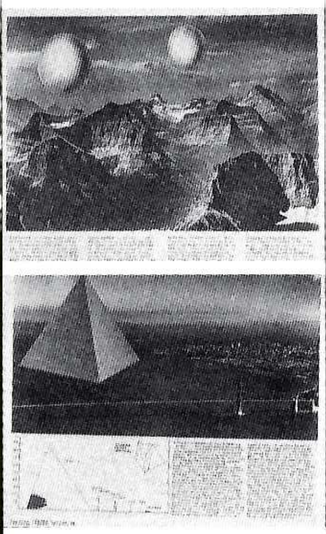
PLANETARY

Richard Buckminster Fuller, who surrounded himself with statistics, models, and five-hour lectures, was first and foremost an artist, an image maker. Despite his professed disinterest in the look of his projects, each is an artistic manifesto. All the layers of science are carefully organized to produce an aesthetic effect. Science is deployed as an art form. Not just any art. The art of housing. More precisely, the art of ecology.

Consider the photomontaged megastructures that Fuller and Shoji Sadao design in the early 1960s. The Tetrahedronal City of 1965, a monolith with sides of 3.2 kilometers and a million passengers, can anchor anywhere in the ocean. The Cloud Nines of 1961, giant spheres one kilometer in diameter, carry thousands of people around the world and



(Top) Cloud Nines, 1961
(Bottom) Tetrahedronal City, 1965

occasionally anchor themselves to a mountaintop. Both are images of huge floating houses conceived from an ecological point of view. They extend the 1960 proposal to house a million people more efficiently by planting a two-mile-diameter dome on the unsuspecting island of Manhattan. For Fuller, the buildings of Manhattan are "but crops in a farm that needed to be rotated, turned over, ploughed under, and the elements reused and replanted, recycled into a new crop." The dome is meant to exhibit both the recycling of materials and the recycling of ideas, an ecologically balanced physical environment and an ecologically balanced environment of design thinking.

The success of this famous image – which Fuller energetically launches at a Midtown press conference, lectures on all over the planet, and promotes in numerous interviews and articles – does not simply derive from the sophistication of the photomontage or the sprawling technical polemic in which it is imbedded. Both give a sense of realism to the project, making the translucent dome appear to be more than an image, more than a fantasy. They suspend the viewer between fantasy and reality, leaving the sense of a fantasy realized. But the geodesic dome always remains a fantasy. No matter how many thousand domes have been built, the dome structure is, above all, an image, the image of a single world, following the single world/single house/single family polemic that Fuller cultivates throughout his career. He portrays the planet as a house for a global family and each family house as a surrogate planet. It is not by chance that so many of his projects take the same shape as the planet. The Manhattan dome is but the tip of a spherical iceberg, an ideological formation that still shows no signs of melting.

BLUEPRINTS FOR A FLUID IMAGE

This concern for a singular domestic image of the world is most explicit in Fuller's lesser known Geoscope project that transforms his geodesic structures into a literal image of Earth, a transparent sphere onto which Earth's geography is precisely marked. It is a new kind of mirror. People see themselves in their total environment for the first time. Because the Geoscope is fixed in the same orientation as the planet it simulates, the observer standing at its center sees the stars in their exact location above each geographic point and feels the planet's spinning trajectory within the starscape. The sphere's surface is graphically encoded with layers of information about the planet to produce a hypermap, a totalizing view that is unavailable with any other technology of representation. Fuller argues that the most efficient form of analysis of complex data is visual and offers the Geoscope as a mechanism for producing visual images of an otherwise invisible global scene, a compact accounting of planetary flows. Diverse interacting phenomena become aesthetic patterns. Constant observation of these patterns will supposedly enable a more equitable distribution of resources.

Fuller promotes the Geoscope in 1961 at the sixth congress of the International Union of Architects (UIA) in London, arguing that architectural schools around the world should study how to "render" the total resources of the world. Looking for a "dramatically communicated solution" to act as the focal structure of a major world city, as the Eiffel Tower does for Paris, he passes up on the possibility of using the entire facade of a skyscraper or mountain cliff and proposes that the rendering be a 200-foot-diameter globe which inventories all available planetary resources and their historical movements. Schools are to develop working models and photograph the resulting "data array" for an exhibition at the 1965 UIA congress in Paris. The mission: to launch a 10-year effort on the part of the international architectural community to design the means to reallocate global resources.

Architecture's institutional involvement with the Geoscope actually begins in the early 1950s. Fuller moves from school to school, and a series of increasingly sophisticated prototypes develop. The idea is to build up a comprehensive data display out of layers of information located within the flat surfaces that define a geodesic globe's surface. The challenge is to perfect both the surface and the lightweight structure that held it in place. The structure develops much more quickly than the surface. Fuller already established the key geodesic principles when he first formulats the project, but the imagistic surface was to remain somewhat speculative. By the time he is able to persuade the executive committee of the UIA to formally adopt his proposal in 1962, he predicts that:

predicts that:
Its interior and exterior surfaces could be symmetrically dotted with ten million small variable intensity light bulbs and the lights controllably connected up with an electronic computor [sic]. . . . At 200 ft. minimum distance away from the viewer, the light bulbs' sizes and distance apart would become indistinguishable, as do the size and distances between the points in a fine half tone print. Patterns introduced into the bulb matrix at various light intensities, through the computor, would create an omni-directional spherical picture analogous to that of a premium television tube – but a television tube whose picture could be seen all over its surface both from inside and outside.

