Technocrats of the Imagination

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Published by Duke University Press


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A Laboratory of Form and Movement
Institutionalizing Emancipatory Technicity at MIT

The Bauhaus became the focal point of new creative forces accepting the challenges of technical progress with its recognition of social responsibility. It became the experimental shop, the laboratory of the new movement. —László Moholy-Nagy, *The New Vision*

The task of the contemporary artist is to release and bring into social action the dynamic forces of visual imagery. As contemporary scientists are struggling to liberate the arrested energy of the atom, painters of our day must liberate the inexhaustible energy reservoir of the visual associations. To accomplish this, they need a clear grasp of the social field, intellectual honesty, and creative powers capable of integrating experiences into a plastic form. This goal will be reached only when art once more lives in inseparable unity with human life. —György Kepes, *Language of Vision*

In his introduction to a special issue of the journal *Daedalus* published in 1960 and devoted to the “visual arts today,” Hungarian émigré and Bauhaus veteran György Kepes explained how his early enthusiasm for the formal properties of painting came to seem “anemic” in a world characterized by “mass poverty, depression, and social unrest” (1960, 5). Turning his back on painting and redirecting his interests toward “man-made images” and their impact, Kepes sought in the mass “visual communication of ideas” (5) a means of making lives better, only to find that the suffering brought about by World War II rendered his ideas
“shallow” (5). Kepes decided to go in search of “values” rather than tools and found them in modern science. “Basically,” he writes, “the world made newly visible by science contained the essential symbols for our reconstruction of physical surroundings and for the restructuring of the world of sense, feeling, and thought within us” (5). Kepes became convinced that a purposeful union of the visual arts and science provided the most compelling means of realizing the profound social reconstruction he had so long pursued, and he returned to the pages of *Daedalus* five years later to make a pitch for the kind of collaboration he had in mind. Central to his vision for combining the arts and science was the stimulation of discourse between artists interested in technical developments and generating interaction among artists, scientists, and technologists. “Fully aware of the considerable difficulties” involved in engineering such interaction, Kepes writes, with only the merest Swiftian irony, “I wish to put forward a modest proposal”:

I propose the formation of a closely knit work community of eight to ten promising young artists and designers, each committed to some specific goals. The group, located in an academic institution with a strong scientific tradition, would include painters, sculptors, film-makers, photographers, stage designers, illumination engineers, and graphic designers. They would be chosen for their demonstrated interest and alertness to certain common tasks. It is assumed that close and continuous work contact with one another and with the academic community of architects, city planners, scientists, and engineers would lead to a climate more conducive to the development of new ideas than could be achieved by individuals working alone, exposed only to random stimulations and subjected to the pressures of professional competition and the caprices of the art market. (1965, 122)

Two years later, Kepes would realize his ambition with the opening of the Center for Advanced Visual Studies (CAVS) at MIT, nearly thirty years after the center’s core values were first articulated in the US by Kepes and his Bauhaus colleagues.

Shortly after the collapse of the New Bauhaus in Chicago after only one year, its director László Moholy-Nagy rallied his teachers, friends, and advocates to reestablish the school and its progressive curriculum. In late 1938, Moholy-Nagy launched the School of Design in Chicago with a statement of intention “to form a new nucleus for an independent reliable education center, where art, science and technology will be united into a creative pattern” (quoted in S. Moholy-Nagy 1969, 166). Eschewing a traditional board of
trustees, Moholy-Nagy enlisted the moral support of like-minded educators whom he believed understood the nature and ambition of his project, including Julian Huxley, who had worked with Moholy-Nagy on a film about architecture at the London Zoo and who was an advocate of the “unity of science” school; W. W. Norton, the US publisher of Moholy-Nagy’s *The New Vision*; Alfred H. Barr, who sponsored the Bauhaus exhibition at MoMA in 1938; and John Dewey. With Europe perched at the edge of the abyss, the luminaries Moholy-Nagy assembled to back his new iteration of the American Bauhaus represented the combined authority of the US progressive tradition and the remnants of the European design avant-garde. After Barr’s important MoMA Bauhaus exhibition closed in New York, it toured the West and East coasts for fourteen months, with other Bauhaus shows and events taking place across the country through 1939 and 1940. By the time the US entered the war in late 1941, Barr’s promotion of Moholy-Nagy’s synthesis of US pragmatism and European discipline had embedded itself decisively into American cultural life as a vision of the future. When asked why he felt the Bauhaus important enough to warrant a show at MoMA, Barr’s response captured the extent to which US modernity and old-world vanguardism had found a common language: the Bauhaus, Barr explained, had “accepted the machine as an instrument worthy of the artist,” removing the gap between “the artist and the industrial system” and between “fine” and “applied arts” (quoted in S. Moholy-Nagy 1969, 168).

Kepes had worked with Moholy-Nagy in Berlin and Chicago, and now joined him on his staff at the School of Design, where he adapted the influential program of study on light and color that would lead to his appointment at MIT in 1947. The vision for socially transformative arts-science collaboration Kepes articulated in the mid-1960s is unthinkable without the Bauhaus, but it was probably unachievable without the postwar clout of a heavyweight research university like MIT. Nevertheless, despite the long germination process, CAVS would last only seven years under Kepes’s directorship. As with Moholy-Nagy’s New Bauhaus and School of Design, the American context proved welcoming in theory but resistant in practice. As the intellectual, academic, and institutional climate in the US during World War II and the early Cold War shifted, as we saw in the previous chapter, away from the collectivist spirit of the New Deal era and toward a more competitive, meritocratic, and hierarchical model of ends-oriented corporatism, the kind of exploratory and, indeed, often emancipatory tendencies of projects like CAVS, with their roots deep in early twentieth-century European radicalism, meant that although they might be supported rhetorically (as evidence of creative freedom), they were often financially and politically vulnerable.
Nevertheless, CAVS caught the wave of speculative techno-utopianism that rose in the early 1960s to become the first of MIT’s art-and-tech labs. Kepes was able, in his influential post-Macy conference interdisciplinary studies series of publications Vision + Value, to set the tone and the terms for what an integrated and institutionalized US art-science program might look like. Drawing in important artists and thinkers, including Buckminster Fuller, Norbert Wiener, Walter Gropius, John Cage, Robert Smithson, and Jack Burnham, CAVS laid the groundwork for subsequent MIT ventures such as the influential Media Lab, under Nicholas Negroponte, and the Center for Art, Science, and Technology (CAST). Situated within a prestigious and influential university flush with Cold War military R&D dollars, CAVS was able to mobilize Kepes’s thirty-years-in-the-making vision of a studio-lab fusion that might, as he hoped in 1960, be capable of restructuring the physical and spiritual worlds—of inventing the future.

**Light, Vision, Kunst und Technik: The Bauhaus in America**

László Moholy-Nagy joined the Bauhaus in Weimar at the invitation of Walter Gropius in 1923 and developed the foundation course for the school in that year. After emigrating from Germany initially to Amsterdam and later London, he landed in Chicago and became the first director of the New Bauhaus. *The New Vision*, first published in 1929 and translated into English for a US edition in 1935, helped broaden Moholy-Nagy’s reception while cementing a Bauhaus continuity with Europe. The work chimed with that undertaken by Gropius at Harvard and Albers at Black Mountain as émigré scholars, artists, and theorists returned elements of Dewey’s pedagogical philosophy to the US. The centrality of arts-and-design education, as well as aspects of the pragmatic application of new industrial materials, for building an emergent and semi-utopian social urbanism proved a key feature of this experimental educational practice—“the laboratory of [a] new movement” as Moholy-Nagy (1946a, 21) called it—and the grand ambition undergirding the design program was no less than the transvaluation of everyday life. “We shall give you a laboratory of form and movement,” László Moholy-Nagy promised a Chicago audience in September 1937, “a place where all you’ve swallowed down inside of you during office hours and in factories gets liberated by experience and coordination. When you have been with us, your hobby will be your real work” (quoted in S. Moholy-Nagy 1969, 149).

