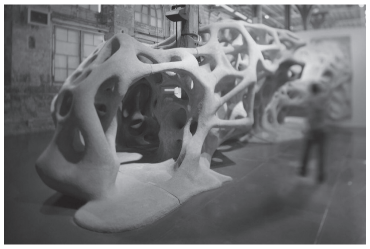
ECO-REDUX: *LYDIA KALLIPOLITI*

ENVIRONMENTAL ARCHITECTURE FROM "OBJECT" TO "SYSTEM" TO "CLOUD"



1971: Charles Harker, founder of the TAO Design Group in Austin, Texas, juxtaposes Le Corbusier's "machine for living" with a new concept for habitation that he coins the "soft machine."[1] The TAO Design Group—a group of architects, sculptors and artists—experiments with building without drawings, spraying urethane on a chicken wire armature based on sketches and written rules for enclosure. Every step is a fluctuating process of incremental adjustments that necessitates constant reinvention of the original plan. In his manifesto, Harker outlines an alternative definition of matter as patterns of energy that solidify in time. He writes, "We are in the midst of a Socio-Psychological, Cybernetic, Mass-media, Space Age revolution,"[2] and speaks of "softness" as an expansion of environmental perception; both literally, through curvature and the use of plastic materials, and conceptually, envisioning an elastic understanding of tectonic conventions.

2005: François Roche, principal of R&Sie(n) in Paris, France exhibits a "hypnosis chamber" at the Modern Art Museum (MAM) in Paris.[3] Designed with computational scripts—protocols that allow for growth of the original "seed" design—and fabricated with a five-axis milling machine, the hypnosis chamber renders an immersive space of disalientation from the social sphere in a state between sleep and wake. A complex intrauterine vascular space, the hypnosis chamber is intended to introduce uncertainty in the individual's environmental cognition, as a means of creative speculation and experimentation which may open up the possibility of transforming one's environmental sphere.[4]

Are these two practices exploring the same issues with similar designs or not ? Are we destined to remediate unsettled memories of our recent past? Is regression a defensive reaction against future disenchantment? Or have we already imagined in the past something beyond the present of that time?

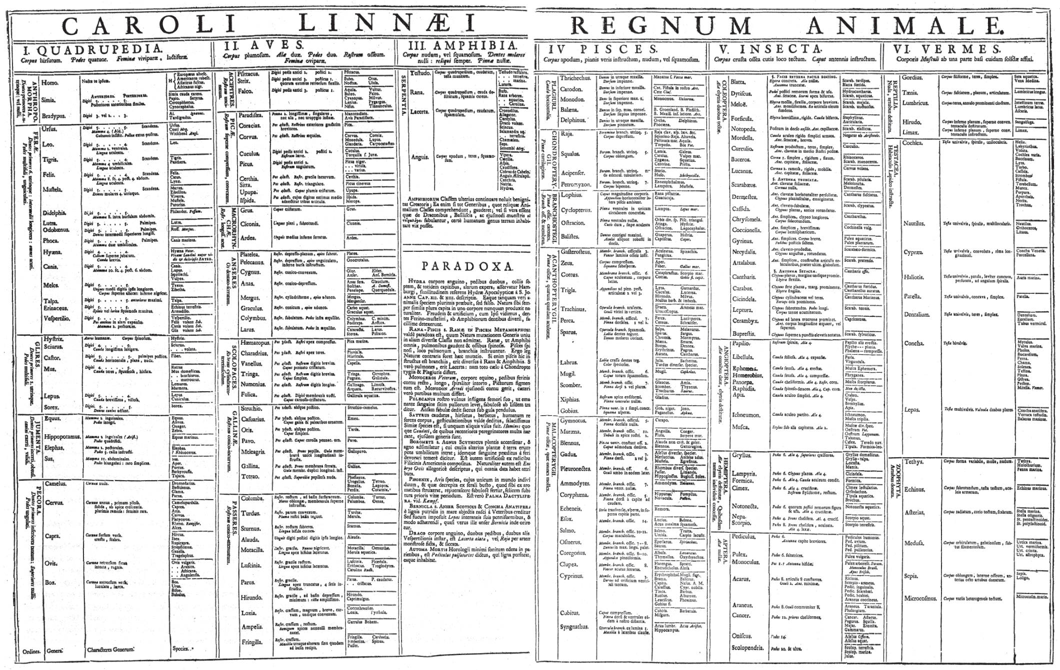
The kinship between present-day experimental design and that of the 1960s-1970s is so striking that we can speak of uncanny resemblances, eerie images of projects already seen and experienced as déjà-vu. In psychoanalysis, déjà vu is a "disturbance of reality perception, which serves to reassure the patient against this insecurity, by divesting, through an estrangement affect, the recurrent circumstances of the impact of a new reality."[5] Déjà vu is an unconscious effort of the ego to bridge a gap between the past and the present; it is a peculiar defensive reaction against the fear of the unknown,[6] manifest by projecting the future not as an entirely new course of events but as mixture of past and present stretched in time.

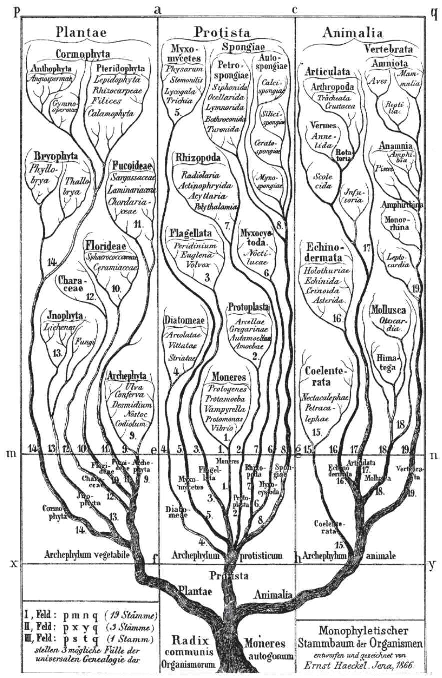
In our field, a number of critics have described concepts, forms, and approaches retrieved from the recent past as a pervasive phenomenon of "media archeology."[7] Is this type of regression, however, merely expressive of historical interest? Looking to the postwar period may be more than a quest to identify historical antecedents. It could be quite the opposite: that the present helps us understand this recent past and, of course, vice versa. History only survives as a relevant discourse through revivalism of the oblivious past. Leftover histories—environmental experiments with organic matter, synthetic growth, and other alternative technologies that were once esteemed as marginal and deviant—are now of core significance to architectural discourse. Displaced from the periphery to the center of deliberations, these counter-histories may account for the multiplicity and diversity of current ecological anxieties in architecture.

As such, déjà-vu might be used procreatively to rebuild future disciplinary courses. Reconstructing projects and ideas of the past through a new organizational and classificatory lens might enable us to generate a critical discourse that migrates to different terrains of thought throughout time.

The way we classify things bears a profound impact on disciplinary structures; the means by which we organize information emerges from and profoundly affects our social, political, intellectual, and cultural constructs. The legacy of ecological ideas in architecture evidences this effect. Post-enlightenment, environmental debates focused on assiduous observation and documentation of objects and organisms, analytically classifying the living stock of the world. In the postwar period, environment was addressed through diagrams of feedback cycles, and global resources were examined as interconnected systems that could be redistributed. Today, while the environmental discourse is much more diverse than in the past, it shares an investment in local data classification of living systems, similar to information clouds of data constellations online.

Beyond the pretext of healing the planet and the strategic relocation of finite natural resources, the present ubiquity of ecological concerns illustrates a persistent taxonomical thinking in





design. Expanded materials listings, technical standards, mechanisms, natural and synthetic processes and methods assemble a rising sensibility of design agency where authorship, as a projected vision of a new reality, is replaced in favor of editorial observation and data reshuffling. The permeation of organizational tools in our discipline is not innocent. It is not merely about facilitating and managing knowledge; it also transforms the nature of design, but with no return. Is it not critical that we give equal attention to reconsidering our classification systems and how they are affecting architectural discourses?

The recent invasion of ecological anxieties in architecture has many faces: from the restitution of moral values in design thinking, in revival of an archaic humanist discourse; through the substitution of "performance" for "function," in restoration of a lost modernist and positivist ethos; to the post-structuralist denunciation of environmental improvement and the critical recognition of waste and pollution as generative potential for design. As a circular, causal form of reasoning, ecology surfaces as an inevitable salvation in architectural debates, in advocacy of unity and the common good. On a planet without a square inch of untouched environment, however, the new wave of ecological architecture cannot be explicitly directed to the ethics of the world's salvation and the rhetoric of confinement. It rather projects a psycho-spatial or mental position, fuelling a reality of change, action, and disciplinary crossbreeding.

OBJECT

The term ecology is attributed to eminent German biologist, naturalist, and artist Ernst Haeckel, who identified embryonic interrelationships between living organisms and their ambient environment.[8] In *The General Morphology of Organisms* (1866),[9] a reformation of Charles Darwin's "Theory of Descent," Haeckel conceptually linked ontogeny with physiology and illustrated all known life forms in a genealogical tree. Haeckel's work was a revolution in visual mapping compared to the Hippodamian gridded classification tables of his predecessor, Carolus Linnaeus (*Systema Naturae*, 1735).[10] Whereas Linnaeus established the normative method of naming and numbering the world's living wealth in boxes, Haeckel's genealogical tree graphically described the relationships between organisms, introducing shape and scale as decisive parameters for his classification system. Nevertheless, both maps still follow a paradigm of understanding the world through component pieces and objects, and classify the natural world as wilderness—an object of observation and conservation separate from the man-made.

