An Excerpt from

The Experimenters

Chance and Design at Black Mountain College

by Eva Díaz

BUCKMINSTER FULLER'S EXPERIMENTAL FINISHING SCHOOL

Fuller found an unlikely ally at Black Mountain in John Cage, and in the summer of 1948 they began articulating a model of risk and failure in experimentation that discouraged incremental change in the interest of a nearly libertarian freedom from restraint. Cage, after his first encounter with Fuller, deemed experimentation an American individualist “utilitarianism” as distinguished from purposeful, collective (read: European), and ultimately failed politicizations of form. Superseding that decline, the men jointly proposed a new model of the test as an act of radical transformation by renegade experimentalists, quite unlike the systematic testing of variables characterizing Albers's method. “Comprehensive design”—Fuller's terminology—or “indeterminacy”—Cage's—were couched in language directed against the system of methodically varied modifications in Albers's pedagogy and artistic process. (And yet both men, like Albers, were quite methodical in their approaches to formulating “experiments,” and singularly regimented in their daily lives.)

As Fuller recalled of his first summer at Black Mountain,

> John Cage and Merce [Cunningham] and I had breakfast every morning together out under the trees. And we really did have a very great deal of fun because I spent that summer with them on a fun schematic new school, and I called it “the finishing school.” We would finish anything. In other words, we would really break down all of the conventional ways of approaching school. And “the finishing school” was going to be a caravan, and we would travel from city to city.

It's hard not to read Fuller and Cage's iconoclasm about the “finishing school”—itemizing “all of the conventional ways of approaching school”—as both triggered by and directed against the existing experimentation models endorsed by German émigrés at Black Mountain. Though Fuller was sympathetic to Albers, calling him a fellow “experientialist,” he found Bauhaus architectural design misleading in its claims of engineering structural innovations. When in 1955 Fuller was asked by John McHale of the London Independent Group if Bauhaus ideas had influenced his work, he testily replied, “I must answer vigorously that they have not.” He isolated two major methodological differences separating him from Bauhaus predecessors. First, he believed in the teleological nature of technological innovation as an “absolute principle”—as he claimed, “The more you used technology, the more it improved.” Second, his model of experimentation emphasized the construction and operation of structures as opposed to buildings' aesthetic appearances. He decried the “international style thus brought to America by the Bauhaus innovators,” which operated “without … knowledge of the scientific fundamentals of structural mechanics and chemistry.” In sum, “they only looked at problems of modification of the surface of end products.”

Upon his first visit to Black Mountain, Fuller's distance from Bauhaus precedents was immediately noted. As Elaine de Kooning commented, “Bucky, with his emphasis on how things *worked* and his total disregard for the Bauhaus concern with design—with how things *looked*—was a bit of an irritant to the regular faculty.” Snelson, for his part, soon realized that the geometric models Fuller was testing—experiments

“By parsing three different versions of experimentation—performed by Josef Albers, John Cage, and Buckminster Fuller—Díaz shows us how their individual efforts were part of a shared commitment to art's capacity to reinvent the world, to alter how we see, experience, and shape it in our own image. In the name of experimentation each of the artists suspended, if only for a moment, the metrics of failure and success, and replaced them instead with the values of intellectual pleasure, expanded sensory experiences, and aesthetic innovation. While the book is undoubtedly a historical account of a particular time and place, it is also a road map for many paths that, while not taken, still remain open.”–Helen Molesworth, Museum of Contemporary Art, Los Angeles

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that had emerged from close study of the structural properties of tetrahedrons and spheres—would produce architectural forms very different from the basic Bauhaus unit of the cube. He credited Fuller with demonstrating that in most design, "how you occupy space with architecture … has nothing to do with structure. And it became clear to me what kinds of experiences or experiments you had to conduct before you know what a structure really is … because it's a result of forces which can form stable systems… . That's what I got from Bucky, quite opposite to the loose notions of structure that the Bauhaus ideas were involved with." For all Bauhaus members' interests in axonometric projections and dynamic geometric perspectives, to Fuller these were merely static representations; instead, he foregrounded architectural forms as embedded in systems (transportation, energy, mediatic communication, and so on) seen holistically and as functions of society's total needs.

