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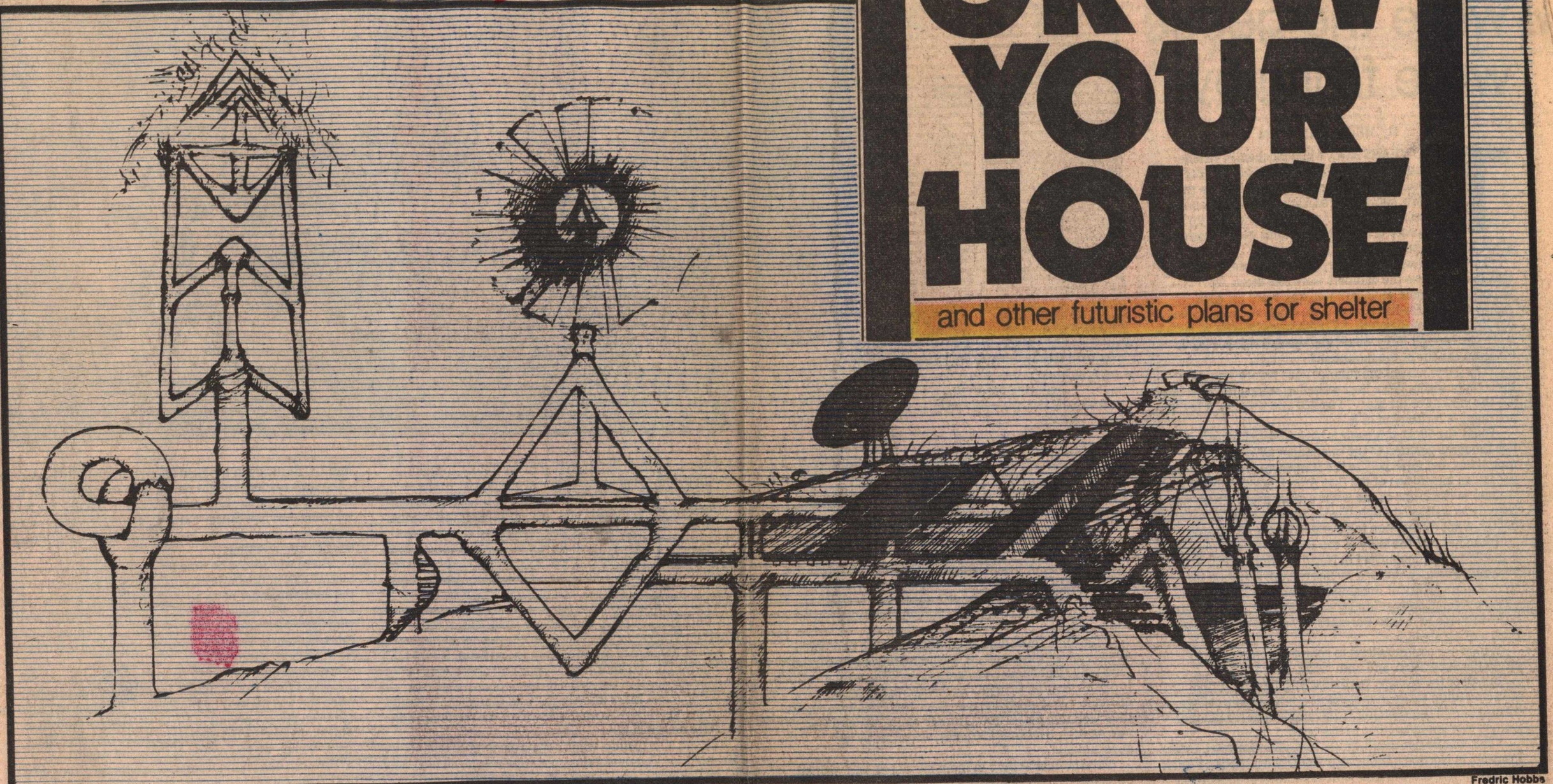
GROW YOUR HOUSE

