

# S(t)imulating Art and Science: György Kepes and the concept of “Interseeing”

Márton Orosz

Márton Orosz’s keynote lecture unfurls a captivating case study, shedding light on an overlooked precursor of media art and delving into the historical context of achieving a symbiosis between artistic self-expression and the anonymity of science. Focusing on the “Cold War Bauhaus” program in the late 1960s and early 1970s, Orosz introduces the revolutionary theories of György Kepes, polymath, and founder of the Center for Advanced Visual Studies (CAVS) at MIT, an early pioneer of exploring the intersection of art, science, and technology. The central question addressed is how to develop an agenda that bridges between aesthetics and engineering, not merely as a gap-filling exercise but as a means to forge a human-centered ecology using cutting-edge technology. Kepes’ visionary concept involves offering “prosthetics” to emulate nature, providing an alternative for building a sustainable world—a groundbreaking idea in Post-War art history. Kepes’ prominence lies in his cybernetic thinking, theories on human perception (evident in the notion of “dynamic iconography” from his 1944 textbook *Language of Vision*), and his antecedent use of the term “visual culture” in art literature. Moreover, he stands as one of the earliest to employ nanotechnology in creating artwork. Orosz explores Kepes’s insights into visual aesthetics, his concept of the “revision of vision,” and the impact of “the power of the eye” on human cognition. The lecture scrutinizes Kepes’ concrete examples aimed at humanizing science and fostering ecological consciousness through the creative use of technology. The in-depth analysis extends into Kepes’ quest to establish a universal visual grammar imbued with symbolic meaning, crafting a novel iconography of scientific images he termed “the new landscape,” that extends to community-based participatory works utilizing new media engaging and synchronizing sensory channels within our bodies. The paper contemplates Kepes’ recently discovered legacy, emphasizing the democratization of vision, and reflects on its historical context, sources, reception, and enduring impact.

The Greek word “theoria” (θεωρία), although typically translated as “theory,” traces its roots back to the word “thea” (θέα), which means “to see,” “contemplate,” or “reflect.” In its archaic usage, the word evolved to encompass the sense of “vision” or “visual perception.” The Greek philosopher, Plato’s frequently cited dialogue, appositely called *Theaetetus*, which seeks to answer the question “What is knowledge?” concludes without a definitive

answer. The only consensus reached is the necessity of distinguishing between the two forms of perception. The dialogue’s participants, *Theaetetus* and Socrates, conclude that these two forms of theory manifest in “seeing” from one side and “looking deep into things,” the other. Following Socrates’ determination that perception alone lacks semantic structure as it cannot refer to things in the world, György Kepes similarly held the belief that “the experiencing of every image is the result of an interaction between external physical forces and internal forces of the individual as he assimilates, orders, and molds external forces to his own measure.”<sup>1</sup>