SYSTEM

The post-WWII period signaled the rise of a modern environmental era, distinctly different from earlier environmental positions of wilderness preservation. In the 1960s and 1970s, ecologists instrumentalized the prevalent social and political discourse of a closed, ill-managed earth, arguing that their science provided the most faithful account of planetary values. As awareness of worldwide pollution levels mounted, environmentalism became a form of social activism calling for a redistribution of global resources. Buckminster Fuller, John McHale, and Ian McHarg played a seminal role in formulating this discourse, explaining ecosystems with parallels between the earth and human processes.[11] A physiological diagnosis of planetary resources was precisely the agenda of Fuller's "World Design Science Decade,"[12] which took cognitive analytical form in McHale's *The Ecological Context*.[13] Through systemic management, the totality of the earth could—or should— serve as a stage of action, envisioning a new empire and reasoning backward to a colonial and empirical modality.[14]

These mid-century environmentalists' work represented a significant shift in the field of ecology: from understanding the built environment as distinct from nature, to understanding the built environment as embodying natural ecosystems' cyclical behaviors. This change was deeply rooted in ecologists' appropriation of a specific scientific language and a set of classification tools used by cyberneticians in the postwar period. Cyberneticians' diagrams of the flow of energy in the natural world as input and output—circuits in a cybernetic ecosystem—provided ecologists with new research techniques and a biologically informed, and yet computational, theory of the world as a system of subsystems.

The work of this period forms the basis for the online archive *EcoRedux*, which I assembled from various personal collections and archives during the past four years. The name refers to the contemporary return of ecological awareness as a phenomenon of resurgence from the 1960s and 1970s, and assembles a database of ecological material experiments as well as their ramifications on architectural design. In this sense, the intention is to document and track an unexplored genealogy of design experimentation conducted by underground architectural groups, as a prehistory of a rising biotechnological imagery and a new social and planetary vision, throughout different design disciplines.

In curating the *EcoRedux* archive, I am seeking to offer a counter-history to the canonic environmental discourse of this period that was centered on the decryption of the planet as a whole ecosystem; the experiments in this archive eschew these notions. Rather, all imaginable provisional structures and small-scale strategies—pneumatics from used parachutes, handmade domes from discarded materials, electronic-lawn carpets, pills, garbage houses, capsules and self-sufficient systems, foam shelters—become part of new equation in reflection of the intense socio-political concerns of the time and the collective fantasizing about new technologies as remedial tools. The collection of these experiments recounts ecological strategies as discrete fragments in defiance of a larger scheme for global harmony, like a peep show of the world, or a selective perspective that reconstructs the globe from pieces.

As a collection, the *EcoRedux* experiments suggest an alternate model for urbanism that presupposes a new form irreverent to the master plan—a form that needs to integrate the parameters of continually variable micro-environments.[15] Although these improvisatory techniques only provide rudimentary shelter, they suggest a new approach in contrast to prior geometric configurations, integrating constantly changing environmental parameters into the design and construction process. Furthermore, we witness a germinal connection between the macro-urban scale and the micro-material scale, leaving the medium scale—building—out of the equation. Peter Cook recalls how, at the end of the 1960s, "It was fashionable to introduce a project as 'anti-building,' or a conglomeration of environmental elements."[16] By looking back at this time, it is not proposed to dispense with the significance of "building" as the main edifice of architectural practice and education, but instead to interrogate extremity of scale—the focus on the micro and macro—and to inquire into this "out of focus" moment as a reflection of intense socio-political upheaval.

These experimental schemes, beyond being historically informative, narrate stories, wonders, obsessions, blemishes, and personal values that haunted their authors. In many cases, the projects were very crude in form, leaving their authors unsatisfied or in anxious search of the materialized visions they could not somehow pin down. Many experiments utilized erratic material interactions and therefore defied established definitions of representationwith little tectonic control over their formation. This realm of impossibility, the moment when representation fails to describe the form of objects, is both magical and terrifying. As such, these architects were prisoners of their visions, openly willing to fail.

Compared to the scientific definition of experimentation, these open-ended explorations were obscure in direction and purpose. The scientific method requires an experiment to either verify or falsify a hypothesis, or research a causal relationship between phenomena. Moreover, an experiment should be capable of replication, under certain predefined canonical conditions, and in a particular number of steps/phases. On the other hand, the fuzzy, non-linear nature of design processes makes it unfeasible for a design experiment to align to this universal clarity. One could argue that design experiments seem "hypothesisless," while the value of contingency—mediated by the interaction of materials and their deployment tactics in varied circumstances—constitutes a key feature of design experimentation.

The model of "direct action" that the *EcoRedux* projects proposed, stimulated design debates, the echoes of which still reverberate in contemporary practice. This emerging framework of critical thinking undermined the imperial significance of formalism as the distiller of value, in favor of open-ended potential in procedural design. As an effect of this discourse, alternate means of production were recovered, disengaging design from the conventions and limitations of drawings, which have for the most part governed design practice throughout the century.

Foremost, several projects documented in the *EcoRedux* archive do not target environmental improvement as a planetary strategy. The archived experiments are partial, small-scale, ad hoc and opportunistic; unclassified under a larger plan. In this sense, the archive documents a counter-history of ecological anxiousness. The projects are not performative agents of amelioration; rather they are, in themselves, their own ecologies, producing new worlds.

CLOUD

Today, the extensive recovery of ecological concerns broadcasts mainstream values and stands as a defense mechanism for late capitalism. Yet, at the formative stages of the green movement in the 1960s and 1970s, ecological design debates were of a very different political and ideological orientation. Ecology not only embodied an alternative route to mainstream political action, but also an inspirational model for design creativity. It embodied an evolutionary design process in several stages and lifecycles through material experiments as analog computation tools. Looking back on this period offers an alternative elastic understanding of the term "ecology," at a time when the term addressed not only a new kind of naturalism and techno-scientific standards, but also systems theory: a recirculatory understanding of the world and its resources. In this context, revisiting the term "ecological," rather than "sustainable" and "green," is of essence and may potentially contribute to a reassessment of contemporary debates. It may be through this epistemological fusion that we can ask more of architecture.

EcoRedux strives to map a history of architectural imagination, rather than a history of technological development. Through this documentation, the hope is to question current mainstream perceptions of sustainability and the LEED program (as a technical classification tool that empowers capitalist production, creating a new revenue source veiled by the ethics of environmentalism). The archive is also an educational open-source online resource (www.ecoredux.com) with a dual function: as a tool to explore the history of the period, but also as a pedagogical tool for design. Given the open source nature of the project, architects and designers are able to actively participate in the expansion of the website by submitting their own interpretations of ecological experiments that are documented in the database. The scope is to foster the reuse and recycling of the information documented in the historical archive in order to explore innovative ecological strategies in contemporary architectural practice. It is implicitly argued here that the permission to reproduce, translate, or even "misuse" information to observe and transform existing material and ideological structures endows architecture with its creative potential.

This open source system of gathering information online in clusters, assembling ideas mixed in past and present time, might relate to our data-driven culture and the emergence of "cloud computing." The term "cloud computing" was coined in 1997 by Ramnath Chellappa to describe information storage in networked online clusters, as distinct from localized storage in physical data centers. Chris Anderson, editor in chief of *Wired* magazine, argues that information is now untethered from the archive, the library, and even the organization of complex three dimensional classification systems, and instead it renders an order of "dimensionally agnostic statistics." [17] The cloud necessitates an entirely different way of understanding the world, "one that requires us to lose the tether of data as something that can be visualized in its totality." [18] Growing out of Google's model of detecting correlations through applied mathematics and not through context, the cloud ranks fractional connections above holistic perceptions of phenomena. An embodiment and representation of change and self-organization, the temporal space of the cloud grows, crystallizes, and dissolves. What is essential about the cloud is the absorption and collection of data that crystallizes in a region, rather than the overall contextual interpretation of the data. In a world where complexity can no longer be decoded systematically, the cloud is a byproduct of incidental data accretion; it defies any precise definition of form and representation.

In many respects, the *EcoRedux* archive is like a cloud in its content and organization: seemingly unrelated characters, projects, and environments—that have little in common phenomenally—swarm together in blurry mass. Even though they never worked together, the architects collected in *EcoRedux* are the protagonists of a profound transformation seeking to amplify the main disciplinary focus from object to environment, system, and situation. This archive is not a marginal history of non-architects that needs to be written because it is left untold; it is assembled to uncover spatial and architectural concerns and ideas that have surfaced now, though they originate from a historical moment when the discipline underwent a fundamental reorientation in the deployment of normative tools of representation.

The stories outlined in *EcoRedux* archive appear as side effects in the history of ideas, rather than being allied with the normative course of what we premeditate as of core historical significance. The experiments register retroactive moments—incomplete bubbles of events. They are manifestations of a moment between the "system" and the "cloud" that was never cognitively addressed at the time it took place.