and other futuristic plans for shelter



Fredric Hobbs

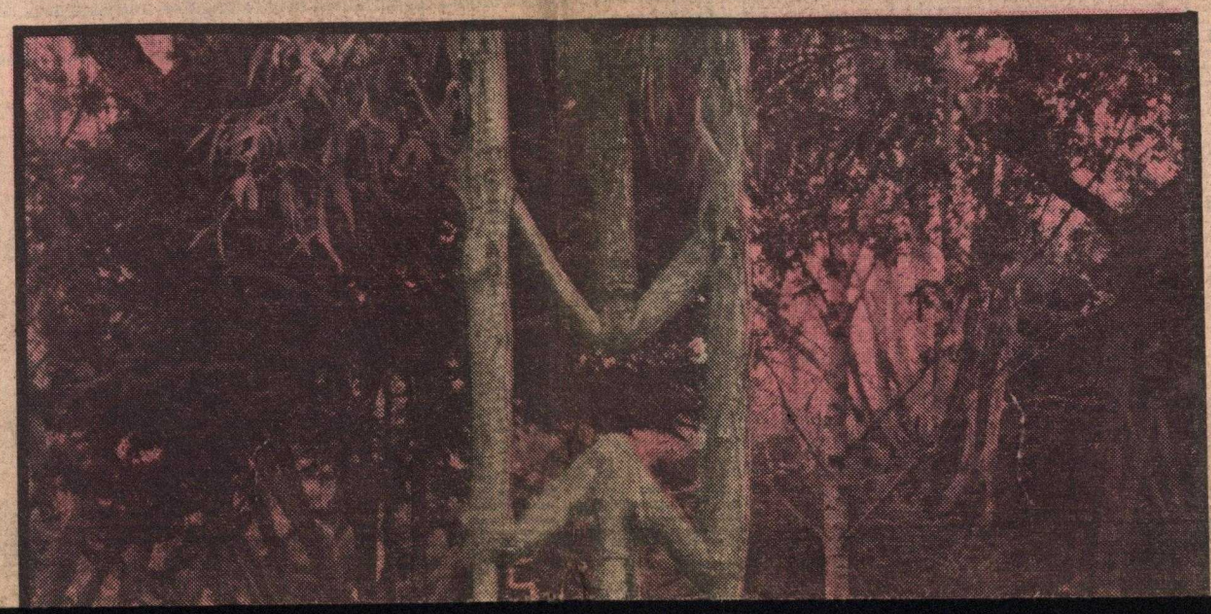
The Tree Circus

By Fredric Hobbs

FUTURISTIC, SELF-SUFFICIENT, nomadic living is no longer a science-fiction fantasy. It is only common sense, if not survival, in the 1980s to look for shelter in nature, to live in harmony with the land. Instead of urban-suburban blight, people can create a humane architecture that does not desecrate the planet. Eventually, society will learn to build down, to compose and recycle natural camouflage of the landscape as an integral part of each living environment.

Many of today's model earth dwellings are the work of simplistic, "back-to-the-land," "agra-funk" builders. But as the grassroots movement toward voluntary simplicity becomes a significant moral and economic force in the '80s, dramatic new interpretations of what Frank Lloyd Wright once called "Organic Architecture" will alter the way we live.

Perhaps the most radical and potentially the most exciting element of this concept is botanic architecture, an outgrowth of the back-to-the-earth movement. In simple



Experiments in biotecture

By R. Bruce McColm

ON A SHALLOW SHOAL at the bottom of the Gulf Stream 320 kilometers southwest of the Cayman Island, a research ship will sink wire-mesh forms the size of football fields. A small generator sends electrical charges down through these forms and sets in motion a process known as marine accretion. The electrified structures collect minerals from the sea and begin to grow like coral reefs. An organic platform eventually forms a self-growing habitat that will shelter a community of scientists, engineers and artists.