The shared commitment of the Bauhaus and Deweyan pragmatism to a socially emancipatory “learning by doing” philosophy runs through Kepes’s
writing. In *The New Landscape in Art and Science*, for example, Kepes cites a 1919 speech by Dewey delivered in Tokyo in which Dewey claims that “there is no more significant question before the world” than the challenge of reconciling “practical science and contemplative esthetic appreciation.” Without science, Dewey goes on, “man will be the sport and victim of natural forces which he cannot use or control,” while without art “mankind might become a race of economic monsters, restlessly driving hard bargains with nature and one another, bored with leisure or capable of putting it to use only in ostentatious display and extravagant dissipation” (cited in Kepes 1956, 28). For Kepes, tasked at MIT with directing a revamped drawing program intended to run through all levels of the university, the visual image could function as an “act of creative integration” able to “mobilize the creative imagination for positive social action, and direct it toward positive social goals” (13–14). This required, at the individual level, retraining the eye of the perceiver, but also, more broadly, reshaping social perception. The purpose of books like *The New Landscape*, with their carefully designed interplay of image and text, was to assist in the reorganization of visual literacy. This was the pedagogical basis for Kepes’s new “Visual Fundamentals” course at MIT.

In a fresh edition of *The New Vision* published in 1945, Moholy-Nagy includes a short introduction that underscores the importance of fundamentals in Bauhaus thinking. Aimed precisely at the nonspecialist, the postwar version of *The New Vision* set out to explain how the Bauhaus merger of theory and practice amounted to no less than the groundwork for a new society. The National Socialists closed the Bauhaus in Germany, Moholy-Nagy reminds his readers, but in the US it was possible for the Bauhaus to aid “America as the bearer of a new civilization” that had to “simultaneously cultivate and industrialize a continent.” The US is the “ideal ground,” he continues, “on which to work out an educational principle which strives for the closest connection between art, science, and technology” (Moholy-Nagy 1946a, 10). Explaining Gropius’s first Bauhaus of 1919 as “a community of workers” that resulted in “the powers latent in each individual [being] welded into a free collective body,” Moholy-Nagy highlighted the practical dimensions of art as experience (19). What this means for Moholy-Nagy is that art is always historically contingent, and he gives an account of how the German iteration of the school arose in response to industrialization and the redundancy of traditional forms of design and manufacture. “The Bauhaus,” he explains, “became the focal point of new creative forces accepting the challenge of technical progress with its recognition of social responsibility.” Conceiving of a design school as “the experimental shop, the laboratory of the new movement” (20–21) situates education
at the center of innovative social and cultural production, much as Dewey had conceived of the school as the engine of democracy.

Moholy-Nagy recruited a heavyweight team of supporters to launch the Chicago Bauhaus, just as he was to do with the launch of the School of Design. Gathered from different universities, some even working gratis, sympathetic researchers included “unity of science” members from the University of Chicago such as Charles W. Morris, Carl Eckart, and Ralph W. Gerard, the latter an important neurophysiologist who became a founding participant in the Macy conferences on cybernetics. Morris and Gerard would provide pieces for Kepes’s later book *The New Landscape in Art and Science*, and the holistic sensibility shared by voguish intellectual trends like Gestalt psychology, organicist biology, and cybernetics became integrated into the utopian Bauhaus ethos of crafting form from fragmentation and of creating whole sociobiological humans through aesthetic and visual training.

This loosely defined mix of information theory, Eastern-inflected, process-oriented investigation, and Hungarian aesthetic rigor would come to shape a range of artistic preoccupations through the 1950s and 1960s, so it is not surprising that someone like John Cage felt at home among the Bauhaus crowd. Cage, who would later collaborate with Kepes on numerous projects, met Kepes and Moholy-Nagy at Mills College when they were all teaching a summer institute there. The conversations were such that Moholy-Nagy invited Cage to teach a course called “Sound Experiments” at the School of Design in 1941. Such was the sympathetic engagement on all sides that Cage occasionally described his work as “a counterpart in music of the work in visual arts conducted at the School of Design, which is the American Bauhaus” (cited in F. Turner 2013, 121).

In 1945, as Moholy-Nagy typed out the introduction to the third edition of *The New Vision*, the short-lived Chicago Bauhaus had metamorphosed into the School of Design, and then the Institute of Design. American soil was perhaps thinner than he had hoped, and unable, or unwilling, to allow the luxuriant foliage of the Bauhaus vision to prosper. Yet the republication of the book, as well as the extended work documenting the results of the experiment in Chicago in his posthumous volume *Vision in Motion*, attest to Moholy-Nagy’s unchecked determination. Signs of a larger economic shift away from progressive values in the US can be found in Sibyl Moholy-Nagy’s account of her husband’s tenure at the School of Design and its restructuring as the Institute of Design, complete with an administrative board. When László engaged in fundraising activities, he offered donors “a stake in the future,” not in the kind of intellectual influence that can be achieved in a lifetime but rather that
attained “in the lifetime of generations.” The newly appointed professional fundraiser for the Institute, on the other hand, offered donors “an income tax deduction” (S. Moholy-Nagy 1969, 217). With the new fundraiser’s appeal to the rational motivations of individual actors, a different economic context for arts-and-design education becomes apparent. That Moholy-Nagy could not sustain the School of Design with his dedicated community of internally regulated artists and teachers, and needed the infusion of business expertise to survive, marks the changing values emergent in the shift from the school’s founding in 1938 to the institute’s in 1944. The postwar world of expertise and individual action entered the experimental lab and classroom of the Bauhaus in Chicago and converted it into another office.

The dissolution of the Chicago Bauhaus scattered its influential artists and educators across the US. Kepes wound up in north Texas, where he finished Language of Vision, his own version of Moholy-Nagy’s The New Vision, which would bring him to larger prominence. Here Kepes revealed the same tenacious idealism toward social progress and modernist belief in arts education that drove Moholy-Nagy. The introduction to Language of Vision is a paean to Deweyan pedagogy, with its desire for the perceiving subject to interpret and reconstitute the chaos of the world into forms capable of fully realizing the human capacity of each individual. Looking beyond the catastrophes of the twentieth century, Kepes maintained a vision of humanity as a transcendental good, following in the utopian steps of nineteenth-century forebears such as William Morris, Thomas Carlyle, and John Ruskin. Language of Vision led him to the heart of technoscientific research in the postwar US: MIT.

Language of Vision: Kepes in Print

As an educational institution, MIT has a unique R&D history, with shifting relations between industry and government, especially defense spending. As Anna Valley notes, Kepes’s arrival at MIT followed an extensive institutional reconstitution of MIT in the 1930s from an applied sciences extension of industry to a full research-based science university interested in basic scientific research (2013, 146–147). The shift was somewhat prescient because Vannevar Bush makes the same case in his influential apologia for basic research, Science: The Endless Frontier, just after World War II. Writing for a general audience, Bush defends the long-term instrumentality of basic scientific research on the basis that “blue sky” investigations eventually translate into applications initially unforeseen. Technological process as such is therefore a consequence of untrammeled scientific curiosity. In many ways, Kepes’s tenure at MIT between
1946 and 1977 was characterized by a similar commitment to basic research and a trust in the virtues of the unintended consequence of a genuinely de-instrumentalized experimentalism. In Vallye’s assessment, Kepes was “directed toward inventing a discourse of the aesthetic image as both analog and catalyst for communities of knowledge—tentative, exploratory and allusive structures dedicated to the production of the ultimate postwar desideratum: social potential, aleatory and opportunistic” (146). His educational ideals, in other words, embodied the elements that constitute a lab. And MIT knows labs.

The MIT motto _mens et manus_ (“mind and hand”) chimes perfectly with core Bauhaus pedagogical principles. The two institutions, however, could not have been more different when it came to financial stability and relevance within the national research agenda. In 1943, in the midst of World War II, MIT handled $25 million worth of government contracts. The president of the university at the time, Karl Taylor Compton, wrote a report to his trustees that said: “The value to our country of this type of institution in a time of emergency [is enormous]. Its war value is parallel to that of a fleet or an army . . . I submit that its value to our country justifies it maintenance on the highest possible plane of effectiveness” (quoted in Schweber 1992, 152). After the war, Department of Defense funding continued to rise. Flashpoint events such as the Czech coup and the blockade of Berlin in 1948/9 proved pivotal, but the Korean conflict “cemented” the postwar partnership (152). The volume of sponsored research at MIT doubled every six years during the immediate postwar period, and from 1948 to 1968 accounted for 80 percent of the university’s total operating budget (Kaiser 2011, 105). These were the years of Kepes’s most fervent activity at MIT, activity that helped contribute to a momentum of institutional alliances, geopolitical demands, total war mentality, and a shared belief in technological solutions to military/political problems that can be found in the technicity the university established with the government prior to World War II.