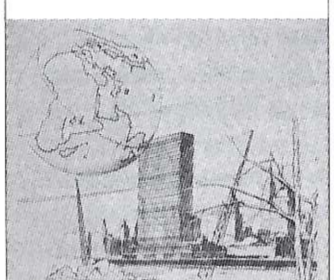
HOMEBOY

Mark Wigley

The Geoscope is a glorified television set. This 200-foot TV does not sit in your living room. It is your living room. Furthermore, everybody's house is inscribed in it. The scale of the sphere is determined by the fact that at that particular size each individual house on the planet is discernable as a 1/100 of an inch speck on 35mm aerial surveillance images spread across its surface. Fuller calculates that if you look at the sphere from 1000 feet with good binoculars, your house but not your car would just be visible. The representation of the global house is only possible at the moment that it can account for every single house. It is reliant upon both a new lightweight structural system and a new sophistication in surveillance photography, the ability to register a certain level of detail on a certain kind of film.

The Geoscope is born of a technological advance in dense imagery. A detached house finally becomes larger than the grain of the film. You can only see the outside of your own house, the world outside, when every other house is visible. The modern architect's dream of bringing the outside in and taking the inside out makes a quantum leap. The goal is "to afford the viewer a swift and comprehensive awareness of man in the universe, to provide a World View." The world in a glance. By providing such a total picture, the huge TV set redefines architecture. It becomes the paradigmatic architectural project, transforming the world into a single space, an interior with a domestic economy to be regulated.

Fuller nominates two possible sites to the UIA. The Geoscope could be installed as the central urban focus for whatever city is holding the Olympic games and then reinstalled in each successive sponsoring city. Alternatively, it could be permanently suspended

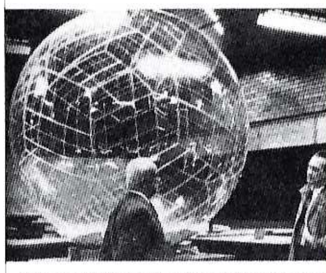


Geoscope over the East River, 1955

on wires over Blackwell's Ledge, a set of rocks in the East River directly opposite the United Nations headquarters, to "serve as a constant confronter of all nations' representatives of the integrating patterns, both expected and unexpected, occurring around the face of man's constantly shrinking 'one world town.' "

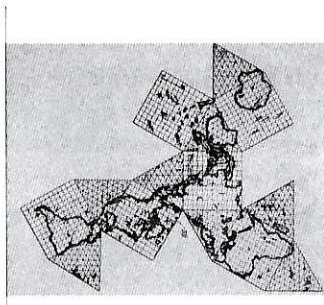
As with the contemporary two-mile-diameter dome project, Fuller focuses on Manhattan because it is the international center for the production and redistribution of images, the world's "most concentrated pattern-processing and exchanging center," as he later puts it. Elevators lift people up (from ferries, bridges, or tunnels) into the center of the Geoscope where they witness the presentation of stars, satellites, earthquakes, electromagnetic and astrophysical patterns, economic, demographic, and sociological displays, or world news 24 hours a day, with all the images being generated in a remote computer housing. Fuller presents the $10 million project to the secretary general of the United Nations, U Thant, who apparently likes the idea and organizes Fuller's subsequent presentation of it to all the ambassadors in a New York hotel. Half of them attend. Nothing comes of it.

The rendering Fuller presents is by Winslow Wedin, a University of Minnesota architecture student. A group of his fellow students worked on the design under Fuller's supervision, detailing a 160-foot-diameter Geoscope with a weight of 35,000 pounds to be hung over the East River on ten cables strung from five poles so that "it will almost look like a big ball hovering low over the earth." The project is part of the three-year "Design-Science" program launched at the School of Architecture in 1954, with Fuller attending for a number of weeks each year. After numerous calculations and a small test globe, 30 students build a "pilot



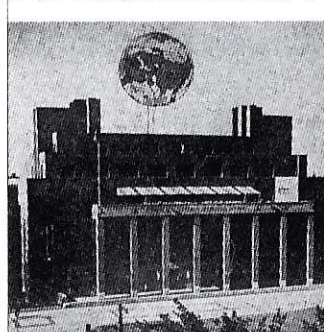
Fuller and John McHale in front of University of Minnesota prototype Geoscope, 1954

model" with an 8-foot diameter and a transparent surface of acetate packed with global information arranged on triangular vinyl sheets marking every small lake, river, railroad, and highway. Their goal is to build a 50-foot-diameter "Minni-Earth" and install it atop a university



Dymaxion Map, patent drawing, 1944

building with a stairway to its core passing through the Indian Ocean. The sphere would contain 2,160 triangular openings in its surface corresponding to each of the triangular subdivisions of



Photomontage of Geoscope suspended on steel wires over University of Minnesota building, *Architectural Record*, 1957

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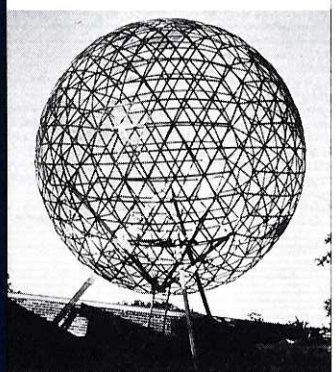
the Dymaxion Air Ocean Map of 1943 recently revised by Fuller and Sadao. Each opening accepts an easily removable 5-foot-deep triangularly sectioned drawer (a truncated tetrahedron), producing an interior sphere of 40-foot diameter to represent the earth's surface (at 1 to 1 million scale) and a five-foot depth to represent the successive layers from ocean floor to outer atmosphere. The



Cornell Geoscope on roof of Rand Hall, 1952

silhouette of all landmasses and geopolitical organizations are drawn "as an open lace like pattern" on the inner surfaces and the drawers are sectioned into concentric layers to display information. Neon tubes and colored lights provide a "spectacular display" of global events to be followed "like a great big baseball game," as Fuller describes it to one reporter toward the end of 1955. The proposal is well publicized in local newspapers, and at the end of the three-year program, **Architectural Record** summarizes the recently completed "preliminary studies," publishing a photomontage showing how the sphere would look on the roof of a Minnesota campus building alongside Wedin's rendering of the U.N. proposal.