Wolf Hibertz, who directs the Symbolic Process Laboratory at the University of Texas in Austin, and founded the Marine Resources Co., is America's major practitioner of a new architectural school called biotecture. Its goal is to

and pleached or grafted to form a living bond with the branch of another tree. Thus, if trees are planted in a structural grid or cluster, and pruned and trained to this site plan, branches may be joined together. No lumber from felled trees is necessary, and little conventional hardware other than modular, free-form window-skylight-greenhouse elements adorns what is essentially a natural construction process.

The most immediate example of early tree architecture and pleaching is found in the overgrown ¾-acre lot that houses what used to be known as "The Tree Circus" in Scotts Valley, near Santa Cruz. Until recently, the Tree Circus was largely ignored by the local populace. But through the efforts of a young Santa Cruz architectual designer, Mark Primack, the Tree Circus may have been saved for posterity.

According to Primack, the living tree sculptures were the work of an uneducated farmer named Axel Erlandson. A native of Minnesota, Erlandson came to California during the Depression and stayed to become an unsuccesful bean farmer and experimenter with tree pleaching near Turlock. His wife dreamed of creating a bean empire, but Erlandson was struck with a vision that would make him a master of tree pleaching. Like Simon Rodia, builder of the Watts Towers in Los Angeles, Erlandson worked alone. Ostensibly, the Tree Circus was to become a lucrative tourist attraction, but the state of California routed its new Highway 17 around Scotts Valley. Erlandson's little plot of trees was lost in the gradual overgrowth of neighboring cypress and encroaching real-estate development. Still, Erlandson single-mindedly kept working at what had become a sophisticated form of organic sculpture. For the last 25 years of his life, until he died in 1964, Axel Erlandson created 50 living sculptures from 15 species of trees.

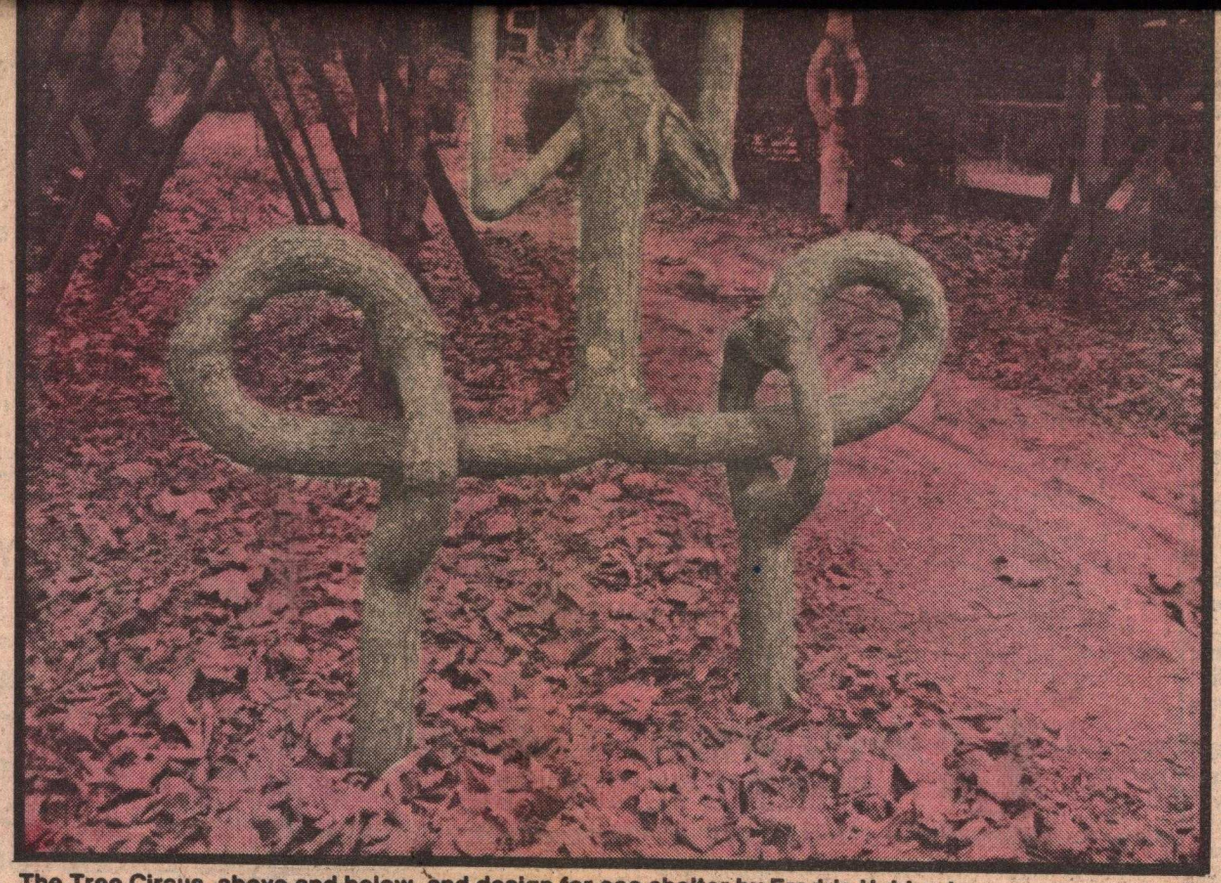
During the late '60s, Erlandson's masterworks passed, together with the land in which they were rooted, into the hands of land developers who preferred the prospect of lucrative real estate development to the delight of tree art. But Primack started a media campaign to preserve the Tree Circus, and the site was aquired by a sympathetic landscape designer from Southern California named Joseph Cahill. Today, with public and state support, the Tree Circus may be preserved as Erlandson had envisioned it.