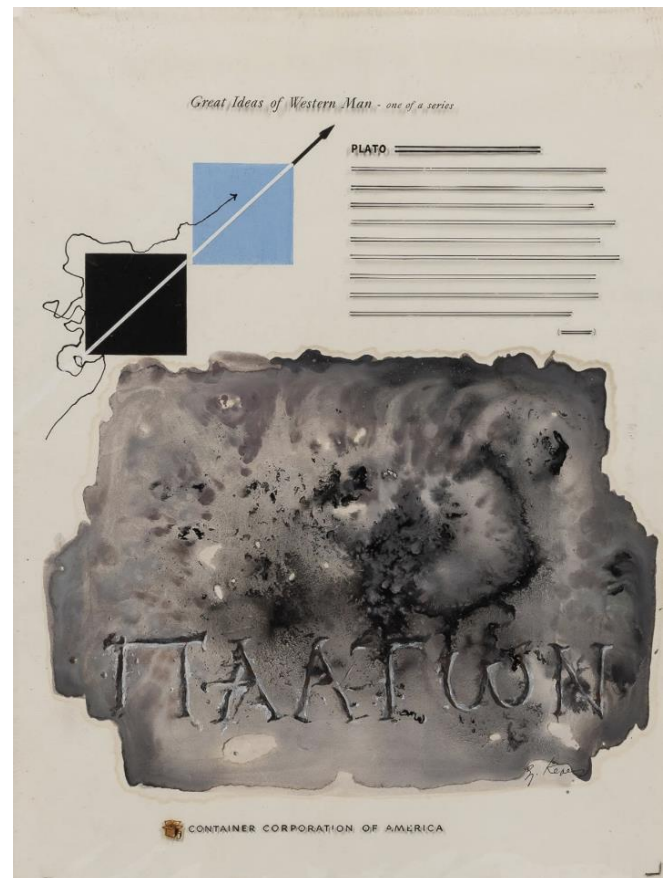


Figure 1. György Kepes: “A Man Who Is Good for Anything...”, 1952, unpublished sketch for the book “Great Ideas. Container Corporation of America”

When in the early 1950s György Kepes was commissioned by the Container Corporation of America to illustrate a wise saying of a great philosopher, the artist depicted the final words of the condemned Socrates. (see Fig. 1.) Given that Socrates’ ancestors were sculptors, Kepes incorporated a relief adorned with an amphora and an engraved stone slab into the artwork. The sarcophagus slab bears a Greek inscription (Πλάτων), the name of Plato in Greek, and accompanied by selected lines from Socrates’ defense speech. Kepes explained the painting by stating that Socrates, whose works were preserved for posterity thanks to Plato, saw his mission as the pursuit of knowledge leading to a virtuous life. Socrates and his disciples sought truth through dialectical inquiry, engaging in dialogue with each other. The philosopher’s

[1] G. Kepes, *Language of Vision*, Chicago, P. Theobald, 1944, p. 16

method was built on unraveling polarities, dedicating his life to acquiring humanity and wisdom. He believed that a person could discern between good and evil, true and false, only if their knowledge rested on solid foundations. This line of reasoning, exploring the interplay between observation and cognition, appears to serve as one of the foundations of György Kepes' aesthetic accomplishments.

Kepes, a Hungarian-born artist, was a dedicated proponent of the Bauhaus holistic program, aiming to bridge the gap between art and life. Spending most of his life in the United States, he seamlessly integrated various mediums and artistic fields, including painting and kinetic works, emphasizing their interconnectedness. As a versatile creative, he explored painting, photography, graphic design, architecture, and environmental art, while also contributing as an educator, curator, editor, and art theorist. Kepes firmly believed in the transformative power of art, seeking to make life's inner richness tangible by expanding human perception through innovative mediums and fostering collaboration between scientific and artistic disciplines. He envisioned a better world achievable through the harmonious use of technology and the exchange of ideas between artists and scientists. A collaborative relationship he called "inter-thinking" (the interaction of thoughts) and "inter-seeing" (a novel scale sensitivity in vision).<sup>2</sup>

The Compton Lecture Series was established in 1957 to honor the late Karl Taylor Compton, who served as president of MIT, the Massachusetts Institute of Technology from 1930 to 1948. Kepes, who was elected as Institute Professor of the School of Architecture and Planning at MIT, as the first and only person who won that title up until today, was invited in 1975 to participate in this prestigious lecture series. During his speech, the presenter concluded his introduction by lauding Kepes' life and work, culminating with the statement: "How to design a car that can make friends with a tree."<sup>3</sup>

This phrase could readily serve as György Kepes' proverb as a pertinent summary of his achievements. It consists of pairs of diametrically opposed, even contradictory elements—art and science, design and technology, nature and the constructed world.

György Kepes' interest in the visual phenomena of the environment and the ecology of the urban landscape, however, dates back to an earlier period. The German art historian and expert on the history of the Bauhaus, Otto Stelzer, in the postscript to László Moholy-Nagy's English translation of the 1925 book *Painting, Photography, Film* argued that "the display of (military camouflage studies) mounted in the School of Design by (...) György Kepes was at once the first Op [Art] exhibition, 'trompe l'oeil,' and its theoretical constituent."<sup>4</sup> (see Fig. 2.)