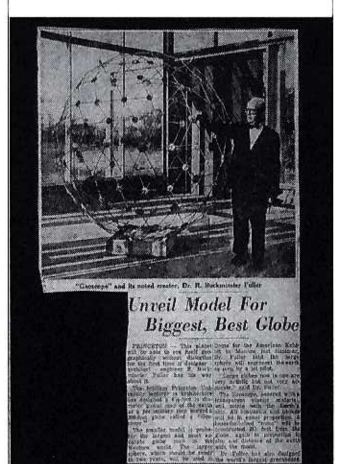
The proposed rooftop Geoscope develops an earlier prototype at Cornell University. In May of 1952, a group of Fuller's students (including Shoji Sadao) assemble a 20-foot-diameter wooden geodesic sphere. They paint it blue, cover it with chicken mesh, and weave in strips of bronze-colored screen to mark all the landmasses. The sphere is installed on the rooftop of Rand Hall with Ithaca at top center to give it the same orientation as the earth and thereby "a true picture" of the planet when viewed from the inside.

The sphere attracts considerable publicity. Newspapers cover it closely and speculate on its symbolic meaning. It makes the cover of **Gentry** magazine and two photographs are promptly published as Fuller's "latest discovery" in **Fortune** alongside images of Fuller energetically lecturing to the annual Aspen design conference. The sphere is supposed to be a permanent installation but on October 31, a week before **Life** magazine's extended photo shoot is to take place, seven students decide to move it to a quadrangle as a Halloween stunt. They climb up a nearby elm tree, saw through the wooden tripod, and cut the securing wires. The "delicately balanced" 200-pound sphere falls to the roof, crushing the bottom third. Taking the action to be that of a "fanatic" attempting to steal the project, the 10 students who built it write to the editor of the local newspaper, noting the "considerable skill" with which their "inside-out planetarium" had been destroyed while lamenting the loss of "good publicity" for Cornell, the College of Architecture and, "above all," Fuller. The demolition experts are soon identified. They claim to be unaware of "the material and intrinsic value of the sphere" and offer to help reconstruct it, but the administration soon announces that the sphere sustained damages beyond repair. The original student team reassembles it as a hemisphere on a raised platform in a more accessible site to demonstrate Fuller's idea of geodesic structure rather than the Minni-Earth concept.

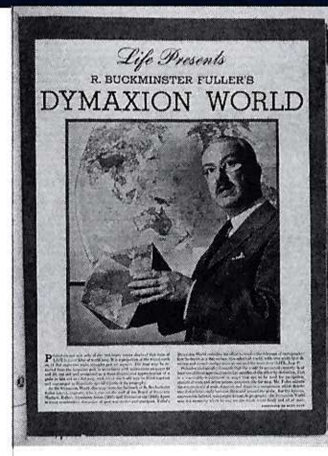
In fact, the two ideas are inseparable.

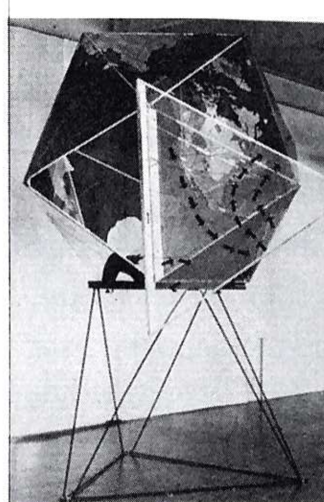
When 15 students at Princeton University build Fuller's first large discontinuous compression sphere a year later, for example, the 40-foot sphere is publicized as "a sort of scale model of the world, at 1:1,000,000." Fuller's spheres are always surrogate planets. Indeed, he describes earth itself as a "tensegrity sphere." The Geoscope simply exemplifies his overall mission to transform the discipline of architecture by reconfiguring the relationship between structure and image, as becomes clear when the ongoing Geoscope project makes another leap forward at Princeton in March of 1960. Twelve students construct an 80-inch transparent sphere of clear vinyl plastic (supported on a geodesic aluminum structure) onto which a triangulated map of the world is printed, with revolving sputniks to be added later and a baseball-sized moon to be put on top of a building 213 feet away. As soon as the basic structural frame is completed, Fuller has himself photographed beside it and makes a series of newspaper statements promoting it as the largest and most accurate globe map in the Western world (sufficiently accurate information on the Soviet Union not being available). The ultimate goal is still the 200-foot version with which "the dream of all geographers will be realized. A mapmaker will then be able to look on his globe and find a dot representing his house." **The New York Times** cites Fuller's prediction that the Princeton prototype will "help architects plan their work in a larger perspective." **The New York Herald Tribune** publishes a photograph of an excited couple looking up at the completed globe, announcing that it "may well revolutionize our understanding of the planet in which we live." The little sphere carries a heavy load.

Four years later, John McHale, Fuller's first biographer, publishes an article in **Architectural Design** focusing on the prototype recently completed by 11 volunteer students under his direction at the University of Colorado. As when Fuller first published the Dymaxion Map as a do-it-yourself globe kit in a 1943 issue of **Life** magazine, McHale's team folds the map into a small icosahedron. It is formed by faces of sandwiched thicknesses of Plexiglas. Layers of information on Mylar sheets are inserted between these triangular surfaces or above and below them on additional



Princeton Geoscope, New York Times, 1960





(Top) Fuller holding Dymaxion Globe, Life, 1943 (Bottom) University of Colorado Geoscope, 1964

surfaces supported by telescoping extension tubes. This layering of "data planes" (along with hinged planes at right angles providing sectional information where needed) produces a complex record of atmospheric, ground, and subterranean conditions. The dean of the School of Architecture describes the dynamic display as "architecture in the broadest sense." It is by far the most sophisticated of the prototypes for a new conception of architecture as fluid image.

