

How to Make the World Work

EARTH PIECE

Listen to the sound of the earth turning.

1963 spring

—Yoko Ono, “Earth Piece”

I now see the Earth realistically as a sphere and think of it as a spaceship.

—Buckminster Fuller, *Operating Manual for Spaceship Earth*



Those scientists who ushered in the Atomic Age felt responsible to humanity. Whether they worked on the Manhattan Project or not, and even if they helped the war effort in socially justifiable ways, they felt responsible. The dawn of a new postwar world had left behind the Great Depression and created a country with a clear leadership mandate on the global stage but without a clear

strategy to articulate the mandate. It was also a nation that found the bottle of technology and science empty and the genie nowhere to be seen. That which had enabled victory in the war partially hobbled the future in peacetime. Most scientists had carried out a given task and had plowed a narrow furrow in the larger research field, head down and duty tasked, but once successful as a collective, the individual felt a need to save civilization, perhaps again, without the specter of war driving the agenda—even as the Cold War darkened the new US horizon. These scientists knew they could do better.

It was with such determination and muted optimism that the Macy conferences got underway again in the postwar period. The participants had been keen to pursue ideas raised during meetings before the war and did so during the conflict through letters while stationed around the globe fighting and contributing to the war effort as asked. They knew when they assembled again after the conflagration had ceased that they would face new demands with regard to civilization that needed to be addressed through their collective, interdisciplinary scientific, technological, and aesthetic experimentation. Such concerns had long been the purview of the token anthropologists, Gregory Bateson and Margaret Mead, who indeed spent their entire lives pursuing such experimentation. As exemplified by the Macy conferences and their principled pursuit of cybernetics as a kind of unified science model, they prioritized research that helped us understand how the world worked. Bateson and Mead explored how humans worked in relation to larger environmental and ecological systems while also developing increasingly experimental means of representing to other academicians and the interested general public these systemic relations in their glorified diversity and fundamental unity. Bateson's photographic and film work, though predating the Macy conferences, influenced a new set of experimental ethnographic filmmakers as well as artists seeking to address a war-damaged society. Stan VanDerBeek and Gene Youngblood, as well as Buckminster Fuller, took inspiration from this work, and Bateson and Mead both spoke eloquently on these practices and their limitations to an eager audience of counterculture, avant-garde, social, and artistic engineers.

In the first paragraph of Norbert Wiener's *The Human Use of Human Beings: Cybernetics and Society* (1950), he claims the changes in historical conditions in the shift from the nineteenth to the twentieth century were responsible for "the marked break" in art, literature, and science between the two centuries. Unlike some aspects of Dewey's occasionally synchronic vision of science as a semi-universal endeavor impervious to the vicissitudes of time and context, Wiener argued for it as being in the mix and driving history as much as being driven by it. Alongside Einstein, who fully supported Wiener's ethical stances in relation to science/technology and its military applications, Wiener perceived science as operating in larger systems than itself, and playing in fields demarcated by aesthetic practice and experience as much as by scientific debate. Steve Heims, writing in the introduction to the second edition of Wiener's application of cybernetics to society and history, argues that Wiener resembled Dewey insofar as he understood technology not so much as applied science but as applied social and moral philosophy (1980, xii). And Heims describes

Wiener's book as one that "might have been made by an artist as readily as by a creative scientist" (xv).

As with many of the other Macy conference participants, Bateson, Mead, and Wiener held that the imperative of the moment was to salvage civilization after World War II through scientific, technological, and aesthetic experimentation and interdisciplinary exploration of the interrelatedness of the human, natural, and machinic worlds. For Bateson, this meant a literally endless engagement with "mind" as an evolving and evolutionary set of systems linking the individual to society and nature in an aggregate of ideas: "an ecology of mind" or "a science of mind and order." Citing the work of Wiener, von Neumann, and Shannon on communications and information problems, Bateson saw a glimmer of hope for a devastating half century of world wars when he states that "cybernetics is, at any rate, a contribution to change—not simply a change in attitude, but a change in the understanding of what an attitude is" (2000, 483). The attitude toward science as an epistemology geared toward teleological autocratic ends was the anti-Deweyan hubris of science in the twentieth century, and cybernetics applied to individuals, societies, and ecosystems offered a way to alter this consistently failed enterprise.

The larger pedagogical impulse that drove the ethical and intellectual interdisciplinary imperatives of cybernetic research and researchers profoundly influenced the multifaceted works produced by the Eames Office, headed by the designers Charles and Ray Eames, and the decades of visionary writings and designs by Buckminster Fuller. Similarly, the experimental ethos of avant-garde techniques and aesthetics, practical engagement with materials and technologies, and a general eschewal of goal-oriented processes shaped the pedagogical enterprises of these three thinkers and designers as they sought, like the Macy conference scientists, to examine how the world worked and how to make the world work—and to share the results of this examination with the general public in as effective and experimental way as possible. New knowledge required new articulations of it.

The Eames Office as Cold War Design Lab

Through a number of commissions for global fairs and representing US and/or corporate interests, the Eames Office designed visions of a technological and informationally shaped future using avant-garde techniques of the early part of the twentieth century. The Eames Office operated as an IT, media, arts, and design lab *avant la lettre*, not unlike those officially founded around the same time such as E.A.T. and CAVS. The Eames Office, though, held no singular

institutional frame or constituency, while such was not the case for Klüver's project at Bell Labs or Kepes's center at MIT. The Eames Office's ability to work with and for a range of clients across the corporate, university, entertainment, and government sectors echoes the relationships between these sectors emergent in and essential to the new Cold War world, relationships connected by technology, aesthetics, global computing, and geopolitical agendas.

The Eameses stated in 1969 that their "interests have included many aspects of communication—photography, exhibitions, writings and motion pictures. Our work in education has intensified this and has provided a natural overlap with several governmental agencies" (quoted in Lipstadt 2005, 151). This overlap essentially transformed the Eameses into "cultural ambassadors" during and for the Cold War representation of the US because "their design agenda aligned with the political agenda the US government wished to communicate" (Schuldenfrei 2015, 43)—and communication became their new mode of design as well as its content. They were designers of the immaterial world of information and think-tank concerns, partnering with RAND, Metro-Goldwyn-Mayer (MGM), MoMA, and IBM. Many designers as well as occupants of the government expressed surprise that the outwardly "nonideological" and "cutting-edge" design firm/lab would fit with and continue to work for the US federal government for many years (Lipstadt 2005, 151–152). It is difficult to distinguish cause from effect with regard to the Eames Office and its various patrons or commissions and its interests, especially when one considers the Eameses' stated position that they would not work on projects with which they did not ethically agree. The Eames Office served as a singularly well-positioned platform that allowed for deft movement across educational, corporate, governmental, entertainment, and technological collaborations, all of it grounded on a solid fine-arts base. The Eames Office received much high-profile patronage from numerous corporate clients, while maintaining links to many university scientists, heads of major corporations, and public as well as private cultural institutions.

The US Information Agency (USIA), the State Department, the Department of the Interior, the Smithsonian, Pan Am, the Ford Foundation, Columbia Broadcasting System, Cummings Engines, Westinghouse, and Herman Miller Furniture counted among their clients. Long-time collaborators included architect Eero Saarinen, designer and US government exhibition organizer and design theorist George Nelson, film director Billy Wilder, film score writer Elmer Bernstein, and designer Alexander (Sandro) Girard (Lipstadt 2005, 152). Buckminster Fuller housed Eames installations in pavilion settings, and György Kepes provided them influential direction with regard to visual

language, social progress, and education. The RAND Corporation links, in particular, proved pivotal for the Eameses in their work on various US pavilions abroad for exhibitions of technology, urbanism, postwar visions of the future, and US consumer market economy as the exemplification of democratic beliefs during the Cold War.

From their geographically marginal site in Venice, California, the influence of their office marked a larger shift in the US begun during World War II from East Coast control to the West. The war efforts in aerospace industries both in terms of design and manufacture, not to mention the siting of the RAND office, Hollywood, and television production all loosened the hold of East Coast power. In the early days of their marriage during the first years of the 1940s, Charles worked as a set designer for MGM while also experimenting with molding plywood for a range of uses in the war effort, ranging from plane parts to splints for wounded limbs, thus emphasizing design and materials in the service of applications from military technology to field medicine to cinema production and art. The biomorphic shapes afforded by molded plywood made their way into Ray's sculptures before shaping their influential and lucrative chair designs. Some of these sculptures featured on the cover of an issue of *Arts and Architecture* in September 1942. The convoluted and folded wooden structures evoked a Möbius strip of planes that aesthetically bore the same interest in perspective found in Braque's and Picasso's cubist sculptures (Giovanni 2005, 60). The process of molded plywood also found its way on to MGM sets, as well as into furniture and industrial design, so that from the outset the Eameses' work cut across art, architecture, and cinema, and military and industrial production: a materiality that physically links the military-industrial-university-entertainment complex. The plasticity of the material allowed it the potentialities plasticity provides. And plasticity of materials and aesthetics, as well as topics, ideas, and clients, proved central to the Eames Office.

