Simply Complex

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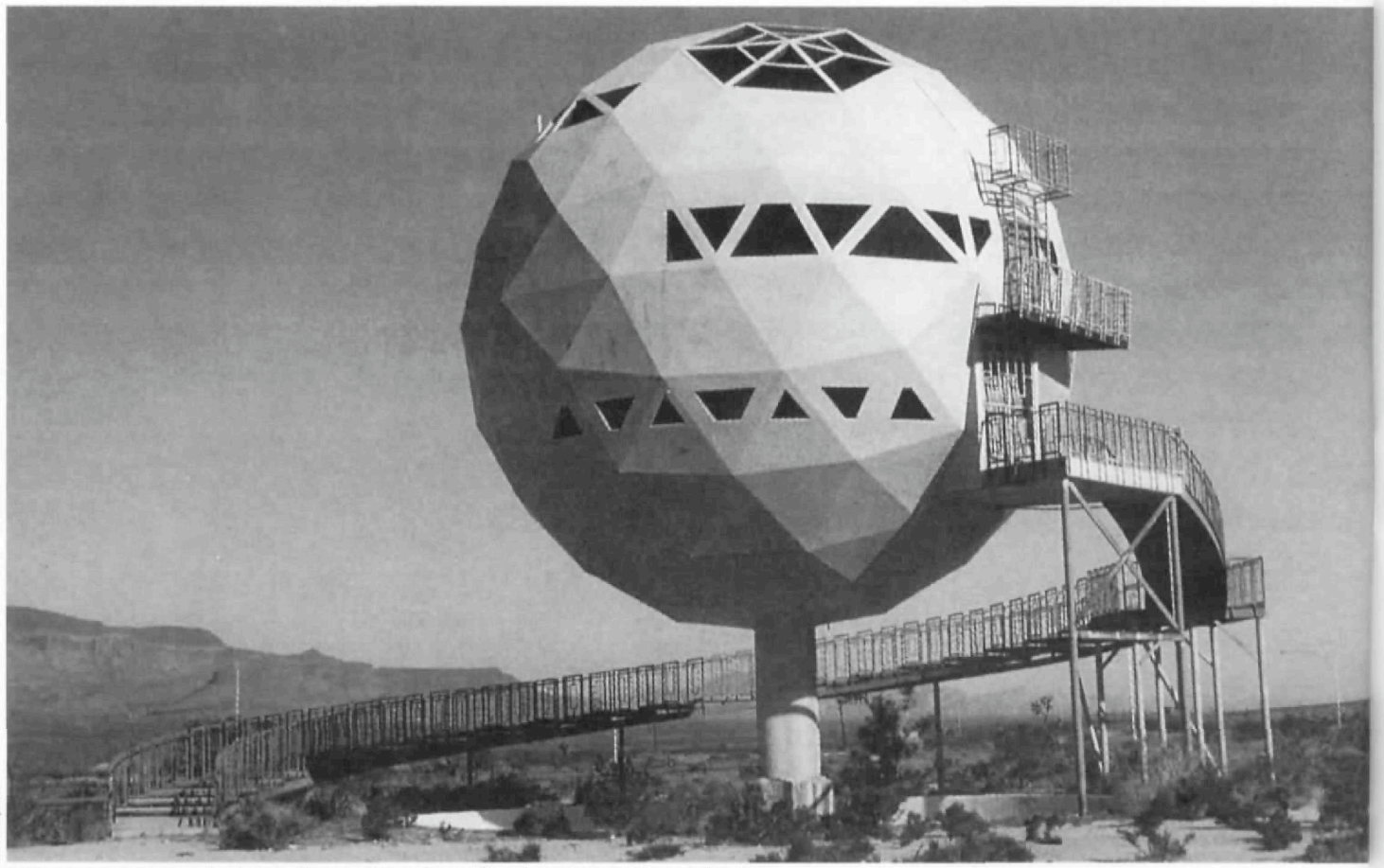

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Combination restaurant, bar, and real estate office, near Yucca, Arizona. Bill Wood (Dyna Domes), designer-builder, 1988.

The Architecture of the Jumping Universe, A Polemic: How Complexity Science Is Changing Architecture and Culture *by Charles Jencks. London: Academy Editions, 1995. 176 pp., illus., $20.*

How Buildings Learn: What Happens After They're Built *by Stewart Brand. New York: Viking Penguin, 1994. 243 pp., illus., $30; $20 paper.*

Reviewed by Danny Samuels

In recent decades, a significant new cross-disciplinary synthesis has developed in science that addresses the basic question, How do order and complexity emerge from chaos? After centuries of predictable, confirmable, linear science based on reductionism — breaking things down into their smallest constituent parts in order to examine them — some scientists have again started looking at the wholes that are greater than the sum of their parts, at the overarching "patterns which connect."