Vannevar Bush argued that although a continuity existed in the pre-war and wartime alliance between MIT (as an example of, and metonym for, university-based research), the military, and technological development, a fundamental change occurred within the momentum of the trajectory during the war and into the Cold War. The fact that “World War II was the first war in human history to be affected decisively by weapons unknown at the outbreak of hostilities,” he wrote, created “a situation that demanded closer linkage among military men, scientists, and industrialists than had ever been required” (quoted in Schweber 1992, 156). This is the context in which the expanding
scale of scientific research moved toward so-called Big Science. During the
decades after the war, with the momentum of large-scale projects aimed at
solving large-scale problems, the sciences, physics especially, moved from in-
dividual and small-team labs to huge factory or multi-sited projects involving
large numbers and many teams, as Peter Galison (1992) explains. The teams
included not just scientists but engineers, administrators, and technicians with
university research entering the industrial factory floor and scientists becom-
ing project managers more than experimenters.

In the immediate postwar moment, Kepes helped overhaul MIT’s cur-
riculum shift toward general education and basic science with a set of courses
structured around vision, techniques, and their social implications. Much of
this was articulated in Language of Vision (1944), in which Kepes generates
“a philosophy of the image as both index and instrument of a visual technol-
gy of knowledge” (Valle 2013, 154). Kepes charts the demise of traditional
perspective due to visual technologies that have freed the biological eye to see
otherwise. The section titles indicate a dramatic, dynamic narrative movement
in which perspective expands, proliferates, fragments, and converges in kalei-
doscopic sequence: “Amplified Perspective,” “Multiple, Simultaneous Perspec-
tives,” “Breakdown of Fixed Perspective,” “Integration of the Plastic Forces,”
“Compression, Interpenetration,” “Final Elimination of the Fixed Perspective
Order,” and “Ultimate Opening of the Picture Surface.” As is the case in some
aspects of cybernetic theory, the centrality of the human in a given process (in
this case, image-making) disappears.

The interdisciplinary influence of Kepes’ book is indicated by the in-
cision of an introduction (in the first edition) by Sigfried Giedion, a cultural
historian of automation and of architecture, and the addition, in the 1969 re-
print, of a new introduction by universal grammar advocate S. I. Hayakawa.
That thinkers working in advanced technology and information theory were
considered suitable advocates for a volume by a designer, artist, and educator is
a measure of the extent to which Kepes perhaps achieved his aim of dissolving
disciplinary barriers. Hayakawa highlights Kepes’s emphasis on the relatedness
between viewer and viewed as a revolutionary call to move beyond “the de-
luded self-importance of absolute ‘individualism’ in favor of social relatedness
and interdependence” (1969, 10). The emphasis on process and connections,
of mediations and interactions between things, spoke to the general impulse
toward systems art at MIT and the new Center for Advanced Visual Studies
(CAVS). But as Donna Haraway reminds us, “it matters which figures figure
figures, which systems systematize systems” (2016, 101). For Kepes, the systems
with which he wished to systematize his own visual systems emerged from the sciences through a belief that the arts could positively and effectively engage with the challenges of contemporary society. The sciences were the ultimate pharmakon: poison and medicine. Just as the only solution for nuclear proliferation appeared, paradoxically, to be more nuclear proliferation, for Kepes the only solution to technological turmoil was more technology and science, but funneled through and tempered by visual communication obtained in arts training. Learning to see differently in a literal sense would, for Kepes, engender a transformation of vision in a figurative sense: the perspective wrought by perspective, in other words, held the key to social healing, if only it could be envisioned—seen—as such. “To perceive a visual perception implies the beholder’s participation in a process of organization,” Kepes claims in the introduction to the second edition; “the experience of an image is thus a creative act of integration” (1969, 13). Such acts were essential for imposing structure on an exponentially chaotic social sphere, leading to his conclusion that the plastic arts, therefore, are “an invaluable educational medium” (13). The language of integration, important to visual communication, found institutional fit at MIT in defense-related research in the post–World War II environment that demanded interdisciplinary cooperation (Valle 2013, 162). CAVS emerged out of such efforts.

Both Reinhold Martin and Anna Valle separately argue that Kepes’s *The New Landscape in Art and Science* (1956) lays out the philosophical vision for CAVS. A similar argument could also be made for his foundational work *Language of Vision*, and, more pertinently, for the Vision + Value series and its Macy conference-inflected gathering of interdisciplinary scholars. In the years between *Language of Vision* and *The New Landscape*, an explosion of technological expansion of the human sensorium and its capacities materialized. Kepes, as did Moholy-Nagy, had an interest in scientific or technologically generated images that dated back to their days in Weimar Berlin, something they carried onward to their London and Chicago activities. Further, the opportunities, challenges, and problems such images posed to traditional modes of image production figured strongly in their artistic production, course design, and critical writings. The capacity of technological tools to alter spatio-temporal relations provided visual access to elements of nature not otherwise detectable and transformed the field of the visible. Just as Étienne-Jules Marey and Eadweard Muybridge had done with motion studies in the previous century, and Marey had done with electrocardiograms, labs at MIT and elsewhere at the time Kepes was writing *Language of Vision* were busy capturing the splash-back from drops of
water (Berenice Abbott) and spark photographs of objects in flight. “The products of the oscilloscope, stroboscope, and interferometer,” Vallye writes, and “the images on radar screens, radiographs, and spectrographs, were diagrams of events, rather than descriptions of ‘things’ or ‘properties’” (2013, 163–165). Just as systems theory moved from object-centered research to processual investigations, representations of natural events previously undetectable by unaided senses provided graphic representations that challenged artistic mimetic forms. Rendering the invisible visible held fascination for Kepes and others.

In “Toward a Dynamic Iconography,” the final section of Language of Vision, Kepes writes about the non-artist role in Dada and Surrealism in a way that evokes the scientist in the lab (1967, 194–196). Both work to deliver through specific techniques a form from nature in spite of the fact that it is the artist/scientist who provides and applies these techniques. Sounding like an early incarnation of John Cage and his experiments with chance, Kepes writes that the earlier generation of avant-garde artists had telescoped their role in artistic production “only to a sheer assistance of chance happenings” (194). It is but a small step from the artist as scientist setting up an experiment in a lab to the systems art that would preoccupy CAVS from Jack Burnham’s fellowship there into the end of the 1960s.

The Vision + Value series of publications resulted from an interdisciplinary set of seminars and editorial commissions by Kepes intended to foment further exploration of a visual field capable of synthesizing technological change while also taking into account the shift marked by cybernetics toward systems and information as leading the age toward, in Kepes’s words, “communication and control” (quoted in R. Martin 2003, 67). Kepes attended some of the Macy conferences and had been inspired by the cross-disciplinary goal of pursuing cybernetic theory as a means for thinking the entire biosocial domain of human and nonhuman action, whether in the form of nature or machines. The echoes with Bauhaus ideals struck him as obvious, though certainly in the repetition of these goals the stakes had been raised significantly. And the role of the Vision + Value books in laying the groundwork for CAVS is significant, emerging as they did in 1965 and 1966 and reflecting overlapping interests found in Gestalt psychology, physiology, biology, systems theory, logical positivism, linguistics, architecture, art, design, music, and perception theory. Attending the events that Kepes organized were friends from the New Bauhaus days, the University of Chicago scholars Charles Morris and Ralph Gerard. The impressive array of contributors also included Christopher Alexander, Rudolf Arnheim, Saul Bass, John Cage, Buckminster Fuller, Sigfried Giedion,
Marshall McLuhan, George Nelson, I. A. Richards, Lancelot H. Whyte, and Ludwig von Bertalanffy. The range of disciplines huddled under titles such as *Structure in Art and Science, The Nature of Art and Motion, Education of Vision*, and *Sign, Image, Symbol* that reveal the scope and ambitions of Kepes’s vision of a lab that could bring the arts and sciences harmoniously together as avant-garde composers and artists argued ideas with mathematicians, physicists, microbiologists, psychologists, architects, systems theorists, literary theorists, sociologists, art historians, and media theorists.