The study of optical principles, the aesthetics of vision and perception, and their application in industrial design, began in the early 20th century, particularly in the field of applied arts education. These studies found a place in the curriculum of the German Bauhaus school, notably in the preliminary course, thanks to figures like Johannes Itten and Josef Albers. However, it was truly

pioneering for these studies to be applied beyond the walls of an educational institution in practical settings. This breakthrough occurred with the camouflage course taught by Kepes in Chicago at the School of Design, the successor institution to the New Bauhaus, between 1940 and 1942.



Figure 2. Installation view of the exhibition displaying the results of György Kepes' camouflage class at the School of Design in Chicago, 1941/1942

On May 8, the *Chicago Daily News* reported that the city administration had proposed the development of a colossal, \$100 million camouflage plan. According to the newspaper, students at the School of Design had already begun camouflage studies on drawing boards, exploring various color combinations, distortion optics, and in-depth study of light and shadow effects, designing fog and smoke patterns, and conducting several other undisclosed confidential experiments. The school's director, László Moholy-Nagy, and the instructor, György Kepes, suggested enveloping the city in a cloud of fog. The artists proposed to the Civil Defense that every head of household on the south side of the city be equipped with the appropriate chemicals for camouflaging the steel mills, allowing them to generate steam instantly by adding the chemicals to the boilers. Furthermore, they suggested replicating the downtown area (known as the Loop) on barges placed on Lake Michigan, covering the desired camouflaged area with painted canvas. The city administration expected Kepes to propose how to eliminate the glow of the steel mills from the city's night view. His laboratory experiments confirmed that the glowing red lights of the mills could be nearly eliminated by illuminating the building with green spotlights, which as the complementary to red, would effectively cancel out the red glow.<sup>5</sup>

For Kepes, vision meant the structural manipulability of an image with light. The appeal of light as a creative aesthetic medium to Kepes was likely because he perceived it as a phenomenon that fused vision and knowledge into a common, synesthetic unity, creating a connection between human senses. "To function in his

[2] G. Kepes, "Toward Civic Art," *Leonardo* (4:1), Winter 1971, p. 71; G. Kepes, "Art and Ecological Consciousness," in *Arts of the Environment*, ed. G. Kepes, New York, G. Braziller, 1972, p. 7

[3] György Kepes' The Compton Lecture, Massachusetts Institute of Technology, 11<sup>th</sup> of December 1975, György Kepes Papers, Stanford University, Special Collections, Box 46, Folder 8

[4] O. Stelzer: "Moholy-Nagy and his Vision," in László Moholy-Nagy: *Painting, Photography, Film*, Cambridge, Mass., The MIT Press, 1969, p. 145

[5] "Kelly and Army Plan Hiding of the City from Foe," *The Chicago Daily News* 67:109 (May 8, 1942), p. 12

fullest scope, man must restore the unity of his experiences so that he can register sensory, emotional, and intellectual dimensions of the present in an indivisible whole”<sup>6</sup>—proclaimed Kepes in his 1944 book *Language of Vision*.

The first concept Kepes developed to make light art as a new, democratic medium, something that every one of us can access, share, or benefit from, a concept that defined light as a universal emblem, an illusive, but due to its power solid and eternal form, and the ultimate icon representing the commonalities in our life, was an idea of a museum dedicated to light. In the 1951 January issue of the *Interiors* magazine, a monthly journal for design published in the US, Kepes came up with some utopian-looking sketches (see Fig. 3.) and he gave them the following explanation: “I believe that it would be nice to have a building in which all facts connected with light and space could be demonstrated. This I would do not as an exhibition superimposed on an architectural framework, but as an architectural layout which itself is the exhibited material. The building includes a perspective tower of many distorted planes to illustrate the illusions of linear perspective, undulating walls, varied textures, and sculpture, all illuminated by changing colored light.”<sup>7</sup>