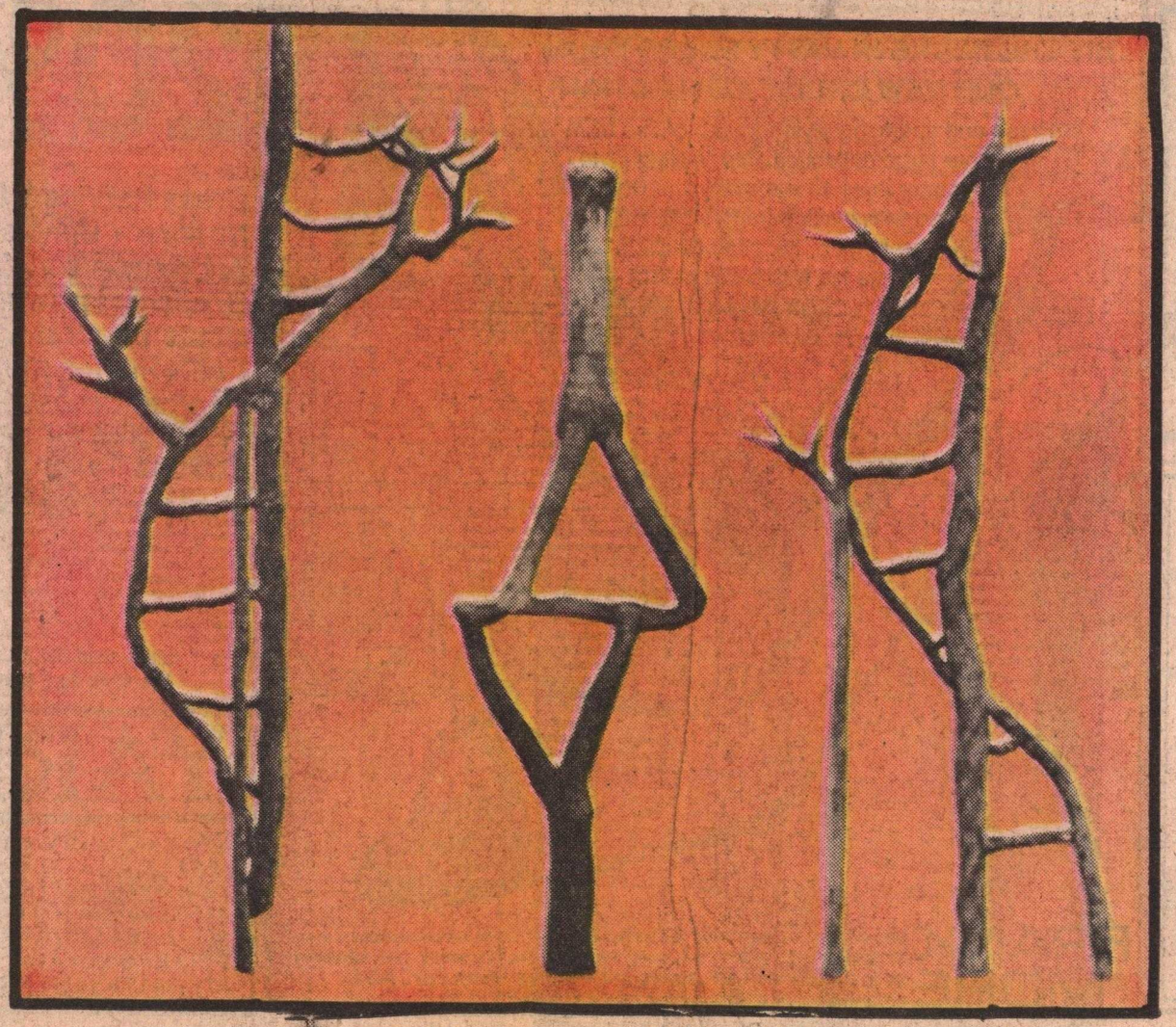
Another example of tree architecture is found in the great banyan tree at the Calcutta Botanical Gardens in India. The 200-year-old banyan, a member of the fig tree family, ficus benghalensis, is the largest tree in the world, with more than 1,000 auxiliary trunks selected and guided by gardeners. Within its canopy of four acres, a small community of five hundred people could find shelter.