The stories of unexpected offspring at times germinate as derailed paths from the central line of inquiry and more truly speak of today's ideological diffusion, despite the fact that they are not perceived as central. They constitute a marginal practice that subconsciously informs the core, feeding history through its dross. These stories, incidental side effects produced as a discipline undergoes transformation, may suggest an alternative reading of architectural history: not by offering actual objects and a new paradigm, but by suggesting new tools and new modes of practice.

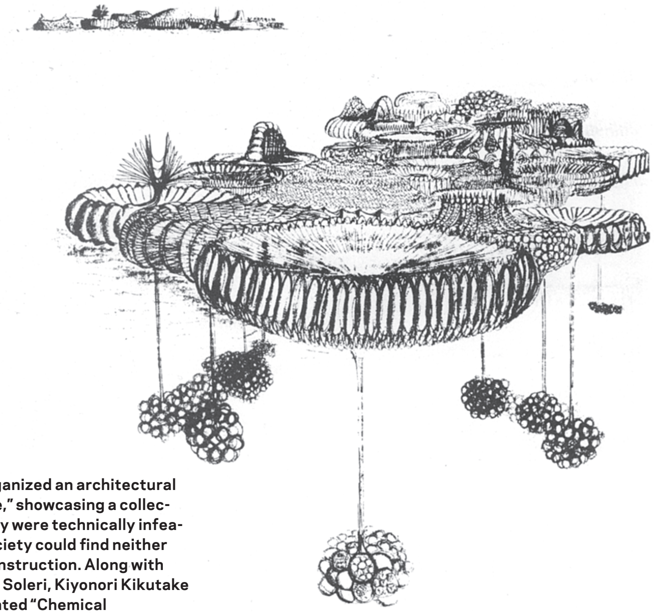
What is essential about the cloud is the absorption and collection of data that crystallizes in a region, rather than the overall contextual interpretation of the data. Meaning is not essential for the cloud; neither is the understanding of phenomena's complexity as a whole. Instead, the cloud evokes localized data collection and the fractional correlations between bits and pieces. In a world where complexity can no longer be decoded systematically, the cloud is a byproduct of incidental data accretion; it defies any precise definition of form and representation. It is impossible to map or draw the cloud, as there is no tectonic control over its formation. In this sense, the emerging ecology of the cloud is our contemporary obligation to translate. It feels like rain.

SOFT VERSUS HARD; AN INDEX OF MATERIAL TECHNIQUES

The EcoRedux archive is organized in genealogies that synthesize the experiments in groups, organized according to material technique from *soft* to *hard*. *Soft* experiments are based on the transformation of substances and biological material evolution and growth, while *hard* experiments are based on assemblies of reused materials and building components, transferred to different contexts.

The term hard indicates a combinatorial multiplicity of standardized units, where variability emerges as an effect of repetition in a larger system consisting of regular subsystems. Contrary to this logic, the term soft conjures the variability, growth and evolutionary change of the prime unit itself. "Softness" implies a physical transformative process of chemical interactions; it signals a fusion of form and material. This conceptualization of matter undergoing evolutionary transformations renders a counterpart model of architectural practice to the combinatorial multiplicity and the propagation of complexity through recursive unitary logic. If we categorize these two material techniques, the term hard denotes an additive logic of juxtapositions and superimpositions, whereas the term soft denotes a procedural, evolving logic of transfusion.

Needless to mention, there are significant overlaps between the documented genealogies and the respective case studies. The boundaries between categories are elastic, while similar or even contradictory techniques germinate in many experiments. In any case, the hard and soft principles may be used as analytical tools for the examination of material experimentation in the 1960s and 1970s. Movements such as "adhocism," "opportunism," "garbage architecture," and "anti-industrialization" are directly associated with hard material techniques, while structures referred to as "organic," "soft", "pneumatics," "sculpting" or "spraying" are associated with soft material techniques. The examination of these experimental genealogies may enlighten current perceptions of sustainable design practices by depicting a shift that was already at play in the 1960s from object to method: from objects, like photovoltaic cells, solar panels, recycling devices, et al., to method—a process-based understanding of materials and recirculation of world resources.



SOFT 1.1

GROWTH AND LIVING SYSTEMS investigates the integration of organic matter and biological substances as evolutionary building blocks and systems. The term 'construction' is superseded by the term 'growth,' with built elements gradually taking shape in several stages of formation through chemical processes. The end product is partially controlled and partially emergent from erratic transformations of living systems.

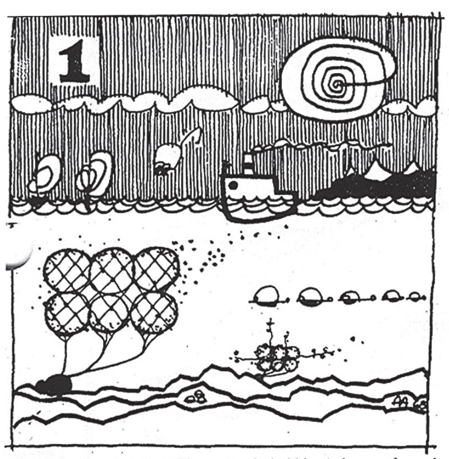
1.1.1 CHEMICAL ARCHITECTURE BY WILLIAM KATAVOLOS (1960)

The Museum of Modern Art in New York organized an architectural exhibition entitled "Visionary Architecture," showcasing a collection of unbuilt projects, either because they were technically infeasible at the time they were designed, or society could find neither the justification nor the money for their construction. Along with Frederic Kiesler, Buckminster Fuller, Paolo Soleri, Kiyonori Kikutake and many others, William Katavolos presented "Chemical Architecture," later canonized as the "Organics Manifesto" in Ulrich Conrad's collection of twentieth century modern manifestos. Katavolos envisioned the design of cities through the microscopic manipulation of materials and imagined a city that would grow softly, rather than be designed as an end product. His manifesto identified the soft, biological, chemical potential of design as a democratic and sustainable outlet to deterministic design "through the matrix of chemistry." He wrote: "We are rapidly gaining the necessary knowledge of the molecular structure of chemicals, which will have a specific program of behavior built into them in a sub-microscopic stage. Accordingly, it will be possible to take minute quantities of powder and make them expand into predetermined shapes, such as spheres, tubes and toruses." [20]

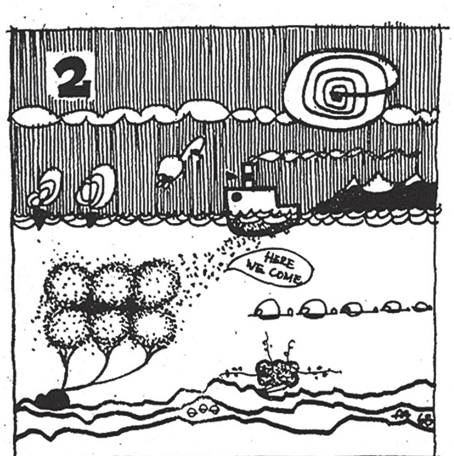
Provolution
R + D (or Rudolph Doernach)

Interdisciplinary micro-macro-game

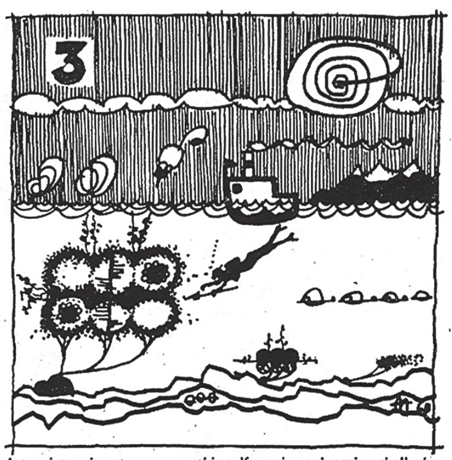
How to grow a maritime city?
How to grow a fur for society?
How to grow Biocity edible city?
How to regain PARADISE?



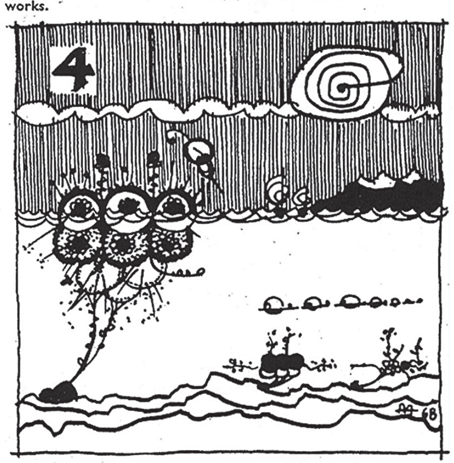
Take net and cables to hold pneumatic bubbles below surface of sea. Maritime micro-organisms colonize everything: Bubble system and captain Smoky's boat.