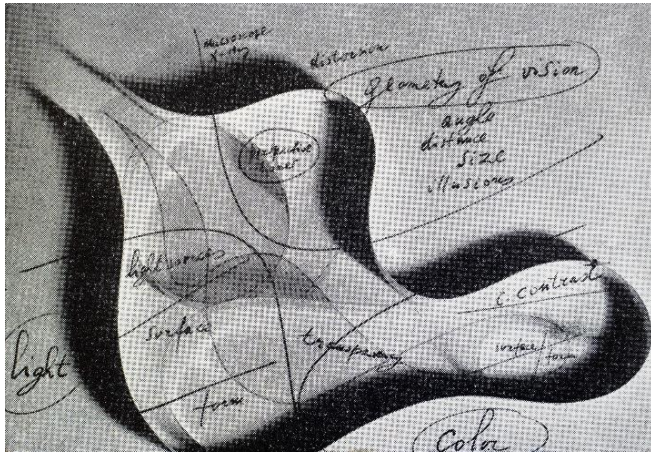


Figure 3. György Kepes’ “Light Diagram” in the 1951 January issue of *Interiors*

Kepes’ article, featured in *Interiors*, coincided with one of his most groundbreaking exhibitions titled *The New Landscape*.<sup>8</sup> This exhibition, curated by Kepes himself, took place at the Hayden Gallery, an ample gallery space linked to the library wing of the human sciences at the Massachusetts Institute of Technology. (see Fig. 4.) Kepes’ show displayed scientific images sourced from laboratories, delving into both macro and microcosmic aspects and their aesthetic arrangement. He aimed to juxtapose the geometric-mathematical patterns of “science” with the dynamic, organic formations of “art.” Through the exhibited works, he endeavored to draw parallels between abstract visual art and micro- and macrophotographic images. His overarching objective was not only to underscore formal similarities but also to forge a new

iconography that integrated the notion of bridging the gap between the “two cultures”—the humanities and the sciences.



Figure 4. Installation view of György Kepes’ *The New Landscape* exhibition in the Hayden Gallery at MIT, 1951

Kepes viewed each image as a natural phenomenon, growing organically within the framework of a hierarchical structure that unified all elements of a composition into a cohesive whole. This structure encompassed principles such as proximity, grouping, closure, similarity, dissimilarity, continuity, proportion, and rhythm. He organized the components of each picture into distinct groupings, analogous to the grammar of a language, with a predefined syntax governing the assembly of syllables and words into sentences, and ultimately forming chapters and books. Kepes saw the field force of a structure, such as the optical hierarchy of a given composition as a pattern that went beyond itself and traced back to some state of self-organization.

This approach resonated with principles advocated by Gestalt psychologists, including luminaries such as Rudolf Arnheim, with whom Kepes maintained a close collaborative relationship. Nevertheless, Kepes drew inspiration from the biological sciences as well, seeking to apply the concept of homeostasis to image creation. In his exploration, he admitted: “I—wrote Kepes—tried to borrow an analogue from the physiological-biological responses of the body to challenge from the art side,” expressed, and he did add, “When the body is overheated... when the temperature is going beyond body comfort, we shiver, so this is a mechanical, automatic movement of the body to regain some heat, and a similar thing happens on a cultural, social level too. When the social body overheated, it has to cool off; when the social body is shivering, it implies that there is some missing warmth.”<sup>9</sup>

For a promotional pamphlet titled *Illustration* published in 1941, Kepes produced a striking drawing.<sup>10</sup> (see Fig. 5.) His image shows loose pages patterned with the essential formal elements of modern

[6] G. Kepes, *Language of Vision*, Chicago, P. Theobald, 1944, p. 13

[7] “Kepes looks at light; sees spots,” *Interiors* (January 1951), p. 78

[8] The exhibition was accompanied by a brochure serving as its catalog, however a few later Kepes dedicated an entire book to the show: G. Kepes, *The New Landscape in Art and Science*, Chicago. P. Theobald, 1956

[9] Judith Pearlman’s interview with György Kepes, Cambridge, Mass., 1981; Montreal, Canadian Centre for Architecture, Archive of Bauhaus in America

[10] [G. Kepes], *Illustration*, Chicago: Collins Miller & Hutching Inc., February 1941

art—points, lines, shapes, and shadows, or what Kepes called “visual fundamentals”—appear to cast rays of light that penetrate an eyeball. Reflected through the cornea, these beams imprint an inverted image on the retinal surface. The illustration outside the eye is mirrored within it. Kepes’ diagram presents an inventory of compositional groupings resembling iconic styles from the historical avant-garde, even a page from one of Kepes’ own work at the bottom. It is suggested here that the grammar and the syntax of pictorial organization is dependent of the seeing eye and the interpreting mind.