Twelve years of research have gathered momentum. The planned exhibition of Geoscopes for the UIA Congress takes place in the Tuileries Gardens in July 1965, then another two years later in London's Bloomsbury Square. Many schools take part. A public "Think In" optimistically restrategizes the millennium. The year 2000 becomes the target for revolutionary change.

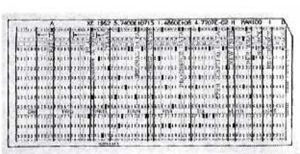
THE ART OF THE INVISIBLE

In fact, the exhibitions are not a big success. Even the best prototype falls far short of the dream. As a test of the "dramatic picture" the Geoscope should present, McHale films the dynamic trends in human population since 4000 B.C. at 30 years per second against the

'sing, cf. Womb of Permitted Ignorance. – Fuller, SD **ARCHITECTS:** They know how to draw, but they don't know how to design an airplane. – Fuller, quoted in David Jacobs, "An Expo Named Buckminster Fuller," New York Times Magazine, April 23, 1967 **ARCHITECTURE:** Architect

Dymaxion Map, arguing that ideally the data ought to be electronically recorded and retransmitted by precisely mapping it to coordinates on the triangular surface on which it is displayed, thereby enabling his small Geoscope to be linked on-line to similar ones in schools around the world. With each successive prototype, Fuller and McHale end up focusing on such technologies of representation, studying multiprojection devices, flat screen data displays, triangular-faced television tubes, new kinds of photography, multislide machines, microfilm, eight-millimeter cinema units, videotape mechanisms for film or data storage, and so on. They deploy state-of-the-art image making, storing, and distribution, while dreaming of the 200-foot version that will be made possible by much more advanced forms of computer and display.

The vision of an all-powerful computer that drives the project from the beginning only starts to be realized in 1962 when McHale becomes director of the newly formed World Resources Inventory, which takes over responsibility for the project. Based at Southern Illinois University in Carbondale, where Fuller had been teaching since 1959, it uses the campus to coordinate and expand all the data from his many previous attempts to inventory global resources. An idealistic image of the computer network underpins the series of six documents McHale edits for the World



Computer card from World Resources Inventory program, as published by John McHale in the second document

Resources Inventory between 1963 and 1966. Fuller, outlining the project's overall agenda in the "The Design Initiative" of 1964, calls for the "general extension of dynamic network operating principles into formerly 'static' areas of environmental control both internal and external." McHale elaborates the point a year later in "The Ten Year Program," insisting on the prosthetic extension of the body and the mind with the latest technologies. This "organic extension is exemplified by communication electronics and the computer. Their exponential miniaturization "towards invisibility" and increase in power approaches the "dimensional complexity and performance per unit of nature itself." The ability to gather and coordinate vast amounts of information enables the designer to deal once again with the "design of the whole." In a series of accurate predictions, McHale argues that sketching directly onto the display with a lightpen will allow all design-work to be done on a computer that will then directly control the production and distribution of whatever is being designed. The computerized designer becomes an "overall 'systems' and 'pattern' creator."

Once again, the dominant criterion is aesthetic. It is all a question of "pattern." Science makes possible a new form of art. Or, rather, science is the means of art's survival in an exponentially expanding and confusing world, the means of detecting or imposing pattern on apparently chaotic flows.

Fuller uses the third document in the series, "Comprehensive Thinking," to advise "the design-science artist" that the technological extension of the human body into the farthest reaches of the electromagnetic spectrum will lead to a historical era of "invisible architecture" that is only detectable by an aesthetic instinct located somewhere between the unconscious and the conscious. As in the formal tradition of aesthetics, his model of this instinct is the appreciation of the female body: "the subconscious measuring capability of man's eye to judge, at considerable distances, to a sixty-fourth of an inch accuracy, the diameter of the female leg." Throughout his career Fuller employs sexual analogies, associating each of his discoveries with the arrival of a new sexual partner and even making graphs of his own sexual activity. The world of high technology is an erotically charged body. When the document goes on to describe his work on the "ecological problems" of lightweight geodesic domes, it is as if the goal of comprehensive design is a spontaneous discharge of sexual energy in the face of a visual image that walks right out of the nonvisual realm of calculation:

I deal with the hows of mathematics and economics, the hows of industrial production and distribution, assembly, and service. I don't even consider how any structure is going to look until after it is finished. If, when finished, the structure seems beautiful, I know it is all right. To me "beautiful" apparently emerges as an ejaculation, spontaneously released by my total set of subconscious control coordinates. "Beautiful" is probably ejaculated when my entire chromosomic neuron bank is momentarily in "happy" correspondence with my entire experience (memory) neurons bank. I speak of my brain as if it were a computer. It is.

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Likewise, a massive computer will enable the Geoscope to extend the controlling gaze beyond the visual, offering a visual image of the nonvisual world's architecture, an image as intoxicating as a well-organized chart, a veritable erotics of statistics.

The computer is to be the basis of a new and attractive architecture. McHale argues that the Geoscope takes advantage of the networks that exist "embryonically" in universities, libraries, international agencies, and communications infrastructures to transform university institutions and deemphasize the role of buildings. The network itself becomes the architecture of the university. Like Fuller, McHale adopts the cybernetic account of the production of knowledge, insisting – in a 1966 article on the possibility of a global university orchestrated by communications satellites, transistor radios, telephones, and television sets – that computers will facilitate the emergence of "world men" that "are not confused by the explosion of information about the earth and its peoples but are able to conceptualize this whole as easily as one previously conceptualized one's hometown, neighbors and surrounding country." The computer is the new means of domesticating the planet, satisfying the old demand for information to be converted into knowledge by being "simply and elegantly structured into new conceptual form." The scientific project is an aesthetic project. The computer is the new art form. It is the elegance of the structure that counts. It is not by chance that when later advocating the transference of most of people's mental functioning to globally interconnected computers to produce a kind of unconscious control of the emergent planetary community, McHale turns to his own "formative" experience as an artist. He insists on the creative uses of unconscious perception and the artist's capacity to recognize pattern in disorderly environments. Likewise, Fuller conceives of the Geoscope as a mechanism for blurring the distinction between science and art. His original promotion of the project to the UIA calls on the hybrid figure of the "scientist/artist" to reconceptualize the future.

