambridge University program or McGill University’s Minimal Cost Housing Group.³⁶ Some were individual obsessions, such as Jim DeKorne’s Survival Greenhouse or Tim Burrows’ Cliff Top Mound.³⁷ The University of Sydney, Ouroboros South, Street Farmer, and Dimetrodon projects were student-led design-build experiments.³⁸ Independent research and educational institutions, such as the New Alchemy Institute, Biotechnic Research and Development, Farallones Institute, Ecotope or De Kleine Arde (Small Earth Society), also generated projects.³⁹ The houses materialised as conceptual drawings, systems diagrams, sophisticated prototype models, institutional research facilities and private dwellings (from the professionally constructed to amateur bricolage). They were discussed in ephemeral pamphlets, small magazines, scholarly research journals and commercially published books. The writings and projects of the autonomous house designers explored the intersection of architecture, ecological systems-thinking and technological innovation in the pursuit of visions for more self-sufficient, sustainable ways of living. The projects rethought the porosity of the home and household as a site of different flows – water, energy, food, technological, infrastructural and financial.

The conclusion drawn within this paper is that there is value in an historical examination of the collective experimentation with autonomous housing during the 1970s. The projects became vehicles for unsettling the existing material, social and technical flows of domesticity and reworking the boundaries of the natural and cultural, technical and political, public and private, human and non-human. The architectural historians Christine Macy and Sarah Bonnemaison have suggested that a whole generation of ecological architecture “has not yet begun to be critically analysed within the architectural mainstream.”⁴⁰ This paper takes up that point in arguing that consideration of a 1970s “autonomy moment” will draw together histories of experimental architecture, environmentalism, cultural transformations and post-war technology debates. It will contribute to a better understanding of the way that the experimental ecological architecture of the 1970s was more than simply a collection of buildings; rather, the objects, ideas and practices aspired to reconfigure architecture as an assemblage of interconnected circulatory systems.

Lastly, a more intensive examination of the autonomous house will give attention not just to the experimental beginnings of green design, but also guide consideration of the ways in which those attempts to infrastructure domestic self-sufficiency and systems-independence are an on-going concern – implicated in continuing experiments with autonomy that highlight architecture’s entanglement with not only how buildings are designed but how we live in them.