These seminars and their resultant publications displayed an ongoing concern with the scale of visual and intellectual inquiry that underpinned much of the impetus behind Bauhaus-influenced education, making, and theory. The import of scale is markedly evidenced across the decades, for example in Kepes’s *New Landscape*, in which patterns of nature become scaled and technologically envisioned; and in Moholy-Nagy’s *Vision in Motion*, where he discusses the Industrial Revolution’s transformation of the world through “mass production, mass distribution and mass communication” resulting in the need to think in global terms (1946b, 13). The latter understood art as a means to bridge the biological and the social, the individual and society, the intellect and emotions. The role of the artist in society, he writes, is “to penetrate yet-unseen ranges of the biological functions, to search the new dimension of the industrial society and to translate the new findings into emotional orientation” (11). The arts for Moholy-Nagy are essential for a healthy society, and it is incumbent on artists and designers to solve the problems wrought by technology and industrialization. The exhibition *The New Landscape* that Kepes curated at MIT in 1951 displayed images from microscopic photography and the edges of telescopic imagery of outer space. The exhibition of images suspended in air essentially embodied a three-dimensional still version of the Eameses’ massively influential film *Powers of Ten* (1968), which placed micro and macro technologically enhanced scientific photography within an art-centric context. The title of the book that Kepes published five years after the exhibition, *The New Landscape in Art and Science*, suggests that the visual essay and collage format of the text provides “a kind of laboratory experiment” in which the “visual images” provide “the content” and the “verbal statements—comments and documents—are illustrations” (1956, 17). The simplistic inversion of the standard power relationship between image and text in scientific publications belies the larger agenda of subverting science as a privileged site for knowledge production. Offering the verbal texts as supplements for a visual story told through images, Kepes reveals the necessity of the supplement for the foundation of the main text—in
this case, one composed of a “poetic vision” for the “new landscape” the book invoked, evoked, and embodied (17).

The organization, layout, and textual strategies of *The New Landscape*, according to Vallye, operate as “a collage of instruments and agents, a subjects-objects collectivity within which ‘pattern-seeing’ would spring forth” (2013, 171). The book—as did the Vision + Value series, though to a lesser extent—offers a dynamic juxtaposition of images, quotations, text, and image captions resulting in an Eisenstein montage effect of images propelling textual exegesis (see figure 2.1). The historical arc depicted in the book is long and intercultural, drawing on examples from ancient and early civilizations in a synchronic though historically framed manner. The pattern-seeking agenda that scales from micro to macro levels of visibility and skipping through chronotopes of world history offers a reading of nature and culture in visual dialog that expands the struc-
turalist interests of the moment. The experimental design deployed in Kepes’s and Moholy-Nagy’s books show the sustained interest in graphic design for Bauhaus educators, working as they did across advertising and numerous other design applications. Graphic design, back in the Weimar Republic, offered an early instance of industrial reproduction capable of appropriation for artistic production. The enthusiasm never left them, as *The New Landscape* exemplifies. Reinhold Martin, however, finds in the book a sense of “exhaustion,” of the Kepes project for sociobiological training and control running into a technological momentum no longer containable (if it ever was) (2003, 72–75). It is difficult to follow Martin on this one given that in 1956 Kepes leapt straight into the seminar series that became Vision + Value, and thus constituted the immediate interdisciplinary precursor to CAVS. Perhaps this exhaustion can be noted in the almost immediate collapse of CAVS projects as they ran into a sociopolitical and institutional context that made the avant-garde art and science/technology lab an untimely intervention in US academia. Nonetheless, Kepes forged ahead and his first group of CAVS artists included Jack Burnham, Stan VanDerBeek, and Otto Piene.

At the university level at MIT, the late 1960s anti-war backlash registered loudly, as it had at many universities across the US. Given the institution’s heavy reliance on government-funded research, MIT acutely felt the change. The Hoffman Committee’s 1970 report *Creative Renewal in a Time of Crisis* addressed a host of problems facing the university, including the drying up of government-sponsored research and the failure of the school of Humanities and Social Sciences to deliver on its mandate of creative, interdisciplinary thinking for all MIT students (Kaiser 2011, 115–117). It was within such a context of institutional self-reflection and examination that Kepes’s CAVS emerged. The report also argued that the institution had a burgeoning PR problem in the midst of Vietnam War controversies due to the institution’s close association with weapons of war, an image unlikely to help recruit students or serve the university well in the long run (much as IBM had made its own public-facing pivot from military computation to universal computation). Again, CAVS could help with this problem.

**The Totality of Patterns**

“Experiment in Totality” is the subtitle of Sibyl Moholy-Nagy’s detailed, critical memoir of her husband’s life and work (1950, 1969), and it neatly articulates the consistency of Bauhaus ideals, at least as espoused by Kepes, from 1919 until the 1970s. The consistency of the ideals proves especially marked in each postwar
moment. The subtitle could well be applied as easily to the Macy conferences, cybernetics, systems theory, and systems aesthetics. The history of the Macy conferences as the fount of cybernetics is well documented. Once Norbert Wiener and Johann von Neumann had become increasingly convinced during their World War II research that inquiry into neurology and engineering (biology and machines) had essentially joined up as a single subject, they attempted to form a research center at MIT to pursue this path. Although their institutional efforts ultimately failed, the Macy conferences became their lab for scientific and social scientific interdisciplinary debate and experimentation with cybernetic models and processes (Dupuy 1994, 70–89). Designed as a forum for discussion and debate, not a site for the presentation of final thoughts and findings, the informal laboratory nature of the conferences allowed for experimentation with shared problems and interests across disciplines.

The primary driving force behind the Macy conferences was not Wiener or von Neumann but the University of Chicago physiologist Warren McCulloch, who initiated the interdisciplinary examination into “cerebral inhibition” in 1942, an event funded by the Josiah Macy Jr. Foundation. At that event, Wiener and Julian Bigelow presented some of the research they were conducting for the military on the theoretical problems posed by antiaircraft defense, research that found unexpected resonance with that pursued by Mexican physiologist Arturo Rosenblueth. The paper presented at the initial Macy conference, and published in 1943 under the title “Behavior, Purpose and Teleology,” found analogy between antiaircraft targeting systems and the movements of patients suffering from brain damage: essentially self-correcting mechanisms or systems. An obvious difference between the two examples is that one system is mechanical and the other organic, with the self-correcting behavior of each overriding the difference. The paper contained nascent elements of cybernetics, including feedback loops and the difference between how a system (human, machine, or human-machine) actually behaved, and its stated or intended results. After the war ended, a series of ten additional conferences took place leading to the establishment of cybernetics, information theory, systems theory, and artificial intelligence as important interdisciplinary areas of academic study.

Kepes, along with many artists and art theorists, was drawn to these theories as a means of articulating, according to the latest jargon, the convergence of mechanical and organic energies that had preoccupied his work since the 1930s. As “interpretive syntheses” (Shanken 2013, 83–86) of systems theory and cybernetics, Kepes’s applications and inspirations, as with many of the art world’s adaptations of cybernetics research, were a less than rigorous deployment of new scientific models and, as Jones suggests, more of an “ameliorative
project” to keep art and science together through “analogy and translation” (Jones 2013, 517).

Systems theory in biology predates by a decade the cybernetic inklings articulated by Wiener et al. in 1943. Posited by von Bertalanffy in the 1930s, systems theory concentrates on processes over objects, relationships between parts, organic teleology over mechanical function, and the organization of an entity in relativistic terms. In a manner of speaking, cybernetics provided mathematical and engineering underpinning for the insights laid in biological systems theory, and hence their frequently linked status. The developments offered by cybernetics to the emergence of information theory by Shannon and Weaver, again initially offered at the Macy conferences, added ideas of control and communication to the potent mix of theories available to the artistic avant-garde. Some members of the Macy conferences were also prone to a kind of metaphorization and interpretive synthesis, though of a stripe more scientifically grounded and informed than that which filtered out into the art world. Pushing back against the then-dominant positivists and behaviorists, many of whom occasionally antagonistically attended the conferences, Wiener, along with the anthropologists Gregory Bateson and Margaret Mead, and philosopher Filmer S. C. Northrop, also gravitated toward using elements of their theoretical insights as a means to generate knowledge about the world (Heims 1991, 248–272). Wiener easily traversed a vast terrain of social and political issues using the language and conceptual apparatus of cybernetics as a discursive heuristic to consider communication’s similarities in nature, machines, and society—rendering cybernetics, in his work for a general reading public, more moral philosophy than mathematics. Bateson too later attempted rather vast experiments in totality that made him a leading light in the emergent counterculture of the 1960s. These grand visions spoke to Kepes’s own desires.