The Eames Office occupied a noninstitutional site that operated chronologically and intellectually between the New Bauhaus and CAVS, with the work, ideals, and spirit of Moholy-Nagy but operating in ways more attuned to the predominant corporate culture. With lab and studio seamlessly merging, the sculpted plywood chairs that populated the 1946 MoMA show "New Furniture Designed by Charles Eames" were tested physically and aesthetically at the Eames Office in laboratory conditions. Photos of the chairs were taken next to works by Alexander Calder to underscore their abstract, sculptural, and biomorphic qualities, as well as to place the Eames Office's design work explicitly in dialog with contemporary art (61). Greatly inspired by information and communications theory in the early 1950s, the Eames Office, led by Charles's

enthusiasm for these research areas, turned from primarily working on furniture design to films, information visualization, and multimedia installations. The 1953 Eames film *A Communications Primer* was essentially an animated version of Claude Shannon's 1949 book, *The Mathematical Theory of Communication*.¹ The films also served as experiments in the filmic medium, as well as its installation, engaging technologies of vision that altered the scale of seeing as well as the scale of projection. At the same time, the films suggested the Eames Office was the embodiment of a creative and experimental lab, delivering information theory in a profit-led model of benign US corporate and Cold War idealism of progress.² The Eames Office was a platform of experimentation for the materiality of ideas and the immateriality of thought articulated through objects and images capable of effecting sociopolitical change.

The Eames Office shared with more institutionally formalized art and technology labs a strong and sustained link to some of the larger aesthetic and formal concerns of early twentieth-century avant-garde movements, but markedly in their case without explicitly progressive pedagogy and radical social agendas. As we have seen, in each instantiation of the art-and-technology lab, a dilution of the more adventurous social concerns of the Bauhaus or Dada, for example, appeared in the US versions that drew on their traditions. Charles Eames might have gotten the most credit for the Eames Office's success and been its public face, but it was Ray's background in and knowledge of the syntax found in the avant-garde and experimental art milieu of NYC in the early part of the twentieth century, in which she was deeply involved, that provided much of the visual and technological knowledge they updated, recontextualized, and domesticated. In much the same way that Surrealism became part of the Disney studio and popular culture toolbox, the Eames Office brought this same domesticated syntax to various institutions and spaces. The various forces at play in the emergence of Cold War geopolitical parameters and borders made it difficult to maintain fully any alternative political agendas for the various art and design movements that provided inspiration for the Eames Office and other experimental labs. Nonetheless, the idealistic belief in art's efficacy for social change barely wavered. André Breton, vigilant to the end, devoted his aptly titled final publishing endeavor, *The Breach*, to such larger goals. Running from 1961 to 1965 and offering images and new art by various artists still involved in Surrealism's transformations, the publication also included discussions of Pop Art and film as well as pieces about the increasing political demands and pressures of the Cold War (Gale 1997, 414–415). The Eames Office, various politically charged art movements and art-and-technology labs in

university and corporate settings were clearly not alone. All of these enterprises held varying agendas, though with an oddly singular goal: to make peace perpetual during a nuclear standoff through aesthetic, technological, and information experimentation.

The idealistic (and post-ideological) spirit of the Eames Office remains in the present. Although no longer functioning, the Eames Office still maintains an official website with links to archival material, photographs, films, and historical information about the Eames house and their exhibitions. The site includes the ethos of the Eames Office, which reads: “Charles and Ray’s work was a manifestation of one broad, all-encompassing goal: to positively impact people’s lives and environments.”³ The site also provides a shop where people can purchase products such as prints, toys, books, furniture, memorabilia, and an Eames app—the singular vision of a collective future made material and consumable.

Powers of Ten: The End of Interiority and the Effect of Adding Another Zero

Public education regarding technological developments that were rapidly shaping the postwar world played an important role in the Eames Office’s work in film. *Powers of Ten*, their most famous and still most influential such work, went through three different iterations, starting in 1963, and again in 1968 and 1977.⁴ The 1968 version was made at the behest of an MIT physics professor working on the Kepes institutional agenda to update and upgrade visual tools at MIT as a means for more effective pedagogy. When presenting the film at Harvard in 1970, according to Schuldenfrei, Charles Eames framed the film as linking economics and ecology to collective responsibility. The application of cybernetic theory to ecosystems as found in Bateson and Fuller, as well as to society and history as articulated by Wiener, exerted its influence on the Eameses’ 1977 revision of their film. Schuldenfrei connects some of the NASA-sourced images to the emergent ecological movements of the time (2015, 137–140). *Powers of Ten* addresses, in Martin Heidegger’s phrase, “the age of the world picture” when Spaceship Earth, as Buckminster Fuller called our planet, got its owner’s manual (courtesy of his own polymath erudition and certitude) as well as an environmentally driven libertarian catalog for the counterculture from Stewart Brand (1968). The Eameses were in the mix too, and used their platform to reframe and recontextualize their film to raise environmental consciousness. The final version, completed in 1977, sports the subtitle: *A Film*

Dealing with the Relative Size of Things in the Universe, and the Effect of Adding Another Zero. Underscoring their ecological concerns, some new lines were added to the voiceover—lines that read like the prophetic insights of Fuller or Brand but intended for the masses. When the film has reached the outer edges of the universe, and the world picture becomes a black screen with the illuminated planet now no longer even a speck, the narrator states: “We pause to start back home. This lonely scene—the galaxies like dust—is what most of space looks like. This emptiness is normal. The richness of our neighborhood is the exception” (quoted in Schuldenfrei 2015, 140). The multitude of images showing our lonely planet in its exposed unique fragility became an important strand of the perspective on rapidly rescaling human vision the Eameses offered in this piece of popular visual pedagogy. Home is the place where we start adding zeros and powers of ten to our corporeal vision; it is a dwelling of singular qualities.

The Eameses’ film explicitly moves up into the atmosphere through visual technologies multiplied by powers of ten, and then takes audiences into the deepest reaches of outer space, before plunging us back to Earth and eventually into the nucleus of a carbon atom found in the human body. The macro and the micro, and the astronomical and the nano, that constitute the scopic movements of the film chart a history of Western technoscientific power as primarily visual in source and manifestation. The triumph of the visual in the Western sensorium and its empirical power to overturn received *doxa* (and thus create a new world in which science had sway) meant that seeing not only equals knowing but also that seeing equals power over the seen, as satellite technology and other Cold War tele-technologies of surveillance manifest.

Just as their films exploited the most recent innovations of visual technologies and their explosion of scales, so too were they interested in scales of projection and exhibition. An immediate and influential precursor of *Powers of Ten* can be found in an earlier Eames film called *Glimpses of the USA*, a multiscreen presentation at the 1959 Moscow Exhibition.⁵ As the undesignated designers of the Cold War through their numerous films, exhibitions, and multiscreen experimentations, the Eameses helped popularize scientific and technological innovation, consumer culture, and the powers of abstraction operative within complex systems. *Glimpses* provides their first foray into displaying the optic capacities made by satellites, using the zooming-in technique that they display in *Powers of Ten*—in fact, some of the imagery of Earth seen from space found in *Powers of Ten* comes from *Glimpses*. The film tracks from the tele-technological wonders of a satellite vision of Earth down to the

mundane start of the day within “the average” US household, zooming rapidly in increments from the space view down to the quotidian making of breakfast. Both films offer the power of the micro and macro technological amplification and production of vision, with universal computation providing the means to scale rapidly up or down.

In *Powers of Ten*, the midway point of the 1977 version arrives with its return from the outer reaches of space back to the human scale before moving into the body and the atomic formation of it. When the film enters the micro-level of prosthetically enhanced vision, it marks the end of a certain kind of human interiority. The site of moving from the macro to the micro is through the epidermis of the hand, that grand metonym for humans as makers. The human is what gets repositioned in these new technologies of scales of vision. Writing contemporaneously with the production of the film, Jean Baudrillard argues for the slow dissolution of human scale and psychological possibility of interiority. He claims that “with the television image—the television being the ultimate and perfect object for this new era—our own body and the whole surrounding universe become a control screen” (1983, 127). The cybernetic desire of control and homeostasis within an individual, society, ecosystem, or machinic operation becomes a control-room screen. The very liberatory possibilities the Macy conference participants, as well as Fuller and the Eameses, espoused in cybernetics as potentially capable of derailing Western scientific epistemological hubris has been hijacked, according to Baudrillard, for the very technoscientific ends these experimentations sought to resist. Baudrillard places televisual technologies and media/information theory within three larger “irreversible” trends of the contemporary moment: “an ever greater formal and operational abstraction of elements and functions and their homogenization in a single virtual process of functionalization; the displacement of bodily movements and efforts into electric or electronic commands, and the miniaturization, in time and space, of processes whose real scene (though it is no longer a scene) is that of infinitesimal memory and the screen with which they are equipped” (128–129). The technicities that Baudrillard charts would be systems that undercut homeostasis or the potential for progress within Western science, turned as they are toward instrumental ends for which the human scale and its potential for interior self-reflexivity is obliterated, much as the human body as pivot for the nano and macro scaled modes of scientific seeing passes right through the power of zero. *Powers of Ten* performed the new scales of vision made possible by intensive military technological research, work that further reframed human existence on the face of Earth.

