2_VISUALIZING

Design, Communicative Objectivity, and the Interface

THE AERIAL OBSERVER FOR WHOM CAMOUFLAGE HAS TO BE largely considered today is a mobile observer. Every factor involved in his vision is in continuous movement. His eye is moving, the light conditions are changing and the landscape is moving."[1] With these words written in 1942 the prominent designer and artist Gyorgy Kepes inaugurated a new concept of visual perception. Writing for an issue of *Civilian Defense*, Kepes described a course on designing camouflage that he taught at the School of Design with László Moholy-Nagy as part of the New Bauhaus in Chicago. Working for the U.S. Department of Defense, the designer took flights above the city, where his perspective was transformed. He wrote of an eye no longer moored in a single space or time. He was trained to trust instrument panels streaming data from radar and radio transmissions, to rely on the guidance of machines and the recordings of surveillance teams. Calling on this experience, Kepes described a new form of vision, one that was

FIG. 2.1__**Landscape, Oscillation, Survey.** Images from Kepes, *New Landscape*: patterns emerging from charged particles; aerial survey of Chicago; oscilloscope patterns of an Analogue Computer (1956).

mobile, relative, nomadic, and autonomous. He began to consider designing for information flows coming from communicating machines.

Developing this theme of technically transformed vision, Kepes later insisted, in a text fittingly titled *The New Landscape of Art and Science*, that "precise observation" and a new armory of sensory devices coming from nuclear physics and electronic computing that no longer operated at the levels of the human sensorium had produced a "new foundation for our material existence." This material existence converted what he had previously labeled the "language of vision" to a "landscape" of "forms"; the terms "language" and "vision" mutated into environment and process by way of a new computational sense.[2]

What are we to make of this turn from language to landscape? Arguably, Kepes demonstrates a midcentury reconfiguration of cognition, perception, and sense into algorithm, pattern, and process. In his work, and that of his many colleagues in the computational, communication, and design fields, we witness a subtle hope that a world of static objects and pictures might become one of interactive images and pattern recognition.

In chapter 1, I demonstrated how cybernetic attitudes to storage and time heralded a new epistemology of data inundation. These attitudes to archiving and recording made perception autonomous and material and produced a discourse of storage and interactivity that continues to inform our relationship to the interface and data. This chapter traces how designers, like Kepes, encoded this epistemology into environment. In design practices, ideas of cybernetic temporality, data inundation, and process transformed the nature of the image, perception, and observation.

To offer further sustenance to this argument, let us consider another example. In 1953, the prominent designers Charles Eames and George Nelson stood before a crowded hall at UCLA and proceeded to run an experiment. The purpose of the course was to see "how much information could be given to a class." The function of the class was to combine and apply the latest theories at the time in communication science, cognitive and behavioral science, and design to the training of budding engineers and business management students.[3]

Titled "A Sample Lesson," Eames and Nelson implied that this course would be but one element of a process, a "sample" of something larger. In the optimistic tone that personified Eames design, the brochure announced that "something new" was happening, "bringing down the barriers between fields of learning." This something was not, or perhaps could not be described, because "a *sample* lesson is more of an experience than a tangible solid . . . because it is more of an emotion than an action . . . it is difficult to explain. . . . A sample lesson must be seen and heard and felt and smelled."[4] Implying that language itself was behind the times, Eames and Nelson appear to suggest a pedagogy of sense. Emotion described as active, and pedagogy as affective and material (touchable, feelable, seeable), it was not clear what the course would teach, except perception itself.

Coming at a moment of massive change in higher education spawned by the war and perpetuated by the GI Bill, the work of Eames and Kepes marks a historical shift in the relationship between knowledge and vision. In this span between the training of the camoufleur in design to the education of the future manager of the information economy, wartime imperatives of surviving by means of the identification and evasion of the enemy became autonomous and self-referential technologies of perception. Vision and cognition were rendered equivalent, a "process," to repeat Kepes, and envisioned as part of a single communicative channel that could be algorithmically represented, materialized as technology, and circulated autonomously, separate from content.

This algorithmic optic did not terminate in the hallowed halls of special seminars run for elite students. Arguably, what had begun as the aerial surveillance of cities became a new measure of environment and territory.

Scaling from the personal vision of the designer to the perception of the city, one of the most famous urban planners and policy-makers in American history, Kevin Lynch, began a study at MIT and Harvard, under Kepes's tutelage, titled "The Image of the City," also in 1953. One of the single most influential studies on urban space in the postwar era, it was a landmark in challenging policy at a moment when the city was rapidly being transformed by way of new technologies and economies.

While the title of the study utilized the term "image," Lynch initially equated urban space with the rhythm and cadence of music. He wrote that the city is composed of "sequences" and that urban planning is a "temporal art . . . like music." Continuing in this vein, Lynch argued that vision is musical because of its interactive qualities; "nothing is experienced by itself, but always in relation to its surroundings, the sequence of events leading up to it, the memory of past experiences."[5] Lynch repeated the cybernetic insistence, perhaps inherited from his mentors, on translation between sensorial forms, and chose to reinterpret topics of space, structure, and environment in terms of sensation and affect. Transforming the study of cities, Lynch forwarded the idea that it is through sense and cognition that the urban could be planned. "The purpose of this study . . . will [be to] consider the visual quality of the American city by studying the mental image of that city which is held by its citizens." Psychology and memory are conduits to reinterpret and ultimately reconstruct built environments. Lynch's assessment of urban life both straddled the long-running idea of the city dweller as inundated by information and overwhelmed by stimulus while offering a new type of research methodology by which to contain that deluge, unearth its patterned sequences, and reconstruct space as a mental process. Lynch, like Kepes, signals a transformed attitude to vision and images: perception collapsed with cognition and memory, and used as a conduit to scale between individual subjects and vast territories.

I open with these three case studies because they offer, at different scales, evidence of an emergent form of observer and a nascent concept of environment or landscape. Each of these practitioners was closely related and important to late 1950s design and planning and was central to popularizing ideas of communication and cybernetics throughout culture. Each of these practices, in important ways, offers insight into a newly bequeathed autonomy given to vision as a material process in this immediate post-war period, and each gestures to the reconceptualization of space as an interface. This channeling of the divide between the object and subject redefined aesthetic practice and human perception not in terms of surfaces, screens, or mediating bodies obscuring fantasized political or natural realities, but rather as conduits for communicative exchanges. In the course of this chapter I will move from the training of designers, planners, and engineers to the application of ideas of communication into the structure of urban space, culminating with a classic example of how new models of attention and knowledge negotiated changing economies, racial tensions, and urban formations in the 1964 New York World's Fair. The chapter scales from within the classroom to the organization of corporations

and territories. In these movements ideas of perception, cognition, and environment were reformulated and were contested in a myriad of manners.

Counter to our standard assumptions of information theories as disembodied or abstract, this move to give vision autonomy and to turn language into an environment was not a return to some mythic Cartesian perspective. Rather, this move was, in Kepes's words, an "experiential" form of vision, even as it was grounded in nascent concepts of information and communication. In postwar design practices, cognition and perception were rendered equivalent, and both took on new forms of materiality that could be technically and aesthetically manipulated—objectivity was redefined as subjective. To be objective, Kepes wrote, was to learn the "basis of the language of vision," a "basis" that was a process and a technology to be designed. Objectivity, Kepes and his colleagues in the information and communication sciences and psychologies intimated, was no longer about documenting an external truth or reality about the world, nor was it about taxonomy or ontology (describing the essential characteristics of objects). Instead, to be objective would now require producing the most effective and affective method or process to induce, if not replicate, conscious experience.[6]

The infrastructure for this transformation in the practice of urban planning or the training of managers was an epistemology of informational surfeit. Assuming a world of abundant data, designers, planners, and social scientists focused on methodology. Information was redefined as apprehension; a measure not of content but of the way the observer would process data. Designers and urban planners began to view their work in terms of communication, focusing on interactions between agents and concentrating their efforts on producing replicatable methods and processes that could be transferred into any environment. Behind these changes lie fundamental shifts in the treatment of archiving, documentation, and objectivity as related to aesthetic practice. For the figures I portray here, the practices of storage came to focus not on documenting individual data points but in storing the traces of method, in making process a material and archivable object.

While much scholarship attends to the relationship between the military, communication sciences, computation, cybernetics, and fields ranging from design to the social and the life sciences, what has not received much attention in the historiography of postwar and Cold War science and its relationship to art and visual culture are the attendant forms of epistemology and knowledge that condition and accompany such aesthetic transformations.

Architectural and design historians have often returned these studies to

discussions about built space or home (domesticity) and have largely framed these materials within the context of debates over modernism and its heritages. At the same time historians of science have largely ignored the aesthetics of truth and the centrality of method as an autonomous and central feature of Cold War discourse, with a few major exceptions. Most important, neither group has asked: what are the stakes attendant to making representation a question of process and environment instead of meaning and identity? How do these new tactics and strategies enter the lived field of history, and to what effects? How do older histories of archives, power, and knowledge intersect with these newer modalities of technicized vision?[7]

As the nature of the observer was reconceived, knowledge claims were also transformed. As cognition, perception, and the body (both social and individual) came to be redefined in terms of feedback and patterned interactions *between* objects and subjects (as a communication process), what it meant to produce a truthful account of the world (or a product) shifted, coming to be no longer about hidden truths, invisible elements, or psychological depths but rather about affect and behavior. This transformed idea of truth found itself embedded in an entire new set of tools for the measurement and analysis in the social sciences and behavioral sciences, and a new set of tactics with which to train the observer.

This section excavates this epistemology that links the way we might think to the design of a new type of screen—the interface. This reorganization of knowledge and perception produced new machineries of computing, social research, and marketing. In the course of this section, I will trace the relationship between the emergence of a new form of observer, one both radically individuated and simultaneously networked, and a novel form of knowledge production based on assumptions of informational infinitude, a "communicative objectivity." In the immediate postwar period one can document a shift from modern normative and disciplinary concerns with documentation, objectivity, indexicality, and archiving to a new set of investments in process, communication, and circulation, now encoded into built environments, machines, and attention spans. In these many movements and translations between different sites and practices, however, we can also witness bifurcations and multiplications in how cybernetics, cognition, and communication were understood in relationship to human perception and life. It is as important to examine irreducible differences in interpreting shared epistemologies as homogenizing similarities.

Perhaps most important, in these design and urban planning projects, en-

vironment came to replace discourses of structure, class, and race, as the observer was conceived as the subject of a personal and reflexive data space both radically isolated and always networked into a broader ecology. While it may appear obvious from today's vantage point, at the time it was not automatic that transformations in economy, and the increasing changes in urban space, stratification, and racial and class relations would be negotiated through design and a turn to aesthetics and personalization. One might say that these designers were part of a move to produce the world as an interface, making attention itself a material and scalable technology. This shift between structure and landscape did not occur, however, without creating a new set of tensions and possibilities that continue to inflect themselves in our contemporary media environments and urban forms.