Nonetheless, Kepes’s selective engagement did not deter the scientists themselves from speaking to or collaborating with him and others in the arts; nor did these dialogs dampen the impulse to experiment with totality in any and all domains that Kepes kept alive. Wiener, for example, responded to Kepes’s brief for the expanded book version of the exhibition *The New Landscape* with a contribution entitled “Pure Patterns in a Natural World” (1956). In the chapter, Wiener outlines three approaches to abstract patterns in the world from the point of view of science and mathematics: one is the approach constructed through axioms or postulates that describe “intellectually or emotionally satisfying arrangements in the world” (274); the second approach works to
disentangle neat axioms; while the third approach, where Wiener sees mathematics and artists coming together, observes “specific patterns of intrinsic interest” and then offers “a free composition as an essay of the patterns observed” (274). This is the affinity he feels for Kepes’s agenda predicated on six images the artist has sent him. Wiener asserts that his brief contribution intends to illustrate that the patterns in these images not only “excite a sensory interest in the eye of the observer,” but do so precisely because “they have a specific mathematical structure” (274). Wiener then briefly analyzes the images by dividing them into mathematically sound patterns made available through telescopic and other prosthetically enhanced visual technologies and those that are mere “emotional puns”—that is, accidents of morphological analogy. Some of the latter are produced through the operation of visual technologies rather than from a mathematical standpoint. One of the more interesting of the former, for Wiener, and here echoing Kepes’s overriding agenda, depicts “dielectric breakdown,” which leads to a few lines from Wiener on the import of understanding and theorizing the phenomenon of “breakdown” for physics, mathematics, and indeed society (274). Wiener’s ongoing interest in noise and entropy finds its way into his comments and offers Kepes a real nugget to work with, while his critique of “emotional puns” flags up the problems inherent in wishing to find analogies and wholes at every turn. For Kepes’s part, though, he was under no illusion that his agenda would occasionally teeter on the vagaries of chance, happenstance, and mistaken analogs.

Ralph Gerard (1956), also fresh from Macy conference engagements and recalling his days as Kepes’s colleague in Chicago, follows Wiener’s contribution with a piece entitled “Design and Function in the Living,” which argues that while beauty might be in the eye of the beholder, it might also reside in “the object beheld” (277) as well. Gerard’s brief but wide-ranging and variously scaled reading of structure and patterning in living organisms chimes with the New Landscape remit beautifully. Citing evidence available through X-ray and electron microscopes, Gerard explains “chemistry, the structure and behavior of molecules and molecule aggregates, thus grades insensibly into biology, the structure and behavior of cells and cell aggregates” (279). Just as Kepes’s selection of technoscientific images for the exhibition and the book scale from micro to macro, so too does Gerard’s argument that “nature has an anatomy at all levels” (279). In the end, though, Gerard concludes that the most complex of organisms yield the most beauty, with a kind of evolutionary progress and bias smuggled into his nuanced overview of form, function, structure, and biology.

Despite Kepes’s efforts to keep Bauhaus principles of experimentation and wholeness operative through the 1970s, Moholy-Nagy’s wife and collaborator
thought the spirit of the endeavor ended quite a bit earlier than her friend’s efforts would indicate. Writing in the second edition of her memoir in 1969, Sibyl Moholy-Nagy states that the first experiment in totality ran from 1919 to 1945, dying the year her husband did. Nevertheless, she notes a renewed interest in his work among a younger group of artists, thinkers, and scholars who distanced themselves from the “Art and Technology foundations whose aim is ‘the esthetic contribution to technology, the upgrading of the new world of automation science through art’” (S. Moholy-Nagy 1969, xviii). Such foundations, she claims, have nothing to say to this new generation who fully understand in “Moholy’s bio-technical matter the message of an inexhaustible cosmic energy he tried to decode” (xviii). Sibyl Moholy-Nagy captured important strands of the emergent consciousness-raising next iteration of Bauhaus experimentation with holistic visions found in the work by Gregory Bateson, Buckminster Fuller, Gene Youngblood, Stewart Brand and others.

Following in Moholy-Nagy’s footsteps in his attempt to rethink design pedagogy from the ground up, Fuller published a curriculum of “design science” that includes “general systems theory,” “theory of games (von Neumann),” and “cybernetics” alongside more traditional areas of scientific inquiry such as meteorology, geology, biology, and sciences of energy (Fuller 2008). The list also includes an area of scientific inquiry he calls “synergetics,” which examines “the behavior of whole systems as unpredicted by the behavior of their separate parts” (78). The examples that he provides link the effects of the moon and sun on the earth within the solar system, as well as the exchange of gases by mammals necessary for plants and vice versa within the ecosystem. Each part requires the others within the system, but the behavior of each separate part does not predict the behavior of the others nor that of the system as a whole (78). This curriculum appears in the first volume of Steward Brand’s Whole Earth Catalog (1968), which explicitly describes the project instantiated by the catalog as one initiated by the writing, thinking, and strategies of Fuller. The curriculum Fuller proposes, as Sibyl Moholy-Nagy states when scanning the intellectual horizon, reiterates Bauhaus biosocial concerns for the study of design writ large but does so in a manner that raises the stakes and scale exponentially.

Systems theory, as we have seen with Kepes’s New Landscape, always addresses concerns of scale and complexity. And a problem with systems, as noted by von Bertalanffy (1950), is that open social systems are much more complex and difficult to circumscribe than closed physical ones. For Moholy-Nagy’s and Kepes’s borrowing of systems theory, and indeed going back to Wiener’s writings, there is a continuum of systems that scale across those domains found in their sociobiological concerns about technology and materiality. But this is
taken to even greater lengths by Buckminster Fuller in his musings on “general systems theory” in *Operating Manual for Spaceship Earth*—a title inviting contemplation of scale if ever there was one (2008, 65–82). Fuller claims that the challenge to systems theory is to think the biggest systems possible: the planet within the solar system. Using his newly established field of “synergetics,” Fuller approaches the behavior of large-scale systems (in this case, the largest we have) and their constituent parts, including Earth, all life upon it, and the ecosystem in which that life functions. Fuller’s sci-fi imaginary positions humans as astronauts who must learn how to live in the closed system Spaceship Earth affords while understanding fully the rapidly changing nature of the elements in the systems. A year later, Fuller wrote his famous introduction to Gene Youngblood’s influential study, *Expanded Cinema*, where holistic design and thinking, as it is in *Spaceship Earth*, is in its fullest glory, helping establish him as a key countercultural futurist, and doing so within an experimental visual arts context. Fuller enters the text in speculative fiction mode, positing telepathic communication between all unborn children *in utero*, so-called womblanders that constitute, at the time of his writing, a quarter of the population of Africa (1970, 16). To protest against the conditions into which they would be born, in a kind of reverse or sideways Lysistrata revolt, an allusion one of them invokes telepathically to the others, the womblanders in collective social resistance refuse to leave their individual amniotic worlds (17). Fuller’s account becomes a springboard for thinking about long stretches of human history, travel, and cross-cultural interaction to comment on current globalization and real-time telecommunications technologies for reshaping the future of human life on the earth.

One of Fuller’s primary targets is the false geometry of Cold War planetary divisions, without considering the liberatory potentialities of emergent communication technologies. The visualizing technologies that Youngblood’s book (1970) discusses at length, the realm of expanded media, holds the potential for “Space Vehicle Earth” to awaken our sense of interconnected fragility within the biosphere of our benevolent, isolated sphere (Fuller 1970, 30–31). These technologies, as theorized by Youngblood, can correct our “misorientations” of terrestrial power and control, Fuller claims, toward the “forward, omni-humanity educating function of man’s total communication system” (34). Fuller closes by stating that Youngblood’s notion of the “Scenario- Universe principal” “must be employed to synchronize its senses and its knowledge” in order to ensure the survival of those installed on “Space Vehicle Earth” (35).

Telepathic fetuses and geometries of power, subjugation and financial gain might at first glance seem a far cry from the pedagogical trajectory of
Moholy-Nagy and Kepes. Yet the claims for what the “expanded cinema university” of the near future can provide through “a synchronizing of the senses” and an alignment of knowledge attendant upon their technologically enhanced operation are consonant with Bauhaus-era utopianism and the insistence on the control and utilization of the full range of human capabilities by Kepes and others. The techno-utopian moment perhaps has arrived, but Fuller has seen such possibilities squandered before; thus there is no breathless technophilic cheerleading here. Rather, Fuller’s aim is a reckoning of human capacities and limitations, an understanding of human vulnerability in an ecosystem on a planet hurtling through inhospitable space. To recall the Bauhaus edict, he is looking for a biosocial perspective to emerge from technologies of visualization that expand human sensorial perspective.