Drawing together the diverse disciplines of physics, mathematics, biology, information theory, and computing into a synthetic approach commonly known as "the sciences of complexity," the new paradigm offers insights into how complex systems — such as an oak tree, an ant colony, a wetland, a brain, an economy, or a city — arise and evolve. In essence, complexity theory shows that all such systems are generated by, and evolve according to, similar kinds of rules.

Complexity doesn't simply happen. Simple elements in simple relationships build up in hierarchical layers, simplicity upon simplicity, until eventually, unpredictably, a system organizes itself and new, complex orders emerge. Once established, a complex system continually draws energy and information from its environment in order to maintain its characteristic form and structure, seeking stable configurations in a context of continual change. Sometimes it will evolve toward ever greater complexity, but the more precisely adapted it becomes to its environment, the more vulnerable it is to a sudden change in the context. In effect, a system coevolves with its environment, one changing and the other responding elaborately to those changes, which then cause more changes, and so on.

Darwinian evolution is a central mechanism in the development of complexity and has now been seen to operate, not just in biology, but in the development of intelligence, culture, and even technology. Evolution is a means of generating vast numbers of alternative designs that are then selected according to their usefulness. The philosopher Daniel Dennett makes the point that every conceivable design, whether natural or artificial, can be seen as existing somewhere within a vast (not quite infinite), continuous space of all possible designs, and that evolution, whether biological or intellectual, is a process for generating possible designs, "for finding good ways to solve the problems that arise," within that space. Furthermore, designs bootstrap themselves to ever-higher levels of complexity.[1] Kevin Kelly, editor of *Wired* magazine, in a book currently making the rounds of the design studios describes how the adaptability, resilience, and autonomy of living organisms are becoming the models for understanding complex man-made systems that are beyond human control, such as the global economy or the Internet. Kelly predicts that in the future, more products, systems, and technologies will be "grown" through distributed evolutionary processes rather than centrally manufactured.[2]

What, if anything, do these trends in scientific thought have to do with architecture? Is a building a complex system? Does it, in any sense, evolve? Of all the foreign banners under which architecture has marched, from existentialism to historicism to semiotics to deconstruction, this, it would seem, is the first that directly addresses issues of form and structure that are intrinsically architectural.

Charles Jencks, ever the evangelist of the next wave in architecture, certainly thinks so. *The Architecture of the Jumping Universe* is intended "to change architecture, not just interpret it." Jencks argues that architecture should represent and interpret our view of the universe; since the universe is now seen to be complex, dynamic, and evolutionary, architecture should at least look (if not be) that way, too. He envisions an architecture "of undulating movement, of catastrophic folds and delightful waves, of billowing crystals and fractured planes, of layered glass and spiraling growth." His approach is to discuss, topic by topic, various areas of complexity science (fractal geometry, nonlinearity, folding, emergence, chaos, Gaia), then to find examples of buildings by contemporary architects (mostly the usual gang, Eisenman, Gehry, Koolhaas et al. — and Jencks, who discusses his own work at length) that seem to embody that idea. Yet his discussion focuses almost entirely on what these buildings look like. What Jencks advocates here is, as usual, an architecture of surface and appearance rather than substance or process.

On the other hand, Stewart Brand's *How Buildings Learn: What Happens After They're Built* really could change architecture, if only students of architecture would read it. Brand, protégé of Gregory Bateson, polymath, media guru, inventor-designer, was a founder in the sixties of *The Whole Earth Catalog*, later of the *CoEvolution Quarterly* (now the *Whole Earth Review*), and recently of The WELL (the Whole Earth computer conference network), and is the author of *The Media Lab: Inventing the Future at MIT*. He lives on a rebuilt tugboat and writes in an office installed in a freight container. Brand has now turned his attention to buildings.

Although he only glancingly refers to any scientific underpinnings for his ideas, Brand exhibits a much deeper understanding of the implications for architecture of current scientific thinking than does Jencks. Brand looks at the real processes involved in creating buildings — design, financing, construction, occupation by the users, energy exchange with the environment, adaptation to changing circumstances, maintenance, expansion, renovation, and reuse — and sees buildings as dynamic, evolving entities that progressively, through the actions of their occupants, "learn" how to adapt to their environments and uses.