Learning to See: The Algorithm of Design

In 1951, Gyorgy Kepes wrote to Norbert Wiener thanking him for his contribution to *The New Landscape of Art and Science*: "after reading your essay I saw that your contribution could be the focal point of my book and that gave me the courage to ask you more than I originally dared."[8] This interchange between the cybernetician and the designer prompts a more global question: what was this "focal point" on which the education of vision was to rest? Kepes answered—method—and introduced a pedagogy to train artists, designers, and engineers by which this "focus" might now rest.

As one of the foremost design and arts pedagogues in America at the time, Kepes had much to say about the future of media and education. With a biography that traversed many legacies of modern design and art, Kepes's life mirrored his recombinant, archivally dense practice—merging influences from multiple genealogies in design and art and remixing aesthetics of nation, identity, and class. A Hungarian émigré who had fled Fascism, he had been born into an aristocratic family in the final years of the Austro-Hungarian Empire. In his memoirs he recalled turning to art at the age of eighteen in order to address "the inhumane conditions of the Hungarian peasantry," some of whom lived on his father's estate. World War I furthered his concern with finding ways to address the suffering of human beings within a technological world, turning at the time to new techniques such as film. He wrote, "only film could bring into a single focus my joy in the visual world and the social goals to be realized in this world."[9] This interest in social welfare apparently inspired his obsessive desire to reconcile art and science throughout his life.[10]

Seeking an ideal with which to negotiate this industrial modernity and the human being, he seemingly found sustenance and inspiration from the ideas of both Soviet constructivism and the Bauhaus (although he never formally joined either). He left Hungary to study art in Berlin, befriending there his fellow Hungarian Moholy-Nagy in the late 1920s.

At the time, Moholy-Nagy was part of the emerging design and arts movement the Bauhaus, which had been started by the architect Walter Gropius in Weimar in 1919. Dedicated to modern approaches to art and design, the school sought to integrate all the arts, craft, and technology in the interest of improving industrial design. The school embraced the machine and technology and never taught history, as design should be taught according to principles, not precedent. It was a large and far-reaching movement whose complexities cannot be fully interrogated here. Most of its practitioners were forced to disperse when the Fascists closed the school in 1933. Many of its leaders found homes in the most prestigious American art and design schools. Tel Aviv, Israel, is another center of Bauhaus design. Kepes himself fled Germany with Moholy-Nagy for London in 1935 and arrived in Chicago to teach in the New Bauhaus in 1937.[11]

Kepes's career, however, was largely marked by his time at MIT, where he taught for upward of thirty years. Invited in 1945 by the then president of MIT, James Killian, to begin a program in visual arts and design, Kepes went on to start the Center for Advanced Visual Culture (CAVS) at MIT and became a central figure in revising the architecture, design, and urban planning programs at the university. Working at one of the central institutions for reenvisioning architectural, planning, and design practice after the war, Kepes had great influence in American (and global) design.[12] In the United States his colleagues and interlocutors included figures such as George Nelson, Buckminster Fuller, and Charles and Ray Eames. His students included figures such as Kevin Lynch, whose work would go on to pioneer environmental psychology and reconfigure urban planning through psychological models of feedback between subjects and surroundings.[13]

Kepes opened the book *The New Landscape of Art and Science*, to which his aforementioned letter was dedicated, with the following words, devoted to his methodology: "the method . . . has served as a kind of laboratory experiment—fuses visual images and verbal communication in a common structure. The visual images . . . are the content. The verbal statements . . . are illustrations. They do not constitute a connected systematic account. The quotations touch the subject from one angle, the comments from another, with

the visual images forming the basis of the interrelated structure that alone tells a connected story."[14] The designer implied that verbal statements are illustrations, and images serve as grammars, syntaxes, or structures generating "stories." His focus, however, was not a specific image or text but the "systemic account" and the "common structure" organizing the "experiment." Kepes implied that this text operated to create a story, or meaning, if the reader could create connections between mediums and objects. The fact that Kepes labeled this an "experiment" implied that the concept underpinning the book was not to train individuals in a style, or single practice, but as scientists in a method of conducting inquiry.

In his treatment of vision, Kepes was therefore translating one history of visual practice and psychology into the postwar American milieu. Of great influence on his work was *The New Vision*, put out by Moholy-Nagy in 1929. In this text Moholy-Nagy sought to merge the "physiological experience" of vision with the psychological and cultural aspects of life to produce a form of pedagogy that would encounter the changing technical experience of life, and address the "ABC of expression itself."[15] Moholy-Nagy, like Kepes after him, was seeking the patterns that organized perception, and attempting to formulate a visual pedagogy based on this concept of an expressive abstraction.

The foundation for this design was a "new structure-order," in Kepes's language, that emerged from the recombination of vast data fields. These were archives of images that the designer had compulsively collated through a constant outreach campaign to corporate and academic labs, art museums, and a vast range of colleagues in almost every field imaginable. Kepes's personal archive at the Smithsonian is largely constituted of a network of correspondences concerning the imaging techniques and image acquisition of various institutions and labs in the physical, human, and life sciences.[16]

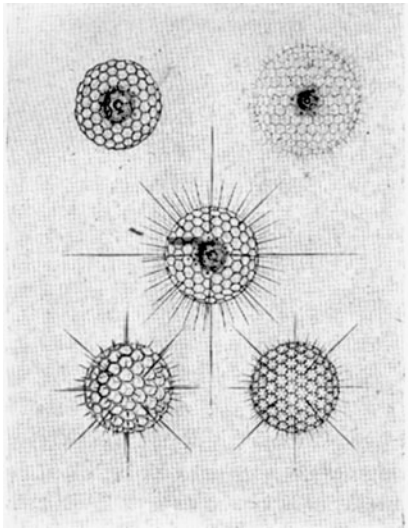
Archive Frenzy

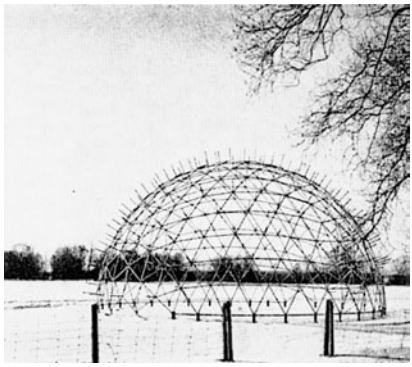
Of what, however, were these archives composed? What did Kepes seek when he collected images, texts, diagrams, charts, and mathematical equations? The texts are highly idiosyncratic. These books published for the purpose of engaging the design and art community with topics in aesthetics and science, are not organized through taxonomies of historical periods or content (see figs. 2.1–2.4. There is no set organization of history in the display of images or artifacts. Chapters in the books, and sections of his courses at MIT, were not organized around a material or medium or a method. Syllabi left in Kepes's papers list,

for example, guest lectures crosscutting neuroscientific ideas of vision and perception with urban planning studies of space.[17]

Kepes did insist, however, that both courses and books should be organized around three terms—"pattern," "problem," and "scale." Kepes collected different varieties of ways to capture processes and to compare seemingly disparate phenomena as linked. So for example, in his book *The New Landscape*, he arrayed aerial photographs of a city through the advanced fish-eye lenses of geographical surveillance teams alongside the famous intimate images shot by Julius Shulman of Mrs. Kaufmann before the pool of her Richard Neutra–designed home in Palm Springs, California, an architectural rendering of the Crystal Palace from the 1851 Great Exhibition in London, aerial images of crop planting, and short texts by William James, Coleridge, and Kafka. Whether town and country are automatically linked, and suburbia or bourgeois sensibility hovers in between, is a matter of ongoing debate by urban planners, but from a pedagogical standpoint, these many forms of life were linked through tactics of scaling and a focus on line and movement—the graphic line of a blueprint, the traces of crop tilling, the curvature of a skyscraper from the lens, the cadencing of language—these elements compose a process where the focus is not on the representation of the world but on the many modes that may be used to do so. Kepes would repeat such exercises with many physical and social phenomena, such as recombining photomicrography and crystallography with aerial examples of earth patterns or geological formations and patterns of urban development.

Authorship had become a curatorial project, and learning came to be about scanning. The student of this course, being inundated with data without context, or linear historical or spatial organization, presumably was urged to examine the relationship between images, to attempt to extract relations between objects. This was, therefore, a matter of collecting not artifacts but methods. This was a collection, and celebration, of the many (particularly technologically) available modes of apprehending the world. Kepes's diagrams, collections, and notes evoke the idea of a course that has no medium specificity but is focused entirely on producing "structures" for vision, or perhaps equivalent to vision. Kepes proposed the terms "dynamic," and "effective action" to describe seeing as part of a new method. The conjunction of "action" and vision denoted both a materiality to the perceptual process and its autonomy as an object of study and as an independent actor. The visual process equated with method, and made material. Kepes's attitude to vision anticipates later attitudes in conceptual art and in cinema where the medium or the artistic process, becomes itself an object to collect, curate, and reorganize.[18] As the archi-





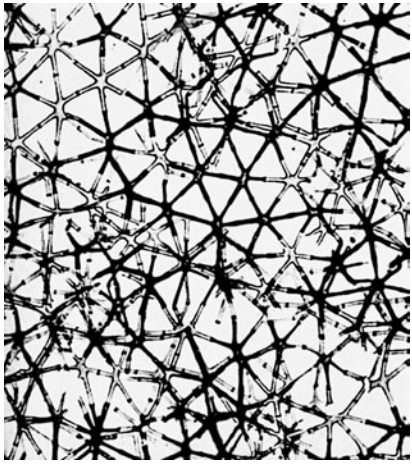
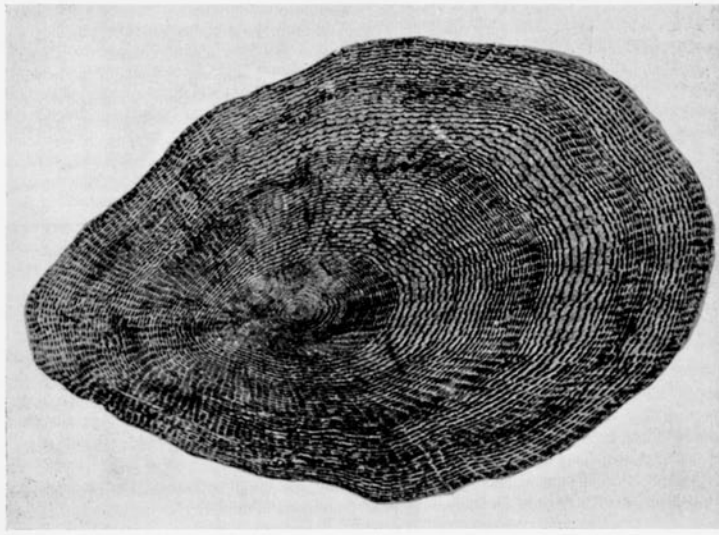


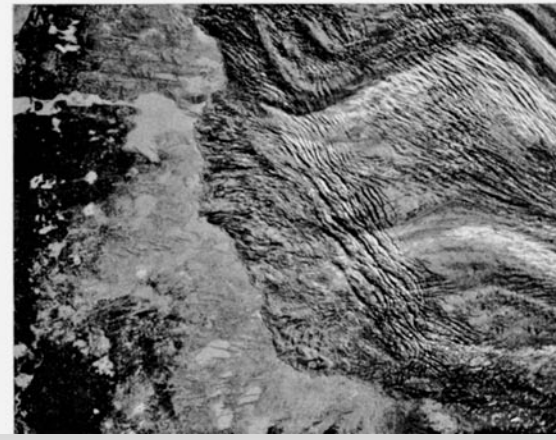
FIG. 2.2__**Structure, Network, Environment.** “The notion of *structure* is taking an ever greater Importance in the field of human knowledge, even with immaterial and abstract concepts; we hear, for instance, of: Structure of thoughts, structure of mathematics, and so on. . . . Seeing in space is not as we believe merely having a keen sense of the occupation of space by some physical object, but rather being able to grasp the notion of combinatorial arrangements in view of obtaining certain peculiar conditions.” Le Cicolais, *Contributions to Space Structures*. *Radiolaria*, from Haeckel, *Report of the Scientific Results of the Voyage H.M.S. Challenger* (*London, 1887*); Geodesic dome, by R. Buckminster Fuller. “Discontinuous three-way grid which stresses its members equally and acts almost as a membrane in absorbing and distributing load.” Photograph: Fuller Research Foundation; “Stellate Cells in Pith of Juncus (rush),” photomicrograph by Carl Strüwe. Preceding text and images from Kepes, *New Landscape*, 365.