The great banyan supports its large, spreading horizontal branches with a complex structure of aerial roots that descend from limbs like bracing. Gradually these structural "prop" roots form trunks, which in turn send out branches fed by linear underground roots. Eventually, the banyan, although still only one tree, becomes a small forest.

In its wild state, the prop roots often become stunted and tangled, due to thick foliage that prevents rainwater from irrigating and softening the soil below. So gardeners have interceded in the untangling and subsequent shoring up of the banyan's prop roots.

The invervention of humankind with nature in the cases of the great banyan and of Axel Erlandson's tree sculptures are examples of pleaching — or interweaving branches — to form "botanic architecture." As Primack says, "The revival of architectural pleaching can be seen as a positive step toward living in the natural world. The very fact that it demands a commitment to both time and place attests to its merit as an alternative trend in human environments. And pleaching can be undertaken without denying our present dependence on mechanical living systems. We still have access, privately or collectively, to some outdoor space, and, though our knowledge of what to plant and how to grow it is only as limited as our imagination, there is reason to hope. For in summer, sleeping beneath pleached arbors that grow as noticeably as themselves, our children will surely glimpse broader possibilities."





The Tree Circus, above and below, and design for eco shelter by Fredric Hobbs, top

design human habitats as organic systems, wholly integrated with their immediate environment and built from renewable sources. "I simply became discontented with existing technology and traditional thinking," says Hilbertz. "So I formulated the idea of evolutionary environments. Using crystal growth, plant forms and geological formation, architects can play a vital part in the evolutionary process. Eventtually humans will live in a symbolic relationship with their environment. Natural sensors and the artificial intelligence within the environment will not only adapt the physical realm to human needs but provoke new conditions. A house will sense a coming hailstorm. But its presence may also cause a hailstorm. By building with these processes, you create an instant ecosystem."

Today, advanced technologists are making such architectural visions increasingly possible. A crack in the wall of conventional design has opened new vistas of human habitation that leave today's cities far behind. Martin Pawley, whose book "Private Future," speculates on the complete human withdrawal into the house, suggests that we may outgrow city life altogether. "Everybody is pretending that community life is having a rebirth. But the opposite is happening. Abandonment of the world's cities is proceeding on a large scale."

If we are leaving our cities behind, we may be heading toward living systems that parallel Hilbertz's underwater Autopia.