Fluxus, Abel Gance, and the Eames Office: Another Bauhaus Moment in the Techno-Avant-Garde

Ken Friedman, regional outpost co-chairman (San Francisco) of Fluxus at the time of the Eames Office in its full glory, called the movement “an international laboratory of *ideas*—a meeting ground and workplace for artists, composers, designers and architects, as well as economists, mathematicians, ballet dancers, chefs, and even a would-be theologian” (2011, 35, original emphasis). The Eames Office as lab experimenting with developing technologies, designs, media, theories, educational aspirations, and collaborative projects finds elective affinities with Fluxus, as well as CAVS, E.A.T., and LACMA, especially when the larger, transcendental or ideological rationale for these endeavors is explored. One strand of Fluxus experimentation draws its genealogy from the Soviet avant-garde loosely bundled under the 1920s Russian journal *LEF* and Constructivism back to Dada (36). Friedman further links Fluxus-as-lab to American pragmatism and American transcendentalism, with its influences on Emerson and Thoreau (37). The heady eclectic mixture of pragmatism, transcendentalism, hermeneutics, and “intermedia” highlighted a desire to uncover larger political and existential truths lurking in the quotidian. The combination also foregrounds the discipline of daily routine and instruction that Fluxus artworks perform.

The social effects of such making were explicitly in play with the Fluxus group, as much as it was in the Eames Office’s pedagogical mission. In terms of near contemporary artistic influence, Marcel Duchamp’s influence on the Fluxus group proved most important, especially his attempt to “reconcile art and the people,” as Apollinaire put it in 1912 (Apollinaire 2002, 183). Referring to Duchamp’s then emerging *The Large Glass*, Apollinaire suggests “art such as this could produce works of unimagined power. It might even have a social function” (77). Dada also simultaneously held anarchistic and idealistic beliefs regarding the transformative powers of art and aesthetics confronting failed sociopolitical institutions and values that were articulated through technological change. This schizoid belief held that we could turn the tools of war and violence into sources of liberation and revolution. A repetition of such thinking could be found in the ways in which Fluxus and the Eames Office attempted, in rather different ways, to engage a general public facing a new techno-military moment. If Apollinaire felt the seams of society and culture coming apart on the eve of World War I, and if the Fluxus movement felt a similar technological-aesthetic shift in Cold War America reverberating on a global scale, then György Kepes

saw the same strains from within the heart of US military-technological innovation achieved through university R&D at MIT.

Repetitions and recycling of avant-garde techniques and strategies can be found in the multiscreen immersive experiences used by the Eameses in the 1959 USIA-sponsored pavilion in Moscow, and most intensively in the IBM pavilion at the 1964 New York World's Fair. Especially influential for them was the narrative avant-garde cinematic developments of Abel Gance in the first decades of the twentieth century.⁶ The points of comparison between Gance and the Eameses film work are vast, including editing techniques, screen expansion on horizontal and vertical planes, and innovations in projected film and image work. Most importantly for both, these formal experiments served the significantly idealistic, conservative, even melodramatic nature of the content of the works. Both Gance and the Eameses were lauded for their formal innovation while simultaneously derided for their capitulation to genre demands, nationalist cheerleading, and general celebration of bourgeois values. Norman King describes Gance's work as "reactionary innovation" in so far as it wedded melodrama with formal innovation (1984, 3)—both a phrase and a critique applicable to the Eames Office's screen productions as well. The links with Gance proved to be substantial for the Eames Office, and they shared many formal and content-related qualities. Other avant-garde influences made their way into international pavilion displays during the 1950s and likewise influenced the Eameses. Although these experiments operated with significantly different Cold War agendas, they were nonetheless often recycled by the Eames Office for their governmental and corporate clients in pavilion settings.

The multiscreen strategy the Eameses first used in Moscow with *Glimpses*, and again later for *Think* (1964),⁷ clearly draw on specific strands of European avant-garde theater and performance, more recent iterations of which they encountered at the 1958 Brussels World's Fair. There, Le Corbusier's multimedia show entitled *Poème électronique* provided an explicit display of Philips technology in the service of social commentary and political critique of twentieth-century injustice.⁸ Also at the Brussels fair, installations by the Czech avant-garde theater designer Josef Svoboda, such as *Polyekran*, part of the ongoing multimedia project *Laterna Magika*, arranged screens with unconventional angles, shapes, and sizes for projection, allowing the viewer to be bombarded by projected images in an immersive and disorienting manner. Both Le Corbusier and Svoboda owed a great deal to the projection experiments by the Bauhaus designer Herbert Bayer and the projected theater works from the 1920s by Erwin Piscator in collaboration with Walter Gropius and Moholy-Nagy

in Berlin. Piscator emigrated to the US and continued his projected-image and live-actor stage-set experimentation into the 1940s. Various scholars have traced specific elements of these long-range influences displayed by Le Corbusier and Svoboda, back to early twentieth-century avant-garde experiments in projective technologies. Such display techniques also found their way into the Eameses' installations (though in a much tamer fashion and with a markedly different ideological agenda in 1959, and again, and more explicitly in 1964).⁹

Gloria Sutton astutely observes that although the Eameses' films have often been labeled as experimental, they used very few "untested elements" (2012, 154), and many of these elements operate in Gance's early twentieth-century films. Gance had commercial and critical success with his rapid montage and varied and contrasting rhythms of film, which seemed to point toward areas in which cinema could compete with poetry and music in terms of artistic and aesthetic expression (King 1984, 4). Working from a spot squarely within and contributing to the burgeoning experimental avant-garde of the early twentieth century, Gance's close friends and collaborators included Antonin Artaud, Blaise Cendrars, and Max Honegger, while his experimental works were in conversation with those by Apollinaire, Delaunay, Léger, and Picasso (Abel 1987, 4).¹⁰ Richard Abel calls Gance part of "the narrative surrealists," or the First Avant-Garde (1919 to 1924), along with Louis Delluc, Germaine Dulac, and Marcel L'Herbier. The films by these directors mixed styles and modes, generated complex narrative structures, and used patterns of images for rhetorical purposes (280–281). Gance melded melodrama with "polyvision" (multiple screens), allegorical image superimposition, wild camera movement, montage editing, and color-filter overlays for emotional resonance—techniques that the Eameses deployed in *Glimpses* and *Think* (Kirkham 1995, 328). All of the narrative surrealist filmmakers were interested in image perception and how sensory data provided by technologically generated means could be deployed as a goal in and of itself. Abel argues that the more experimental avant-garde that left narrative behind completely—including iconic later films such as René Clair's *Entr'acte* (1924), Buñuel and Dalí's *Un chien andalou* (1929), and Léger's *Ballet mécanique* (1924)—found many of its strategies and tools in this earlier moment (Abel 1987, 281). The poetic or impressionist avant-garde admired Gance for "his work on the sensations constructed by the image" (King 1984, 21). But this later avant-garde also found his output deeply schizophrenic, with Clair, for example, writing a 1923 article on Gance's experimental melodrama *La roue* that offered a very early take on the form and content split that dogged Gance's career. Similar criticisms were leveled against the Eameses' work for IBM and the US government, as well as the projects generated by Kepes in the late 1960s.

At the time of the initial screening of Gance's epic *Napoléon* in the late 1920s, Émile Vuillermoz wrote two articles about the film that praised the director's cinematic vision and formal achievements with editing, superimposition, multiple screens, and general refusal to treat cinema "as a slave to a profitable and demagogic Taylorism" (quoted in King 1984, 43), while at the same time deploring his knuckling under to "the law of genre"—a narrative technology inherited from Hollywood (42). About Gance's use of multiscreen projections and their effects in the film, Vuillermoz at the time wrote: "There is an extremely valuable element of polyphony and plurality of rhythms here which completely transform our traditional conceptualization of visual harmony. The monody of the optical melody is supplemented by the possibility of a notation of music of images on three staves. That is truly revolutionary" (quoted in King 1984, 48). But at the same time, the critic derides the director for not moving cinema away from Hollywood's narrowing of narrative options, as well as for the conservative celebration of France's imperial past. The nostalgic nationalist politics displayed in the film actually received less attention than the apparent aesthetic betrayals. Clearly Gance's formal experimentation served different ends aesthetically and politically than the works of other avant-garde artists.