255
Haddock Scale, 9 Years Old
U.S. Department of Interior.
Fish and Wild Life Service
Photograph: Howard A. Schuck

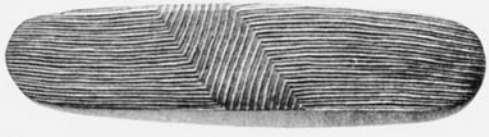
256
Beech
Photograph: Tet A. von Borsig

257
Schwan Glacier Tasnuna Valley
Photograph: Bradford Washburn



FIGS. 2.3 (LEFT) AND 2.4 (RIGHT)__Pages depicting patterns, scale, and time. From Kepes, *New Landscape*, 214–15.

258
Strip Cropping and Contour Cultivation
Aerial Photograph: Mitchell
U.S. Soil Conservation Service



259
Shield, Australian Aboriginal. National Museum of Victoria

tectural historian Rheinhold Martin has noted, Kepes inaugurated a discourse of patterns and organization in design and architecture.[19]

Archival Truths

This was a most curious pedagogy, therefore, predicated on a strange imperative to agglomerate data. While it has perhaps always been the nature of design to deal with generalizable approaches to the production of objects, Kepes demonstrated a particular reconfiguration of the relationship between process and material. He wrote, "what is called technical education, the mastery of a particular skill or a particular habit of visual representation, should be put off as long as one learns the objective basis of the language of vision."[20] Situated historically, this comment marks a break from an object-oriented or utopian design practice. For Walter Gropius, the famous architect and former head of the Bauhaus from 1919 to 1928 and later professor at the Harvard Graduate School of Design, different elements and mediums were to be taught separately and then brought together into a utopian synthesis identified, for him, with architecture.[21] Johannes Itten who designed an image of the Bauhaus curriculum in 1923 demonstrates this principle in his diagram (see fig. 2.5). Kepes, however, articulated no such linear and progressive structures for the student to work toward; all mediums became media. Kepes took from the Bauhaus and from his previous work with Moholy-Nagy but reformulated many of the same methods toward an expansive use of mediums, and away from concerns with architectural space, or specific forms.

Kepes also had had an extensive interest in the science of Gestalt psychology and had been exposed to the Theoretical Biology Club during his time in London while in exile before coming to the United States.[22] As Donna Haraway has noted in her work on twentieth-century developmental biology, the Theoretical Biology Club was part of a greater movement, engaging gestalt, forwarding a new idea of structure as encompassing interrelationality, wholeness, change, and self-regulation. These ideas in the sciences, Haraway notes, developed before the war, emerged with force and prevalence after the war, becoming the very basis for life and computational sciences.[23] Leigh Ann Roach, in her work on Kepes, has made visible this close intimacy between Kepes's work and thinking and these earlier movements in developmental biology.[24]

Kepes applied these ideas liberally. He took from gestalt and previous modern design movements, but often modified their tenets. He demonstrated little interest in ideal forms, or in finding static biological or immutable structures

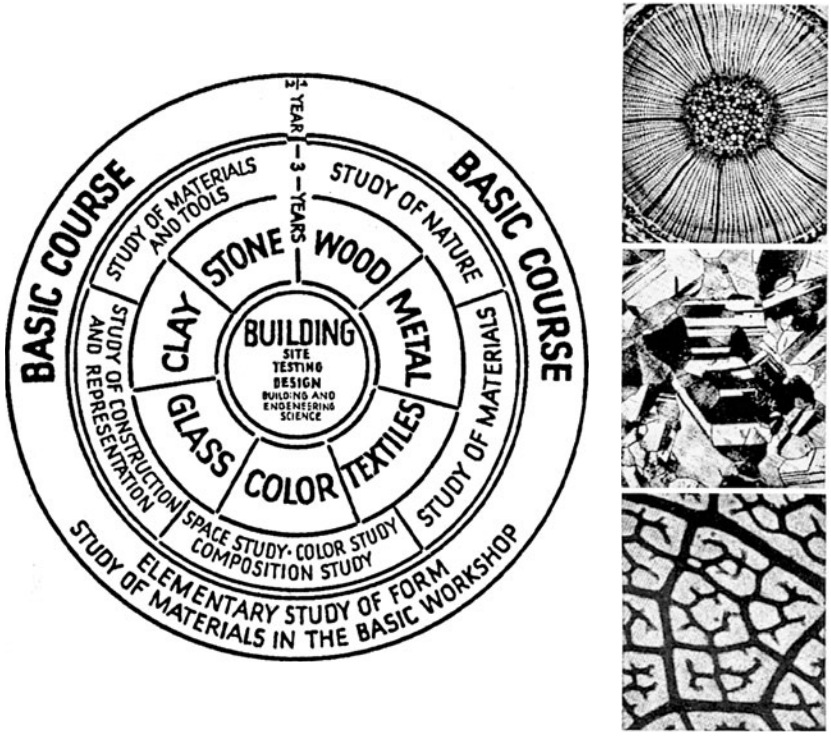


FIG. 2.5__"Images of Pedagogy," diagram of the Bauhaus Curriculum by Johannes Itten (1923). From Lupton and Miller, *ABC's of Triangle Circle Square*, 5. Courtesy Princeton Architectural Press; Plant stalk cross-section, polycrystalline aggregates, and the structure of a leaf. Kepes was interested in linking structure to growth through finding patterns in the natural and scientific world. Images from the essay by Wiener, "Pure Patterns in a Natural World," in Kepes, *New Landscape* (1956), 274.

that underpin perception. His was a nonnormative vision; a pragmatic and empirically driven idea of practice. For Kepes, the designer was supposed to reflexively reproduce and mime this method of algorithmic seeing. He or she was supposed to simulate how *any* image or data set could be integrated into new scenarios to produce an affective response in the viewer. The ideal notion of design, for Kepes, was not about medium specificity and ideal forms but rather ecology, process, and interactivity.[25]

In the courses, the student was explicitly encouraged to concentrate on the method before developing expertise in either any single medium or technique. Vision itself, understood as an algorithmic method or a logical pattern, could

be extracted and made the object and "objective" of education, from which designers must form "experience."[26]

Experience was based on data inundation as a form of truth and moral virtue. "These observations [made by sensory technology, computational, and electronic devices]," Kepes would come to write, "have made a new order of objectivity possible when looking at the world. The permanent record that the camera provides gives us the opportunity for sustaining visual experience as long as we wish, long enough to overcome the errors that the eye makes because of our impatience, prejudice and inability to recall."[27] Objectivity here was associated with the power of recall. The human eye might possess "errors" as a result of its archival limitation, but the machinic eye does not. The perfectly extended memory of the machine affords a perfect recall that facilitates a "sustaining visual experience.[28] Ignoring or dismissing problems of recording, Kepes focused on memory and access, like the Memex mentioned earlier, as the fantasized sites defining both objectivity and the objective of science and design. The designer being trained in these courses was building a process and "landscape" of vision, not producing individual and isolated objects to be seen. Correlating memory with objectivity, Kepes argued that error was *not* the result of subjectivity, embodiment, or mediation but was, rather, based on a failure to recall and store data. He depicted an informationally dense world, where it was access, not the recording of data, that would be the future challenge. Objectivity was the ability to produce different forms of subjectivity. To be objective, Kepes implied, was to be able to "sustain" and modulate an experience for as long as one "wishes."

The new form of truth being valorized was, thus, a claim for manipulation and mediation, not documentation, as the site of value, goodness, and aspiration. Objectivity was redefined in terms of the production of algorithms, methods, and processes that facilitate interaction, based on the assumption of an infinitude of stored information always/already readily available. The best, which is to say most objective, system for Kepes was the one that allowed the most conditions of possibility for seeing to emerge from recombining data. His work gestured to a wholesale relocation of objectivity away from unearthing a perfect record to the management and organization of patterns and the construction of dynamic structures out of vast data fields in the most effective manner. He wants the designer to produce these autopoietic structures—to mime, perhaps materialize, the process of seeing itself. Kepes, as I already mentioned, explicitly and repeatedly told students not to focus on any one style or one medium or one image.

Design practice is not imagined as answering to existing problems or oper-

ating by prescripted principles. Rather, designers, artists, and engineers are encouraged to agglomerate information and retroactively discover patterns. This "communicative" objectivity was data driven, nonstructural, and relational. Turning away from ideals of medium and form and assuming the world as informationally dense, designers could focus on process as material and method. This process was equated with perception and cognition simultaneously—to see and to think being analogized into a single channel.

Reconfiguring the Practice of Art and the Experience of Space

This production of entirely novel environments found its focus in Kepes's dedication to producing new spaces for artistic practice. In the course of his career he moved increasingly from visual design to spatial and environmental design, and to creating new institutional spaces for art practice. While he was always an artist, his greatest contribution and enduring legacy may be the CAVS, started in 1967 after decades of increased interest in humanizing engineering and science.[29]

Kepes's vision for the future of the arts was unique at the time. As Anne Goodyear has noted in her work on CAVS, the 1960s saw an intensified artistic interest in science and technology. This interest, however, did not always take the same form. Artists and designers coming from pre–World War II Europe often had conflicting concerns about technology as a Faustian bargain between hell and heaven. The work of art, for many of these figures, including Kepes, was to make technology more "human." New forms of visualization should offer proof of the interrelatedness of life to assist in averting future conflicts. Art's work was to use the informational surfeit available through the technical optic of the day, but never to subscribe to it. However, for many of the engineers and artists whose attitudes were forged after the war, technology was often seen as a route to economic and political success. The focus was not on art's place in challenging or forming technology but rather art's subservience to science and technology. Art should be defined by using the latest technologies, rather than challenging or reenvisioning them.[30]

Critical to Kepes was less the application of technology than using art to enhance science. "The scientific-technical enterprise needs schooling by the artistic sensibilities. . . . One of our most urgent and significant educational tasks is the fleshing out of our atrophied sensibilities," he wrote in a 1967 letter to a potential donor. This filling out of sensibilities, an enhancement of capacities for seeing, feeling, and, in his language, attaining "the fullest and

richest human use of our opportunities," would not come through exploring the deficiencies or lacks in the human senses, psychology, or capability. His was not a discourse of insufficiency, disability, or lack. Rather, he viewed CAVS as a "testing ground" of new ideas, tools, and media that could "explore the creative forms engendered by technology";[31] CAVS would be the embodiment of his ideals of research and experiment.