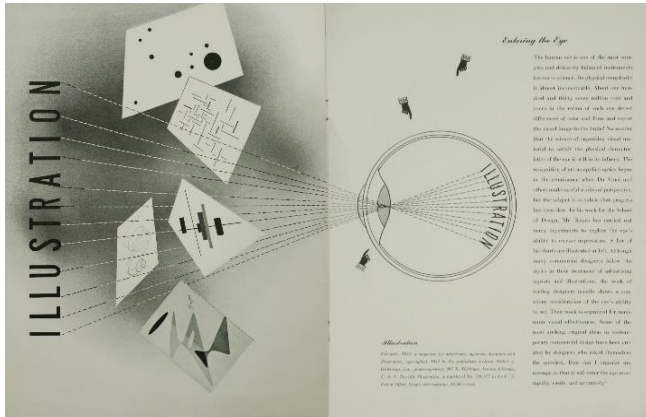


Figure 5. Spread with György Kepes’ drawings and explanatory text “Entering the Eye” published in *Illustration* magazine, 1941

The power of the eye, that was Kepes’ *ars poetica*. His name became synonymous with the human organ of seeing. No wonder why Alexander Calder, the sculptor, for example, addressed a postcard to Kepes in the spring of 1950 with an all-seeing eyeball on the side of the addressee.<sup>11</sup> This very simple pictographic sign is an emblematic manifestation of Kepes’ ideas, his role as a visual thinker in the post-war visual culture. He frequently employed a range of charts to enhance understanding of the structure of vision. These tools were primarily utilized to bolster his idea of utilizing visual perception and stimuli for navigating urban environments, with the goal of constructing an urbanistic framework based on the functioning of our eyes. This endeavor aimed to articulate the experience of moving through architectural spaces.

Teaching visual design at the MIT School of Architecture and Planning, Kepes found it logical to begin studying the formal characteristics that constitute the optical fabric of cities at a theoretical level. These features, akin to the pages of a street’s visual book, bombard residents with known or unknown signs, influencing their momentary mental state. At the College Art Association’s annual conference in 1947, during the “Varieties of Artistic Value”

section, he presented his research approach to cities based on cognitive methods in a paper which was later published in the *College Art Journal*.<sup>12</sup> The key to Kepes’ programmatic text lies in the argumentation following a Gestaltist logic: that the reality perceivable through our senses could be organized into “meaningful unities.”

His fascination with perceptual experiments led him to embark on concrete research into the spatial extension of vision, wherein he delved into interpreting the city not merely as an urban form but also as an optical topology. The focus of his study revolved around a newly coined term derived from the amalgamation of “legibility” and “visibility,” termed “imageability.”<sup>13</sup> Expanding upon this concept, Kepes approached urban space from a psychological standpoint, considering the senses and memories, asserting that residents are interconnected not solely by the city’s physical structure but by its mental imagery. In collaboration with Kevin Lynch, his research project titled *Perceptual Form of the City* garnered a Rockefeller Foundation Fellowship in 1954. This allowed for the subjective exploration of the mental image of three American cities (Boston, Jersey City, and Los Angeles) from the perspective of their inhabitants. This pioneering work marked the first instance in architectural history of the development of a theory on urban form through personal consultations with city dwellers, challenging the hierarchical doctrines of modernist urban planning that had prevailed in the preceding decades.

The notion of perceiving the city as a continuous, dynamically-evolving kinetic entity permeated many of Kepes’ public works. For instance, a light mural he conceived in 1959 for the Royal Dutch Airlines (KLM) was erected in midtown Manhattan, New York, adjacent to Rockefeller Center, at the intersection of 49th Street and Saks Fifth Avenue (see Fig. 6.). In a report financed by the Shell Oil Company for the magazine *Progressive Architecture* in 1960, it was stated that Kepes’s piece “is believed to be the first attempt to create a vibrant and dynamic panorama of light, color and motion using contemporary tools and techniques.”<sup>14</sup> Over fifty feet long and eighteen high, Kepes’ KLM mural was basically a gray aluminum screen with some 60,000 random perforations and larger cutouts. The sources of light were a bank of spotlights and incandescent and fluorescent bulbs and tubes behind the surface. They were controlled by timing and switching devices that actuated the circuits. The purpose was to create a fluid, luminous pattern exhibiting random change and continuous transformation of color intensity and pattern. In order to avoid the mechanical repetition inherent in a mechanized device, many thousand different color filters were scattered freely behind the perforations.