Gance's experimentation and theorization about cinematic experimentation nonetheless provided a profound base for thinking through the capacity of images to create a new visual syntax. In 1923, Gance wrote: "One has to judge images not on their material quality but also on what they express—the value of cinema is to be found not in the photography *on the surface* of the images, but in the rhythm *between* the images, and in the idea, *behind* the image" (quoted in King 1984, 56, original emphasis). The new art that cinema could represent relied, according to Gance, on montage and superimposition (57), yet these formal elements, and a theoretical interest in the potential of image-generation in the mechanical age, are about all he really shared with the avant-garde. Like the Eameses, but contra the avant-garde he helped form, especially the Dadaists and Surrealists, Gance was deeply committed to the "democratic," "popular" and "universal" possibilities of cinema (57). In a similar fashion, the Eameses' exhibition work on behalf of science and technology also steered a politically suspect terrain geared for the masses: science without destruction, technology without devastation, a brave new frontier led by benevolent governments and corporations working hand-in-glove to deliver Cold War propaganda about a promised, brighter tomorrow.

The montage editing developed fully by Gance emerged most powerfully in the work of Sergei Eisenstein, who acknowledged the debt. Eisenstein's correspondence with Ezra Pound linked montage with Imagism as an explicitly

symbolic and nonnarrative means of juxtaposing images to create meaning in the minds of the audience through spatial proximity. The rapid cutting of images intended to overwhelm and affect the senses not by the logic of argumentation but by an onslaught of information and perceptual input became essential to the Eameses' *Glimpses* and *Think*. The formal editing capacities and opportunities afforded through Gance's innovations resulted in both immersive efficacy and rather frequent befuddlement on the part of pavilion attendees. When Stan VanDerBeek writes about experimental cinematic interests in the mid-1960s, at the same moment that *Think* is up and running, he lists "simultaneous images and compression, abstractions, superimposition, discontinuous information, social surrealism, [and] episodic structure" as being among the most telling concerns of filmmaking of the moment (1966a, 338–339). The list speaks to the past and to VanDerBeek's present, just as it perfectly describes the work of Gance and, to a large extent, that of the Eameses.

While *Think* was flashing away inside the IBM dome on Flushing Meadows, a special issue of *Film Culture* was published that contained an "expanded arts diagram" by George Maciunas.¹¹ The diagram provided a de facto genealogy of Fluxus. Maciunas turns some of his explanation of the diagram into a thinly veiled shot at E.A.T., but more directly at the whole technology-and-art lab collaborative moment when he writes that "pseudotechnology, or 'engineering' (in quotes) has been derived from the fact that artists at best can acquire technological knowledge or understanding comparable to that of a technician (TV repairman) rather than that of an engineer or a scientist who spends many years studying his specialty (just as artists spend many years producing art)." In this scenario, Maciunas can envision only a dumbing down of techno-scientific knowledge because, "(1) artist's new ideas or concepts will be affected or limited by his own past and recent scientific knowledge rather than the uncommunicated knowledge of the engineer. (2) the collaborating engineer meanwhile cannot very well communicate a sophisticated technical and scientific knowledge to the artist without giving him a four year university course on related subjects." For all of his general dismissiveness of such fashionable endeavors, he found some collaborations of this sort more palatable than others, and in his diagram he offers under "International Exhibitions" a section listing those working on "Expanded Cinema," which he places in bold. Here the Fluxus founder lists Stan VanDerBeek, Harry Smith, and Charles Eames as "artists" capable of holding their own with engineers.

If Charles Eames could keep up with current engineering knowledge, according to Maciunas, then Ray Eames could certainly stay on pace with the neo-avant-garde work of the time, thus positioning the Eames Office at the fe-

cund intersection of the two avant-gardes we are examining in this book. If one were to look for the most influential avant-garde influence on the Eames Office, one would find it in Ray Eames and her artistic career in early twentieth-century New York, and this influence permeates all aspects of the varied areas the Eames Office engaged in. Ray Eames, according to Joseph Giovanni, was an integral player in an important moment of US abstraction and its development out of the European avant-garde through the American Abstract Artists movement. This movement, largely populated by students of Hans Hofmann, began meeting in 1936, and sought to explore and combine “Expressionist, biomorphic and geometric elements” with a thorough knowledge of, but ultimately an eschewal of, Realist and Surrealist tendencies (Giovanni 2005, 58). Ray Eames worked with this group for years and was at its core when the 1941 Abstract Expressionism show was held, an exhibition that featured works by Léger and Moholy-Nagy, among others. The group also kept close ties with Willem de Kooning and Arshile Gorky. All of this grew out of Ray Eames’s full-spectrum interaction with the early 1930s New York avant-garde and artist-as-activist scene, taking classes with Hofmann and visiting exhibitions by Boccioni, Cézanne, Picasso, Matisse, Miró, Léger, and Calder (45). She also had a profound interest in dance (both modern US and classical Indian), working with form and movement in space as it pertained to bodies and the built environment, which become hallmark attributes of the conceptualization of pavilion experience the Eames Office brought to the US government and major corporations. Studying dance, architecture, design, painting, and music as iterations of the same kinds of impulses, Ray Eames charted a multifaceted and immersive career in the arts prior to meeting Charles and starting up the Eames Office.

Hofmann, for his part, had lived in Paris from 1904 until 1914, conversing with the Fauvist and Cubist movements and circulating with Braque, Delaunay, Picasso, Picabia, and Matisse. After getting his own classes up and running in New York, he counted among his students Gorky and de Kooning, along with Jackson Pollock and Clement Greenberg (56). Giovanni argues that Hofmann provided an integral link between pre-World War I Paris and post-World War II New York (56). Hofmann taught Ray Eames a great deal about space, within the plane of the image but also with ways in which the image can be broken into parts and redistributed to create different senses and sensations of space. Both *Glimpses* and *Think* bear the signature of critically deploying various ways of breaking frames of the image (moving or still) as well as that of the exhibition space. Similarly, the plasticity of molded plywood finds some initial theoretical and formal engagement in Hofmann’s classes about the plasticity of the image, the plane, and the frame. These ideas about plasticity

proved especially useful for Ray Eames as Hofmann encouraged students “to test color tensions by moving and pinning small pieces of colored paper on their canvases” (56). This method foreshadows the ways in which the Eameses broke with single-projector filmic images and scattered screens about a space of installation (in Moscow and New York) to alter relationships between spectators, space, and the images being viewed. For Hofmann, perspective presents problems because it is only concerned with “one movement in depth, while plastic experience goes in and comes back to the observer” (quoted in Giovanni 2005, 57).¹² With Ray Eames neatly moving between different genres and kinds of depth, the Eames Office brought the avant-garde past and present to the promotional aid of IBM and the US government, an avant-garde in form and to a certain extent in spirit, but by no means revolutionary. This was an art-and-technology collaboration that corporate America found more palatable, and indeed desirable, unlike LACMA’s A&T. The Eames Office unlocked a formula that provided more purchase for their “experimental” pavilions than E.A.T. could ever hope to muster for its contribution in Osaka.

Think: Communicating Comfort with Universal Computation

As the crowds at the New York World’s Fair in 1964 flowed around the Universe and stared at the future of robotics-as-entertainment provided by Disney for the General Electric exhibition “The Carousel of Progress,” they also headed to the IBM pavilion to partake in the last and most extravagant immersive multiscreen event the Eames Office would generate. The Eames Office continued to make films, but *Think*, housed in the “Information Machine,” proved to be the last in a pavilion setting. It would also be their last to raid the avant-garde exhibition, projection, and moving image larder for a general spectatorship in a thoroughly designed and controlled environment.

In its attempt to change its image as a corporation primarily producing defense computation for the military to one generating universal computation, IBM knew that it needed to educate the general public (that is, stockholders and taxpayers) about how their new product (computation) would change every aspect of their daily lives. The company unveiled its new look at the World’s Fair in their pavilion. The IBM pavilion was largely the product of the Eames Office in cooperation with regular collaborators. From the multimedia experience of *Think* to the robotic puppet display, to the large-scale information boards complete with photos and timelines, to the signage and graphics and down to the furniture that tired fair-goers were able to relax on, the pavilion essentially provided a 3D multisensory display of the Eames Office in

action. The highlight of their offerings was *Think*, a multimedia projection and immersive educational experience that furthered the overall pavilion theme of computing and daily problem-solving. The building's design replicated an IBM Selectric typeball that bore only the letters IBM and not the full alphabet. Those entering the pavilion inhabited the corporation's latest innovation in typewriter technology. The centerpiece, *Think*, used a hydraulic lift called "the people wall" that pushed some 500 spectators 50 feet in the air into the suspended theater. The audience was physically thrust into the theater, itself strung with randomly arranged non-uniformly sized screens (fourteen long and eight smaller ones in the shape of rectangles, circles, squares, and triangles). The Eameses had been experimenting for several years with expanding the cinematic technological format with lenses, throw (the distance between projector and screen), and screen shape, as well as editing and narrative techniques. The effect of the space was like being in a control room or TV studio (Colomina 2001, 7–8), and thus anticipates our dashboard-driven computer navigation. The earlier film *Glimpses* provided a similar, less ambitious attempt at fully immersive high-tech, avant-garde inflected public relations, with the client in Moscow being the State Department.