Already Hilbertz has grown several artificial reefs and underwater monuments off St. Croix in the Virgin Islands and in Corpus Christi, Texas. In nature such man-made objects as junk cars, old tires and concrete blocks have formed barrier reefs. With windmill power and wire-mesh forms that resemble the submerged hull of a World War II naval vessel, Hilbertz has created instant reefs teeming with plant and animal life. Marine biologists found that after a year Hilbertz's Virgin Island reefs attracted three to 16 times more fish than natural-junk reefs. Hilbertz now is using marine accretion in the Cayman Islands to grow an underwater park for scuba divers.

Significantly, the grown material — largely calcium carbonate — acts like bone and repairs itself. Hilbertz says, "This is the first construction material to have the regenerative properties of bone. It has the same mechanism that properly distributes minerals wherever they are needed. This means that is the reef breaks or is hit by a ship, the accreted material will heal itself."

The notion of a self-growing island such as Autopia may sound utopian, but embryonic sea cities already exist in the new port of Rotterdam and the large oil rigs in the North Sea off England. Hilbertz envisions a day when whole underwater cities will be grown. Mother ships will drop forms to the sea's bottom, where they will accrete material. Once they have reached the desired shapes, the ships would harvest the building structures from the ocean floor with the aid of flotation collars. These building materials would then be assembled offshore into buildings.

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In Germany's Black Forest the Luddite of the biotecture movement, Rudolf Doernach, grows buildings of a leafier sort. For the past decade Doernach, director and founder of the Biotecture Institute in Stuttgart, has adapted a 300-year-old weaving technique to build living willow houses. "Architecture, as well as technology, is an evolutionary mistake," Doernach comments caustically. "It is basically parasitic, polluting and nonproductive. The central issue is to build houses in the same way as trees grow. It is far more intelligent to cohabitat with a living plant system than to cut it into lumber and lose 50 percent of it. What do you get in this manner but a house that eats a lot of energy?"

Doernach's "biohouse" is a shelter composed of variou living trees bent, grafted and pruned into a habitable shap On the outside, his homes look like huge, slightly hyperboli beehives. Leaves act as "living shingles" against bad weathe A hexagonal inside shape stimulates interior growing. Th overall design allows all sections of the house to receiv constant sunlight from the "sun eye," an opening in the roo

A biohouse sports the obvious advantages of any plant. I recycles water. It uses human waste as humus to fertilize th

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Experiments in biotecture

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house. It produces food. It cleans the air. It stores solar energy.

Biotecture's biggest problem is psychological. Few can easily accept the idea of a house as both an employer and a primary food producer. "It takes people at least two years to recondition themselves to work in the house," Doernach explains. But biohouses and biovillages, he believes, are inevitable developments for Germany, Great Britain and the United States, as they enter the post-industrial age. In American cities, for example, Doernach would suppress the rage to retrofit old buildings in blighted areas — with a blitz of biofitting.

Doernach has already taken the first steps in putting his ideas to use. His "vertical gardening" is transforming center-city rooftops of Zurich, Dusseldorf and Stuttgart into greenhouses and mazes by covering the facades of the old homes with trellises woven into various food-producing plants. Experiments have been conducted comparing these biofitted houses with others not involved in the project. Owners of Doernach-modified homes saved 30 percent on their energy bills, and those who lived in them had only half as many illnesses. Better health results from exposure to "psychological green," which benefits the mind. The way in which plants absorb more viruses than ordinary building materials do is good for the body as well.

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Martin Pawley shares Doernach's jaundiced view of industrial society. Consequently, his architecture is trash. Beer cans, rusting old cars, tires and bottles. He especially likes the 48-ounce "Crowd Pleaser" made by Coca-Cola. Under stress tests, the Coke bottle withstood 10,000 pounds of pressure. "You could build the Brooklyn Bridge with those things," Pawley says.