Upon closer examination, Fuller's emphasis on the "experimental" as tests of total systems can be situated within a cultural lexicon that had in fact emerged at the Bauhaus just a few years earlier. His philosophy of efficiency, and the economy of resources and labor, echoes that of Bauhaus practitioners, much like what Albers had earlier called the "ratio of effort to effect." In Albers's version of experimentation, reduction to the fundaments of form (and form was always understood in its structure *and* appearance, despite Fuller's stereotyping of Bauhaus methods other wise) was a way to induce complex comparisons between subtle variations often overlooked in "macro" judgments. Yet to Fuller, the goal was not reduction and economical presentation—"less is more," one could say—but rather the effective employment of existing resources to appear and function greater than their parts—that is, synergistically. As he wrote, "The whole strategy of [the] artist–engineer initiative comes under the head of progress by comprehensive simplification, by constantly *doing more with less*." "Doing more with less" implied efficiency at the level of labor–saving technologies and in the interest of ever–increasing technological productivity, not in order to think of production processes themselves as human endeavors worthy of close study and complex attention. In this, Fuller's emphasis on systemic rather than formal concerns can be clarified by comparison with the work of László Moholy–Nagy, Albers's partner (and sometimes antagonist) in teaching the required foundation course at the Bauhaus.

Moholy–Nagy had been a member of the Bauhaus faculty from 1923 to 1928 and went on to found the New Bauhaus in Chicago (ID, where Fuller himself taught during the academic year between his summers at Black Mountain). Exact contemporaries (both were born in 1895), Moholy–Nagy died of leuke mia in 1946, two years before Fuller arrived at ID. Though they never worked together directly, in important ways Fuller's deductive experimental model, which edged design toward a vision of a new technological utopia, overlapped with Moholy–Nagy's ambitious project of experimentation as radical technological innovations undertaken by artist–designers.

Moholy–Nagy called for a culture of artistic production, driven by scientific advancements, that would reject disciplinar y specialization while understanding the designer's responsibility to the total system of society. Like Fuller, he wanted to reclaim science from its misapplication by specialists; as he wrote in his 1938 book *The New Vision: Fundamentals of Bauhaus Design, Painting , Sculpture, and Architecture*, "Specialists—like members of a powerful secret society—obscure the road to all–sided individual experiences." Instead, Moholy–Nagy saw design as "an integration of intellectual achievements in politics, science, art, technology, in all the realms of human activity… . Our time is one of transition striving toward a synthesis of all knowledge." His emphasis on cross–disciplinarity was similar to what Fuller would soon be defining as comprehensive design. To Moholy–Nagy, this disciplinary fusion could be accomplished by the universal application of technological innovations. As he contended,

> The possibilities of the machine—with its abundant production, its ingenious complexity on the one hand, its simplification on

> the other, had necessarily led to a mass production which has its own significance. The task of the machine—satisfaction of mass requirements—will in the future be held more and more singly and clearly in mind… . Invention and systematization, planning and social responsibility must be applied in increased measure to this end.

Systematization allowed designers to categorize the structure and function of materials, as opposed to manipulating superficial characteristics that might in fact be quite subjectively understood. Altering the mere appearances of forms facilely disregarded the complexities of production; Moholy–Nagy claimed that the artist "today knows usually very little of engineering problems … nothing about statics, mathematics, technology, although an understanding of these would be more helpful than aesthetic rules in suggesting an efficient working method." In art, for example, dynamic, not static elements of forms should be accentuated, a result Moholy–Nagy referred to as "equiposed sculptures," in which volume and material were unified in balanced yet mobile systems. With such objects, "the path to the freeing of a material from its weight" could be found. The equiposed sculpture not only brings "more and more new single pieces into relation," it expands the notion of sculpture into its environment, and "demonstrates the whole borderland lying between architecture and sculpture."

The second–to–last image of Moholy–Nagy's *The New Vision* is striking in how it posits structural lightness—material freed from weight—as an inherently positive social value (fig. 3.13). The photograph, taken in 1926, depicts a dozen or so men balanced on a soaring, intricate lattice of triangular struts; the caption indicates that they are constructing the framework for the Carl Zeiss planetarium in Jena, Germany. The description continues: "A new phase of our victory over space: men poised in a swaying open network, like airplanes flying in a formation." As was the case for Fuller, Moholy–Nagy's vision of lightness as the new, universal property of modern construction linked engineering innovations to unified yet networked social design. The ability of technologically advanced structures to represent, metaphorically, the interconnected matrix of social systems was key. Like Fuller's dome designs, whose shape simultaneously referenced the enclosure of domestic life, kiosk–like community shelters, and the networked systems of Spaceship Earth, Moholy–Nagy's networked forms could inspire a "universal outlook" that would posit design improvements as part of a pattern of growth applicable to the whole of society. The artist–designer would deal above all with information and its representation; in an issue of the journal ANY devoted to Fuller it was noted, "The ability to gather and coordinate vast amounts of information enables the designer to deal once again with the 'design of the whole.'"