Kepes’ mural sought to represent a dialogue between two overlapping qualities: the stable and the unstable, the elusive and the uncertain, the maintenance of a rhythmic interplay between a

[11] Postcard from Alexander Calder to György Kepes, dated 8 April 1950, György Kepes papers, Archives of American Art, Smithsonian Institution, Washington D.C.

[12] G. Kepes, “The Creative Discipline of Our Visual Environment,” *College Art Journal* (7:1), Autumn 1947, pp. 17-23

[13] Kevin Lynch, *The Image of the City*, Cambridge, Mass., The MIT Press, 1960, pp. 9-13

[14] G. Kepes; W. LeBrun, “The Mobile Light Mosaic. Dream and Reality,” New York, Jones, Brakeley & Rockwell Inc., [25 January 1960], György Kepes Papers, Stanford University, Special Collections, Box 30, Folder 17

constant and a changing pattern. As an underlying design concept, he used the algorithm for the randomness of the pseudo-numerical symbol system “quipu,” which he had read about in a book written by the anthropologist Franz Boas. On the Paracas Peninsula, in what is now modern-day Peru, the rule of “maintaining a rhythmic interaction between a constant and an alternating pattern”<sup>15</sup> is used in the making of woven cloths, which has survived from the pre-Inca civilization in the fifth century. The Canadian philosopher Marshall McLuhan discovered in György Kepes’ KLM mural the emergence of a previously unknown art form, the “electronic landscape,” and wrote about the work as follows in his 1964 book *Understanding Media*: “From the air at night, the seeming chaos of the urban area manifests itself as a delicate embroidery on a dark velvet ground. Gyorgy Kepes has developed these aerial effects of the city at night as a new art form of ‘landscape by light through’ rather than ‘light on.’ His new electric landscapes have complete congruity with the TV image, which also exists by light through rather than by light on.”<sup>16</sup>

Kepes’ piece at the Dutch airlines’ ticket office exemplified the inseparable fusion of the organic and the artificial, the natural and the man-made, forming a unified organic entity. This holistic viewpoint, which regards nature and our surroundings as constantly evolving living entities open to change, adaptation, and reinterpretation, drove his artistic endeavors that were evidently embedded in this piece as an underlying concept.



**Figure 6.** View of György Kepes’ programmable light kinetic mural at the Royal Dutch Airline’s (KLM) ticket office in New York, 1959

The KLM mural can be best understood as a cybernetic system. While it didn’t involve any feedback-regulation mechanisms *per se* in the technical sense, sequences of light play created from changes in templates, color filters, and modulated lights were capable of visually evoking the image of the nighttime metropolis as if

[15] G. Kepes, “Light and design,” *Design Quarterly* 68, Minneapolis: Walker Art Center, 1967, [p. 24]

[16] M. McLuhan, *Understanding Media. The Extensions of Man*, New York, McGraw-Hill, 1964, p. 129

depicting an abstract diagram of real-time events. For Kepes, the continuously transforming, light-infused mural, constantly altering its shape and color, served as a visual model of urban entropy. He was intrigued by how the self-regulatory activity of adaptation to the external environment, encompassing a chain of reactions to environmental changes, akin to physiological systems, could be demonstrated in a dynamically functioning artwork. (see Fig. 7.)