The Geoscope is nothing more than an attempt to transform the communication networks into an artwork. It reproduces, at the level of image, what is already in operation in numerous systems. In Fuller's hands, the diffuse architecture of the network, no longer easily distinguishable from the planet it wraps, is transformed into a singular aesthetic object. Even the technical drawings and analysis of the globe have to be considered as artworks. They mark the obsolescence of preelectronic forms of building and urbanism itself. As McHale argues in the fourth document, the city is becoming "but one type of waystation in an extended social and communication net." A few years later, he describes the arrival of the "instant city phase," inaugurated by electronics, in which "a center can be anywhere – even in orbit around the earth." Buildings must be as mobile and ephemeral as the nomadic clusters of information that endlessly circulate. Indeed, they are constructed out of that information. The overlapping networks define a new space, a global ecology of subliminal rhythms and flows whose shape can only be made visible through the Geoscope's artistic synthesis of the information pouring in through its infinitely extended sensors.

TECHNICOLOR SURVEILLANCE

As Fuller and McHale's discussion of the Geoscope repeatedly acknowledges, the network, like the computer itself and the whole concept of systems analysis, is a military invention. The NORAD Center, with its colossal display screens for online tracking of troop movements and missile paths, acts as the model for the Geoscope. Even the scale of the sphere is taken from the resolution of the film used by the United States Air Force in its ongoing Cold War project to produce a complete map of the earth's geography through mosaicked aerial photographs, a map accurate enough to organize blind military operations. But there is another model that Fuller does not discuss. The NORAD display itself is derivative of displays that Fuller himself had worked on during the war.

Back in 1941, Fuller becomes part of a secret team of artists, filmmakers, designers, and architects (including John Ford, Raymond Lowey, Walter Teague, Henry Drefuss, Norman Bel Geddes, Louis Kahn, Bertrand Goldberg, Lewis Mumford, and Walt Disney) working for the Visual Presentation Branch of the newly formed Office of Strategic Services (OSS, the predecessor of the CIA) to design a Presidential Situation Room that coordinates and efficiently presents "a panorama of concentrated information" during war. Based on the principle that one picture is worth a thousand words, this proposed two-story windowless space contains a central semicircular auditorium, which is to be filled with numerous presentation devices, including semitransparent screens on which information is to be projected from front and back, statistical charts in fluctuating panels of light, television monitors, topographic models, three-dimensional displays, and new forms of animation. The design for the building, code named Q-2, is approved at the end of 1941, but the Combined Chiefs of Staff promptly ask for the same devices to be installed in their own building. Eventually they decide that their proposed Situation Rooms will suffice. By June of 1942 the spaces are under construction.

Interestingly, the team had been called in to elaborate a preliminary design by its leader, the Hollywood moviemaker Merian Cooper, that was, as Barry Katz's study of the Visual Presentation Branch notes, "dominated by an immense illuminated globe on which could be projected everything from weather fronts and oil fields to the disposition of land, air, and naval forces." Excited by this idea, the OSS publicizes it in an October 1941 issue of **The New York Times**. The article is called "The War in Pictures." It describes how the "huge globe, lighted from within" can register all the tactical, economic, and political consequences of any military action "blocked out in vivid color and measured in large numerals." A dense mobile image of all available facts is presented to the "tired mind" of the President: "If this ambitious hope matures, the light within the globe can be adjusted so that these pictures of facts will be projected in successive sets and in technicolor. The sum will be an easy statement for the eye of the war's status quo."

This raises a nagging question. Is Fuller responsible for the idea of the illuminated globe as dynamic data display, or is the Geoscope project derivative of that idea? He may well have been involved in the formulation of the concept since he was an acknowledged pioneer in the visual presentation of global statistics, as is clear in his 1940 special issue of **Fortune**, and most of the design team had long been friends and had collaborated on projects (notably the 1939 World's Fair in New York). But it is significant, given that Fuller tends to backdate his innovations, that on the one occasion he speaks of the genesis of the Geoscope project, he locates it in 1950. The only crucial distinction between the Geoscope and the original design for the Situation Room is the transparency of its globe, the capacity to see the entire surface in one glance and view it from the inside.

In fact, the illuminated globe is never built for the Situation Rooms. Information is simply projected onto a large curved steel map on which magnetized symbols can also be moved. The War Department does commission six 50-inch (1:10,000,000) globes "designed as a tool for strategic military purposes." Calibrated by 50 geographers and cartographers, they are the largest and most accurate in the world. Franklin D. Roosevelt, Winston Churchill, and each of the services receive one by the end of 1942. The remaining globe goes on display at the Museum of Modern Art in the August 1943 "Airways to Peace: An Exhibition of Geography for the Future." Fuller is again involved. He even introduces his Dymaxion Map in a March 1943 issue of **Life** by presenting the Dymaxion Globe alongside the "President's Big Globe," insisting that it meets the same strategic objective of a "visually correct picture." Symptomatically, the previous issue of **Life** features a color spread on the "military holy of holies," the recently completed Situation Rooms. The roots of the Geoscope are to be found in the command and control center.