The Moscow exhibition brought together a number of notable Eames collaborators under the auspices of their old friend George Nelson. The others included Billy Wilder and Buckminster Fuller, whose geodesic domes protected the US missile-siting perimeter and early-warning-system stations, but also projected US construction and engineering prowess in international forums. Fuller constructed a massive golden dome on site in Moscow, a construction project that Khrushchev watched intently. The USIA team was hired to exhibit highlights of US "science, technology and culture," with Nelson receiving the commission from USIA to put together the US exhibition.

Housed near Disney's 360-degree film projection system Circarama—yet another projection experiment—and Edward Steichen's *The Family of Man* photo exhibit, the Eameses' film *Glimpses* was projected onto seven screens (each 20 feet by 30 feet) suspended inside Fuller's geodesic dome. The film showed a "typical work day" in nine minutes, and a "typical weekend day" in three minutes. Schuldenfrei (2015, 71) connects *Glimpses* to the city symphony genre of the 1920s, the early twentieth-century nonfiction genre that loosely includes Dziga Vertov's classic 1929 avant-garde paean to posthuman vision, *Man with a Movie Camera*. George Nelson described the series of images as not so much a film but "a projection of data," rapidly moving and on such a scale as to prevent Soviet criticism that the objects portrayed on the screens were but a *Potemkin* film set (F. Turner 2013, 250). The purpose of the USIA

exhibit was to promote the advantages of consumer goods within the material economy of the US (as the Nixon-Khrushchev kitchen debate displayed). In what amounted to a sustained act of “product placement” with the daily doings of US life being augmented by its massive bounty of gadgets and appliances, the Eameses’ multiscreen film contained images of many of the objects on display in the pavilion. Some 2,200 still and moving images with saturated editing were shown on the massive screens by seven interlocked projectors, with each screen showing a different but occasionally synched scene. Still images constitute most of the film, with the majority of the movement resultant from the rapid editing that deployed Gance- and Einstein-inflected montage to create a near hallucinatory kind of audiovisual immersion.¹³ *Glimpses* worked with scale and speed, such that the term “glimpses” in the title refers not only to the brevity of the “average day of life” synecdoche approach but also more importantly to the fast-cutting technique deployed for the shifting images. The “high-speed technique” is designed to overwhelm the viewer with detail and rapidity in a deluge of evanescence.

Glimpses contains images almost exclusively viewable through the advanced optical technologies of telescopes, zoom lenses, airplanes, night-vision cameras and so on, projecting “a hyperviewing mechanism” (Colomina 2001, 13). The visual technological prostheses perform and display the visualizing power resultant from intensive high-tech research, and the performance of these visual technologies is what is on display as much as the material economic contents. Though the film played with scale and the operations of the quotidian, it did so in an age of viewing technologies of surveillance deployed for the Cold War. Of *Glimpses*, Beatriz Colomina states that “intimate domesticity is suspended within an entirely new spatial system—a system that was the product of esoteric scientific military research that had entered the everyday public imagination with the launching of Sputnik in 1957” (12). Emerging from the Eameses’ multimedia events comes a new visual and spatial norm, one in which the vast scales of micro and macro viewing found in Cold War tele-technologies become the basis of ubiquitous screen culture as the source of information and control. The merging of the corporate sphere and the geopolitical agenda deployed in the Moscow and New York pavilions show the Eames Office (and others) as interfaces for the avant-garde of military R&D investment and the artistic avant-garde.

Prior to the Moscow event, the Eames Office had begun to shift increasingly toward experiments with space and the built environment. They concentrated their focus on modeling and imaging work and away from Renaissance architects such as Filippo Brunelleschi in order to address what they believed

to be the pressing demands of twentieth-century architecture: “organization of information.” As cybernetics, systems theory, and information theory began to change the intellectual landscape, so the Eames Office responded with a full engagement of how best to visually and spatially convey these developments. *Think* becomes their most direct, and indeed audacious, manifestation of these concerns. In addition to educating the public about problem-solving through universal computation, *Think* intended to make the public feel more “at home” with an increasingly “changing and complex” world (Schuldenfrei 2015, 162–163). Further, it connected information theory and communication theory to larger systems that supposedly allowed for individual choice in spite of their scale and complexity. Their earlier film *A Communications Primer* contains a voice-over ideologically laden with the assertion that “no matter where it occurs, communication means the responsibility of decision all the way down the line” (F. Turner 2013, 255). The strident reinforcement of the individual and choice in a Cold War world of automated weapons systems attempts to rescue democratic ideals clearly in peril. By explaining how universal computation could be used in daily life as well as for military purposes, IBM hoped attendees would come away from the exhibition with an image of the corporation as helping the average citizen attain “the negative capability” (to borrow from John Keats) required to be comfortable in a world guided by information, abstraction, consumer wealth, material gain, and nuclear destructive capability—while conveniently eliding the fact that the same systems and technologies made possible all of these contradictory contemporary phenomena.

In order to achieve this PR sleight of hand, the Eameses dug deep into the avant-garde aesthetic store of formal experimentation. Beyond reaching back to Svoboda’s innovations of screen placement, arrangements, and relationships from the 1950s, they looked to Herbert Bayer’s 1935 design sketch “Diagram of 360 Degrees of Vision” (figure 5.1) for their own fully immersive space determined by communication and information (Turner 87–90). As with *Think*, Bayer’s 1930 Paris exhibition at the Grand Palais was intended to overwhelm the audience with images and evoke a visual gestalt. This general exhibition ethos was carried forward to his work during the next decade. Bayer’s design for MoMA’s *Road to Victory* exhibition in 1942, led by Edward Steichen, exploited the potential plasticity of the exhibition space and materials that he had promoted in the previous decade. The opened traditional exhibition space offered a walk-through collage environment with angled images surrounding viewers. Elements of this kind of display remained in effect in Europe in the 1940s and

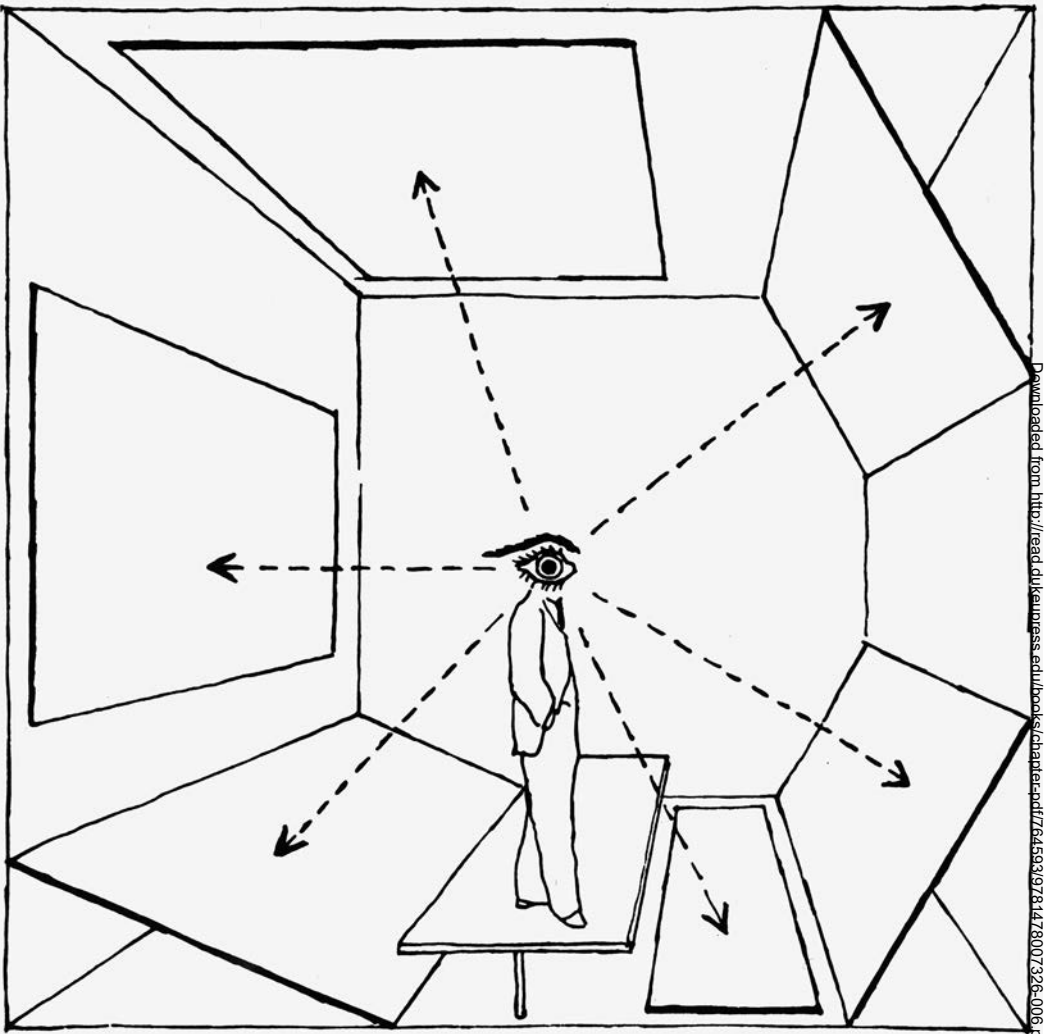


Figure 5.1. Herbert Bayer, "Diagram of 360 Degrees of Vision" [1935], in *Visual Communication, Architecture, Painting* (New York: Reinhold Publishing, 1967), p. xx.