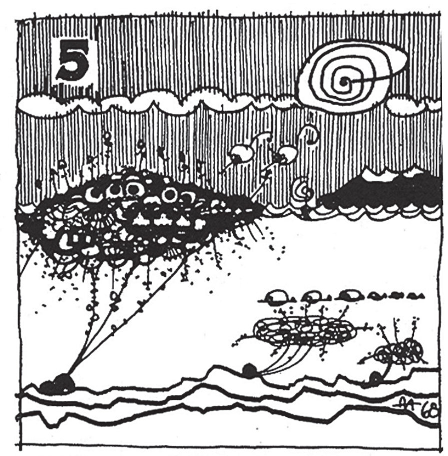
While captain Smoky's boat slows down and loses speed because of algae crust, the bubble matrix grows a live space frame of optimal loadbearing capacity—huge macro bone. Oysters and shells climb to this surmarine Bio and nibble from it, not knowing yet that ...r they get nibbled themselves.



A tourist arrives to conquer this selfgrowing submarine shell—he perforates some of the Plastic bubbles as he has learned, when he left his mother or when he deflorates. Soon he has bigger inner spaces in INNER SPACE: living-room, bedroom and the whole works.



The bubble - over - perforator - deflator - deflorator loosens some of these cables to let his house mate with the sun in summer, when the sea keeps quiet. He also re-uses some bubbles to grow more space for bubbling companions. Among them his friend Delphine, who hauls in breakfast every morning and some fabulous sea lettuce too.



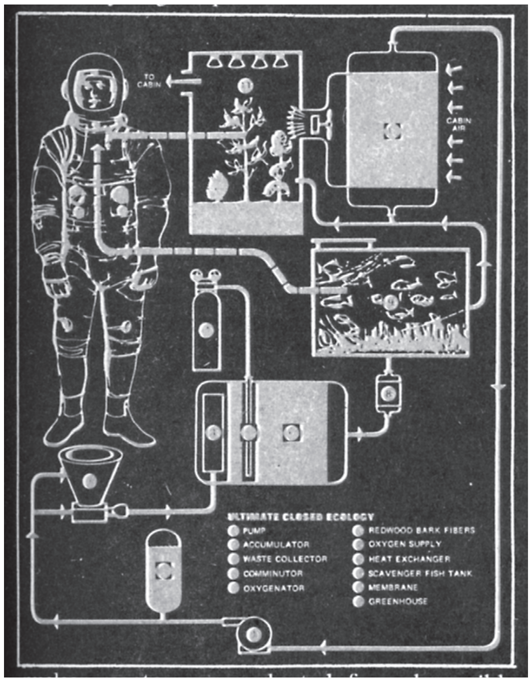
Edible City keeps growing because one tourist found out how to use fluid plastics and fibrous plastics to reinforce Edible City's liv space frame. Another started to fool around with a perforated hos simply because he likes to play with all round-long things; this wa he discovered how to feed the big sea bubbles with all kinds goodies from EDY Chemical Co. At the same time he used th invisible plastic hose to cool his HAPPYTAINER. One day a bottl of whisky caught fire; the cooling system acted as a fire patro One day Rudolf—called R + D—brought a little atomic breede for Edible City. You should have seen all these animals going-nut growing-huts in the warm sea.

1.1.2 PROVOLUTION BY RUDOLPH DOERNACH (1969)

German architect Rudolph Doernach was one of the chief early pioneers of plastics architecture according to Arthur Quarmby in his 1974 book Plastics and Architecture. [21] **Doernach was regularly hosted in the pages of AD's "Cosmorama" between 1966 and 1969, publicizing a peculiar socio-spiritual material discourse that strategically positioned organic and plastic matter as the primary foundation upon which, and by which, a city could grow. In his project 'Biotecture,' "contractible and reusable organic matter would become the universal building material, invented and programmed by the environmental scientist that he called the comprehensive architect."** [22] **Doernach envisioned animated matter as a tool for social reform and was obsessively searching for a spiritual 'extension' of matter, beyond its physical limitations.**

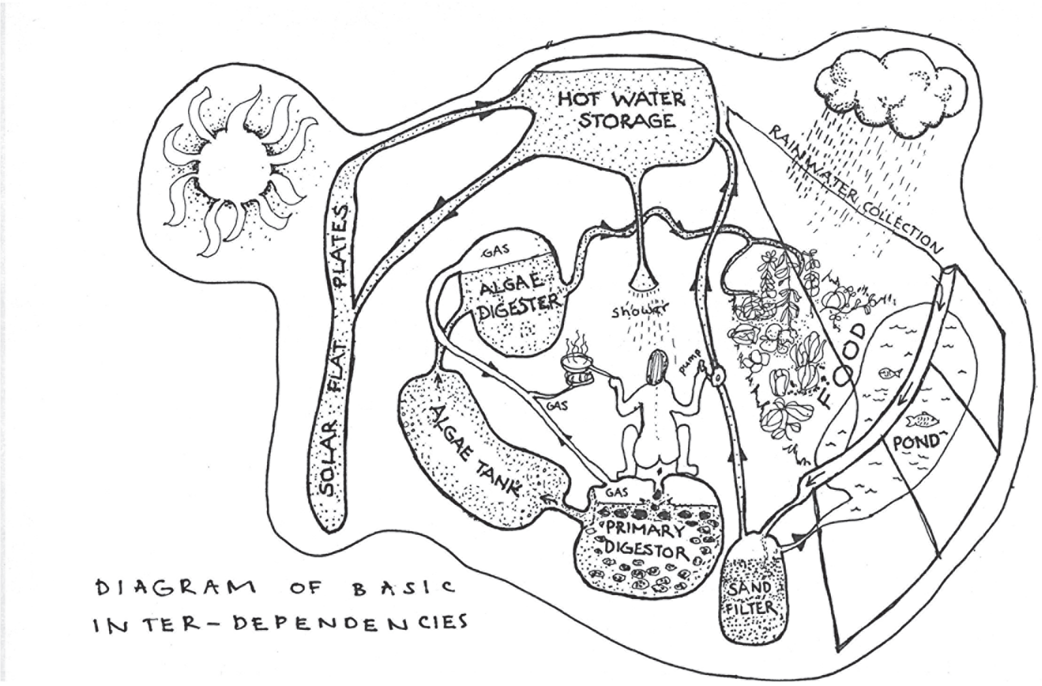
SOFT 1.2

RECYCLING investigates space as a physiological feedback mechanism that receives input from the environment and returns it to useful output. Input is understood in the form of sunlight, rainwater and air, or in the form of waste resulting from human occupation—excrements, grey water et al. Output is understood as energy generation that is fed back into the operation of the inhabitable system. Space functions as a cybernetic machine of cyclical causal processes converting byproducts into useful products.



1.2.1 BIOLOGICAL WASTE SYSTEM BY EDWARD BURTON (1966)

Under the pseudonym Ruppert Spade, Martin Pawley wrote in 1970 the article "Trick Recyclist,"[23] describing the experiments of Mr. Edward Burton for a Biological Waste Treatment System (BWTS). Between 1960 and 1966, Burton assembled several patents for a waste recycling system, with a view to adapting it for use undersea or in space. To develop his inventions, Burton was in touch with the Grumann Corporation, a leading aeronautics and spacecraft firm that consulted NASA, in the early 1960s. BTWS offset smart technologies incoming from space shuttle engineering to home-made reprocessing systems. In his own domestic experiments, Burton, managed to nourish a duck, fifteen goldfish, an apple tree sapling, an apricot tree plantlet and a small rhododendron plant, explicitly from household effluent. With a number of conversions, oxidizing and permeation devices, Burton's system became commercially available in the US in the early 1970s, promising to clear off effluents and grow tomatoes.