**Figure 7.** Detail of György Kepes’ KLM mural

Expanding the concept of regulation theory from the individual to the societal level, as did his colleague Norbert Wiener, Kepes found the interaction of feedback loops intriguing not only from mathematical or biological viewpoints. For instance, in the harmonious interplay of energies defining the relationships within a composition, he identified the purest manifestation of civic (Kepes’ term for “public”) art, reflective of the potential aesthetic form of a structured social organization emerging from the collaborative synergy of individuals. “There is a need for homeostasis on a large-scale environmental level and [...] a new metabolism of our cities,”<sup>17</sup> he argued. In a broader sense, Kepes extended this concept beyond solely man-made creations, viewing all human interactions through the same lens: “We seek equilibrium, the optimum condition possible in our circumstances. Individually and collectively, men are self-regulating systems. An engineer who designs a self-regulating system must learn to synchronize error and

[17] G. Kepes, “The Lost Pageantry of Nature,” *Artscanada* (124–127), December 1968, p. 32

correction of error in order to avoid ‘hunting’—excessive oscillation about his target point. Central to a self-regulating system is the notion of feedback, or to express it more generally, interdependence.”<sup>18</sup>



**Figure 8.** Detail of the Centerbeam outdoor installation with György Kepes’ *To Whom It May Concern* laser-drawn image at the 6th documenta in Kassel, Germany, 1977

The idea of interdependence evolved within György Kepes’ artistic program, most vividly represented by the Center for Advanced Visual Studies (CAVS) that he established at MIT in 1967. This was the place where Kepes, adhering to his vision, brought together selected artists to work on current, socially relevant issues utilizing the infrastructure provided by MIT, enabling them to engage in dialogue with scientists and engineers to collaboratively develop works that require the interaction of art, science, and technology. As a result, participation and collaboration in Kepes’ MIT Center became integrated into a unity. Having a vision is essential for contributing value to the world, yet realizing that vision in a more persuasive, comprehensive, and let’s say “valuable,” manner is achievable through teamwork. This perspective shaped the functioning of CAVS during Kepes’ leadership.

[18] G. Kepes, “Toward Civic Art,” *Leonardo* (4:1), Winter 1971, p. 70

[19] N. Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine*, Paris, Hermann & Cie & Cambridge, Mass., The Technology Press, 1947, p. 129; The longer version of the Wiener saying

One of the last and most successful exhibitions in which Kepes was involved during his affiliation with MIT was Centerbeam. It was a 144-foot-long outdoor interactive media sculpture that combined water prisms, holography, an argon-neon line encased in a glass tube, an ice line, and laser projections on steam clouds, along with poetries heard from loudspeakers. The piece was built for the 6th Documenta in Kassel, Germany in 1977, and a year later also exhibited at the National Mall in Washington D.C. Centerbeam was conceived as being “an aqueduct” in between urban and natural environments. Kepes submitted an image to be redrawn in laser light. The picture he chose was that of an unopened envelope, titled *To Whom It May Concern* after his painting by the same name. It appeared three-dimensionally as it was projected onto the hazy, cloud-like substance looming above the structure. (see Fig. 8.)

This virtual, unreachable letter symbolically conjured up the famous quote “To Whom It May Concern” by his MIT colleague, Norbert Wiener, the father of cybernetics that served as the reference point in communication theory, suggesting that the mass-mediated world consisting of signals, actually every object or event, from a plant to an organism—as Wiener put it when he coined the term cybernetics in 1947—“may be viewed a myriad of To Whom It May Concern messages.”<sup>19</sup> Kepes shared the belief that these signals, these messages can only possess a value if they could be arranged into the right optical configuration, representing the world composed through their fragments, such as his work was also part of a larger entity, a single element of a larger piece that is produced collaboratively. To illustrate this concept figuratively, we might best characterize Kepes’ method with the phrase favored by Gestalt scientists: “The whole is (always) larger than the sum of the parts.”

*Dr. Márton Orosz is the Director of the Vasarely Museum in Budapest. He also serves as the founder of the Collection of Photography and Media Arts at the Museum of Fine Arts–Hungarian National Gallery. He is a scientific advisor to the Kepes Institute in Eger and the Michèle Vasarely Foundation in Puerto Rico. Alongside his curatorial endeavors,, his first documentary film, titled “György Kepes. Interthinking Art + Science” was completed in 2023.*

was quoted: C. E. Shannon, *The Redundancy of English*, *Cybernetics*.

*Transactions of the Seventh Conference* March 23–25, 1950, Edited by Heinz von Foerster, New York, Josiah Macy, Jr. Foundation, 1951, p. 154