1950s, including specific postwar pavilions, and then found their way into the Eames Office's own pavilion work for the State Department and IBM. Such display experimentation also caught VanDerBeek's attention, as exemplified by his Movie-Drome. For Bayer and the Eameses, the control of information had intentional, and propagandistic, agendas in contrast to the more liberatory and open-ended desires that marked VanDerBeek's projects. With *Think*, cinematic and anti-cinematic, as well as gallery and anti-gallery, exhibition techniques came together, and the experience proved simultaneously disorienting and comforting for spectators. With Bayer's influence on the Eames installation for IBM, along with the long-established dialog between the Eames Office and Kepes, the spatial imaginary of the Bauhaus as well as the socio-visual imaginary of a post-historical ideology geared toward a techno-future of communication and control permeates the exhibition.

The early part of the twentieth century contained an abundance of experimental forms of exhibiting images (still or moving or both) that found echoes in *Think*. El Lissitzky's 1926 piece *Kabinett der Abstrakten* (*Cabinet of Abstract Art*) and Frederick Kiesler's *Raumbühne* (*Spatial Theater*) from 1924 offer spectators an exploded spatial relationship between the act of viewing and the displayed works (Sutton 2012, 148–150). *Think* took forward the Bauhaus desire for “total environment” as articulated by Walter Gropius and Bruno Taut in the 1920s, itself a kind of updated kindred aspiration of Wagner's *Gesamtkunstwerke*. The Eames Office control of the exhibition space clearly moves toward the kinds of effects the E.A.T. Pepsi pavilion in Osaka hoped to achieve. Extending this Bauhaus principle of “total environment,” Bayer's brief 1939 “fundamentals of exhibition design” booklet provided alternative display strategies for public exhibitions, ones he utilized later for his influential US installations during World War II and immediately after. Bayer's usage for these display techniques included avant-garde attempts to undermine bourgeois assumptions about art engagement. For the Eames Office pavilions, however, such viewing and exhibition strategies actually found form *as* bourgeois infotainment that furthered the shared political and economic horizons articulated by the US government and major corporations.

VanDerBeek, writing in *Film Culture* at the time of *Think*, expressed an ethos for expanded cinema and the new language of vision resultant from the increased speed with which humans, images, and information moved. “Man as mobile-man suddenly discovering tremendous amounts of communications consciousness, communications aesthetics and communications instinct” is his audience, VanDerBeek claims (1966b, 15). This audience would contribute to his expanded cinema projects and benefit from them by fully engaging the

global community wrought by real-time technologies. The issues expressed here pertain explicitly to the future of expanded cinema while also looking back a few decades to Moholy-Nagy's *Vision in Motion* (1946b). VanDerBeek and the Eameses were covering similar aesthetic and technological terrain, using similar strategies, techniques, and technics. Their rhetoric also echoed one another: VanDerBeek called Movie-Drome "an experience machine" and the Eameses called *Think* an "information machine." A residual Deweyan progressive view of experience is evident in both, with VanDerBeek aligning with the technolibratory potentialities of Kepes and the Bauhaus, and the Eames Office leaning toward corporate-driven futurist visions. Movie-Drome ran from 1962 to 1965 but also was fired up again for the 1966 NY film festival, and thus operated contemporaneously with *Think*. Just as the Eames Office understood itself as a laboratory for general education of contemporary, cutting-edge scientific theory, at least through their films, VanDerBeek said he wished for the Movie-Drome space to function as "a sight and sound research center" (VanDerBeek 1966a, 339).

VanDerBeek and the Eames Office operated in a larger New York scene of multiscreen experimentation, some for avant-garde artistic purposes and others for the kind of corporate promotions and geopolitical agendas found at the World's Fair. Andy Warhol's experimental multiscreen films from the mid-1960s include *Inner and Outer Space* (1965) and *Chelsea Girls* (1966). Similarly, Smithsonian Folkways collector Harry Smith created a four-screen experimental art piece, *Mahagonny*, which Smith called "a mathematical analysis of Duchamp's *The Bride Stripped Bare*" expressed in terms of "Kurt Weill's score for *Aufstieg und Fall der Stadt Mahagonny* with contrapuntal images (not necessarily in order) derived from Brecht's libretto for the latter work" (quoted in Friedberg 2006, 212). At the New York World's Fair, the Eames Office had other multiscreen competition with Francis Thompson and Alexander Hammid's *To Be Alive!*, for the Johnson Wax pavilion, which used three screens to depict life in Africa, Europe, and the US. The eighteen-minute film won the 1966 Academy Award for Best Documentary Short Subject. Thompson and Hammid provide exquisite examples of turn-of-the-century aesthetic practice co-opted for mainstream ends, having traveled from avant-garde experimental film work to the first IMAX via World's Fair pavilions with their multiscreen work. Prior to these multiscreen extravaganzas for the general public, Thompson directed the city-symphony-inspired film, *N.Y., N.Y.* (1957), which employed refracted images made through Moholy-Nagy techniques, and Hammid codirected with Maya Deren the vastly influential *Meshes of the Afternoon* (1943). Following their Oscar-winning hit in New York, Thompson and Hammid made an epic six-

screen extravaganza for Montreal Expo '67 called *We Are Young*. The projection included a sly sequence that sent up *Think* by featuring shots of the IBM Selectric as a symbol for the boredom created by soulless corporate office work.

Usefully, Colomina likens the Eameses' multiscreen displays to the grid space of a newspaper, "a space where continuities are made through 'cutting'" (2001, 22). Of course Gance's and Eisenstein's montage and nonlinear editing were in visual dialog with the earliest of Picasso's and Braque's collage works, which used the newspaper grid as inspiration, structure, and content. Although the "people wall" for *Think* provided enforced immersion in the media and mediated environment, the rapid editing on the oddly shaped screens flashing contradictory images sometimes overwhelmed the method of explaining complex universal computing in the simple manner that the Eameses wished to convey. In spite of half a century of collage-driven aesthetics in a host of print and visual culture works, the speed of this enclosed environment and the expanded frame of cinematic projection made for an uncanny experience for many who witnessed it. Trained as they were within the single-screen image space of cinema (and TV) and the singular narrative trajectory of popular-culture production, it is no wonder audiences found it all somewhat bewildering.

Colomina argues that the Eameses created a space with their multiscreen images that emerges out of a Cold War mentality in terms of architecture, experience, space, and imagination that has become a norm for us in the present (25). *Think* becomes the model of the control room: the multimedia/multiscreen space of the war room/control room for space flight, situation rooms, tele-governance of the globe, TV studios, avant-garde "happenings" and "expanded cinema" (7–8). The kind of multimedia experience the Eames Office generated in Moscow and New York belong to a larger trajectory of media and ideological formation that Fred Turner calls "the democratic surround" (2013), but which we argue has even larger geopolitical ramifications through the perpetuation of the material and immaterial effects of universal computing and the normative constitution of Cold War systems.

To be thrust up in the air and into *Think* was to enter a sphere of knowledge, influence, and control made possible by universal computation, a sphere of near-future technological controls resultant from military research spending crossing over into the consumer market and presented through domesticated avant-garde techniques. It was to enter a sphere of immaterial processes rendering the world as a sphere, a globe, a self-contained monad of information and screens birthed during, and becoming constitutive of, the Cold War, which has only been exponentially accelerated and amplified ever since.

Buckminster Fuller: Maker of Domes, Counterculture Visionary, and One-Man Lab

Utopia or Oblivion: The Prospects for Humanity is the title Buckminster Fuller gave to his 1969 collection of essays about the fate of our species on the planet. Very much of its moment, the title reflects the Manichaean options generated by the Cold War arms race and the decades of dread that the Macy conferences considered immanent and yet hoped to stave off. The standoff between nuclear powers, though still a cold and not a hot war (except in proxy sites), exerted its influence on the emergence of art-and-science/technology labs, as we have seen, but more importantly the institutions that housed them and the rationale that they had for funding them. In this moment, Fuller, the one-man lab freed from institutional constraints, emerged as what he had always imagined himself as being: a visionary for humanity. Fuller held an understanding of humanity's place within a history driven by a technological development of humanity's own making but without much consideration of its consequences or potentialities. The long historical view Fuller insisted upon helped contextualize present concerns and design plans for the future. In one of the essays in this collection, "A Citizen of the Twenty-First Century Looks Back," Fuller, who was born in the nineteenth century, looks backward and forward from the chronotope of his writing and concentrates on "the world-transforming and world-shrinking developments" of technological change that largely determined geopolitics (1969, 17). From this perspective, "politics is, inherently, only an accessory after the fact of the design-science revolution" (17). The most serious side effect found in geopolitical thinking, he consistently argued, was the *a priori* of the zero-sum game in which the self is pitted against the other in a Malthusian struggle over limited resources. In order for the other to gain, the self must lose and vice versa: in other words, the Cold War struggle of nation-states played out as larger metonymic collectives of the individual and the other. Such assumptions and their destructive, oblivion-creating operations emerge in his late writings with great frequency, guiding his ever-alternative thoughts away from status quo concerns. The large systems of self-destructive global processes he addressed were often generated as much by the unintended consequences of military R&D as they were the intended results of geopolitical policies.