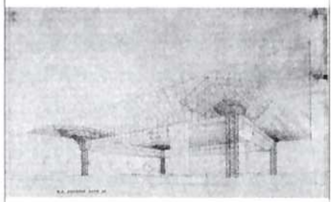
The Situation Room project is therefore the hidden context of

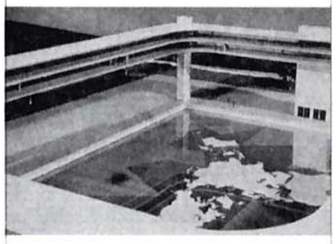
Fuller's 1955 letter to the commander of the Air Technical Intelligence Center of the Air Force, attempting to raise money for the Geoscope research then under way at the University of Minnesota. The letter gives a complete discussion of the concept, specifying the role of the computer in coordinating the input (from photoelectric cells and radar sites around the world) and networking the sphere to a series of identical "repeaters" in other centers, before arguing that it can be used by the military to more precisely monitor the flight of missiles. No funding is forthcoming, but the students complete a design for its installation at the Pentagon in addition to the one in Manhattan. Elsewhere, Fuller and McHale promote the Geoscope's antimilitary capacity. The first proposal to the UIA, for example, repeats Fuller's lifelong call to displace scientific research from "weaponry arts" to "livingry arts." The sphere's ecological sensitivity makes it a weapon for peace. Fuller eventually advertises its peacemaking capacity to provide a real-time display of the global deployment of military forces and equipment immediately outside all the ambassadors' windows at the United Nations building. The technologies of command and control are turned against themselves by putting television on steroids.

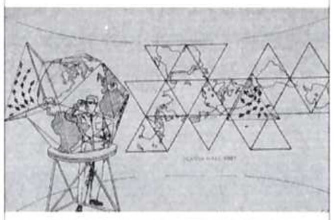
INSIDE THE INTERFACE

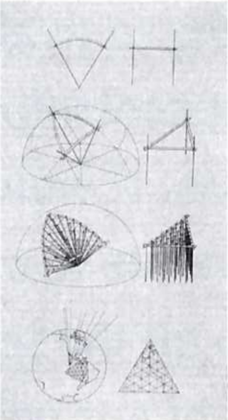
Fuller never stops looking for such hyperpublic sites for the Geoscope. By the time of the Princeton prototype in 1960, he argues that the full-scale version can be filled with helium bags and located on Belmont Island in the East River for the 1964 World's Fair before being pulled to locations all over the world by two helicopters. It becomes the centerpiece of his 1964 proposal for Montreal's Expo 67 in which visitors ascend by elevator to a set of balconies under a vast truss resting on four pylons in one version, or ringing the interior of a 400-foot dome in another. Suspended above them, a glowing 100-foot Minni-Earth would be wired with computer-driven light bulbs capable of displaying the world inventory. The surface of this sphere would gradually turn into an icosahedron with twenty triangular facets which in turn would split along some of its edges before "the whole surface opens mechanically as an orange's skin or an animal's skin might be peeled carefully in one piece," progressively flattening itself out while descending to the floor. The spectators end up looking down on a football-field-sized Dymaxion Map that displays global flows of resources, interacting with the huge image via numerous graphic display consoles mounted on the balconies.

From the beginning, the Geoscope project is based on



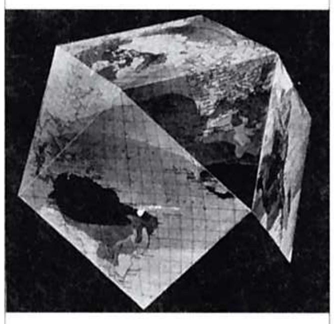


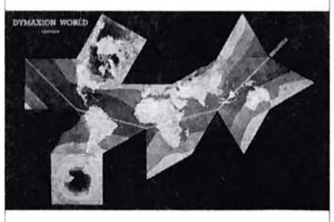




(Top) Perspective drawing of 1964 proposal for Montreal's Expo 67 (Middle Top) Cutaway model of 1964 proposal for Expo 67 showing balconies overlooking Dymaxion Map (Middle Bottom) University of Colorado Geoscope unfolded as wall unit (Bottom) Fuller's method for producing flat Dymaxion Map from sphere

this fluidity between plane and sphere, a fluidity at the heart of Fuller's geodesic structures. Just as the crisscrossing wooden members of the first Geoscope at Cornell are assembled on a flat surface then drawn together to form the 20-foot sphere of diamond lattices, the surface of the Colorado prototype is designed to unfold into a flat wall display of the Dymaxion Map. The principle of geodesic structure and the principle of the map are the same. Indeed, the 1943 map is the very first application of Fuller's geometry. It is based on the possibility of a continuous topological transfer from the surface of a sphere to the faces of a polyhedron. The faces are simply unpeeled to produce a relatively distortion-free map. When it is introduced in **Life** as a cardboard kit, the readers fold the flat surface of the magazine into an icosahedron and are encouraged to unfold it into different layouts of the same map. The geodesic dome, invented in 1947, is based on the reverse possibility of projecting an icosahedron outward into a sphere. The Geoscope is exactly the figure of this coincidence of structure and mapping. Structure as map. Architect as mapmaker or, to use Fuller's favorite image, navigator. The planet is a ship in the "celestial ocean," he insists, "Space-Ship Earth" that can supposedly





(Top) Instructions for constructing Dymaxion Globe, Life, 1943 (Middle) Dymaxion Map folded into globe, Life, 1943 (Bottom) One of the unfoldings of the Dymaxion Globe, Life, 1943

be navigated from the Geoscope just as an ocean liner can be navigated from one of the lifeboats that is fixed to it, provided the lifeboat is open to the stars. To construct the Geoscope is to transform the planet into a "windowed space ship." Newspapers faithfully quote Fuller's claim that "Minni-Earth can, if experienced and studied, give you 'feel' as well as 'know' of passing through the universe just as you would see and know from inside a windowed space ship." The dream of the Geoscope is the dream of the most sophisticated window possible. Fuller is basically a window designer.