This focus on art as actually abetting, challenging, and improving science separated its advocates radically from the engineering-oriented artists of other art-technology groups of the time, such as Experiment in Art and Technology (E.A.T.), a New York–based group fronted by the engineer Billy Klüver and the pop artist Robert Rauschenberg, and closely associated with Bell Labs.[32] Art, for Klüver, was about testing materials to produce new affective experiences. Klüver spoke regularly and often of bringing artists to Bell Labs in order to *do* "technical" things. The focus of E.A.T., arguably, was on transforming engineering into a playful endeavor, and merging artistic practice into engineering and business. The organization of E.A.T. mimed that of a corporation, with boards of directors, and a vision not of sustainability or institutionalization but of applicability. Kepes's vision for CAVS, which was founded in 1967, on the other hand was collaborative, scientific, grounded in the academy, and separated, at least in concept, from industry (despite his work in advertising). His main concerns were with the ethical impact of art in (re)imagining technology and science in relation to society. He was invested in arts of environment and connection.[33]

Both Kepes and E.A.T., however, participated in a data-driven and performative practice. Both groups also assumed a world where emotion was to be carved out of information, but each organization hoped to attach this new epistemology of information to different affects. For E.A.T. it was the improvement of technology through artful engineering; for Kepes it was about returning technology to signification.

In an unintuitive merger between Romanticism and cybernetics, this humanity and "meaning," in Kepes's words, would arrive through the broadening of perception. So dedicated was Kepes to pure affect and this materiality and autonomy of perception that by the 1960s he had turned entirely to producing light sculptures, films, and environmentally focused design projects. Major projected works emerging from his design studios at MIT, never built, included, for example, ephemeral and mobile lighting sculptures for Boston Harbor linked to plans for cleaning the water. This project sought to use the perceptual reorganization through light of the space of the city to induce a hoped-for transformation of the ecology of its waterways. Kepes described

this project as an orchestration of the urban nightscape by means of "developing simulation devices of light patterns coupled to a computer," in order to achieve "creative use of kinetic light designs on an environmental scale."[34] The images of the model show beaming lights looming upward on a grid, imposing a surreal alternative landscape on the space.

These light sculptures were indicative of a new form of observation—one that was networked and interrelated to the environment. Kepes wrote that "art . . . without loss of personal vision—in point of fact through the expansion of such vision—is fast approaching the environmental scale and by its own inner dynamics as a craft becoming a collaborative enterprise involving science and engineering. . . . The focal expression of our corporate existence . . . may well be the shape of gigantic luminous forms celebrating our civic pride in our knowledge and high technological achievement, fountains of light, produced by projected sources of powerful artificial light."[35] Light could bridge the individual observer with a civic network founded on a materiality of sense that linked computers and control systems that he envisioned modulating these experiences in response to changes in the environment and in utilization, producing what he theorized as new forms of relationality and identity (fig. 2.6). For Kepes this was not merely a question of vision but truly a modulation of sense itself. His favorite reference was to "color music," to contemplating an integration of senses in these mobile environments enhanced by artificial lighting.[36]

Kepes proposed a number of other projects, including installing mirroring buoys in the Charles River and creating mile-long programmed luminous walls. As Otto Piene, later head of CAVS and among its first fellows, recalled, this was to "compensate for the lost pageantry of nature,"[37] and was meant to produce new concepts of identity and affiliation in urban landscapes through an exploration of previously unexplored aesthetic and psychological dimensions that focused on the interactions between people and between people and space through raw sensation.[38] Kepes would also build interactive light installations for corporate lobbies, of which the most prominent is an interactive light sculpture in the lobby of the KLM headquarters in New York. The mural is a large set of screens with areas of fluid lights and sections of discrete lights that modulate. The ephemerality and interactive quality of the medium refracted the client's global ambitions.[39]

This move toward light as a pure medium was partially in the legacy of Kepes's earlier work with figures like Moholy-Nagy, who also was deeply concerned with light itself as a structure for artistic perception and as a site for the exploration of this new-found materiality of perception. Kepes scaled this

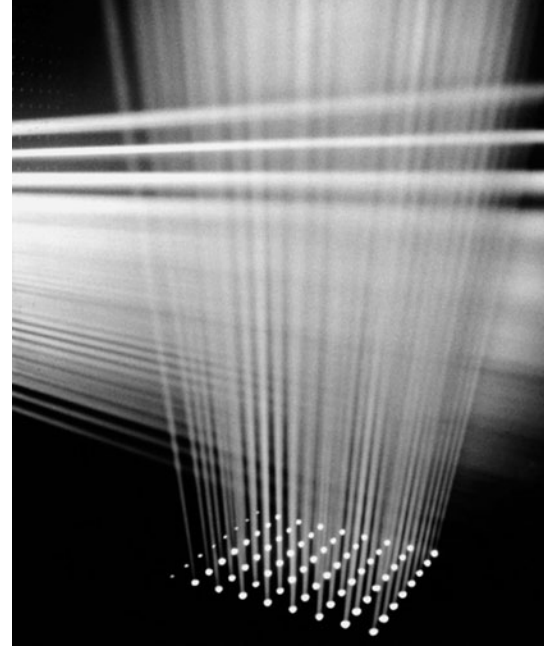


FIG. 2.6__Simulated effects of a proposed mile-long programmed luminous wall, suggested for the Boston Harbor Bicentennial, 1964–1965. From Kepes, *MIT Years, 1945–1977*, 69. Image courtesy of Imre Kepes and Juliet Stone Kepes.

concern with pure opticality to the landscape of the city and into civic engagement in an effort to reunify art and science in the interest of social relevance. His sensorial city, abounding with light, provides an interesting genealogical challenge to my opening scene of sentient space in today's global smart city spatial products. Central to his pedagogy throughout the late 1950s, and particularly later to art practice at CAVS, therefore, were environmental planning and psychology, where the landscape of the city came to be treated as an interface for aesthetic experimentation and as a reflection of both social and individual psychology.[40]

Perception took material form as a channel scaling between the microscopic to the macro systemic. This materiality of process is made evident through the fact that few of his projected works were built and that his greatest success may have been CAVS, an institutional site that formalized this "experiment" and method in using art as abetting science in reconfiguring vision.

Kepes thus demonstrated an aesthetics dedicated to producing a world out of the recombination of images and forms. These texts and projects do not explore an existing world but aspire to produce a self-referential one from the detritus of a world assumed always already fully recorded. As he would write in an interview late in 1971, "today we are in a critical stage of human evolution. Evolution is becoming self-conscious. Our future relies upon how clearly we understand and how well we control the self-regulating dynamic pattern of our common existence. . . . To agree on objectives it is necessary to reach

a better common understanding of 'reality.' What I call reality here is neither absolute nor final."[41] In this model of self-referential evolution, the future was about cybernetically regulating patterns—perception becoming material and subject of design and art, circulative as an autonomous process; knowledge redefined as the subjective ability to modulate, enhance, and manipulate perception.

For Kepes the idea of a world fully recorded pushed design toward materializing process and focusing on the relationship between subjects. Perception itself became a form of thought and created new challenges for design, science, and art; not to reveal some truth of form, of nature, of society but rather to organize the interactions between users. The focus of design turned toward the structure of organizations, systems, and environments. The remaining ethical question was what shapes these networks would take. Evolution could now be "self-conscious" if designed appropriately.

Found Educations: The Pedagogy of Communication

Kepes's work, therefore, should not be seen in isolation but should be understood as a broader effort to revise concepts of knowledge and the practice of business, science, and design. In a reflective postwar moment, when concern with the ethical and humanistic impact of technology was high, Kepes's initiatives were hardly unusual. Many universities introduced new art, technology, and design pedagogies. This reform impulse was spurred further by C. P. Snow's famous discussion of "two cultures" and his critique implying the degraded moral and ethical effects of such a condition. Over the next twenty years MIT, UCLA, Bell Labs, and many other labs, corporations (even RAND Corporation),[42] and universities developed programs to integrate (successfully or not) arts training into the engineering curriculum. What was guiding this reform impulse, however, may have been less a concern with ethics and morals and more a steadfast belief that knowledge (and business) was being transformed, and central to this transformation was the paradigm of information, communication, and computing.[43]

Propagated by the designers and university administrators was a regularly articulated faith that vision, above all, could provide a tool to reconcile the humanities, sciences, and arts; providing a universal language not only within the university but for what was increasingly understood to be a global and interconnected planet. This faith in vision kept repeating itself, ad nauseam, whether in urban planning and design or in architecture and design. The imperative, therefore, was not only to teach art appreciation but also to focus on

FIG. 2.7__Lecture hall during sample lesson at UCLA, May 1953. The Work of Charles and Ray Eames, Negative no. LC-E12, CE 492-B, lot 13181, no. 2, Print and Photography Division, Library of Congress. © 2013 Eames Office, LLC.

visual communication as a location where students might be taught new forms of production and experimentation.[44]

A course taught by the preeminent postwar designers and intimate colleagues of Kepes, Charles Eames, and George Nelson for business school and engineering students at UCLA in 1953 is demonstrative (fig. 2.7). Previous versions of the course were taught at Georgia Tech as well.

Designers whose clients included IBM, Herman Miller, and the U.S. Information Agency (USIA), these are the individuals most commonly associated in contemporary culture, and historiography, with the public face of government, the aesthetics of the Cold War consumer lifestyle, and the office space and style of the postwar (modern) corporation. The course was intended to teach the idea of communication to the uninitiated.

The brochure intimated that the course had to be "experience," and that it was "new." It was so new and experiential, in fact, that the class could not be described.[45] Language seemingly replaced by sensation or affect.

Considering the interactive and contemporary language of the brochure, it is somewhat surprising to witness Eames arguing that this "something new" must come from something old. He spoke, repeatedly in the course of his career and in reference to this course, of a "found education," suggesting that education should be about recombining data. Reflecting on this 1953 course in an article also titled "The Language of Vision," he argued that the main concern for designers and managers was to reduce "discontinuity" between disciplines in an information age. The inverse and implicit corollary was that such a reduction in information flow would result in an increase of the capacity of the individual or the institution to process data.[46]

To produce this smooth space between disciplines, Eames felt "vision" was the best tool. To teach students to see, however, must come through exposure to an excess of data. For Eames only through information *inundation* could learning commence. He was very specific on this point; the purpose of the class was to experiment with "how much information *could* be given to a class." Data overload as pedagogical principle.