Figure 3. 13

Network Lattice–Framework for a Zeiss Planetarium, n.d. Reprinted in László Moholy–Nagy, *The New Vision: Fundamentals of Bauhaus Design, Painting, Sculpture, and Architecture* (Mineola, NY: Dover, 1938/2005), 203. Source: Zeiss Archiv.

To Fuller and Moholy–Nagy, architecture was hybrid in many ways, most essentially so when it provided shelter while managing the representation of networked resources. In particular, Fuller envisioned the dome as itself a net–worked building—a site connected to real–time information feeds updated in various media. One can see this sensibility encapsulated in his 1962 “Geoscope” proposal, a precursor to today’s “digital globes.” The Geoscope was envisioned as a two–hundred–foot–diameter spherical display covered with colored lights.

Fuller planned to have the enveloping space—literally, the environment—of the Geoscope updated with networked information, data that would allow individual spectators to visualize, study, and possibly redesign the total human ecology in order to quickly and efficiently apportion resources globally.

In contrast to Fuller, Moholy–Nagy envisioned planning on a centralized and collective level, and called for workers’ control of industrial capital for the benefit of all. Yet like his American counterpart, he believed that the benefits of technological gains could be extended to many more individuals through socially transformative educational experiences. Training subjective awareness about perception through group exercises and individual assignments could make the larger public proficient in complex visual and structural phenomena. Education could therefore allow students to understand the components of form in order to rethink the structural constitution of problems, rather than letting solutions be executed from habit or tradition. Additionally, education was a process in which outcomes were unfixed (as they would not be in industry) and therefore allowed for greater experimental freedom. Both Moholy–Nagy and Fuller invested heavily in their respective pedagogical efforts, and in some ways one could consider design for these men as a polemical project of shaping minds.

Gyorgy Kepes, Moholy–Nagy’s colleague at ID, also believed design pedagogy was the key to representing complicated variables as intelligible patterns rather than as static objects, so as to train a new and unique breed of designer. As historian Reinhold Martin has commented, for Kepes this new designer “was, in effect, a new social type, bearing a humanistic, universal outlook, an evolutionar y adaptation capable of managing the reorganization of vision for the benefit of humanity as a whole.” Encouraging this universal outlook while teaching at ID and later at MIT, Kepes connected design with other visual systems, increasingly, marketing and product design. Thus, for both Kepes and Moholy–Nagy, systems–based analysis depended on the training of visual perception, which linked their models to Albers’s and others from Bauhaus. This perceptual emphasis recedes in Fuller’s model, as the focus on structure over appearance produces judgments of dynamism linked more to engineering than to vision.

In 1956, Kepes invited Fuller to contribute to *The New Landscape in Art and Science*, a book he was assembling that set out to synthesize and systematize the whole of scientific and aesthetic knowledge around the concept of organizational patterning. Primarily a visual compendium, *The New Landscape* featured images of Fuller’s geodesic dome and other recent inventions, along with objects by Charles and Ray Eames, Le Corbusier’s modular figure, and all manner of microscopic and magnified images from nature, such as snails’ tongues and the Crab Nebula—examples of the harmonious unity of nature organized around morphologies of repetition and networked structure. Kepes later invited Fuller to submit an article to a collection of essays he was editing titled *Structure in Art and in Science*; according to Kepes, the volume would provide a “structure of structures” in order to focus “the power to see our world as an interconnected whole.” In Fuller’s contributed essay, “Conceptuality of Fundamental Structures,” he argued, after musing on the complex math of bubbles and other closely packed spheres, that nature does not “do what we call fudging of her design which means improvising.” Instead, it is the artist who could reveal that mathematical constants such as pi—an irrational (not fractional), transcendental (without end) number—are merely models to help us understand the world, and that patterns beyond calculation exist in nature. Kepes characterized Fuller’s essay as providing “an inspiring bridge between our comprehension of the structural principles of nature and the potential application of this knowledge to creation of man–made forms.” It was this potential for detecting and understanding patterns shared by natural forms and artistic and architectural constructs that Kepes viewed as the communicative prospect of experimentation and a vital educational tool in Fuller’s work.