A frequent adviser to the United Nations on the world's housing needs, Pawley estimates that 20 cities the size of Philadelphia will have to be built each year from now to 2000 if the world's population is to have shelter. He considers building with waste to be the appropriate response. The Unites States, Pawley discovered, produces 12 cans for each brick. By examining the various waste products of American industries, the British architect gleaned a number of cheap but excellent materials to use in building.

"Waste is the only thing that increases in proportion to our construction," Pawley says. "All other resources diminish. If you look at a consumer society and its byproducts, you realize that the packaging, the steel, the aluminum, the rubber, the glass waste products are not poor building materials. They are great ones."

Pawley has used trash in several ways. In 1975, while teaching at Rensselaer Polytechnic Institute in Troy, N.Y., he built the Dora Crouch house. He constructed the house's frame from discarded newspaper cores — heavy cardboard tubing reinforced with metal. The outside walls were made of large cans set in cement and weatherproofed with sulfur washers served as roof tiles, the insulation was polyester rejected from local textile mills, and the stained-glass living room wall was made from bottles. This 56-square-meter house cost $550 to make.

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A few blocks from the Pacific Ocean, in Venice, lies a scrubby, garbage-strewn plot of land. Rows of crumbling bungalows stand adjacent to the lot. This is a most unlikely site for the future — and a low-cost future at that — to take form. But here Southern California architect Glen Small will build "an antibuilding," called the Green Machine.

The Green Machine will be a low-cost housing complex containing either recycled mobile homes or industrialized modular housing units stuffed inside a space-frame pyramid. The project will work as an ecological machine. A structure will rise 5½ meters off the ground, with high-rise, plant-filled boulevards. "The effect is as if you are living in a giant greenhouse," says Small. Dew and rainwater will be collected, filtered and recycled for watering the plants. Parabolic-disc solar collectors installed on the roof will supplement the heat provided by methane-gas disgesters working off all human, garden and kitchen waste. A

may lead to cyberstructures that computers and holographic projectors generate at will. Like a spider spinning its web, a mobile building machine projects a three-dimensional holographic image and then transforms it into a solid structure by spraying it with a mist of plastic that solidifies on contact with light. Lab tests conducted at the Symbiotic Process Lab prove the principle of this speculation. Light waves from a laser were shot through methyl methacrylate, a plastic powder. Small plastic filaments were created and then dissolved by an altered light-wave pattern.

In 1973, in an experiment called Ice City, Hilbertz and some of his students built the first computer-generated building out of ice in Fargo, N.D. The floor design was drawn on an electronic tablet, which a computer then translated into a three-dimensional movement for an ice-spraying machine to follow. The building, an igloo composed of ice layers, was sprayed and, by a reverse process, dissolved. "It is a disappearing environment," says Hilbertz.

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In contrast to Hilbertz's ice house, there is architect Carolyn Dry's vision of deserts that build themselves. Dry, a professor at UCLA and consultant to the U.S. Navy, believes that "botanic architecture" will allow us to roll back and live in our expanding deserts. She foresees a sand-bound civilization much like Frank Herbert's "Dune," where "shelter means a hollow out of the wind and hidden from view."

Architectural oases, Dry thinks, will be built in desert areas. These will be groupings of earth-integrated houses molded from hydromulch, a material made from seaweed, cement, water and plant seeds. When watered by osmotic pumps drilled into the desert ground, the buildings will become giant seed strips. A ground cover will grow and stabilize erosion. As the oases spread across the desertscape, the climate will change. "In effect, what you are doing is creating an environmental feedback system on the desert, she says. "By making the ground cover more absorptive and blacker, you will cause more rain. This process of growing buildings on the desert creates air thermal mountains. So the building itself affects the climate."

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Archigram, an English architectural group formed in the 1960s, turns to technology instead of to nature for flexibility and freedom in new living modes. Archigram's space-inspired work glorifies the wildest possibilities of new technological developments. Blow-Out Village, for instance, designed by the group's leader, Peter Cook, can be a mobile habitat for people affected by some disaster; a portable environment for remote, inhospitable regions; or an attachment to a resort. The whole village can be moved anywhere by hovercraft and then be anchored. Its center is a huge hydraulic mast. From the top of the mast fall air-inflated ribs, which support the village's weatheproof plastic covering. When not in use, the village hydraulically contracts for storage or moving.