This principle was a long-running one. The work of the Eames Office in education was not contained to the courses Charles taught. Charles and Ray Eames were deeply involved in many exhibitions and in developing educational materials for the public. The Eames Office designed brochures (fig. 2.8) for Science Research Associates, Inc., an educational products company owned by IBM, a major client of Eames. Science Research Associates introduced behavioral research to education, and its learning system was influential in postwar elementary education.

The brochures introduce a learning system and new forms of teaching math in lower grades. Central to this "new" math is the teaching of set theory, a central component for programming and computers, at far earlier ages and before university. The courses also emphasize group and collaborative work, modular teaching, and constant assessment and measurement of outcomes. Science Research Associates also emphasized speed reading and analytic capacity, and was a major provider of grade school educational materials throughout the 1950s and 1960s, as part of Cold War concerns about educational achievement (SRA was purchased by IBM in 1964). These methods and training systems were the childhood equivalent to the engineering courses, a system designed to help students deal with large amounts of data, find patterns or sets, and analyze quickly.

Charles Eames believed that design should *amplify* and accelerate the availability of information. In what, from the vantage point of contemporary de-

bates over attention deficit disorders, now appears as anathema, Eames spoke of distraction and overstimulation as an education. Rather than worrying about information overload, Eames thought more data offered more "choice," giving the spectator a freedom to "choose" from and produce his (or her) own patterns and combinations. He would speak throughout his career about "connections," and making connections possible was the purpose of good design.[47]

The Vision of Communication

This was not any form of choice, but a specific type—choice as creatively interpreted from digital communication. As the premier science educators in the United States, the Eames Office maintained close contact with individuals in cybernetics, psychology, computing, and communications engineering. In this "sample" lesson, Eames and Nelson specifically sought to teach both cybernetic and communication principles involving information and feedback.[48]

This course was structured around, and dedicated to, the *Mathematical Theory of Communication*, first formally introduced by Claude Shannon and Warren Weaver in 1949, and defining information as a probability (also discussed in chapter 1). This model, emerging from the multiple influence of telephony, antiaircraft defense, cybernetics, computing, and radar war research, famously split form from content. In the realm of communication theory, information does not denote meaning, only the choice between possibilities within a *structured* situation. Repeating Weaver's summation, we may recall that the idea of communication "not so much to what you *do* say, as to what you ***could*** say. . . . The concept of information applies not to the individual message (as the concept of meaning would), but rather to the situation as a

FIG. 2.8__Science Research Associates brochure (1964). The brochures state: "in March 1964, Science Research Associates, Inc. became a wholly owned subsidiary of the International Business Machine Corporation, operating with its own management and board of directors. Under this arrangement, SRA [Science Research Associates] will continue to develop new materials based on research in the behavioral sciences as it relates to the learning process." Works of Charles and Ray Eames, Print and Photography Division, lot 13195–395/396, Library of Congress. © 2013 Eames Office, LLC.

whole."[49] Redefining information not as an index of a past or present event but as the *potential* for future actions (not what you *say* but what you *could* say) encouraged engineers to defer concern about particular messages and to refocus on interactions between sources of signals, in a move that mirrors the turn in design to complexity, process, and connection.

In the *Mathematical Theory of Communication*, under the joint pressures of military and economic interest, building channels or communication systems was recoded in terms of efficiency, compression, and logic, and came to be understood as engineering the most efficient (least-choice) possibility for transmitting the most potential types of data; leading to the decision to use a binary numeral system—a choice between only 0/1—as the basis for digital communication systems. In communications science there is no ontology or interest in presence, the present, or the index, there is only the modeling of a situation or a relationship that delimits the types of future exchanges to be conducted.

The Eameses, however, were not interested in efficiency as understood by engineers. They were interested in the most choices that could be produced,

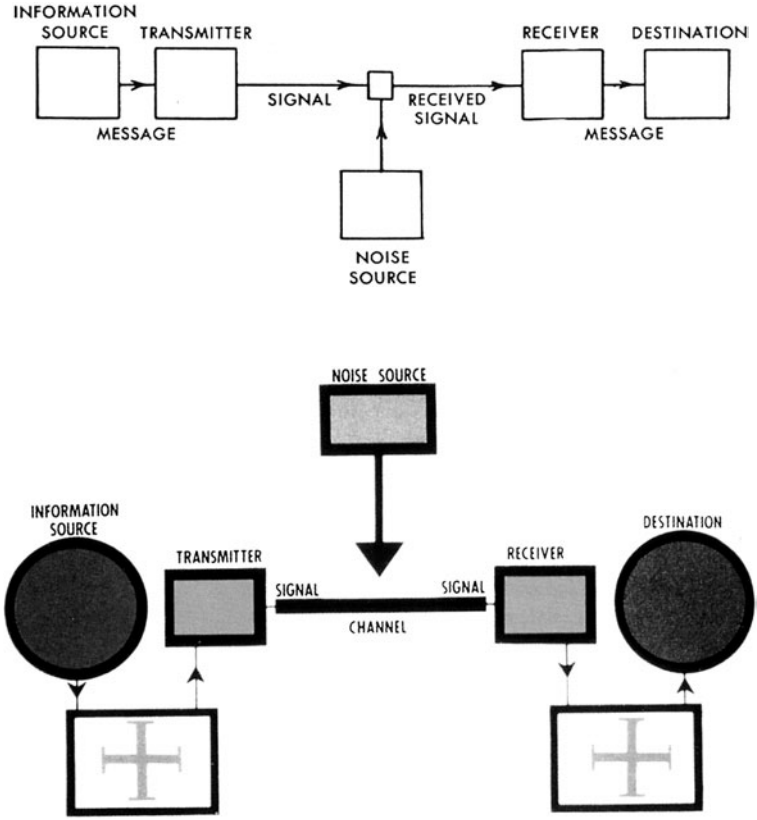


FIG. 2.9__Interpretations on a theme: (top) diagram by Claude Shannon, from Shannon and Weaver, *Mathematical Theory of Communication* (1949); (bottom) diagram by Charles Eames from Eames, *Communication Primer* (1953).The Eameses add an extra step in the diagram for (translation or corruption of message) the little crossed boxes, and interpret the theory more as a concept of interactions with the environment than as a strictly functional idea for information transfer. Particularly salient is their idea of redundancy, which for them can be virtuous by allowing clarity, versus engineers, who often want to remove redundancies, as in audio or video compression algorithms. Film stills from Prelinger Archive, http://archive.org/details/communications_primer.

all the while seeking to make useful and pleasureful things (fig. 2.9). Eames's and Nelson's classroom method was one experiment in attempting to produce a new type of informatic spectator and designer—both the consumer and the producer of such communication systems. Under the influence of these theories of communication, but also influenced by ideas of feedback and behavioral psychology, the team, repeating Kepes, defined the class as a methodological experiment, where students would be exposed to a vast amount of data and asked to distill this data into a single, coherent visual presentation. Anticipating our contemporary multimedia perceptual field, vision should not, however, be understood as a singularly optical register. In the class students were inundated with sensory stimuli, "a live narrator, a long board of printed visual information, and complementary smells . . . piped into a chemistry lecture theater." The principle, Eames argued, was not to produce a "far-out" experience but to develop the concept of the class. This concept, they argued, was that of information theory as it applied to design and architecture.[50]

The purpose was for students to unearth a distilled logic or pattern within a non-media-specific data field constituted of sound, smell, and image that they could then isolate and reenact through a slide show or short film. Decades before the age of PowerPoint presentations, the Eameses trained budding engineers, architects, scientists, and business managers to present their information in the logic of visual language and succinct bullet points. Eames wrote that the best tactic was "to put it on film because through the medium the central idea can be supported by images which give substance and liveliness to it. This reduction of one idea to its essence, using the support of visual images, is the core of several films we made on mathematical topics." He wanted students to distill the "essence" of the data, and he felt that vision offered the best tool to do so.[51] The image, here, is lively and substantial while also reductive and essential. Eames hints that this form of image is a process and pattern that embodies "ideas." This durational image is also historical. It was through the legacy of a different medium, film, that Eames hoped to move to computation. This was not a discourse about the end of cinema but simply the consumption of one medium into another in the recombinant and archival logic we now understand as underpinning computing.

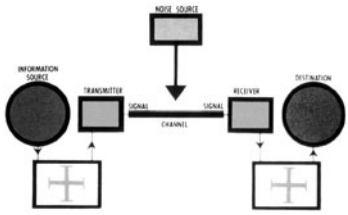
The remaining slides from the course, now in the Eames Office in Santa Monica demonstrate some of what was shown. The slides comprise of hundreds of images. They are arranged in such a way that one detail or a repetitive pattern links what are otherwise discontinuous and unrelated phenomena. So, for example, an eagle's claw turns through its circular shape into a staircase that slowly, through a sequence of shots, becomes a dinner party. In the film

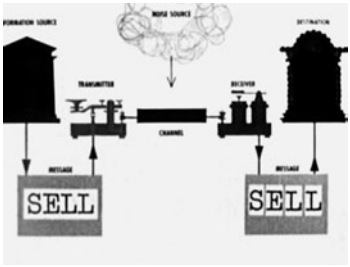
that resulted from the course, *A Communication Primer*, which teaches the mathematical theory of communication, a red light becomes an on/off message, a logic gate, and then a mathematical theory of communication. What stays stable is the structure of presentation, the ratios, the patterns and speed of image delivery, the setup of the screen or interface in relation to the observer. This stability in the organization of vision and sense makes the content malleable in scale and meaning. These slide presentations and films established examples of ideas the Eameses would later encode in their large-scale installations and educational films.[52]

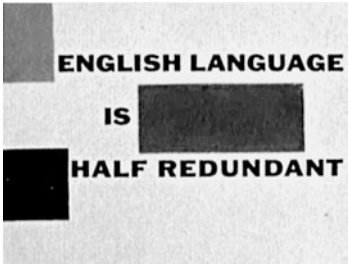
For example, in the images from the *Communication Primer* (fig. 2.10) the Eameses demonstrate how the expression "I love you" can carry no information if uttered within a context in which there is no possibility for the message to entropically degrade to "hate." If one is "in love" and is told by one's partner "I love you," there is no information in the exchange, since the receiver has no choices (no degrees of freedom in selection). A message that will definitely arrive to the receiver contains no information, even if it has great meaning. Only if we are not sure of the love, or if there is a choice to not love, can there be information in the system. The goal of the exercise is to give an example that is "meaningful"—love—and turn it into an example that bears information by making it equivalent to communication and action (maybe affect) instead of an identifiable emotion.