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- 1 *Architectural Design*, Special Issue: “Autonomous Houses,” 46, no.1 (January 1976): 3.
 - 2 Susan Leigh Star and Geoffrey C. Bowker, “How to Infrastructure,” in *Handbook of New Media: Social Shaping and Consequences of ICTs*, ed. Leah A. Lievrouw and Sonia Livingstone (London: Sage, 2002).
 - 3 Examples of individual project focused research includes Lydia Kallipoliti, “Clearings in a Concrete Jungle,” *Journal of the Society of Architectural Historians (JSAH)* 70, no. 1 (2011) (on Street Farmer’s Eco-House); Sabrina Richard, “Inputs, Outputs, Flows: Sim Van der Ryn’s Epistemology of Design,” paper presented at the 67th Annual Conference of the Society of Architectural Historians, Austin, Texas, April 2014 (on the Integral Urban House in Berkeley); Glen Hill, “Hippie House: Australia’s First Intentional ‘Autonomous’ Architecture,” *Fabulation: Myth, Nature, Heritage: The 29th Annual Conference of the Society of Architectural Historians Australia and New Zealand*, ed. Stuart King, Anuradha Chatterjee and Stephen Loo (Launceston, Tasmania: SAHANZ, 2012), CD-ROM (on an autonomous house at the University of Sydney).
 - 4 Nick Rosen, *Off the Grid: Inside the Movement for More Space, Less Government, and True Independence in Modern America* (New York: Penguin, 2010); Lori Ryker, *Off the Grid: Modern Homes + Alternative Energy* (Salt Lake City: Gibbs Smith, 2005); Lori Ryker, *Off the Grid Homes: Case Studies for Sustainable Living* (Salt Lake City: Gibbs Smith, 2007); Lee Stickells, “Architecture of Doom: DIY Planning for Global Catastrophe,” *The Conversation*, November 21, 2014, <https://theconversation.com/architecture-of-doom-diy-planning-for-global-catastrophe-31836> (accessed February 20, 2015).
 - 5 Stephen Graham, ed., *Disrupted Cities: When Infrastructure Fails* (London: Routledge, 2010); Matthew Gandy, “Rethinking Urban Metabolism: Water, Space and the Modern City,” *City* 8, no. 3 (2004): 363-379.
 - 6 See, for example, Brian Larkin, “The Politics and Poetics of Infrastructure,” *Annual Review of Anthropology* 42, no.1 (2013); Paul Dourish and Genevieve Bell, “The Infrastructure of Experience and the Experience of Infrastructure: Meaning and Structure in Everyday Encounters with Space,” *Environment and Planning B: Planning and Design* 34, no. 3 (2007): 414-430; Vanessa Taylor and Frank Trentmann, “Liquid Politics: Water and the Politics of Everyday Life in the Modern City,” *Past and Present* 211, no. 1 (2011): 199-241; Tanja Winther, *The Impact of Electricity: Development, Desires and Dilemmas* (Oxford: Bergahn Books, 2008); Tom Verebes, ed., *Masterplanning the Adaptive City: Computational Urbanism in the Twenty-first Century* (New York: Routledge, 2013).
 - 7 Michael Mobbs, *Sustainable House: Living for Our Future* (Marrickville: Choice Books, 1998); Ryker, *Off the Grid*.
 - 8 Alexander Pike et al., “The Autonomous Housing Research Program,” *Building Science*, Special Supplement – Energy and Housing (1975): 119.
 - 9 On the “Eco-House” see Stephen E. Hunt, *The Revolutionary Urbanism of Street Farm: Eco-Anarchism, Architecture and Alternative Technology in the 1970s* (Bristol: Tangent Books, 2014); on the New Alchemists’ “arks” see Nancy Jack Todd, ed., *The Book of the New Alchemists* (New York: E. P. Dutton, 1977); on Robert Reines’ “integrated life support systems” see –my, *What Do We Use for Lifeboats when the Ship Goes Down?* (New York: Harper & Row, 1976), 25-67.
 - 10 Aladar Olgyay and Victor Olgyay, *Solar Control & Shading Devices* (Princeton, NJ: Princeton University Press, 1957); Stephen Szokolay, *Solar Energy and Buildings* (London: Elsevier, 1975); William Shurcliff, *Solar Heated Buildings of North America: 120 Outstanding Examples* (Harrisville: Brick House Publishing, 1978).
 - 11 Rachel Carson, *Silent Spring* (London: Penguin Books, 1962); Paul Ehrlich, *The Population Bomb* (London: Ballantine/Friends of the Earth, in association with Pan Books, 1971); Club of Rome, *The Limits to Growth* (London: Earth Island Ltd, 1972).