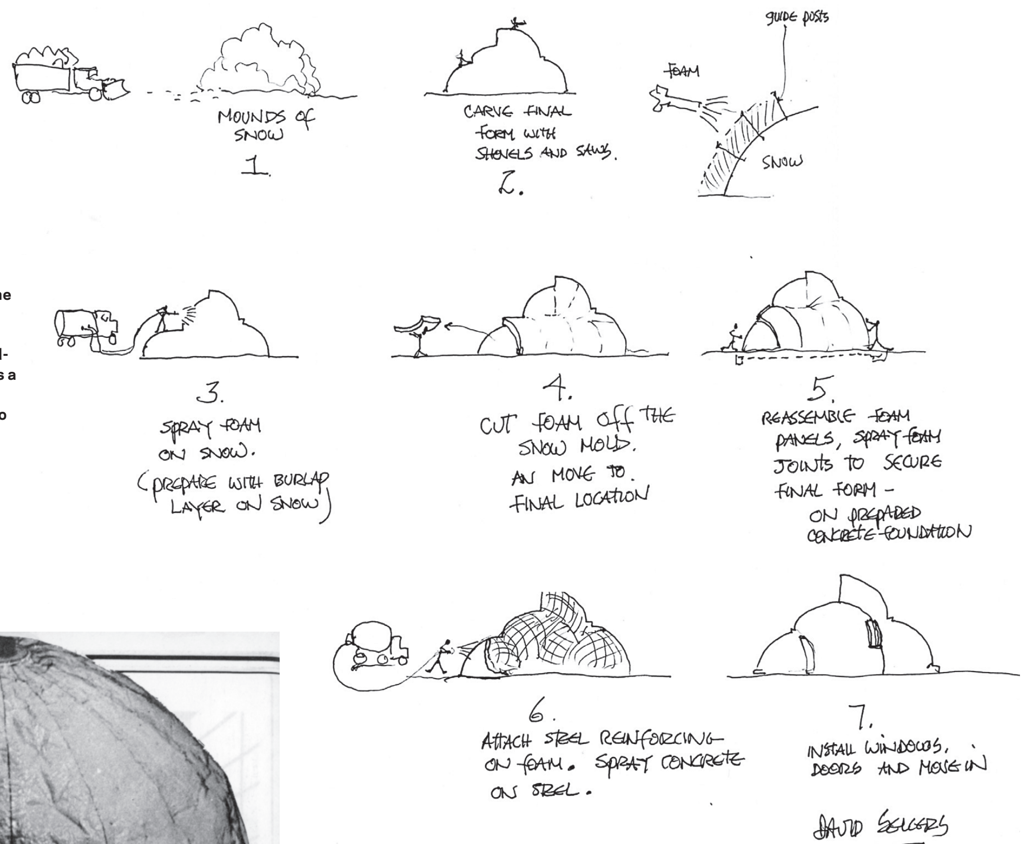


1.2.2 THE ECO-HOUSE BY GRAHAME CAINE (1972)

The Eco-House or Street Farmhouse in Eltham, South London, was one of the earliest ecological houses, built in 1972 as a laboratory and a living experiment by Graham Caine, a member of the anarchist group Street Farmers. The Eco-House was not only a fully-functioning, integrated system that converted human waste to methane for cooking, but was also operated and inhabited by its architect, who used his family as guinea pigs. Caine knew how to feed the house with the right nutrients—how to chop wood, water the plants in the greenhouse, feed the engines, water the greenhouse and power the engines. He experimented with waste, cooking habits, and use of water, closely monitoring every activity of his daily routine until the day the house was demolished in 1974. Caine was an indispensable part of the house he built and portrayed himself as a combustion device for generating electricity, connected to the house in a diagram where excretion becomes part of the system's sustenance.[24] Describing his house as a life-support system, Caine satirically argued that the architect, now being involved with the house's biological cycles, may now relate to his own shit.[25]

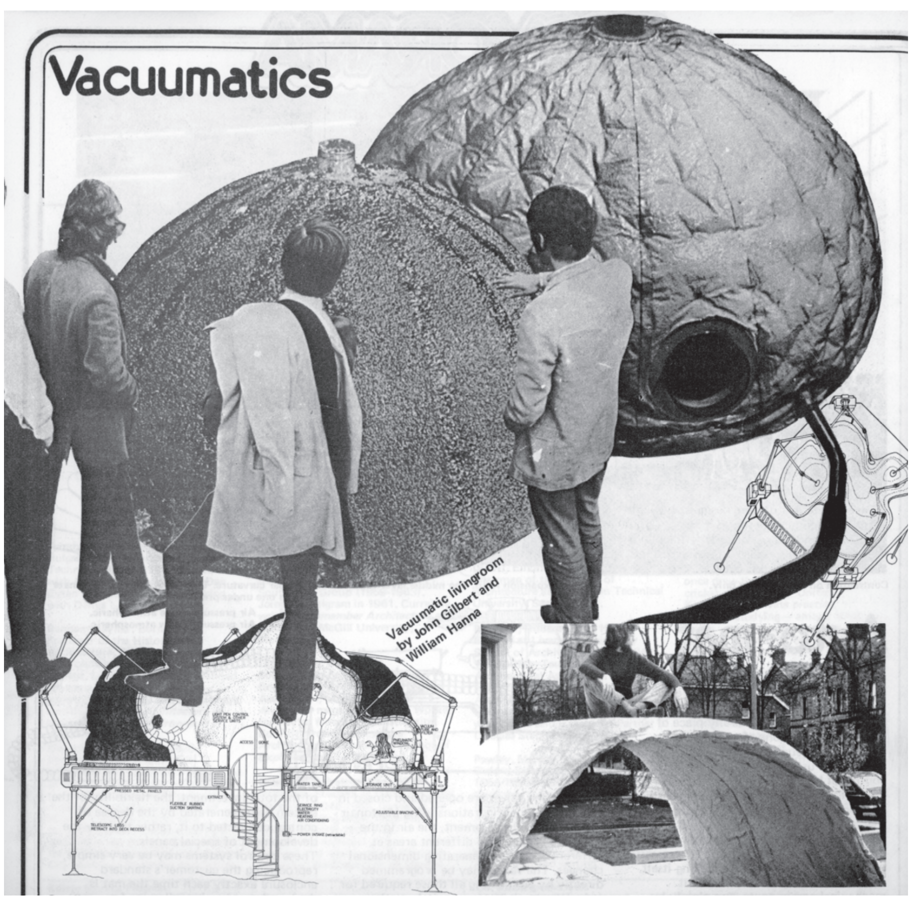
SOFT 1.3

FLEXIBLE MOLDS examines the form-finding possibilities of molding processes, through the use of flexible elements or environmental forces as formworks. Rather than a static mold—like a wooden frame, that produces an inverse of its form—the final product of flexible molding process is derivative from the interaction between the mold and the cast. The final object is not a self-defined entity. Flexible moulding recounts an open formation process: one that allows the object under formation to be affected by environmental parameters, such as local winds, temperatures and other meteorological phenomena. In this sense, a more expanded definition of moulding is suggested, one in which the 'mold' becomes an accumulator of physiological contingencies that play an active role in the construction process.



1.3.2 SNOW MOLDING BY DAVID SELLERS (1973)

David Sellers, an architecture graduate from Yale who moved to Vermont to experiment with low-cost housing, decided to use snow as a building material, abundantly available in his place of residence upstate. Sellers piled the snow to the required shape and covered it with hessian; then he sprayed the mound with low temperature foam to create a shell between two and eight inches thick, depending on the structural requirements.[28] Sellers used snow as a mold, onto which foam was sprayed, so that the occurring shelters resulted from the synergistic effect between two materials—one as the mold and the other as the cast.



1.3.1 VACCUMATICS BY JOHN GILBERT AND WILLIAM HANNA (1971)

The 'Vacuumatics' project investigated an interactive molding process with polystyrene beads inserted in a flexible plastic membrane. Air was vacuumed out of the membrane and the beads, under certain conditions of pressure and temperature, bonded and provided a benchmark-mold for the membrane to set. 'Vacuumatics' exploited the mechanical material properties of expanded polystyrene beads that were capable of softening and fusing with the aid of the proper catalyzing agents, along the guidelines of an article published in AD earlier that year, entitled "The expanding world of polystyrene foam."[26] The method of pumping air out of the flexible envelope provided overall stability to the structure, despite the fact that the beads, on their own, were small-scale and weak particles. The article featured small prototype domes which were erected at the Department of Architecture of the Queen's University in Belfast, using the 'vacuumatic' principle, sucking air out of the mold in a reverse pumping process.[27]

SOFT 1.4

ACCRETION uses bottom-up techniques whereby matter is organized around a reinforcement matrix, which becomes a source of attraction. "Splat" is the engineering terminology used to describe the basic building block in thermal spray technology when a droplet impacts a surface. Multiple overlapping splats solidify to form layers and build outward to fill occurring interstices.[19] This category examines the emerging tectonic principles of the "gun-shot" and the belief in orchestrating and proficiently distributing matter in a micro-scale. Techniques like spraying and the sedimentation process of celluloid foam plastics constitute examples of accretion.

1.4.2 FOAM HOUSE BY FELIX DRURY (1970)

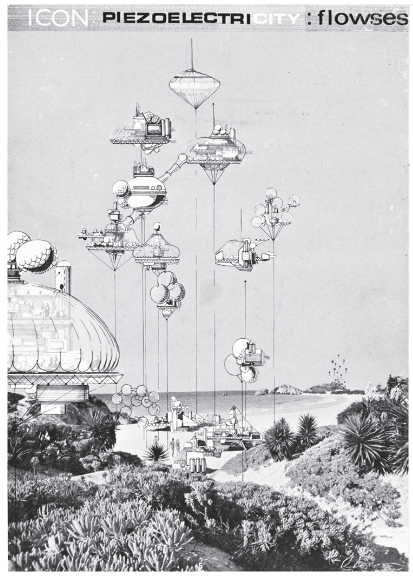
Architect Felix Drury designed a corporate guest house for the West Point Pepperell headquarters at Langdale, Alabama. The house was shot from a spray gun and according to Drury, it represented just an initial technology for the use of foamed plastics—specifically urethane foam—as a structural material for housing. The forms were inflated after being stapled to the formwork of concrete floor slabs. They were then sprayed from the outside with "cold weather" urethane foam of about 3 libres density. After the house was completed, Drury evaluated the result as "entirely unsatisfactory."[31] It seems that the heat of the chemical interaction during foaming determined the layers of polypropylene fiber, leaving a partially loose interior surface. Even though Drury was highly frustrated with the result, he mentioned when interviewed that "this technology is only a crude start. It is not the magical material, but it can do things no other material can do, such as to freely work with curved surfaces. As drastic changes occur in man's use and sense of time, scale and place, foam allows the architect to experiment with conditions which might accommodate these changes."[32]