Brand traces a number of buildings through their life histories, using historical photographs taken at different times from the same angle to illustrate how astonishingly a structure can change. One comparison that exemplifies his argument focuses on two research buildings at the Massachusetts Institute of Technology: Building 20, a sprawling "temporary" wooden structure built in haste during World War II, and the 1985 Media Lab by I. M. Pei. Building 20, funky, well loved, impossible to destroy, has proved flexible and adaptable to changing research demands over the decades. In contrast, Brand finds Pei's building inflexible, sterile, and pretentious. It has inhibited social exchange among the scientists who use it, thereby locking into a fixed pattern the activities of one of the most innovative research centers in the United States, Nicholas Negroponte's Media Lab (the subject of Brand's 1988 book). This "magazine architecture," says Brand, is meant to look good in photographs — precisely what Jencks admires — but lacks a life of its own. Needless to say, Pei, representing most design architects, comes off as a villain.

Brand's arguments echo and elaborate some of the ideas of Lloyd Kahn, an early cohort who, through his *Domebooks* I and II,[3] almost singlehandedly promulgated the hippie dome-building fad of the

sixties and seventies. The domes employed a radical structural technology; every possible new material was investigated to enclose them and seal all the cracks. Unfortunately, nothing really worked well. The inflexible domes were difficult to expand, furnish, heat, and use, leaked like sieves, and too quickly fell apart. In a 1973 essay, "Smart but Not Wise," Kahn made a public mea culpa and disavowed such "whiteman technoplastic prowess," advocating a return to traditional materials and vernacular building technologies. If you want to build shelter, he said, study how the farmers in the region build, and build just like they do.[4]

In Brand's updating of this pragmatic approach, the first responsibility in building is to provide shelter for human activities. Design the structure and the enclosure to last a long time, with interiors and technical systems that can be changed many times over the life of the building. Trust not high-tech materials and solutions, but rely on what we know works. Keep the water out; make roofs that work for a long time. Maintain and preserve and reuse what we have. Brand argues for common sense in architecture: build buildings that can accommodate multiple scenarios of future uses, can grow, adapt, and evolve. No "delightful waves, billowing crystals, or fractured planes" for Brand; "Be square," he admonishes, because the rectangular, cellular plan is the one that can accommodate change and grow in unpredictable directions. Ironically, being square in building results in being open, fluid, and adaptable.

This idea of architecture is quite conservative, and certainly unglamorous, by current standards. It does not necessarily lead to novel and radical concepts of space and form. Instead, exactly like biological evolution, it follows the wisdom of tried-and-true solutions to problems and makes continual marginal improvements: keep what works and build on it, rather than reinventing everything every Monday morning.

Thus, it occurs to me, a building begins life simply enough. Essentially it is a cellular construction that meets the minimal requirement of maintaining a sheltered, homeostatic internal environment for diverse human activities such as living, working, or shopping. It should be designed in a simple, efficient, and elegant way, incorporating flexibility and adaptability into the design. Then, in time, responding to the needs of its occupants and its changing milieu, it acquires unanticipated and diverse qualities, thereby becoming enriched, with a life and character of its own.

Consider, then, that this simple unit is multiplied many times and woven together, over long periods of time, layer by layer, into a fabric held together by webs of movement, servicing, communication, and flows of capital, and energy. This pulsating fabric is the city. It is emergent, distributed, evolutionary, always in flux, out of control, adapting, shedding exhausted parts of itself, renewing others, growing new parts. In short, the city is alive, and it does indeed evolve toward increasing complexity.

This view of architecture requires a new and synthetic understanding of the relationship of the building and the city: the city as an evolving space of extensive webs and continual flows, the building as a necessary and integral conduit that acquires its changing form by modulating those flows locally. City and building exist together, organism and ecosystem coevolving, continually influencing one another. The dilemma of the architect is that, on the large scale, it is futile to try to control or plan such a complex ecology, while at the local scale, simply to invent unique and novel forms is insufficient and scarcely relevant. Instead, to influence evolving design, we must place ourselves directly into the flows of history and evolution. Only by understanding the intricate forces that shape the forms we find can we hope to inflect them in ever-so-subtle but significant ways. Thus, complexity emerges. ■

1 Daniel Dennett, *Darwin's Dangerous Idea: Evolution and the Meanings of Life* (New York: Simon & Schuster, 1995), p. 586.

2 Kevin Kelly, *Out of Control: The Rise of Neobiological Civilization* (Reading, Mass.: Addison-Wesley Publishing, 1994), p. 521.

3 Lloyd Kahn et al., *Domebook One* (Los Gatos, CA: Pacific Domes, 1970) and *Domebook II* (Bolinas, CA: Pacific Domes, 1971).

4 In Kahn, *Shelter* (Bolinas, CA: Shelter Publications, 1973), p. 176.