- 12 For example *Architectural Design (AD)* 7 (July 1972) Special Issue: "Design for Survival".
- 13 Richard Buckminster Fuller, *Operating Manual for Spaceship Earth* (Carbondale: Southern Illinois University Press, 1969), 54.
- 14 Also referred to as "Radical Technology" or "Alternative Technology". For a critical review of the movement, see Witold Rybczynski, *Paper Heroes* (New York: Doubleday, 1980).
- 15 Mother Earth News, eds., *Handbook of Homemade Power* (New York: Bantam Books, 1974).
- 16 Lloyd Kahn, *Shelter* (Bolinas, California: Shelter Publications, 1973); Alastair Gordon, *Spaced Out: Radical Environments of the Psychedelic Sixties* (New York: Rizzoli, 2008); Simon Sadler, "An Architecture of the Whole," *Journal of Architectural Education* 4, no. 61 (2008): 108-129; Caroline Maniaque-Benton, *French Encounters with the American Counterculture, 1960-1980* (Farnham: Ashgate, 2011).
- 17 Brenda and Robert Vale, *The Autonomous House: Design and Planning for Self-Sufficiency* (London: Thames and Hudson, 1975); Alvaro Ortega and Witold Rybczynski, eds., *The Ecol Operation (Ecology, Building and Common Sense)* (Montreal: Minimum Cost Housing McGill University, 1975); Helga Olkowski, 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* (Walden Foundation, 1975).
- 18 Brenda and Robert Vale, *The Autonomous House*; *Architectural Design (AD)* (January 1976) Special Issue: "Autonomous Houses"; Godfrey Boyle and Peter Harper, eds., *Radical Technology* (New York: Pantheon, 1976).
- 19 S. Tanaka, "Buildings and Ecological Science: The Autonomous House," *International Journal of Solar Energy* 13, no. 2 (1992): 111-119.
- 20 Another isolated example appeared in 2009: Shang-Yuan Chen et al., "The Autonomous House: A Bio-Hydrogen Based Energy Self-Sufficient Approach," *International Journal of Environmental Research and Public Health* 6, no. 4 (2009): 1515-1529.
- 21 Mobbs, *Sustainable House*, 12.
- 22 While Mobbs includes the Vale's own Autonomous House in his list of example projects he provides no historical context for it.
- 23 Kenneth Frampton, *Modern Architecture: A Critical History*, 4th ed. (London: Thames and Hudson, 2007); Manfredo Tafuri and Francesco Dal Co, *Modern Architecture* (New York: H. N. Abrams, 1979); William Curtis, *Modern Architecture Since 1900*, 3rd ed. (London: Phaidon, 1996); Alan Colquhoun, *Modern Architecture* (Oxford: Oxford University Press, 2002).
- 24 Examples that stand out include Simon Sadler, *Archigram: Architecture Without Architecture* (Cambridge, Mass.: MIT Press, 2005); Larry Busbea, *Topologies: The Urban Utopia in France, 1960-1970* (Cambridge, Mass.: MIT Press, 2012). This historiographic condition is discussed more fully in Lee Stickells, "Other Australian Architecture: Excavating Alternative Practices of the 1960s and 1970s," *Fabulation: Myth, Nature, Heritage: The 29th Annual Conference of the Society of Architectural Historians Australia and New Zealand*, ed. Stuart King, Anuradha Chatterjee and Stephen Loo (Launceston, Tasmania: SAHANZ, 2012), CD-ROM.
- 25 Figures that loomed large in the alternative ecological design scene – such as Steve Baer, Sim van der Ryn, Brenda and Robert Vale, the New Alchemy Institute – do not appear. James Steele, *Ecological Architecture: A Critical History* (London: Thames and Hudson, 2005).
- 26 Colin Porteous, *The New Eco-Architecture: Alternatives from the Modern Movement* (London: Spon Press, 2002).
- 27 Giovanna Borasi and Mirko Zardini, eds., *Sorry, Out of Gas: Architecture's Response to the 1973 Oil Crisis* (Montréal: Canadian Centre for Architecture, 2007), 44.
- 28 Peder Anker, *From Bauhaus to Ecohouse: A History of Ecological Design* (Baton Rouge: Louisiana State University Press, 2010), 113-125.
- 29 Kallipoliti, "Clearings in a Concrete Jungle"; Lydia Kallipoliti, "From Shit to Food: The Eco House in South London (1972-1975)," *Buildings and Landscapes* 19, no. 1 (Spring 2012); Lydia Kallipoliti, "Recirculatory Households, or 'How to Grow Tomatoes out of Household Effluents,'" in *Places and Themes of Interiors*, ed. L. B. Perresut et al. (Milan, Italy: Franco Angeli, 2008).
- 30 Boyle and Harper, *Radical Technology*, 136.
- 31 Alexander Pike, *The Autonomous House Research Programme*, SRC/DOE Autonomous Housing Study (Cambridge University, Department of Architecture, Technical Research Division, October 1974), 1.

- 32 John Todd, "An Ark for Prince Edward Island," *Journal of the New Alchemists* 3 (1976): 41.
- 33 Olkowski et al., *The Integral Urban House*, 3.
- 34 Godfrey Boyle, "Interview: Street Farmers," in Boyle and Harper, *Radical Technology*, 171.
- 35 Vale and Vale, *The Autonomous House*, 18.
- 36 Pike, *The Autonomous House Research Programme*; Ortega and Rybczynski, eds., *The Ecol Operation*.
- 37 DeKorne, *The Survival Greenhouse*; "Hand Built Hornby," *Architectural Design (AD)* (July 1978): 478; Gordon, *Spaced Out*, 274.
- 38 Hill, "Hippie House"; Sharon Marcovich, "Autonomous Living in the Ouroboros House," *Popular Science Magazine*, December 1975, 80-82, 111; Hunt, *The Revolutionary Urbanism of Street Farm*; Stephen Morris, "The Prickly Mountain Gang," *Times Argus*, October 9, 2005, <http://timesargus.com/apps/pbcs.dll/article?AID=/20051009/NEWS/510090305/1013> (accessed February 20, 2015).
- 39 Todd, ed., *The Book of the New Alchemists*; Patrick Rivers, *The Survivalists* (London: Eyre Methuen, 1975), 11-36; Olkowski et al., *The Integral Urban House*; Norma Skurka and Jon Naar, eds., *Design for a Limited Planet: Living With Natural Energy* (New York: Ballantine Books, 1976), 174-177; Harper and Boyle, *Radical Technology*, 152.
- 40 Christine Macy and Sarah Bonnemaïson, *Architecture and Nature: Creating the American Landscape* (London: Routledge, 2003), 332-333.