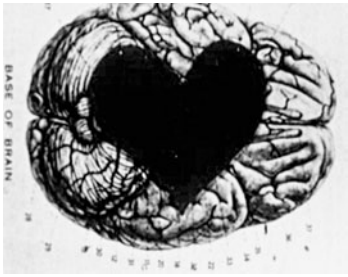
Making "love" unsentimental and emotionally unidentifiable demands some creative modulation of spectatorship on the part of the Eameses. As the voiceover of a man intones the definitions of a mathematical theory in highly standard 1950s monotone documentary style, we see the movements of grass, a man's mouth grazing the ear of a woman, and then a set of flash cards flipping from love to hate. This irrational set of images is lent coherence through repetition, cadencing, and voice. The images themselves possess no stable coordinates in space and time, roaming between locations, scales, and examples. Repetition is key, therefore, to producing this equivalence.

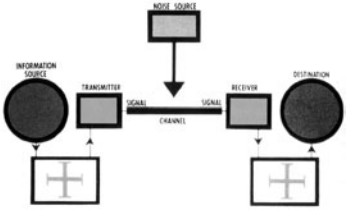
The movie demonstrates the same concept of symbol distortion repeatedly throughout the film. Before love, the definition of communication is repeated four times in the example of reading, the transfer of money between banks, a diagram of the mathematical theory of communication, and finally in the telephone "game" in which individuals whisper to each other. Love is the fifth example. The movie re-performs, literally, the idea of redundancy, the production of noise, and the concept of information, by giving multiple examples of the same idea. In the example of love, which is the apex of the exercise, this redundancy is demonstrated through the compulsive repetition of icons of love











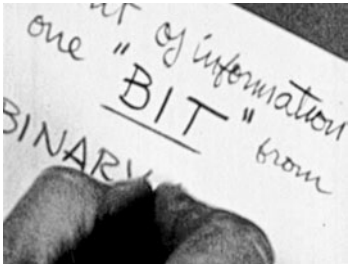


FIG. 2.10__Stills from Eames, *Communication Primer* (1953). Film stills from Prelinger Archive, http://archive.org/details/communications_primer.

again and again from art, including Romantic eighteenth-century paintings, Chagall images, and hearts. There is no mise-en-scène of the love scene, and therefore there is no way for us, as spectators, to identify with the emotional or subjective nature of the scene. What we are permitted to do is recognize our familiarity with such scenarios generically. We see love as a technology equivalent to communication channels, finance, and computers. Spectatorship, finally, is not about scopophilia, or identification or desire with images, but rather about deducing this pattern from the data field.

The Remains of the Archive

Eames did not leave this archival vision in the classroom. The Eames Office, as a design practice, largely operated through recombination, and Charles Eames argued that films should be "found films," implying that the films should recombine footage shot for other purposes in science, art, marketing, or design to produce new patterns and messages. With literally everything being stored—from production stills, mockups, and slides to numerous objects regularly collected in world travels—the work of the Eameses regularly repeats images and conventions from other pieces. Their archive at the Library of Congress is extremely extensive, and was well catalogued, by themselves, upon donation, and their office still contains endless rows of cabinets where Ray Eames would store every button, doll, piece of cloth, yarn, string, and other objects—often toys from around the world—used in their work. Almost all their movies have a scene using footage, just like their found education, from earlier work. Arguably the very distinguishing feature of Eames design was their sense of play, the ability to bring in toys, buttons, games, representations of childhood to the presentation of topics like computers and math, recombining and making nonlinear the very human life cycle.

These are archives, however, that are organized not through a logic of classifying objects but through modes of apprehending objects. It is perhaps no longer even appropriate to label these practices "archival" in the sense of the nineteenth-century interest in taxonomizing and organizing objects, artifacts, and peoples into stable relationships with one another. In the histories of cinema and photography it is the endless efforts of Étienne-Jules Marey to capture the present, or the documentary zeal of Alphonse Bertillon or Francis Galton, that has laid the foundation for theorizing archiving. While these individuals all worried about informatic excess, they just as assiduously worried about capturing, recording, and organizing data; the archive was not always already there, it had to be built through complex assemblages of many instru-

ments, machines, and techniques.[53] If the archive has always been about its structure and the associations facilitated through its organization, this had now become not the implicit and repressed function of the storage endeavor but the *explicit*, and openly advertised, purpose—"found educations," "found films"—a spectacular discourse of remainders, recycling, and storage. This discourse was made more marked by the concomitant absolute disregard for, and total silence about, organization or taxonomy.

This is a subtle but important mutation in the Eameses' own history in design. Originally trained at Cranbrook Academy, and familiar with the Arts and Crafts tradition, both Charles and his colleague and partner, Ray, had come from a space where automation was not aesthetically desired and was eschewed. They took what they understood to be the "human" element of this training, the immanence that the movement had attached to craftsmanship and the people-centered, to rephrase Charles's term, approach and reattached it to a new type of machine. The Eameses sought to balance a desire for mass consumption, information technology, and reproducibility with a fantasy of quality, immanence, and "humanity" in design. What separated their practice from this previous history of design lay in bequeathing the value of craft, essence, and immanence onto information patterns, with these patterns taking the place of the well-crafted and singular object. Even their objects, like the infamous Eames chairs, cannot be seen in isolation from an entire system for reconfiguring the human perceptual system, lifestyle, and work.[54] Innovation, beauty, objectivity, and moral value were all reassigned to a new site—the production of methods. Methodology, process, and, in Charles's words, "connections" assigned the value of craft and object-hood. This, again, may have always been the implicit idea animating many schools of modern design and industrial manufacturing, but now it became the explicit and central goal, separated from any clear-cut endpoint in the single design object or utopian ideal of a pure aesthetic (or even a school) and reformulated to apply to everything from architecture and design to strategy and management in business and engineering.

The Eameses took seriously the idea of process as a material for storage. Their archive is not only full of found materials, which they recycled continuously, replacing redundancy for specificity and signification. They also assiduously documented the actual production of every project. From the first sketches to the action of their assistants arranging images on light walls, the Eames Office was comprehensively obsessed with collecting, collating, and showing not the content of their exhibitions but the process of designing itself. Their understanding of storing information appeared to be imbricated with

the concept of apprehension—how to catalogue and store the tactics and strategies that induce perception and action in the client or observer? Good information design was about figuring out the communication structure of the interaction. The retrospective of their work in 1969 at the Louvre is demonstrative. The Eameses show not the final products, or the exhibitions, but the process of building these exhibitions and the details that come together in their designs. Organizing the show is a famous chart by Charles Eames demonstrating how design must be a dynamic process, by showing the constantly changing relationships between clients, designers, and the public. Central to the office was collecting visions of process itself, and focusing on the ways that design could form attention.

These students were thus being trained to become both the consumers of data, capable of choosing patterns, *and* the designers of vision itself, the managers of this consuming algorithm. Charles Eames regularly implied in his writings and with his diagrams and exhibition designs (figs. 2.11 and 12) that to observe was to scan, to find "connections," with the implication that the cognitive process of learning to see would become equivalent to his self-defined "language of vision"—to see, to think, and to speak all becoming part of a single channel.

The Ecology of Sense: Urban Planning, Information, and Affect

Eames's and Nelson's course offers evidence of a new technique of management by way of an algorithmic optic that made attention and cognition synonymous and could be extracted, and perhaps measured and managed, a theme I will continue in the next section. The move between an organism's perceptual field and the organization can perhaps be no better demonstrated than in the work of Kepes's most famous student and perhaps one of the greatest and most influential of the postwar American urban planners, Kevin Lynch.

Lynch initially hailed from Chicago, where he was born in 1918. He was trained in Catholic schools that were under the influence of John Dewey's educational philosophies. This philosophy's faith in democracy, participation, and pragmatism inflected his later design practice. While his high school experience was during the Great Depression, Lynch in his interviews mentioned the Spanish Civil War as the "first real political influence" in his life, stirring an interest in socialism, communism, and contemporary political matters.[55] On reaching university age, he opted for architecture and was advised to attend the very conservative Beaux-Arts program at Yale. By his sophomore year the

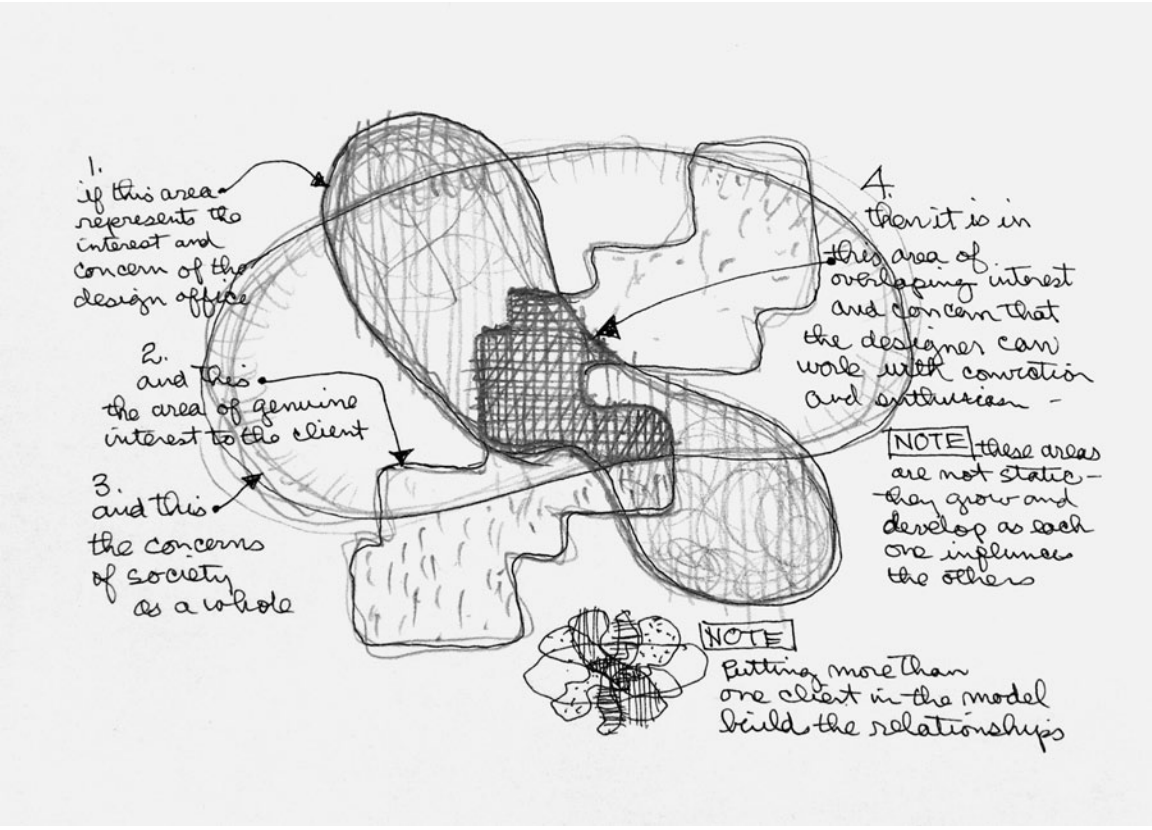


FIG. 2.11__"What Is Design," diagram by Charles Eames (October-December 1969), sketch for the exhibition "What Is Design," Musée des Arts Décoratifs, Paris. The diagram represents the interest and concern of the design office, the client, and the society: "Then it is in this area of overlapping interest and concern that the designer can work with conviction and enthusiasm. NOTE: these areas are not static; they grow and develop as each one influences the others." The Work of Charles and Ray Eames, box 173, folder 9, Manuscript Collection, Library of Congress © 2013 Eames Office, LLC.