In his post–Black Mountain College writings, Fuller increasingly emphasized design pedagogy, but for him a student’s understanding of dynamic structures and the way they relate to social problems could emerge only through heuristic experimentation rather than the focused perceptual training advocated by Moholy–Nagy and Kepes. In contrast to the deductive (and predictive) methods of his own comprehensive teleological social planning, Fuller believed that laborator y teaching methods ought to involve a freedom to try out responses to problems without regard for success—what he termed “intuitive probing ” in his Kepes essay. To achieve this, he discouraged students from concentrating on surface appearances; as he wrote in 1948, “I am particularly anxious *not* to ‘picture’ in advance the nature of logical solutions (á la Beaux–Arts programs), thus leaving the student only those superficial tasks of decoration or assemblage of preconceived components.” He derogated the language of visual form (note the deployment of “pictur[ing]” as a negative value leading to rote “superficial” and “decorative” work). To him, open–ended experimentation without repeated trials allowed students to invent a variety of possibilities that a narrower focus—as Josef Albers re quired —would foreclose, while still demanding the intense examination of a problem in which the stakes were as high as people’s lives: “[As] in aircraft technology, nothing is taken for granted.” Free experimentation was encouraged because Fuller’s system was so encompassing, so universal, that its operations required wide–ranging tests to keep pushing toward a horizon of complete and finite knowledge. As he explained, “Instead of a teaching methodology successfully employed in the past, I assume that all past undertakings are in some degree obsolete, as the total environment of the technical frontier is constantly providing improved means.” By discouraging study of the visual appearance of form, in his pedagogy he emphasized the benefit of leaping to connect form to its social utility.

In this sense, too, failure became the essential feature of experimental pedagogy and design; failure represented the freedom to stumble on the unforeseen. As Fuller declared,

> Design must imagine and discern … in as informed a manner as possible. Design, however, cannot guarantee its results. Failure … provides pivotal data for the efficient designer… . Failure in design is honourable, in science and engineering it is found to be mark of incompetence and failure in politics and finance is ruinous.

He regarded the ethos of speculative experimentation, and its risks of failure, as reflecting the process of personal growth and transformation possible in education itself, and to some extent as helping to shed preoccupations about immediately determining a work’s success. Every experimental failure yielded data and therefore revealed the rules and patterns underpinning the test. The Supine Dome typified his experimentation model; it allowed tactical failures as part of a larger strategy and emphasized the dynamic process of educational risk, not the success or failure of the discrete form of a single dome. For Fuller, alleviating struggles for scarce resources demanded uncovering the principles of a perfectly ordered world of predictable outcomes that could be revealed through experimental verification. As he remarked in 1949, the “integration of a complex series of failures represents the only means of attaining from nature” a plan about where to go next. “Nature” would reveal its elusive secrets only after a prolonged campaign of discovery, each failure reinforcing the experimental methodology and yielding more data about the overarching system.

In Fuller’s sometimes over weening confidence about the inevitable acceptance of his Dymaxion and dome designs, an important pedagogical precedent is found, despite and sometimes because of these inventions’ often spectacular and highly publicized failures. His work represented an influential model for how students could—before they were tracked into disciplinar y specializations—think holistically about their own roles in shaping a better and more just society. Although his methodology was cloaked in the flamboyant, self–important, and sometimes baffling rhetoric of his verbose written tracts and pseudoscientific neologisms, Fuller’s inventions, and his discursive construction of experimentation as not incompatible with failure, continue to influence a diverse array of practitioners in art, architecture, design, engineering, and science (a class of dome–shaped carbon molecules has even been named for him).94 He sensed dangerous cultural decline in specialists’ inability to act in concert toward macro–level planning, and spent his long lifetime proposing alternative collaborative models between disciplines. His justification for risk, and the acceptance of failure as contributing to “systems–level” thinking, proved irresistible to those attending the 1948 and 1949 summer sessions at Black Mountain College. As John Cage paraphrased Fuller, “I learn much more when I have a failure than when I have a success.”95 Beyond Black Mountain, his “failureas–risk” formulation influenced students of future generations as he became a sought–after speaker on the college lecture circuit by the 1960s. Yet instead of his dream of a technological utopia, it was the paradox of self–declared success in the face of apparent failure, of an experimentation model accommodating individual setbacks for the good of the larger holistic program, that is perhaps Fuller’s greatest contribution to pedagogy and design teaching. To accomplish this holistic program, his “design revolution” had to be cleaved from political connotations, and technologically determined functionalism substituted for the vicissitudes of political action.

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The Experimenters : Chance and Design at Black Mountain College
© 2015, , 20 color plates, 58 halftones
Cloth $40.00
ISBN: 9780226067988
E-book $10.00 to $40.00
ISBN: 9780226068039

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