Fuller and Sadao eventually build a 250-foot dome for Expo 67, but the Minni-Earth proposal is rejected. The Geoscope must migrate one more time. In a 1965 keynote lecture at Southern Illinois University, Fuller announces that the university is about to start a "computer feeding game" called "How to Make the World Work." Teams of players will redirect the flows of global resources while a computer displays the effects of their decisions on a Dymaxion Map. By 1967, Fuller is suggesting that this "World Game" take place on a high platform overlooking a football-field-sized map that is fed by historical databanks and live information from spy satellites. Two years later, he presents the sketch proposals for the design of a "World Resources Simulation Center" for the game, restating his belief that decision making is best done on the basis of visual representations, with all available data being absorbed by computer and "massaged and prepared for display." The space for the game has to be a "total world audience enveloping display." The model is again the massive installations of NORAD and NASA (now joined by the screens at the United States Meteorological Service Headquarters), but Fuller argues that their displays are only computer assisted and lack the speed and flexibility of traditional cathode-ray tubes. Since computer speed is unavailable at the "cinerama" scale he seeks, he makes an interim proposal of a dome with a 195-foot span in which a tiered auditorium faces a vast screen at one end on which traditional projectors would enlarge small-scale computer displays. When technology permits, this space will give way to a 5/8 geodesic sphere with a 400-foot diameter whose entire inner surface is to act as a computer display screen "in a visual mode similar to color television screens of today" to produce "immense" on-line images. Fuller's TV has undergone yet another exponential leap in size. Now the audience would be literally suspended in front of this display, moving independently in the face of the moving images. And eventually even this is to give way to placing people inside the image itself:

> Data will be presented on the inner surface of the dome with audience and players electronically elevated one-hundred feet off the floor of the dome and with each sitting in a "pilot's" contour chair which can be omnidirectionally controlled by a computer – keeping the audience in line with images on the dome surface that are important at any given moment and giving them a sense of "electronic" participation in image generation. This display will be even more effective when holography is perfected and audience and players are actually put inside of display image.

nce again, architecture as

Once again, architecture as the space of images, the science of architecture as the art of the image. In a progress report distributed at the conference, Thomas B. Turner (the director of research and development for the project) argues that the appropriate model is the development of the "art of aesthetics" in motion picture, television, and theater. The World Game is likewise meant to "interface" the audience to incoming information by enveloping them in a "hypervisual" presentation. Sophisticated "pattern recognition" software gives seemingly chaotic information an aesthetic form. Turner defends the production of such imagery by quoting McLuhan's popular **The Medium Is the Massage** of 1967 on "the possibility of arranging the entire human environment as a work of art, as a teaching machine designed to maximize perception and to make everyday learning a process of discovery." McLuhan, who was frequently associated with Fuller, goes on to insist that:

on to insist that:

> Application of this knowledge would be the equivalent of a thermostat controlling room temperature. It would seem only reasonable to extend such controls to all the sensory thresholds of our being. . . . Environments are not passive wrapping, but are, rather, active processes which are invisible. The ground rules, pervasive structure, and overall patterns of environments elude easy perception. Anti-environments, or countersituations made by artists, provide means of direct attention and enable us to see and understand more clearly.

The whole ecological movement

The whole ecological movement of the 1960s is precisely such an attempt to turn the global environment into an artwork. Particular aesthetic images of the planet play a crucial role. Turner, paraphrasing Fuller, refers to the famous photograph taken from the spacecraft looking back at earth, comparing the images produced at the World Simulation Center to the mind-expanding effect of "seeing for the first time the sapphire Earth against the black void of space." Without that image of Earth as an isolated sphere, many of the arguments behind the ecological movement may well founder. Diverse groups unite around its preservation. It is always portrayed as a beautiful but fragile image that can only be protected with ecological management strategies. It would seem that the image can only ever be seen as beautiful. It supposedly transcends and orchestrates the psychosexual system of aesthetic judgment that Fuller places at the center of postelectronic space. A quasitheological view underpins the unquestionable sense of the beauty of "natural order," the "harmony" of the cosmos, and so on. Ecology is a barely disguised form of theology.

Symptomatically, a Geoscope (with a three-quarter sphere of 40-foot diameter in black glass) is installed in 1970 at the Edwardsville Religious Center of Southern Illinois University on the outskirts of St Louis, Missouri. Fuller, who often argues that theology is the basis of science, publishes a lengthy poem that credits the structure with the spiritual value of a cathedral:

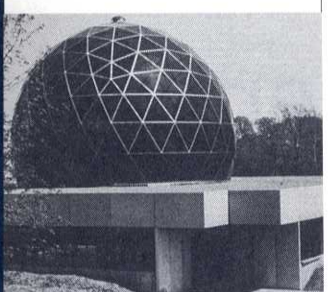
> One goes inside to go outside one's self
> And into the center of the Earth
> And thence outward to the stars in seconds.

To look through the Geoscope's window on the world is to stand in a sacred space. The role of the architect in an electronic age is to preserve an image of the cosmos, an image of its architecture precisely.

BROADCASTING THE HOUSE

Ecology is a question of images in the end, images of architecture and the architecture of images. To raise the question of ecology again in architectural discourse today is already to raise the question of the image. The crucial technological issues are those of the image, which include all the institutionalized technologies of discourse itself, of architectural discourse in particular. After all, the discourse is no more than the exchange of certain kinds of images, an exchange whose politics need to be scrutinized. More precisely, the complicity between technologies of imagery and institutions has to be interrogated. Institutions are themselves technologies of representation with specific agendas.