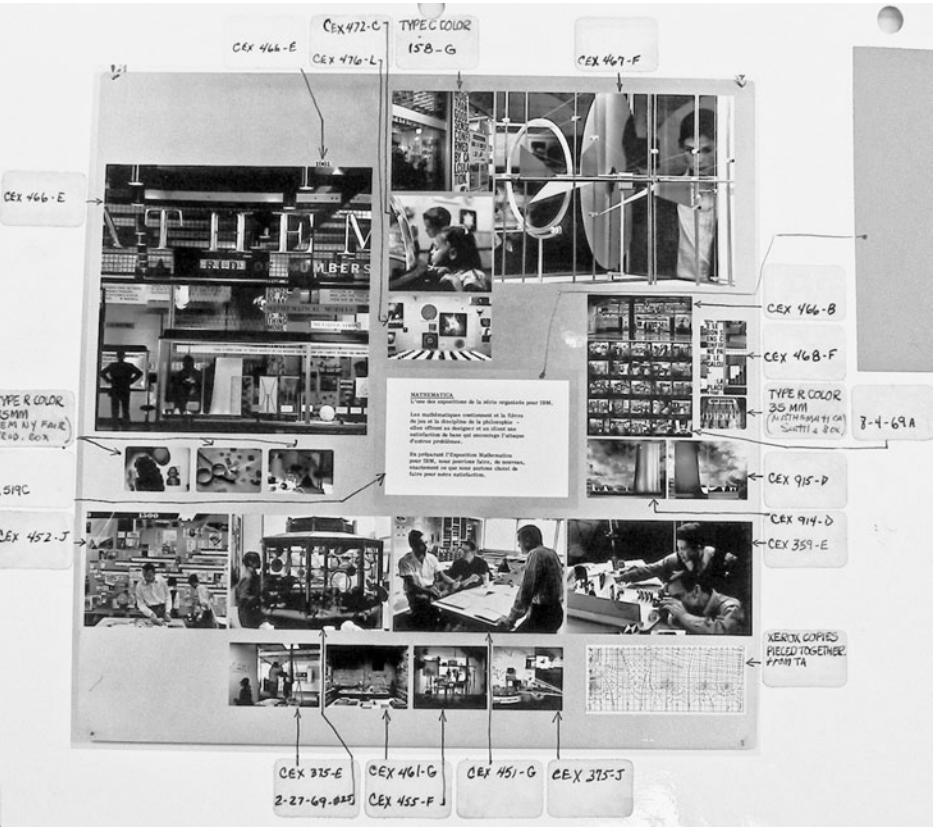


FIG. 2.12__Images from the exhibition “What Is Design” (October–December 1969), Musée des Arts Décoratifs, Paris, depicting the show “Mathematica.” There are panels depicting the process of selecting images, their layout, the mockups, the piecing together of Xerox copies collating mathematical equations and so forth. The exhibition itself was another Eames project in educating the public in mathematics and practices of calculation. Work of Charles and Ray Eames, box 173, folder 10, Manuscript Collection, Library of Congress. © 2013 Eames Office, LLC.

curriculum had frustrated him, and on reading about Frank Lloyd Wright, Lynch wrote to him at Taliesin, "filled with enthusiasm to go to a place with such an atmosphere of freedom and creation." Wright responded that Yale could in no way foster creativity and invited Lynch to Taliesin. There Lynch worked for a year and half, during the school's move to Arizona.

Lynch, while inspired by Wright, found his social philosophy backward, however, and very "arts and crafts" (which put him at an interesting disjunction with the Eameses). He left to study at Rensselaer Polytechnical Institute to gain engineering experience, and was shortly thereafter drafted into the army; he served in the Army Corps of Engineers in Palau Islands, the Philippines, and Japan. On returning, he decided to attend MIT on the GI Bill and complete a bachelor's degree in urban planning. He was hired at MIT with only a BA, on the strength of his thesis and work, and he continued to teach there until the early 1980s.[56]

In Lynch's studies of urban space, landscape, environment, and pattern took the discursive place of structure or function by way of a new epistemology. To understand Lynch's work, and its innovations, demands some recognition of the history of planning. In the United States, planning in the early twentieth century was heavily influenced by men like Daniel Burnham (who planned Manila after the Spanish-American War and Washington, DC), Fredrick Law Olmsted (of Central Park in New York fame), and Ebenezer Howard, the British planner who conceived of the "garden city." For these men, the city was the producer of and mirror to social order and health. Cities were massive instruments of normative force shaping populations into the best forms for society. Lynch had also been exposed to the hyperindividualistic and mobile ideals of Frank Lloyd Wright, whose Broadacre city spread out across the plains as a diffuse space, networked by roads, focused on individuals owning homesteads. Wright was symptomatic of modern utopian planners who extended, in many ways, the late nineteenth-century concept that the city was an organism, or machine, for producing ideal social orders. For Wright this order was about rugged individualism and the motorcar; for other influential architects of the time, such as Le Corbusier, and his Ville Radieuse, it was about the city as a machine for industrial organization.[57] All these ideals of planning shared in a structuralist assumption that sought to impose an ideal social order, rather than generating it through longer term processes of interactions between agents in the environment. The citizens of these cities were envisioned as normative. The work of architecture and planning was to organize these populations into stable hierarchies, locations, and spaces. Kevin Lynch would separate from this history.

In 1960 he published a study titled *The Image of the City* that continues to be one of the most influential texts in planning, transforming modern visions of utopian cityscapes. Dedicated to Gyorgy Kepes, the study had emerged under Kepes's supervision at the Center for Urban and Regional Studies at MIT. It was part of a joint research project between Harvard and MIT that involved examining the relationship between the changing nature of cities at a time of increasing suburbanization, eroding tax bases, and deindustrialization (certainly true of Boston by the early 1960s) and the "look," in Lynch's words, of the space. "Giving visual form to the city is a special kind of design problem," Lynch wrote, "and a rather new one at that."[58] Lynch's hope was that in studying this "look" new answers might be found to solving the problems of what even in 1960 was clearly a rapidly changing urban environment increasingly confronted by racial and class division and clearly degrading in physical infrastructure.

Lynch later recollected in a UN policy paper dealing with the future of the city in the 1970s that the purpose of this research was to link perception and cognition to policy.

> Research into environmental perception began about twenty years ago. Its original purpose was to change the way in which urban areas were being designed. These first efforts have had continuing consequences in many fields but only a superficial effect on public planning at least until rather recently. . . . We began to inquire into the way people perceived their city surroundings in the late 1950s. The aim was to clarify some vague notions about the visual qualities of large environments, and particularly to show that you cannot evaluate a place, and should not plan for it, until you know how its residents see it and how they value it. The very first trials were concerned with how people locate themselves in a city, and find their way through it, but these experiments quickly escalated to considering the entire mental image of a place.[59]

By implication, Lynch was among the first to produce a psychological account of urban space, making individual cognition and perception a dominant discourse in urban planning over the course of his thirty years as an active educator, policy-maker, and planner in Boston and at MIT. While in the 1950s this was merely a side note in planning, public health, and urban public policy, by the mid-1970s sociological discourse concerning urban problems was fully invested in psychological explanations. Lynch's particular account of vision therefore linked the urban form at a large scale to the individual account of space.[60]

The initial studies followed three cities—Boston, Los Angeles, and Jersey City. The city was mapped at different scales: from the air, through standard cartographic methods, street maps, traffic maps, maps of infrastructure, and at the street level. Lynch worked to produce an optic that could scale from the vast to the personal.

Cognition and Communication in Planning

As part of this new perceptual form there was also a novel experimental and methodological apparatus, aimed at measuring affect and sentiment. Lynch produced a taxonomy of process to define and categorize perceptual processes. The first was *imageability*, "that quality in a physical object which gives it a high probability of evoking a strong image. . . . It is that arrangement which facilitates the making of vividly identified, powerfully structured, highly useful mental images of the environment. It might be called *legibility*, or perhaps *visibility* in a heightened sense." The best city is highly imageable, according to Lynch; it produces distinct sensations and well-formed mental maps.

Lynch's concepts of "imageability" and cognition were tightly derived from cybernetics, the rising cognitive sciences, and computing. In formulating the study, Lynch, for example, wrote regularly to J. C. R. Licklider, who helped found Lincoln Labs and was one of the pioneers in computer development.[61] His famous 1960 essay *Man-Computer Symbiosis* reframed cybernetic concepts of feedback into ideas of an evolutionary coupling between humans and machines that would be prosthetic and augmentative rather than competitive. He applied ideas of time-sharing to the relationship between humans and machines, where each would do separate tasks to free time for the other.[62]

Lynch's discussion with Licklider is illustrative of how ideas of cognition and subjectivity were transforming planning, but also the liberties that urban planners were taking with communication theories and computation. Licklider was concerned about the "normative" elements of the study in Lynch's preferences for more "imageable" cities. He was also interested in applying standard tools like Fourier transforms to define form in the city and compare it to human perception. Finally, Licklider worried about the black-boxing of "meaning" in Lynch and Kepes's proposal.[63]

Lynch responded with interest with regard to the normative concerns, but unlike the computer scientist, Lynch was ready to relinquish objectivity and programmability in either defining form or "meaning," arguing that while Licklider's concerns were understandable, the intent of the study was quite different:

> in other words, instead of saying that "cats are black" and being led to a direct test of whether they are indeed black, we are saying, "it would be best for all of us if cats were black." Since we are not prepared to prove this vague statement, we are really saying, "since we assume that we would all be healthier and happier in a black-cat world, then one of the most important things we could learn about cats is how to make them black." It gives us a set of values as guide posts in a complicated beginning [from which future policy and research will emerge].[64]

Rather than defining the goals ahead of time, Lynch works in a fantasy world that accedes to its own illogical assumptions but uses them to change the direction of planning. Instead of asking *how do people see or feel or think*? Or *what is wrong with the city*? Lynch wants to push for an anticipatory design that gathers data first in order to then retroactively unearth the characteristics that might be desired. On one level, Lynch still wants to create "happier" cities, but in terms of method, his focus is on the process—discovering the nature of black cats—rather than on defining terms and definitively proving or disproving facts about cities that have been clearly delineated before the start of the study. In keeping with more contemporary methods in building responsive environments, Lynch prefigures such attitudes by substituting fuzzy logic and data gathering for structural and hierarchical approaches to planning. For Lynch the best social science focuses on post-data-gathering analytics and the production of instrumentation rather than the generation of structural ideals or types for urban forms.