Recently Cook has devised an alternative to the modern city — a highly dense, technological suburb. Cook says, "We have to invent a new kind of city, one that eventually will lead to a development where each person will have his or her own very intense network. You are already getting this in Southern California and in Belgium. This network will be based on the time dimension, on the socio-economic dimension and on habit. My center of London, for example, is not the guy down the block's center of London. We still have only a very primitive idea of how this operates. But I think the future city will be a very concentrated, polynucleated system. It will be incredibly complicated, but also relaxed."

Cook's technologized suburbia, called Arcadia, involves enormous architectural sleight-of-hand. The bucolic haystack hides a dwelling. The nostalgic old barn on the countryside is really a retrofitted commune. Nature and buildings merge, not in the biotecture way, but as occasional props, an ultimate stage set. Orchards support tent structures; tree enclosures, like the English hedgerows, shelter people. Concealed behind all this stagecraft is a vast technological support network. One suggestion by Cook is to replace natural rocks and trees with Rok and Log plugs where community residents can hook their dwellings up to the outside world. Camouflaged with a spore finish, to promote rapid moss growth, these plugs will contain cable lines delivering electricity, telephone, international computer hookups, banking facilities and other basic services.

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Another Archigram member, New York-based architect Michael Webb, avoids the community altogether in his plans. He adopted the slogan, "The overcoat is a house/is a car with the motor clipped on," and he developed a series of proposals for mobile environments ranging from drive-in housing to the Cushicle, or Suitaloon, a house worn like a space suit.

The proposed drive-in housing has stationary components. The kitchen and bathroom are fixed service units, but the living room and other parts of the house are made up of mobile containers that form rooms by means of folding panels. When not being used, the containers are driven off and stored.

The Cushicle — "that's a ghastly Americanization of cushion vehicle — is modeled after the space suit as the minimal house." Webb explains, "The Cushicle is a vehicle to which a person could strap himself. The suit a person wears becomes both a stand-in for the suit of clothes he wears, the metal shell of the vehicle he rides inside, and the house he lives in. With Detroit styling, there would be different vehicles for different types of people."

The Cushicle itself has a spinal system containing all appliances and services, along with an inflatable envelope. Each Cushicle unit has a plug, which serves the same function as the front door. For a romantic interlude, you can plug into your lover's unit and enter his or her suit while leaving yours clipped to the outside. Or, as Webb envisions, several Cushicles can plug together to build a large structure or a "moment city," as he calls it.

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adjusting the complex to climatic changes through a series of sensors and photocells that register such alterations.

If Small were to have his way, all of Los Angeles would eventually be rolled up and put inside his Biomorphic Biosphere Megastructure, a 2,400-meter-high, tentlike structure that would form an artificial mountain range in the air over the Los Angeles basin. Instead of just recycling wastes, the BBM would transform the city by recycling entire blighted neighborhoods back to open space. Conventional building techniques would be used to span downtown Los Angeles with the first sections of the megastructure. Then Small foresees a mixture of biotectural processes taking over. Computer-run holographic projectors would generate parts of the new city, allowing for controlled growth. New materials, such as plastic made from soybeans, would be used to construct the new cityscape. Wind and solar devices would generate power at high altitudes.

Not only would the inhabitants enjoy the sensation of being liberated from the earth's surface, but their houses could be plugged into the structure at any level. "The house," according to Small, "is a derivative of history. The flying house is an attempt on my part to block out our concept of *house*. The house could be a jungle gym, where you bounce off the walls, and it would respond to you. At night the floors would curl up into bedrooms. And at sunrise the walls would automatically open to the outdoors."

Unlike industrial cities, the BBM could also wither away and self-destruct. "If it fails, it can be recycled," says Small. "What would be left would be a great Eiffel Tower or a modern Disneyland."

Hilbertz has also had some interesting notions about habitats that recycle themselves. Architectural evolution