Youngblood’s own, rhetorically Fuller-fueled, analysis of the implications of telecommunication technologies for humanity manages to combine the Bauhaus, the Macy conferences and the Esalen Institute, filtered through Fuller, Wiener, and McLuhan, each of whom is cited as an influence (Youngblood 1970, 44). For Youngblood, the present is what he terms “the Paleocybernetic Age,” a portmanteau phrase he claims fuses the “primitive potential associated with the Paleolithic and the transcendental integrities of ‘practical utopianism’ associated with Cybernetic” (41). For Youngblood, expanded cinema actually means “expanded consciousness” through technological innovations that will allow humanity “to be free enough to discover who we are” through a somewhat oxymoronic, unmediated capacity for externalizing to others our internal consciousness (41). The agenda is grand, but perhaps no grander than the other experiments in holistic theorizing examined here. The fractured visual environment reflecting a fractured sense of society’s relationship to the individual and the world sounded by Fuller and Youngblood echoes the challenges to art and design in the early decades of the century as recounted by Moholy-Nagy and Kepes. Expanded Cinema reiterates and scales their agenda for new materials and immaterialities that look to the same technologies responsible for rending the biosocial order as containing the conditions of possibility for mending it. If the visual field is in crisis, then it is up to art and design to fix it. Youngblood claims to be writing at the end of cinema as we have known it, and an end to a mass media being expanded and decentralized with emergent technologies, with a new wave of cinemas and attendant worlds ready to emerge from the exponentially expanding visual field of humanity: worlds that Moholy-Nagy and Kepes might well have recursively beheld and embraced.
Mens et Manus: MIT and Untimely Interventions

The “Seminar on Technology and Culture at M.I.T.” convened in 1964 by the Episcopalian chaplain, for example, became a model of cross-disciplinary reflection; its premise was that since society’s problems are not generated in any single intellectual discipline, therefore one should not expect their resolution to lie in any one discipline, either. —MIT Arts, “White Paper”

Those of us who have contributed to the new science of cybernetics thus stand in a moral position which is, to say the least, not very comfortable. We have contributed to the initiation of a new science which, as I have said, embraces technical developments with great possibilities for good and for evil. We can only hand it over into the world about us, and this is the world of Belsen and Hiroshima. We do not even have the choice of suppressing these technical developments. They belong to the age, and the most any of us can do by suppression is to put the development of the subject into the hands of the most irresponsible and venal engineers. The best we can do is to see that a large public understands the trend and the bearing of the present work, and to confine our personal efforts to those fields, such as physiology and psychology, most remote from war and exploitation. —Norbert Wiener, Cybernetics

Many of the scientists involved in the Macy conferences had returned to university life from war-related work, including Wiener, whose circular causality and its relation to computing for anti-aerial ballistics found purchase in many disciplines. The postwar hope was for a more unified scientific enterprise aimed at humane social progress and the benefit of humanity. Jones notes that Wiener’s desire that cybernetics and systems theory would elude the fate of instrumental modernity found in the concentration camps was shared by Kepes and his work on CAVS (2013, 532–533). Kepes’s first year running CAVS was devoted to projects that considered art and technology in relation to the “civic sphere” and the “total environment,” works generated to make whole again the visual domain and human positioning within it. Others held similar ideas. The designer and frequent Eames Office collaborator George Nelson echoed Kepes with regard to the potentially healing power of design, art, and aesthetics aligned with science and technology. Nelson expressed these views in Problems of Design (1957), a book that led Kepes to invite Nelson to participate in the Vision + Value seminar. Such endeavors, as with the Macy conferences, would depend on collective rather than individual efforts, though CAVS was more geared toward outcomes than the Macy conferences’ more discursive en-
environment. Ragain describes the CAVS structure as “perhaps most reminiscent of the collaborative research teams popular in corporate and scientific settings; tangible outcomes were expected as well as a collectivist mindset” (2012). The collectivist mindset of research teams flourished at MIT and other sites. However, what kinds of expertise entered these labs was rapidly shifting in the post-war decades. For all the fears of fragmentation in a truly frightening world of atomic physics unleashed—used in violence and constitutive of a new geopolitical world order with potentially apocalyptic possibilities and certain ecological trauma—the general corporate, university, scientific, and artistic consensus seemed to cluster around a firm belief in the lab/studio project to “experiment” our way out of collective imperilment while feeding the democratic belief in collaboration as intrinsically beneficial to society. Even stripped of its progressive Deweyan basis, the collective endeavor of CAVS still fed into the larger but shifting vision of how to advance technology and the modern industrial state, a vision at odds with Kepes’s own, but one that allowed him to establish his center at MIT.

If the Bauhaus in Germany developed a focus on tactility in design and art that drew some inspiration from Filippo Marinetti’s 1921 manifesto on “tactilism,” as well as from the wealth of new materials provided by the early part of the twentieth century (see Smith 2014), its later manifestation with Kepes at CAVS had to address the new dematerialized efforts of current technological explorations of processes and simulation. Kepes’s own interests, though wide, almost always held an immaterial dimension in that he concentrated on vision and light, developing the basic course on light and color in Chicago that he brought to MIT. This movement to the apparently immaterial elements of contemporary technology attracted the attention of Jack Burnham, who, in the last chapter of his book Beyond Modern Sculpture, argued for a move toward systems and the dematerialization of art production (1968, 312–378). Burnham’s and Kepes’s interests had aligned for years before the two started working together at CAVS, and the issue of dematerialization was central to the critical practices of 1960s artists, as Lucy Lippard’s (1967) influential chronicle of the period attests. At CAVS, Moholy-Nagy’s core Bauhaus principle of “experience with the material” (25) refines and questions the constitution of empirical experience with the material and immaterial world when put through post-Macy conference MIT thinking, goals, and agendas.

Kepes wrote to Jack Burnham in 1967 to discuss the potential of CAVS, as well as to covertly gauge his possible interest in the center. Burnham responded enthusiastically and said the project was “already twenty years behind where it should be,” asserting that the logical moment of such an endeavor was
immediately following World War II—that is, around the time of the Macy Conferences (Jones 2013, 528). In an important sense, Kepes’s publications and exhibitions had indeed been pursuing collaborative interdisciplinary work all along, albeit without the institutional frame and imprimatur provided by the center. With CAVS, he secured his platform, at least for a moment. The establishment of the center—his “creative gestalt” (quoted in Valleye 2013, 178)—in many ways was the apotheosis of his entire career as an artist, teacher, and theorist. It also proved to be an untimely intervention.

The capacity to work collaboratively with other sectors of the university and other disciplines, as well as within a community of artists, was the primary criterion Kepes used for the selection of CAVS fellows. Joining VanDerBeek, Piene, and Burnham in 1967 were Vassilakis Takis, Harold Tovish, Ted Kraynik, and Wen-Ying Tsai. Piene collaborated with Kepes on major public art projects and would eventually take over directorship of the center. The experimental filmmaker VanDerBeek arrived at CAVS via Black Mountain College, where he had worked with Fuller, Cage, and Merce Cunningham—each of whom remained inspirations and collaborators for decades—before getting involved with Allan Kaprow’s “happenings.” Described by Gene Youngblood as a visionary investigation into the “cultural and psychological implications” for the “Paleocybernetic Age” (1970, 246), VanDerBeek’s experimental “Movie-Drome” displayed inside a repurposed grain silo suggested his desire for an infinite screen and immersive environments. This project led him to computer-generated cinematic experiments with Poem Field, an early computer-animated set of films initiated at Bell Labs that he continued working on at CAVS.3 VanDerBeek’s work from the 1960s, as Gloria Sutton (2012, 313) argues, was in dialog with Kepes’s Language of Vision, making him a splendid interlocutor for the center and its director.

In a short documentary about his work at CAVS punningly entitled Stan VanDerBeek: The Computer Generation!!, the filmmaker explains he has become “an itinerant technological fruit picker,” or “a film plucker,” working collaboratively in ways “involving lots of machines and other people,” such as computer programmers, technology experts, scientific theorists, and other artists in a range of spaces.4 Freed from the studio by the means of telecommunication (modems and so on) and software storage, VanDerBeek highlights negotiations between himself and others, different technologies, human-machine relations, different languages, and new tools for artistic production. In one short sequence, VanDerBeek and his programmer/collaborator at the MIT Architectural Machine ponder the possibilities of creating an “electronic paintbrush” to complement the electronic pen they use to demonstrate to viewers different
kinds of software for art—such as a haptic program for onscreen finger painting—as well as computer-generated imagery. Drinking from MIT’s cybernetic well, he includes a futural meditation on the possibilities afforded by electronic art platforms, especially television and computers, that promise the creation of completely immersive environments capable of producing “homeostasis and balancing of our whole mind and body.” The documentary concludes with a pitch for more labs like the one at MIT to provide increased opportunities for artists to shape communication systems and networks. Predicting that art schools will soon teach programming alongside life drawing, VanDerBeek claims that the challenge to the artist and “to society as a whole” is to make these tools accessible to all. Chanting the Kepes mantra, he says directly to camera: “we must reach out, communicate, balance our senses and live a good life.”