Relying on the work of friends, colleagues, and collaborators at the Macy conferences, he too wished to use their insights for a peaceful and prosperous world for all humanity through the application of global design science. "Norbert Wiener's and Claude Shannon's cybernetic 'feedbacks,' which implement their 'information theory,'" Fuller writes, "will swiftly and progressively

correct the decisions and thereby the historical course of world-around citizenry evolution. Very swiftly all humanity will learn to think about total Earth, total humanity, and total accumulated knowledge, total resources, etc. and will begin to make some powerful omnihumanity, omni-Universe-considerate decisions” (1981, 342). Like the Macy conference thinkers, and like the Dada movement before them, Fuller intended to turn the innovations found for warfare into universal betterment through critical reverse engineering and alternative applications. Speaking to the audience he had garnered through Stewart Brand’s boosterism—an audience that comprised a kind of counterculture modernist movement desirous to start afresh in communes or individually free of governmental dictates—Fuller highlights how fortunate it is that the “do-more-with-less invention initiative does not derive from political debate, bureaucratic licensing or private economic patronage” (1969, 16). Taking terminology from Big Science, which constitutes the polar opposite of the innovation ethos Fuller espouses, he claims that “the license comes only from the blue sky of the inventor’s intellect” (16). “Blue sky research,” that is non-instrumental research, may be the ideal of Vannevar Bush and the purview of massive governmental funding and coordinated projects, but for Fuller, the “blue sky research” that really counts depends on nothing but the unfettered imagination of anyone. The do-more-with-less initiative, he claims, has developed independently from and in opposition to the arms race, which was designed to kill the greatest number of people from the farthest away with the greatest accuracy and with the least effort. This is what Big Science and governments have delivered to us in spite of the human evolutionary capacity for boundless innovation. Using his own design work as an example, Fuller explains that he decided, as early as the 1920s, to use his energy and intellect for the common good, in this case to create cheap and effective housing, with the “scientific dwelling-service industry as the preferred means of transferring the scientific do-more-with-less capability from a weaponry to a livingry [*sic*] focus” (17). The opposition between weaponry and “livingry” is one that Fuller liked to toss about in his late lectures and writings—another binary option facing humanity and its goals. And it is in this dynamic that Fuller’s potential utopia might emerge through his mantras of designing on micro and macro scales to save Spaceship Earth and those who travel on it.

The other essays in the book lay out this program. The titles of the essays reveal the changes he believes humanity can achieve by redesigning existence at all scales: “Prevailing Conditions in the Arts,” “The World Game—How to Make the World Work,” “Geosocial Revolution,” “How to Maintain Man as a Success in the Universe,” and “Curricula and the Design Initiative.” If the goals and pedagogical means of realizing them seem familiar, they are. This is the

Deweyan progressive line charted in the Bauhaus transplants in the US, especially that of Moholy-Nagy and Kepes. Fuller ends “A Citizen of the Twenty-First Century Looks Back” with claims that neither he nor any other human is a genius, while simultaneously stating that all children might be born geniuses and become “degeniused” by the world (22). Negroponte’s answer to this was to prosthetically outfit the child with digital tools and re-genius youth. The progressive trajectory that Fuller echoes, though no less enthusiastic about technology’s potential, is to retrofit the child’s view of humanity and its place in a globe of limited but adequate resources. Fuller further claims that the accolades and the recognition of his work that arrived late in his life are due to the “world’s youth” seeking “world peace” and understanding that to accomplish this utopian ideal, they must use alternative strategies to those offered by establishment economic, governance, and instrumental teleologies for technological development and innovation (20)—alternatives and steps he had been honing his entire and very active life.

The project Fuller both proposed for Expo ’67 in Montreal (see Marchesault 2017, 210–215) and pursued in his ongoing research at Southern Illinois University, a project that exemplified his global design science and its repurposing of systems of control as systems for liberation, is explained at some length in the essay entitled “The World Game—How to Make the World Work.”¹⁴ The World Game project was not built for the Expo, but it features Fuller’s futurist pedagogical design tendencies on full display. Structured as a game intended to be accessible by anyone—not just the ruling elite who control the earth’s resources—the simulation education platform that Fuller envisioned pitted teams in noncompetitive engagement to solve pressing global issues. In a later discussion of the World Game, published in his last book, *Critical Path*, and in the full flush of a few decades of game theory’s predominance in geopolitical planning, he calls his game the antithesis of “World War Gaming.” The roots for RAND-generated game theory, Fuller argues, lay in the British Empire’s use of data and calculations from them devised by Thomas Malthus, the chief statistician for the East India Company. These assumptions concentrated on “the lethal inadequacy of life support on our planet” as the bases for calculation, planning, and action (Fuller 1981, 202–203). Using data visualization, real-time information, and statistics, as well as programs for scenario planning, Fuller’s game aimed to “make the world work.” Success entailed making “every man a world citizen and able to enjoy the whole earth, going wherever he wants at any time, able to take care of his of needs of his forward days without interference with any other man and never at the cost of another man’s equal freedom and advantage” (183). Fuller argues that the goal of the game is not to improve hu-

manity per se, but merely to up its productivity with regard to resource investment and use. Thus, the game deploys secondary data collection by piggybacking on extant technologies engaged in other operations, for example using spy satellites that are “inadvertently telephoning the whereabouts and number of beef cattle around the surface of the entire earth” (184).

In this way, the game anticipates some of the most current cutting edge deployments of multi-scaled remote sensing systems, such as the Planetary Skin Institute. Initiated by NASA and Cisco Systems, the Planetary Skin Institute provides a multi-constituent platform for planetary eco-surveillance (Beck and Bishop 2016, 18–19, 273–288). The site operates as a nonprofit means of gathering real-time information from remote-sensing systems regionally and globally to create replicable and scalable big data information about ecological and environmental conditions. It is the current altruistic avatar of Fuller’s World Game, but with a twist. As with all of the technologies deployed for the World Game or the Planetary Skin Institute, unintended consequences arise. Just as Fuller wanted to skim secondary inadvertent information off spy satellites, so too can the information generated by the Planetary Skin Institute be used as the basis for resource futures investment, using the same real-time technologies to track environmental conditions and futures markets.

If military technology can be converted to peaceful and progressive use, as delineated in the essay and game, so could Fuller’s “scientific dwelling-service industry” be deployed for military aims in the service of the arms race furthered by Big Science. This was a fact Fuller knew all too well but often chose to repress. We only need to look at some of the various uses and deployments of his signature structure, the geodesic dome, to understand this repression. The geodesic dome moved from housing for anti-aircraft and missile defense positions along the Distant Early Warning (DEW) Line to housing State Department expo events (including Brussels in 1958 and Moscow in 1959—both involving the Eames Office) to being the architecture of choice for counterculture, antiestablishment, DIY, *Whole Earth Catalog*-influenced communities. Using some design principles he had developed for his Dymaxion house in the 1920s, the structure sprang from Fuller’s time teaching at the Design Institute in Chicago in 1948. At Black Mountain College that same year Fuller brought a large geodesic dome from Chicago to rural North Carolina, literally providing a structural linkage between one Bauhaus institution and another, while fueling immaterial and intellectual links.

The dome received its first public viewing in 1954 at the Milan Triennial, built out of corrugated cardboard. The Italians called it “architecture out of the laboratory” (Krause and Lichtenstein 1999, 374), but Fuller thought of

this incarnation as “anticipatory rather than actual,” despite carrying off the top prize at the exhibition (Marks and Fuller 1973, 61). Commercially, and therefore one must assume “actually,” the first dome using Fuller’s patents was built by the Ford Motor Company starting in 1952, using it to cover its new headquarters in Dearborn, Michigan. Fuller therefore claimed his first customer was “Mr. Industry himself” (61). What would become in the late 1950s and into the 1960s “official pavilion typology” in architecture (Scott 2007, 155) entered US government use, in the field as well as in the imagination, for Cold War defense and propaganda. Thus the impetus to provide affordable shelter for humankind shifted to commercial and defense uses and then back again in the utopian futurist design plans offered late in Fuller’s life.