At the same time, any inquiry into the contemporary mechanisms for the production and distribution of images has to be historical. The logic behind the Geoscope precedes the computer



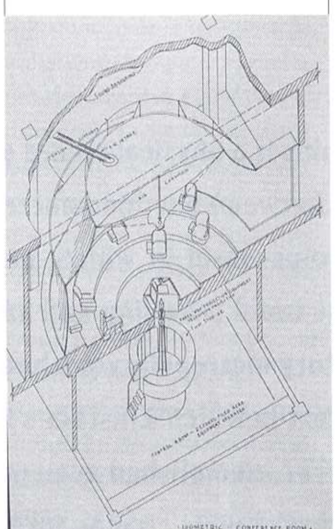
Edwardsville Geoscope, 1970

networks that it attempts to domesticate. Even the structure of its last holographic version is derivative of the "Industrial Conning Tower" design that Fuller publishes in the November 1932 issue of **Shelter**, the magazine he edited since 1930. He proposes that all industrial headquarters install a conference space organized as a set of tiered seats ringing a central mechanism that contains cameras, projectors, speakers, microphones, and three-way screens for "trans-lux visible displays." This mechanism, which emerges through the floor from a technical control and filing space below, can record and replay every meeting ("to see ourselves as others see us") or broadcast them by teletype, telephoto, and television to any other such space. The space is understood as the bridge of a large ship, enabling industries to steer themselves towards the most efficient use of resources. Imagery management is the basis of resource management. Indeed, images become the most precious resource. It is not by chance that Fuller begins the same issue of **Shelter** by defining "shelter" in terms of "ecology": "SHELTER represents the inclusive instrumental security and service of ECOLOGY and ECONOMY" where ECONOMICS ("the management of household affairs") is "derived" from ECOLOGY ("the study of human relations, particularly as pertains to the home"). Shelter is the ecological preservation of image-making capacity.

For Fuller, shelter is provided by literally hooking into the networks of communication. It is the hookup that makes the ecological management of household affairs possible. Indeed, it is the hookup that domesticates a space. The Industrial Conning Tower idea is itself a derivative of the Dymaxion House project of 1927–29 with its "conning facility" in the form of a furniture unit combining desk, drawing board, filing cabinet, steel safe, typewriter, calculating machine, telephone, motion picture machine, radio-television receiver, dictaphone, phonograph, revolving bookshelves, map, and globe storage (located in the living room of the 1927 version of the house and the library of the "clean-up" version of 1929). The World Game is but an extension of Fuller's first domestic design.

The endgame of the Geoscope remains as domestic as the first move. In a 1962 lecture at Southern Illinois University, Fuller envisions a 200-foot Geoscope hovering 100 feet above the campus whose "dynamically viewable and picturable" data can be broadcast all over the world by radio. He argues that this "decontaminated" information can be " 'piped' right into the environment of the home" by two-way television sets that allow people to select the information they want to see. The small-tubed television set in private homes and the large tubed Geoscope in public spaces are presented as parallel inventions. Ever since his involvement in television's very first tests in 1935, Fuller maintains that home television should be the basis of all education. Later, he encourages the students participating in the UIA Geoscope project to make movies to broadcast on it. The redesign of the planet into a single domestic space is bound to a specific redesign of the family house. The first conception of the house as a mobile networked spaceship underpins the final conception of the Space-Ship Earth as house. Indeed, the idea of the Geoscope is embedded in the very thinking behind Fuller's first designs. When he privately publishes his first house in a small 1927 booklet entitled **4D**, he argues that "The point of view, through introspection, unlimited to the segmental area of our temporal eyes, is our abstract central position in the center of the universe, looking or building from inside out, as from the center of a great glass globe." The Geoscope is a domestically centered philosophy of design long before it is a particular design.

Simply put, the Geoscope is the ultimate house, the drawing of a domestic space out of computer networks. As such, it should be evaluated according to Fuller's "Universal Conditions for Scientific Shelter" that he first publishes in a 1931 issue of **Shelter** and revises many times up until the version that appears in McHale's first document. In



Axonometric of Industrial Conning Tower project, Shelter, 1932

addition to fostering growth by providing communication channels with access to the past, the present, and the future (library, radio, television, telephone, maps, transportation), the scientific designer of a house has to oppose the "internal destructive forces" of nerves, fatigue, and repression. The designer of the domesticating space of the network-driven holographic image in the Geoscope, like the designer of any house, has to satisfy Fuller's psychic requirement of "nerve shock proofing," "fatigue proofing," and "repression prevention." As these constraints apply to the architecture of the images themselves, they become aesthetic constraints.

After all, it is no accident that the Geoscope's visualization of the invisible logic of the computer network takes the form of a sophisticated television set. For Fuller, the computer is but an organic extension of the human brain, and the brain is itself a kind of television set. In 1977, the same year he and Sadao complete the last colossal Geoscope design for Toronto, he insists that thinking, whether conscious or not, is no more than the experience of "images," the "visual experiencing of structural conceptions." No matter how dependent these pictures are on input from the sensors on the body or its numerous prosthetic extensions, they remain internal to the mechanism that displays them. In a strict sense, there is no outside of the brain. As Fuller puts it at the beginning of his career, and repeats in the last manuscript he writes before his death in 1983, "all sensing occurs inside the brain's 'television control zone.' " The brain is a thoroughly domestic space without an exterior. Likewise, there is no simple outside or inside to the Geoscope. To enter it is to enter a window, an image of the outside that is thoroughly internalized and yet portable, a mobile image that can be inhabited, an image without which any other form of inhabitation is supposedly impossible in the age of diffuse networks.

Fuller always insists that his requirements for scientific shelter do not presuppose any particular visual form and that modern architecture's obsession with the visual has to give way to an invisible architecture. But his actions suggest that it is only through the production of visual form, precisely when form itself seems to be dissolving, that electronic space can be constituted as a house. The Geoscope is the attempt to produce an occupiable image, a fabulous and comfortable picture window. Its architecture is that of the graphical user interface. Fuller even saw himself and the spectacle of his lifelong production as such an interface.

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