Both the sculptor Wen-Ying Tsai and the sculptor and theorist Burnham explicitly wished to pursue systems, cybernetics, and “post-formalist” aesthetics while resident at the center. The Lincoln Laboratories at MIT especially drew Burnham’s attention and found their way into several theoretical pieces he produced while a fellow at the center, including his highly influential 1968 article “Systems Esthetics” for Artforum (2015d). Burnham’s interest in intelligent systems, artificial intelligence, and computer networks led him to seek out Marvin Minsky while at CAVS. Minsky helped pioneer AI research with chess-playing programs and robotics, and his theoretical work helped formulate Burnham’s approaches to human-machine interactions. Burnham also was in regular contact with Nicholas Negroponte, then working at the Architecture Machine Group before it metamorphosed into the Media Lab, and which constituted the primary site for computing innovation at MIT at the time. Building on ideas that provided the conclusion of his book Beyond Modern Sculpture, which opted for a systems or process-oriented understanding of modern sculpture as opposed to an object-based one, and argued that a systems consciousness would replace the art object, Burnham published articles while at CAVS such as “The Aesthetics of Intelligent Systems” that, while not always explicitly socially progressive in the manner of Dewey, argued for an altogether different understanding of humanist assumptions, which in turn altered sociopolitical relations. Burnham also attempted to distance his own pedagogical approaches from those held dear by the Bauhaus ethos by basing his later teaching at Northwestern University on self-organizing models that he considered far removed from the earlier collaborative and communal approach offered by Moholy-Nagy.

One issue regarding the increased engagement between art and technology that concerned Burnham, who was generally favorable of such interactions,
concerned the scale of funds for cultural production that such projects entailed. He found an example of this issue played out in Billy Klüver and Robert Rauschenberg’s 9 Evenings: Theatre and Engineering events, which he explored in some detail in the article entitled “The Future of Responsive Systems in Art” (Burnham 2015c). Although Burnham considers many of the elements of the 9 Evenings successful and laudatory—not least in the operating assumption that “a dehumanized scientific technology cannot help but destroy itself and the world around it,” but with artists providing the massive “social need for a symbiotic fusion between art and technology” (91)—he argues that the rising costs of technologically informed systems-art will eventually lead to artists finding themselves as part of a “technological elite” in the same way “Nobel prize scientists” have (95). Their entire position and role will merge with that of big science: “rather than being humble experimenters in the laboratory,” he writes, these scientists and future artists “are executives manipulating research money” and controlling the projects of those working under them (95). The critique, however, ends in a call for a Kantian moral imperative to understand the full ramifications of the integrated systems of nature yielding to the unavoidable responsibility society has toward the technological systems that increasingly determine human existence. In a move not unlike the Sartrean existential call placing morality in the hands of humanity because there is no recourse to a transcendental God, Burnham closes the essay by stating that as this new systems consciousness becomes visible and material, “we are beginning to accept responsibility for the well-being and continued existence of life upon the Earth” (98).

Pivoting between the possibilities of technological development and the ontological dread resultant from it in terms of socioeconomic and politico-ethical behavior of humans in relation to the natural and built environment, Burnham’s texts challenge, extend, and occasionally overturn the more sanguine humanism and uncluttered progressivism of Kepes’s books and theoretical positionings. In this way, Burnham’s writings come closer to Wiener’s sociophilosophical concerns than they do Kepes’s written works. CAVS proved an excellent black box for Burnham to think with, and he pushed the social agenda in ways less overtly polite than VanDerBeek or Kepes managed while keeping the general revolutionary spirit firmly intact.

In an echo of the warnings about the power relations inherent in art and technological collaboration, such as with the 9 Evenings events, and where it could all too easily lead, especially with opportunities for instrumental and financial exploitation, Burnham reaches back to a historical example as a cautionary moment in his essay “Systems Esthetics” (2015d). Cozying up too
quickly and easily to engineering and technological thinking led, he notes, to artistic catastrophe for the Soviet Constructivists. A revolutionary movement embraced by Moholy-Nagy while in Berlin in the 1920s, the Soviet Constructivists were not much mentioned in the US at the time, except by Burnham and Fluxus CEO George Maciunas; as a group, they followed both “historical materialism and the scientific ethos” that quickly yielded to the “technological needs of Soviet Russia” (125). As artists, Burnham states, “they ceased to exist,” yielding to “a utilitarian aesthetic” that allowed artists to be “crushed amid the Stalinist anti-intellectualism” that followed the movement’s initial forays into socio-technical aesthetic exploration (125). Even though he provides a historical antecedent of warning, Burnham believes that the current moment of his writing offers ways to avoid the totalitarian impulses that destroyed the Constructivists due to an altogether different economic and material climate from that found in the US in the 1960s. While still clearly fraught with peril, making art in the age of systems means that artists are not engaged in “novel ways of rearranging surfaces and spaces,” but rather they are enmeshed in a larger existential, perhaps even evolutionary, project (125). Burnham states that the combination of art and technology in the current moment shifts from *Homo faber*, “man the maker (of tools and images)” to *Homo arbiter formae*, “man the maker of aesthetic decisions” (125). The further he wishes to distance himself from Moholy-Nagy and Bauhaus influences, it seems, the closer he comes to closing the circle, for the pedagogical goal of Moholy-Nagy was clearly to produce students capable of making contemporary aesthetic decisions of import for the larger community. Concluding the article in a way very similar to the ending of “The Future of Responsive Systems in Art” (Burnham 2015c), he claims the decisions now facing artists, here serving as metonyms for all of humanity, “control the quality of all future life on the earth” (Burnham 2015d, 125).

Implied in this claim, operating in the long mushroom-shaped shadow of Hiroshima and Nagasaki while the Vietnam War raged in the jungles of Southeast Asia and the streets of the US, and again shot through with existentialist inspired ethics, is the intimation that these technological decisions will determine not only the quality of life on the earth but the very continuance of that life. Caroline A. Jones argues that Burnham’s concluding paragraphs move rather quickly and elegantly from “the technocratic progressivism of Soviet Constructivism, the Bauhaus, and the Logical Positivists” implicated in some of the elements of systems theory to “Dewey-inflected pragmatism and Kepes’ ambitious new unity-of-science” desires as articulated at CAVS, operating in what she calls “the crucible of cybernetics and systems that was MIT” (Jones 2013, 531). The stakes of artistic, technological, and aesthetic making at CAVS,
housed in this crucible, for Burnham, Kepes, Wiener, and others were consciously high. But it is worth noting that Burnham opens his article with a gesture toward Thomas Kuhn’s theories of paradigm shifts in scientific revolutions: as he closes the article he pauses to state the time for aesthetic decision-making about the future of technology was evanescent, and once gone, perhaps gone for good, with a new paradigm waiting (out of structural necessity) to overturn the systems moment and its biosociological opportunities as he saw them.

Otto Piene became the director of CAVS after Kepes, at a time when that temporal window for proper aesthetic decisions about technology that Burnham mentioned at the end of “Systems Esthetics” seemed to be closing. Along with Burnham and VanDerBeek, Piene was a fellow at CAVS when it opened. He joined specifically to work on his “sky art” projects, and acquired helium for these massive constructions through the cryogenic lab at MIT (Wisnioski 2013, 776). Intended as art for public spaces, these works were not flying objects but aleatory, floating ones, and thus depended explicitly on environmental conditions without necessarily being environmental art. The ideas for Piene’s “sky art” emerged initially from his days with Group Zero in Dusseldorf and his experiences during World War II. Piene co-founded Group Zero on principles and interests similar to those at CAVS, as Kepes noted, and his move to the center followed a logical trajectory.

While at MIT, Piene also worked with Harold Edgerton on strobe-lit sculpture and the development of “cybernetic sculptures,” continuing his long-held interest in scientifically informed aesthetics (Bijvoet 1997, 46). Gene Youngblood, borrowing a phrase from Buckminster Fuller, called Piene a “design scientist” (Wisnioski 2013, 780). The son of a physicist, Piene claimed that the center under him was different from what it was under Kepes because he wished to foreground “making,” the need for “dirt” studios and making new things by getting one’s hands dirty. Kepes, he said, wrote “beautiful books” and had “wonderful ideas” that he felt bought the center more purchase in its early days (786). When Piene took over CAVS in 1974, he expanded its brief to include environmental arts, media arts, and events/happenings. This expanded the reach of CAVS across MIT and into the public realm. Piene’s emphasis on environmental arts moved CAVS away from the criticisms leveled at Kepes’ exhibits for supposedly glorifying the military-university-technology nexus. Nonetheless, Piene came under specific attack for his “sky art” projects as well as other CAVS initiatives even though the center under his directorship refused defense research funding (786).