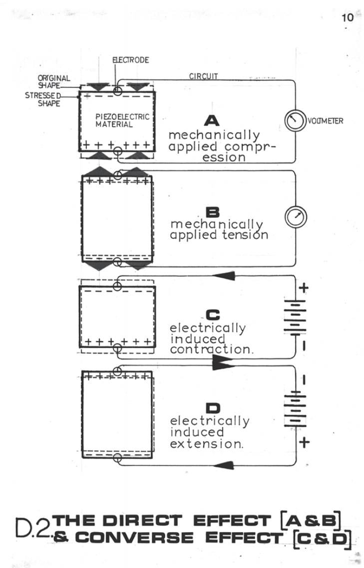
1.4.1 TAO EARTH HOUSE BY CHARLES HARKER (1972)

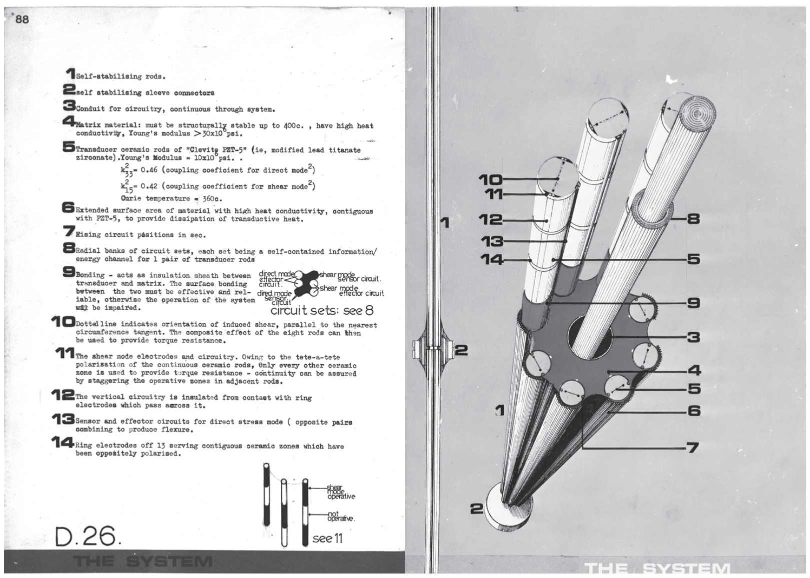
Charles Harker, founder of the Tao Design Group, juxtaposed Le Corbusier's early 20th century machine for living with a new concept for habitation that he coined the "soft machine." The Tao Design Group, an experimental group of architects, sculptors and artists associated with the University of Texas at Austin, explored the application of new plastic materials in architecture and published their molded shelters as environmental paradigms for a "soft future" in Architectural Design and Domebook 2.[29] In his manifesto for the "Soft Machine,"[30] Harker outlined an alternative definition of matter as patterns of energy that come to be solidified in time; he spoke of matter that can be remodeled in numerous ways and materials that could be composed morphogenetically rather than morphologically. For the Tao Design Group, it was key to dispose of tectonic divisions suc has structure, envelope and roof, in order to envision what they described as an environmentally-friendly, "soft future." The term "soft" was therefore used both literally, though the use of plastic materials, and conceptually, projecting an elastic understanding of tectonic conventions.

SOFT 1.5

PHASE CHANGE AND MATERIAL CONVERSION investigates the micro-performance of materials as they undergo a series of phase changes. Critical thresholds of temperature, time, and other parameters define the fragile state of equilibrium in each phase. In physics for instance, a phase diagram shows the preferred physical states of matter at different temperatures and pressures; within each phase, the material is uniform with respect to its chemical composition and physical state. At typical temperatures and pressures, water is liquid, but it becomes solid ice if temperature is lowered below 273 K and gaseous steam if temperature is raised above 373 K. Each material "stage" is defined by a threshold of interrelated bonds and identifiable patterns.

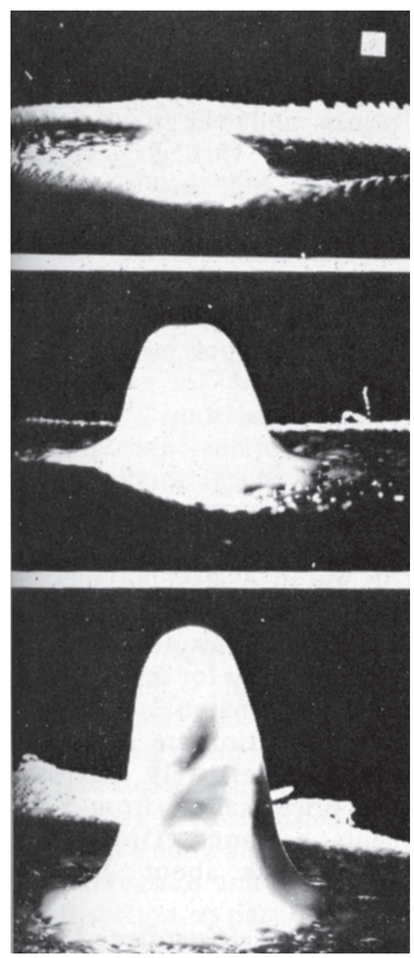


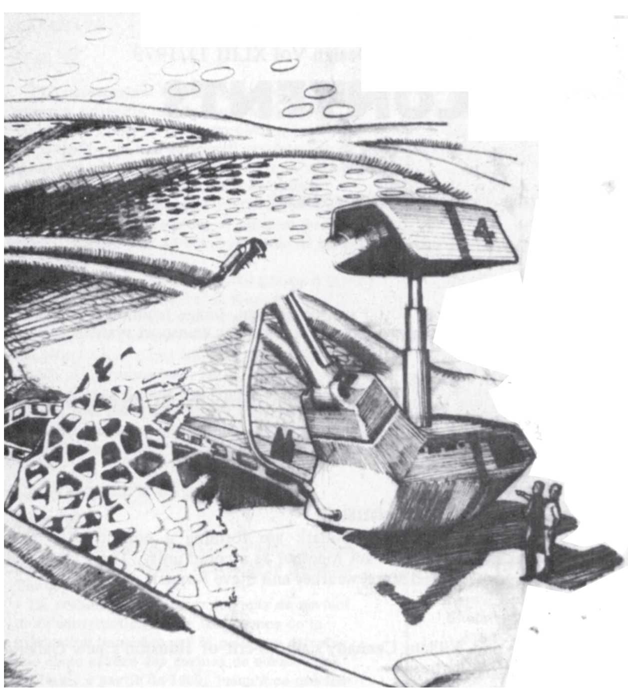




1.5.1 PIEZOELECTRICS BY ROBIN EVANS (1969)

"Piezoelectrics" was the thesis project of eminent architectural theorist Robin Evans completed while at the Architectural Association in London. The thesis was inspired by technological advancements in micro-realm materials and proposed macro-solutions for cities made of piezoelectric elements that are set in position and then made rigid through the passage of an electrical current. The properties of piezoelectric materials which can be electrically charged when subjected to a certain amount of stress, provided a platform for Robins to envision the future city. Evans thought of piezoelectric materials as an emerging type of naturally interactive system and outlined their potential use in the design of a series of interactive structures.[33]