The US government’s deployment of geodesic domes for both propagandistic and defense purposes emerged almost simultaneously in the mid-1950s. In 1956, for a fair in Kabul celebrating the independence of Afghanistan, USA commissioned (through Jack Massey, who worked often with the Eames Office for similar events) a dome 100 feet in diameter for the US stand. As mentioned, a massive dome housed the US pavilion at the 1959 Moscow World’s Fair, which proudly displayed the Eameses’ *Glimpses* and Edward Steichen’s *The Family of Man* (for which Herbert Bayer provided the original display design). Khrushchev reportedly said, after visiting the pavilion displaying *Glimpses*, that he was more impressed with the dome than anything else in the US pavilion and wanted to have Fuller come to the USSR to teach their engineers his techniques (Marks and Fuller 1973, 63). And again in Montreal in 1967, Fuller’s dome, though without the World Game geoscopic display, provided a pivotal moment for US architecture on the international stage. As the Kabul dome was going up, Fuller was providing other parts of the government with domes for use along the DEW line, which operated through surveillance and information. An ad touting the technologies deployed for this system explains, “Basically an early warning radar line is a communications system.” Further, the ad, ironically published in *Life* magazine, claims that Western Electric worked with Bell Telephone and Lincoln Laboratories at MIT to develop the system. The inset image of the geodesic dome in situ reads “DEW line radar station in the Arctic.” The ad provides a public-directed articulation of the increased roles of information and communication technologies and theories in providing for the military defense of the country. The immaterial and somewhat de-terrorialized nature of global surveillance emergent in the mid-1950s became materially manifest in systems like the DEW line.

The Fuller archives indicate that the designer had even grander ideas than simply providing shelter for radar equipment and the personnel required

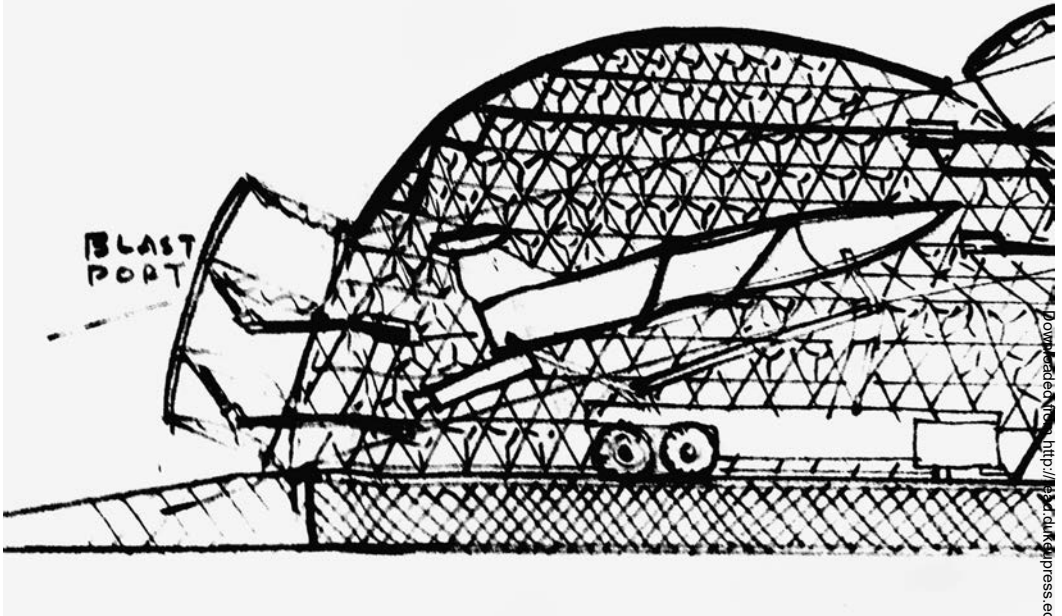


Figure 5.2. Buckminster Fuller, detail from a plan for the US Department of Defense, M1090 Series 2, Box 90 (1955–56), Fuller Archives, Green Library, Stanford University.

to run these remote sensing stations. Fuller's files include blueprints for the domes to have multipurpose functionality, including rotating rocket bases and launching pads that would fuse detection and response (figure 5.2).

The Department of Defense did not take up this specific usage of Fuller's structures in arctic climes or elsewhere, just as the Soviet Army did not follow through on its interests in his 1920s Dymaxion living quarters, about which much correspondence between the Red Army procurement office and Fuller's own office was exchanged (the Fuller archives). These suggested deployments of his designs clearly fall more on the "weaponry" side of the systems, resources, and economics ledger than the "livingry" that Fuller championed in the 1960s. To be fair, Fuller moved easily between domains with a designer's understanding of the client's needs regardless of ideological consideration, and it was through these work experiences that he constituted a kind of holistic vision of alternative thinking about resources in a more expansive manner, one

outside of the geopolitical and economic systems at play in the Cold War while still holding on to thinking globally and materially. His “do-more-with-less” mantra, though, was at play even in his earliest designs. As we see with the blueprints for the rotating geodesic domes as arctic shelters, however, he took the military mission one step further by combining apperception and defense with corresponding retaliation built into the same structure. This was in step with the development of most weapons systems at the time of the Cold War, and it reveals how Fuller’s idealistic reversibility of global military surveillance technologies for human betterment and maximum resource exploitation in the World Game could be flipped the other direction as well: altruism (“livingry”) easily converted to killing (weaponry). Fuller knew this because, after all, he had designed them. He wrote about his structures and design principles otherwise, perhaps aware that his audience also understood fully that reversibility obviously goes both directions, no matter what, and in an age of constant weaponization, his domes, as was the World Game, could be used for military aims.

Although Fuller did not get his proposed, fully operational, large-scale, real-time electronic version of his World Game at Expo ’67 in Montreal, he did get a Jasper Johns painting of his “Dymaxion Air-Ocean World Map” to hang in the massive geodesic dome erected there. Johns’s painting, *Map (Based on Buckminster Fuller’s Dymaxion Airocean World)*, was a multipieced and multi-shaped canvas measuring more than 30 feet long and over 15 feet high. As with Fuller’s cartographic vision, the icosahedron Dymaxion map created by Johns could be disassembled or assembled at will, a result of it being too large to work on in full in his studio. Fuller’s map could be folded together to create a sphere or unfolded, origami-like, to be a flat two-dimensional object. Cocreated with Shoji Sadao, the map provided the model for the interactive, data-driven version used in the World Game. Fuller and Sadao’s map moved easily, then, between 3D and 2D representations of the earth’s continents. These were represented in size based on population distribution and resource usage instead of the standard cartographic nod to land mass. While Fuller’s optimistic vision of the map’s pedagogical elements was at odds with Johns’s more pessimistic view of the geopolitical agonism that marked the moment, the map mimetically reproduces fully “the age of the world picture,” to quote Heidegger (2002). The telecommunications technologies developed to provide constant real-time surveillance of the earth necessary to conduct the Cold War and enforce the Truman Doctrine simultaneously converted the earth into a globe (a bounded sphere visible at all times) as well as into a flattened world without horizon (due to the use of “over the horizon” visualizing technologies and complete surveillance of the entire planet all at the same time). The globe as stage

for Fuller-inflected neighborliness also became a site of contiguous land masses locked in Johns-depicted animus: 3D holistic vision coupled with 2D Cold War strategically generated economic inequities.

Telecommunications technologies, such as satellites, metonymically manifest many of the ways that modern technoscientific culture in the post–World War II moment began to create new visions of the planet and shape the metaphysics of the imaginary in terms of what the earth could and should be. In the first few paragraphs of Heidegger’s essay about the world picture (2002), he argues that modernity’s essence coalesces around a series of seemingly disparate phenomena including science’s most visible manifestation as machine technology, itself using specific forms of mathematics to realize its visibility and power. This situation aligns modern science with modern metaphysics. Further, he argues that within the late modernity of the middle part of the twentieth century, art moves into the domain of aesthetics and thus becomes a means for simultaneously creating and articulating human experience. All of this culminates in human action being understood as culture, which then means that culture articulates the highest point of human achievement and care, with care being converted into “the politics of culture” (57). Heidegger brings mathematics, science, machine technology, art, aesthetics, culture, and metaphysics together in a penetrating view of the legacies of twentieth-century trajectories that bespeak the themes found in Fuller’s writings and his map, as well as in Johns’s interpretation of the latter. Both Fuller’s global design science and Johns’s painting responded to the same sets of concerns that Heidegger did: concerns that were advanced by the avant-garde of US military spending.

The cultural politics of Heidegger’s interpretation of modernity’s generated metaphysics can be charted in the capacity for representation to equate with both experience and the real, for the map to create the territory and the technological means for cartographic representation to become the tools for human crafting of the earth as globe, or as flat observable plane, or as Spaceship. The visualizing tele-technologies on display in *Powers of Ten* and the universal computation of *Think*, as well as in the World Game and Dymaxion map, are just such tools, for they chart a trajectory in which the world traveled from being construed as plane to orb to globe to flat, surveilled entity again. Our capacity to see and render the planet whole erased the horizon of the world and made it capable of being held in our collective tele-technological grasp. The age of the world picture is evoked in these maps made by Fuller and Johns, and it is so in the means by which we have enframed, delineated, and curtailed potential futures, realized or not.