With Kepes still at the head of the center, the 1970 CAVS-directed exhibition at the Smithsonian, Explorations, sought to bring the ethics of techno-
logical innovation directly into dialog with aesthetic production and artistic institutional display habits and priorities. Kepes’s catalog for the show was entitled *Toward Civic Art* and stated the exhibition’s goals were to get “art and the public to come together” through technological innovation and its potentials rather than have the civic sphere cleaved by them (1971, n.p.). But the civic space that the show directed its aims at was a polis torn asunder by war, economics, race, and the seemingly endless stream of technological innovation for military and governmental control of that same civic sphere. The exhibition featured several CAVS artists, such as Burnham, Piene, and VanDerBeek, who were invited to bring the ethos of the center to the country’s political center through one of its most revered cultural institutions. It comes as no surprise that the exhibition was plagued by financial, technological, and critical problems. One highlight of the exhibition, though, was VanDerBeek’s *Panels for the Walls of the World*, which deployed images, collages, drawings, and photos (often from the news) essentially streamed live from MIT by VanDerBeek through newly developed fax machines (by Xerox) for display on an ever-changing set of walls at the Smithsonian. The dynamic and processual nature of the work spoke to the civic cybernetic goal of the exhibition stated in the catalog to place art and museumgoers in a “live audience feedback.” VanDerBeek, drawing on his long-standing Black Mountain influences and friendships, as well as his continued engagement and dialog with Fuller and Marshall McLuhan, related this project to aspirations he had for his Movie-Drome: a site of real-time communications overcoming time-space constraints to bring people together to engage visual materials and produce communicational communities from them. Although the networked ideas underpinning the work relied still on broadcast technologies, in a sense the piece intimated an emergent decentralized means of communication and media that anticipated internet discursive idealism. However, grounded in the moment, the more immediate demand was one that Fuller articulated in 1965, to encourage artists, designers, engineers, and the general public to develop “a design revolution that would put an end to the basic causes of war” (quoted in Sutton 2015, 63). An attempt to heal the ongoing divisions of the Cold War, then red hot in Vietnam, but housed within the Smithsonian and sponsored by MIT, VanDerBeek’s message was largely lost in ambient social noise.

And so the controversies continued and the new director of CAVS often found himself in the crosshairs. Piene’s “sky art” was singled out by Sid Lewis of the Situationist-inspired group Council for Conscious Existence as being “the advanced guard of the cybernetic welfare state, the reconsecration of order, no longer with God as ruler, but with technology raised to myth in the perfect
order of zombies” (quoted in Wisnioski 2013, 188). The colorful pamphleteering in Lewis’s rhetoric raises a central issue for arts investment at research universities, especially one so tethered to defense as MIT.

The Media Lab: Experiment Yields to Opportunity

The institutional self-representation about art and science/technology experimentation at MIT, as indicated in its “Arts at MIT White Paper” (2011), might well have been instigated by CAVS, but the true center of how MIT is sensorially inventing the future is the Media Lab, the site for which Stewart Brand coined the phrase “inventing the future.” The Media Lab has long been a shining star for MIT, and it is likely so for a number of reasons, most especially its digital championing of the individual rather than the social as its target audience. This championing complements and furthers the fundamental role that the digital has played in neoliberal reconfigurations of the general US economy. With the passing of the Bayh–Dole Act in 1980, the year that the Media Lab was launched, universities and small businesses could apply for patents based on research from federally funded projects, which spoke deeply to the coffers of university R&D centers. The Media Lab’s co-founder Jerome Wiesner’s pithy formulation that “if you look carefully, an awful lot of the media technology is art, and the art is technology” syntactically bestows technology and art positions of ontological equivalence through the grammatical leveling of the copula. Nonetheless, the Media Lab has not been much interested in art or the arts, or even full-bore experimentation for that matter, with its corporate-directed gaze. So it is of little surprise that the statements issued from the Media Lab and CAVS about each other should reveal a kind of antipodal set of institutional goals and values.

Wiesner was president of MIT when the Media Lab first opened its doors in 1980 after a massive capital-building campaign. He left the president’s office to join Nicholas Negroponte as co-founder of the lab. More Negroponte’s brain child than Wiesner’s, the latter provided administrative and intellectual heft to the new endeavor. Wiesner, in many ways, perfectly embodied the lab’s initial exploratory interests. Cultured and accomplished, Wiesner was friends with Picasso and Alexander Calder, and founded the Rad Lab, the most successful of MIT’s World War II defense technology breakthroughs. Prior to working at MIT, he collected folk songs with Alan Lomax in the 1940s for the Smithsonian folk music project, and later that decade he attended the Macy conferences where he collaborated with fellow MIT scientist Norbert Wiener, whose thinking would guide Wiesner’s own interdisciplinary lab in the 1950s.
The transition from Architecture Machine to the Media Lab in 1985, with the opening of the Wiesner Building (which had originally been called the Place for the Arts at MIT), meant a shift from primarily defense research to industry-funded research (Negroponte and Steenson 2013, 806–807).

The initial proposal for the lab argued for a new kind of education that would combine “two rapidly evolving and very different fields: information technologies and the human sciences” (quoted in Heims 1991, 279). The lab received funding from IBM, Nippon Telegraph and Telephone, Apple, and the Defense Advanced Research Projects Agency (DARPA), and these kinds of funding sources—corporate and military—proved a dividing line between Piene and Negroponte. The lab offered an explicitly promotional technophilic engagement with the digital, championing high tech’s applications to all aspects of daily life. Such an ethos permeated the lab, and continues to do so (279). The Media Lab has become the primary precursor of contemporary art-technology labs operating with and through the digital because it is no longer concerned (and perhaps never was) with investigating problems, as was the case with the School of Design or CAVS, but rather with facilitating individual opportunity and monetizing new technologies for the market and consumption. A general vision of and belief that studio and lab can combine for the betterment (and increased profitability) of the US and indeed the world and its problems remains central to MIT and its many arts-based labs such as CAST and the Media Lab.

Negroponte would distance his pedagogy from that held dear by those who simplistically espouse Moholy-Nagy’s famous dictum “everyone is talented,” or perhaps merely modify it with the phrase “if aided with the proper technology.” “The impact of computers on the arts,” he says, “will be bringing out the artist in all of us. Much of it will be like hanging the child’s paintings on the icebox. It doesn’t have any meaning outside the family circle, but its very important to the local constituency. You’ll see a return of the Sunday painter” (quoted in Brand 1987, 83). There are important differences though in the vision for art, technology, and aesthetic training that signal the shift from the biosocial commonweal of the 1930s and 1940s to that espoused in the 1980s. The goal beyond the individual has been circumscribed to the nuclear family as “a local constituency” of influence for the occasional artist. For Moholy-Nagy, Kepes, Piene, and others, of course, the aim is much grander and progressive—more of an experiment in techno-social aesthetic training than a consumer good and hobby that could be fun for the whole family but irrelevant beyond that tiny circle.

“The binding principle at the Media Lab, the primary theme,” Negroponte revealed when addressing a group of potential Media Lab funders in
1986, “is personalization” (quoted in Brand 1987, 150). The external private funding and investment from corporations, coupled with occasional federal government monies, to further the personalization of computing and media technologies plays perfectly into a socioeconomic model that favors the individual actor who, in making rational choices for individual good, creates the collective good. Rather than having the social as the explicit goal of innovation, the model the Media Lab operates with has an assumption of the commonweal as a collateral, rather than a primary, result. Writing about Negroponte’s position, though, Steward Brand reverts to his Buckminster Fuller-influenced communal techno-utopian ideals and contradicts Negroponte’s assessment by stating that the primary theme of the Media Lab is not personalization but “conversation”—conversation “with and through computers” (151). Such a sentiment invokes more than a hint of Wiener’s cybernetic ideals, ones with which Wiesner worked in the 1950s, using cybernetics as the foundation for the encompassing theme of communication at his Research Laboratory in Electronics (134). But how the Media Lab has evolved from the Architecture Machine and away from CAVS is succinctly stated by Negroponte and Piene respectively. Negroponte: “This is not an advanced art school” (quoted in Brand 1987, 83). Piene: “The offspring of the Media Lab are Media Lab type things and the offspring of the Center are mostly artistic things. And thank goodness. We never considered ourselves part of MIT doing what other people at MIT are doing very well” (quoted in Wisnioski 2013, 783).