1.5.2 SPACE FORM MANIPULATION BY WOLD HIBERTZ AND JOSPEH MATHIS (1973)

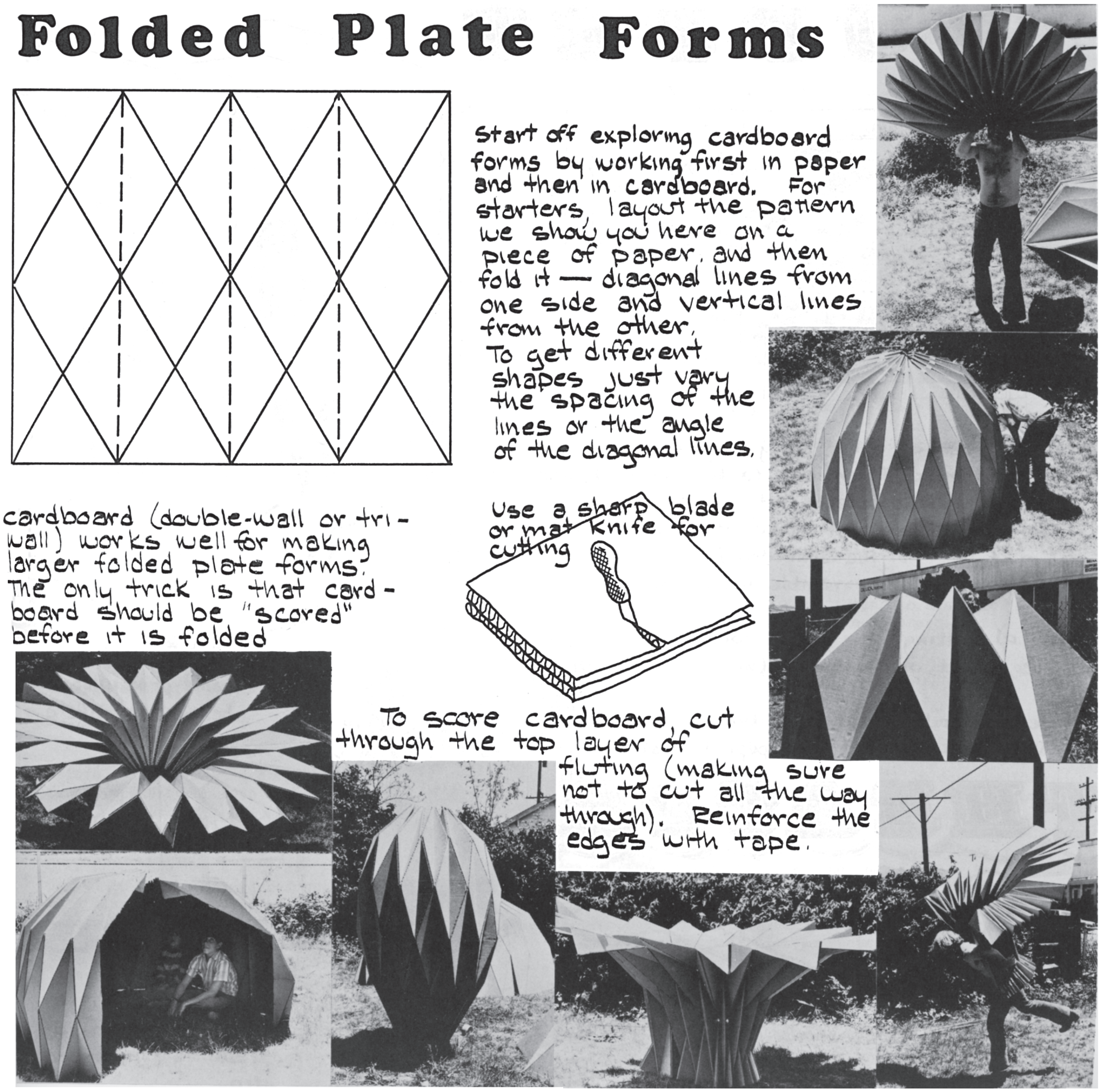
Wolf Hilbertz, a German architect, inventor, and marine scientist, founded the Responsive Environments Laboratory and the Symbiotic Processes Laboratory at the University of Texas, at Austin, where he taught in the early 1970s. Hilbertz's research focused on the emergent possibilities of creating environments by manipulating matter on an atomic level. He envisioned a partially-controlled design process in response to environmental parameters, where matter could be directed to certain behaviors, constellations and shape formations, through the regulation of interference patterns. In his research project "Space Form Manipulation," in collaboration with Joseph Mathis, the authors described their laboratory experiments on form generation by using computer controlled light configurations, interference patterns and photo-polymerizable materials. They wrote, "what if our structures were frequently changing systems, in response to their environments and the user and become increasingly part of the social as well as economic process…Studies to devise more flexible working systems of structural erection and reclamation have centered on various compute controlled devices for extruding or spraying organic and inorganic construction materials."[34] The research that Hilbertz and his students conducted in these laboratories, on automated form generations with pattern interference in a micro-scale, was fundamental to the development of nanotechnology, termed as an explicit field in the early 1980s.

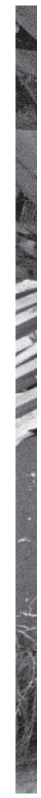
HARD 2.1

FOLDING AND KNOTTING investigates the use of weak materials, not normally used for structural purposes, which strengthen locally through the application of repetitive techniques. This category explored an economy of means through geometries and patterns that attribute new mechanical properties to material performance.

2.1.1 FOLDED PLAT FORMS BY THE FARALLONES INSTITUTE (1971)

"Folded Plate Forms" was an experiment in geodesic dome structures made from cardboard and used for play in a school environment. It was documented along with a series of other experiments for children in the Farallones Scrapbook,[35] self-published by the "Farallones Group," founded by Sim Van der Ryn and Sanford Hirshen in the late 1960s. The experiment was laid out in the form of an instruction manual for making a dome, though various other typologies and volumes were produced as variables of scoring different patterns on a flat sheet. Scoring was examined as a technique to strengthen certain surface areas and produce a series of forms between a flat surface and a dome. This flat sheet methodology embodied quite literally the aspiration for diversity, which was essential for the group not only as a technical solution, but also as a cultural necessity. As Van der Ryn stated: "The institute views architecture not as a technical solution, but a way of effective change in social forms and states of consciousness…As children gain more control over space, the authoritarian control of the system is lost."[36]





HARD 2.2

ASSEMBLY AND MODULES investigates the replication and multiplicity of objects in assembly lines, stacks, arrays, modular pyramids and other volumetric settings. Found objects—like logs of wood or reprocessed objects like refolded packaging blocks—become standardized units, which are vastly reiterated in order to produce complexity via recursive logic. In this category, the overall effect germinates from serial repetition and the variability of connections between modules.

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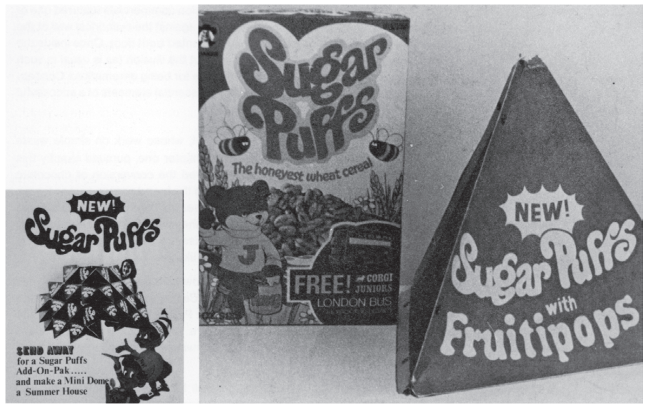
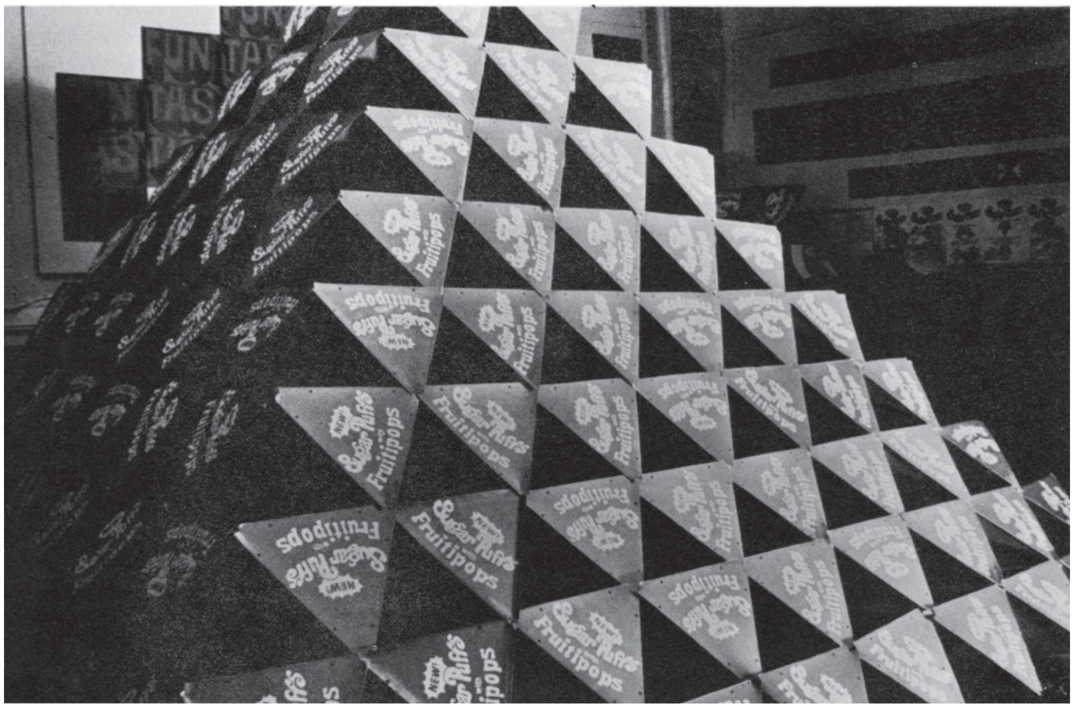
2.2.1 FREE FORM BY JERRY THORMAN AND BOB DE BUCK (1973)

Jerry Thorman and Bob de Buck and were jewelry makers from Trunchas, New Mexico, who built a 5000 square foot house near Albuquerque. The house was a maze of wandering spaces gathered around central shaft of five poured concrete columns that form a flue from the fireplace.[37] The designers found and used scrap lumber, leftover materials, and nails to create three dimensional assemblies, arrays and composite elements out of chopped wood logs. As the envelope was not sealed, many of the exterior layers are without connections or joints. This construction technique furthered the authors' notion of the house as an incomplete but inhabitable project. They lived in the house while under perpetual construction, as pieces were added incrementally in various locations. The authors saw the house as a gigantic piece of jewelry in larger assemblies in which they happened to live.

HARD 2.3

RECOVERY AND REUSE OF PARTS investigates techniques of salvaging obsolete objects and repurposing them towards the production of building elements in different scales. In this category, cans, bottles, defunct windows, car parts and other remnants of industrial production are used in new assembly lines, stacks and surface reinforcements. The motivation was to attribute a functional causality to waste and to feed back into global production the leftovers of industrialization.





2.3.1 SUGAR PUFFS PACKAGING BY DAVID HUNT (1970)

The work of London architectural student David Hunt focused on waste product transformations both physically and conceptually. Physically, Hunt converted breakfast cereal packs from a box to a pyramidal unit, so that they could amass in larger pyramids and other three dimensional volumes, rather than enlarged boxes. Conceptually, Hunt redesigned his unit with a new logo and marketed it as the "Sugar Puffs minidome" with fake advertisements that referenced the original product marketing. With this uncanny resemblance and the blurring of boundaries between the actual product and the reused by-product, Hunt claimed that in order to successfully feed reused objects back into cycles of production, a new consumption culture of recycling would need to be invented. Hunt received the support of Martin Pawley, the innovator of garbage architecture, who wrote: "Hunt's work was largely misunderstood, whereas in fact he pioneered the marketing of secondary use products using the graphic style of the primary use of original." [38]

2.3.1 DROP CITY BY THE DROP CITY COMMUNE (1966)

"Drop City," founded in 1965 in Trinidad Colorado, was not the first rural commune in America,[39] but it was the first built entirely from geodesic dome frames. The frames were clad with assorted garbage and various found components, primarily scrap car parts. Overall, "Drop City" was a unique constructed environment—or at least such were the testimonies of its visitors as well as its dwellers: "We thought of the whole of Drop City as a large environmental sculpture." [40] **Perhaps it was originally unintentional, but the early design decision to build hemispherical shelters enveloped by diverse found objects, set out a remarkably nuanced set of construction principles for the droppers. The droppers' anti-urban retreat clearly manifested a critical renunciation of form and resource management of the contemporary city. Denying the triad urban predicament created the first set of hypotheses for the droppers.**

NOTES

1–Charles Harker, "Supramorphics,"(2006). See http://web.mac.com/charker/TAO_Design_Group/Tao_Design_Group.html (accessed September 25, 2011).

2–Ibid.

3–Hypnosis Chamber credits: François Roche, Stephanie Lavaux, and Jean Navarro, R&Sie(n), with Benoit Durandin; seats shell designer, Mathieu Lehanneur; hypnosis specialist, François Roustang. See http://www.new-territories.com/hypnosisroom.htm (accessed September 25, 2011).

4–Ibid.

5–C.P Oberndorf, "Erroneous Recognition (Fausse Reconnaissance)," *Psychiatric Quarterly 25*, no. 2 (1941): 316.

6–See Oberndorf, 316. See also R.W. Pickford. "Déjà Vu in Proust and Tolstoy," *International Journal of Psychoanalysis*. Psychoanalysis Review 35:188–201 (1948): 200.

7–Ethel Baraona Pohl, "A Design Report from Barcelona," *Domus Online* (March 31, 2011): on the exhibition "EcoRedux 02: Design Manuals for a Dying Planet" curated and designed by Lydia Kallipoliti with Anna Pla Català at the Disseny Hub of Barcelona (D-Hub). See http://www.domusweb.it/en/design/ecoredux-02-design-manuals-for-a-dying-planet/ (accessed June 11, 2011).

8–See Frederic Migayrou, "Extensions of the Oikos," in *Archilab's Earth Buildings: Radical Experiments in Earth Architecture*, ed. Marie-Ange Brayer & Beatrice Simonot (London: Thames & Hudson, 2003), 20.

9–Ernst Haeckel, *Generelle Morphologie der Organismen: Allgemeine Grundzüge der Organischen Formen-Wissenschaft; mechanisch begründet durch die von Charles Darwin reformirte Descendenz-Theorie* (Berlin: G. Reimer, 1866).

10–Caroli Linnæi, *Systema Naturae, Sive, Regna tria naturæ systematice proposita per classes, ordines, genera, & species* (Lugduni Batavorum: Apud Theodorum Haak, Ex typographia Joannis Wilhelmi de Groot, 1735).

11–This is clearly described by Ian McHarg when he writes, "This model contains the possibility for an inventory of all ecosystems to determine their relative creativity in the biosphere. The same conception can be applied to human processes." See Ian L. McHarg, *Design with Nature* (New York: Natural History Press, 1969).

12–The "World Design Science Decade" was a research program that originated with Buckminster Fuller's proposal to the International Union of Architects (I.U.A.) at their VIIth Congress in London, England, July, 1961. Fuller proposed that architectural schools around the world should be encouraged by the I.U.A. to invest the next ten years in a continuing problem of how to make the total world's resources serve 100% of humanity, through competent design, despite a continuing decrease of metal resources per capita. In 1961, the total of the world's resources served only 40% of humanity. See the Buckminster Fuller Institute at http://www.bfi.org/

13–John McHale, *The Ecological Context* (New York: George Braziller, 1970).

14–Denis Cosgrove argues that the representations of the whole earth have established a repertoire of sacred, secular, colonial, and empirical meanings. See Denis Cosgrove, *Annals of the Association of American Geographers* 84, no. 2, (June 1994): 270–294.

15–Excerpt from Migayrou, "Extensions of the Oikos," 20.

16–Peter Cook, "The Electric Decade: An Atmosphere at the AA School 1963–73," in *A Continuing Experiment: Learning and Teaching at the Architectural Association*, ed. James Gowan (London: Architectural Press, 1975), 142.

17–Ibid.

18–Ibid.

19–Joseph R. Davis, *Handbook of Thermal Spray Technology* (Materials Park, OH: ASM International, 2004), p.47. Thank you to Deborah Ferrer for this reference.

20–William Katavolos, "Organics" (1960) in Ulrich Conrads (Ed.), *Programs and Manifestoes on the 20th Century Architecture* (Cambridge, Massachusetts: MIT Press, 1970) p. 163.

21–Arthur Quarmby, *Plastics and Architecture* (New York: Praeger Publishers, 1974), p.170.

22–Rudolph Doernach, "Biotecture" in the 'Cosmorama' section of *Architectural Design*, Vol.36, No.2 (February 1966), pp.4–5.

23–Ruppert Spade, "Trick Recyclist" in the 'Cosmorama' section of *Architectural Design*, Vol.40. No.3 (March 1970), pp. 111–112.

24–Grahame Caine, "Street Farmhouse" in Stefan Szcelkun (ed), *Survival Scrapbook*, Vol. 5: Energy (Bristol, UK: Unicorn Bookshop Press, 1975).

25–Grahame Caine, "A Revolutionary Structure" in *Oz*, (November 1972): pp.12–13. Supplemented by Mike Moore's diagrams based on Grahame Caine's originals.

26–"The expanding world of polystyrene foam" in the "Design" section of *Architectural Design*, Vol.40, No.5 (April 1971), p. 417.

27–"Vacuumatics" in the "Cosmorama" section of *Architectural Design*, Vol.41, No.5 (April 1971), p. 198.

28–"Snow Moulding" in the "Cosmorama" section of *Architectural Design*, Vol.43, No.12 (December 1973), p.751.

29–See "Soft Future" in the "Cosmorama" section of *Architectural Design*, Vol.43, No.10 (October, 1973), 617. See also the work of the Tao Design Group in Lloyd Kahn (Ed), *Domebook 2*, (Bolinas, CA: Shelter Publications, a non-profit educational corporation, 1971) and Lloyd Kahn (Ed), *Shelter* (including *Domebook 3*), (Bolinas, CA: Shelter Publications, a non-profit educational corporation, 1973).

30–See Charles Harker's manifesto statement for the "soft machine," written retrospectively in 2006, in the website of the Tao Design Group. See http://web.mac.com/charker/TAO_Design_Group/Tao_Design_Group.html. Accessed on June 1, 2011.

31–Clinton A. Page, "Foam Home" in *Progressive Architecture*, Vol. LII, No.5 (May, 1971), pp.100–103.

32–Page, "Foam Home," 103.

33–Robin Evans, "Piezoelectric Structures" in the "Cosmorama" section of *Architectural Design*, Vol.39, No.9 (September 1969), p.468.

34–Wolf Hilbertz, "Space Form Manipulation" in the "Cosmorama" section of *Architectural Design*, Vol. 43, No.11 (November 1973), pp.683–684.

35–Sim Van der Ryn and others, *Farallones Scrapbook: Making Places, Changing Spaces in Schools, at Home and within Ourselves* (Point Reyes Station, CA: Farallones Designs; distributed by Random House, 1971).

36–"Advertisements for a counter culture" in *Progressive Architecture* (July 1970) Vol. 51, pp. 71–93.

37–Lloyd Kahn, "Free Form" in Lloyd Kahn (Ed), *Shelter* (including *Domebook 3*), (Bolinas, CA: Shelter Publications, a non-profit educational corporation, 1973), p.145.

38–Martin Pawley, *Garbage Housing* (London: Architectural Press, 1975), p.105.

39–If one excludes the numerous 19th century utopian communities by Owen, Wright, Fourier, Brisbane, Ripley, Cabet and many others, there were many rural communities throughout the 20th century motivated to live exclusively off the land. A pioneering figure in the establishment of self-sufficient rural communes was Mildred Loomis, a former teacher and social worker that established *Lane's End Homestead* in Western Ohio, along with her husband John Loomis. See Richard Fairfield, *Communes USA. A Personal Tour* (Baltimore, MA: Penguin Books, 1972), pp.25–26.

40–Bill Voyd, "Funk Architecture" in Paul Oliver (Ed), *Shelter and Society* (New York: F. A. Praeger, 1969).