Lynch also pragmatically argued against a reduction of language or signification, including what both he and Kepes labeled "visual" language, to strict logical computation. For Lynch and Kepes, signification might be returned to planning by way of reflexively using the archive of individual memory and history.

Lynch on one hand shared a sympathy with communication sciences in attempting to develop standardized methods for comparing human cognitive understanding of an environment with other maps and plans of the same space. Computing, cybernetics, and cognitive science offered Lynch an armory of metaphors and ideas, but on the other hand he resisted attempting to pretend that the techniques of computer science to represent reality were a scientific, or objective, approach. Lynch saw a diversity of patterns and rhythms emerging from comparison, not a single standard approach, such as Fourier transform, to make discrete data points appear continuous. He was even more antagonistic to the idea that human perception operated in one such standard manner.

For Lynch the disjuncture between what is measured, visible, and logical and the complexity and meaning of the space of the city was precisely the disjuncture driving planning interest. Like the cyberneticians discussed in chapter 1, Lynch found a differential between the archive and interface, or the "image" of the city. But unlike many in the computer and artificial intelligence projects of his day, his interest was in multiplying that disjuncture rather than suturing it. Lynch did not seek to suture the space between the imaginative and meaningful "image" of cities in inhabitants' minds and the measurable logical forms that planning could produce, control, and anticipate.

If Licklider was still interested in precise definitions and clear-cut mathematical approaches that were predetermined, Lynch was interested in the reverse—in studying the small differentials between representational approaches to produce a more complex idea of the city. In many ways, Lynch's approach allowed greater penetration of ideas of communication, method, and process than the failing efforts that were being made in the computer science of the time to clearly define language or thought. I draw attention to this feature of the study because it signifies a broader movement in the social sciences and design practices at the time to translate cybernetic and communication science concepts of feedback and communication into practice by repressing the constraints of formal logic and positivism.

The Measure of Perception

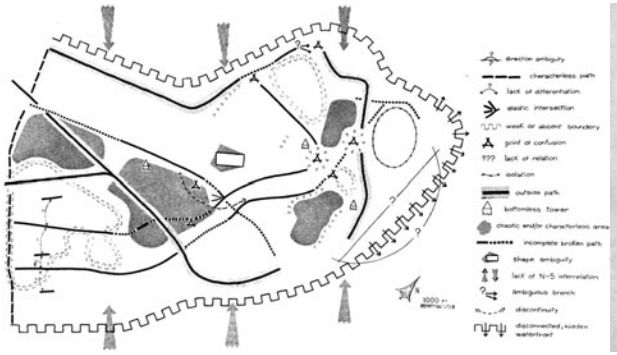
In order to study this psychological and perceptual interaction with space, Lynch proceeded over the course of five years, 1954–1959, to rigorously interview numerous subjects (fig. 2.13). Participants in the study were asked to draw mental maps of significant landmarks, to sketch the paths they navigated every day, and to draw and classify elements of their environment from memory. They were also asked to classify, from memory, types of buildings and types of landscapes. They were asked to describe the segments of the space they found most memorable, remarkable, or affective. The drawn maps were then compared with standard maps made by geographical and aerial surveys of the space, including the actual buildings, parks, and other environmental features occupying the space, and were also compared with the perspective of planners on the environment. To get this other perspective, that of the planner, the studies also involved the systematic field reconnaissance of the area by a trained observer who mapped various elements, their visibility, their "image strength or weakness, and their connections, disconnections, and other interrelations."

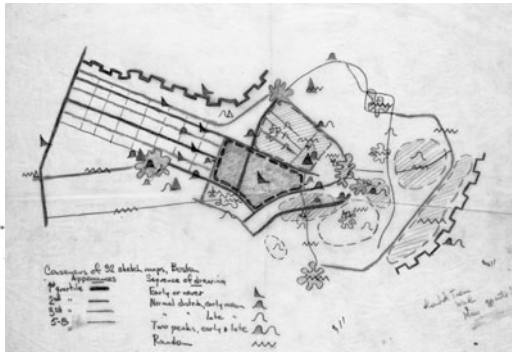
FIG. 2.13__Figures from Kevin Lynch (1960), demonstrating the link between aerial views, street mapping, and perceptual mapping. From Lynch, *Image of the City*, 18 and 24. © 1960 MIT, by permission of The MIT Press; Personal "Images" of the "City" drawn from memory by study participants. From Lynch, studies of *Image of the City*, MC 208 available at the Dome website of MIT Libraries, http://libraries.mit.edu/archives/exhibits/kepes-lynch/index1.html. Courtesy of MIT Libraries, Institute Archives and Special Collections, Cambridge, MA, Kevin Lynch Papers. All rights reserved.

Lynch openly admitted that all these methods were "subjective." In saying so, he valorized subjectivity as a tool, an approach to measurement, and a standard for truth in the sciences of urban planning and administration. Subjectivity was no longer a problem but an operation that could be used to rethink and represent the city if planners, designers, and policy-makers but examined the spaces between different types of mapping rather than the maps themselves. The city emerged by comparing different forms of "subjective" maps rather than through a structural approach that assumed an ideal or normative form before the planning process and evaluation commenced.

In these studies, therefore, perception was conceived of as a channel or a process, if we will, with a temporality. The study states that cities are "of vast scale, a thing perceived only in the course of time." City design, the study concludes, is a "temporal art," and experience is a matter of pattern recognition and manipulation. The new function of urban planning is to deduce these relations and to mime them—solving the problems of urban blight reframed as a perceptual and psychological problem rather than, say, a problem of class or structure.[65] Urban space could be conceived as a channel that could always be improved and enhanced, made more "imageable" and more conducive to circulating sensorial information.

The importance of these studies cannot be overstated. Lynch's work was critical to the imaginary of urban redevelopment and politics emerging at the time. The running of these studies served as an important training ground for many students at MIT and Harvard who served as these observers who conducted these studies and were trained in these methods. From these early studies of the 1950s grew an entire methodology and a series of tactics for urban redevelopment. More significant, Lynch's cognitivist approaches in-





spired and underpinned Nicholas Negroponte's approach and were closely affiliated with the rise of Media Lab and Negroponte's work on simulating urban space and transforming architecture.[66] Lynch also spearheaded initiatives in community gardening, for example, and he is considered central to the formal rise of environmental psychology, a field that owes its existence in part to his work. While today environmental psychology finds itself embedded within organizational psychology or relegated to a side note in public health, psychiatry, and sociology, it was a prominent discourse throughout the 1970s and 1980s, perhaps making a return in our present with the ubiquity of interactive and sensorial collection devices in our lived environments.

When situated within a broader discussion about the future of the city coming at the very threshold of the urban renewal programs of the late 1950s and 1960s, Lynch's work marked a discourse of psychology and space that both critics and advocates of the urban policies toward office space and business development would implement. Major works such as Jane Jacobs's *Death and Life of Great American Cities* and community-based research such as that of Herbert Gans reflected a broader understanding in sociology and urban studies of the importance of psychology and spatial arrangement to the subject, and heralded an affective turn, so to speak, in the social sciences, where the alienated subject of urban life, first posited by such figures like George Simmel in the early twentieth century, could be reconciled with the urban space through a reconceived and newly introduced discourse of environment.[67]

More important, Lynch and Kepes also demonstrated a bifurcation in the social sciences. As Rebecca Lemov has shown, the 1920s and 1930s already saw the emergence of a social science interested in "systems."[68] Integrated with cybernetics and communication theories through the Macy Conferences in

the mid-1940s, these sciences consolidated an approach toward systems that relied heavily on a similar transmission of methods. However, the systems approach came to view cities as exceedingly complex, and planning therefore as anachronistic.[69] Planning projects were viewed as impossible, modern, utopian ideals with no relationship to the society into which they were being imported. Lynch was among the pioneers of a new strategy by which to reconcile the understanding of systems with individuals by using cognitive approaches as a conduit by which to reformulate both the individual and the individual's relationship to populations and territories, making all these entities more flexible, and allowing localized interventions with systemic implications without assuming the need to act globally.

Lynch's work, fostered and encouraged by Kepes, demonstrates a strange folding. Discourses of information inundation, pattern seeking, and communication became those of communal psychology, environment, and community. These new concepts of planning and territory linked subjects to scalable territories through the standardization of method applied through organs such as the UN.

Planning, psychology, health, and space had long been linked throughout the nineteenth and into the twentieth century. We have but to think the relationship between psychoanalysis and Secession art in fin de siècle Vienna, Ebenezer Howard's notion of health and spirit in his garden cities, or the projected plans published in the issue of *Architectural Forum* titled *194x*, which articulated ideals of postwar cities that would manage and control veterans' shock while creating environments for physically and psychically healthy families.[70] All these utopias assumed that the perfect plan would foster spiritual and physical health in inhabitants. However, unlike these earlier efforts, Lynch's planning linked perception and cognition without recourse to utopian forms, and without a preexisting or ideal structure to organize the plan. Furthermore, the single normative notion of subjectivity tied to a specific space disappeared in favor of the notion of a population produced through interactions and data analysis. The population and the individual are linked in Lynch's work through the optic of perception. The nerves of the subject were integrated, at least in theory, with the design of the city and the territory.

Lynch had definite biases toward producing spaces with "strong" images, but no clearly defined ideas of class, economics, or community to mandate a set pattern for designs to follow. The plan should emerge from the relationship between cognition, perception, and the actual structure of the space. For Lynch perception became a channel that was material, and spatial, and could always be modulated and enhanced. Cities could always be made better;

their denizens had perceptual capacities that could be modulated and shifted through design.

More important, Lynch provided a method by which to gather and document psychic processes at an organizational level. Unlike his predecessors, he produced a truly novel methodological apparatus for data gathering, and sociological investigation, that while clearly related to the efforts of other sociologists at the time was also particular and novel for planning. Lynch took older histories of anthropology and psychology, of which he mentions individuals like Bronislaw Malinowski and sciences like gestalt and psychoanalysis, and pushed their methodologies into a new territory with a different type of truth claim. Lynch displaced concerns about what could not be recorded with an infinite faith in the study of subjective perception in and of itself as a tool. Rather than promoting an ideal or normative city, Lynch promoted the subjective space, a city built by means of the playback between individual memory and perception. Lynch put method ahead of end goals or idealized forms in the work of the planner.[71]

Lynch's measurements make visible the emergence of another phenomenon, the displacement of measures of risk and actuarial concern by "unknowability" and uncertainty.[72] Human beings and environments are envisioned here as constantly modulating without clear endpoint. Cities become systems with an endless capacity for change, interaction, and intervention, and problems of urban blight, decay, and structural readjustment have no clear definitive endpoint, just as their solutions become constantly extensive. Total risks, with defined endpoints such as nuclear destruction, were slowly consumed in the course of the 1960s toward a very different model of metabolic change and a methodological imperative for data gathering.[73] With no final ideal prototype or disaster in mind, for these planners, clear-cut endpoints and goals were relocated into variances between perception and action.

This method could be globally applicable while simultaneously capable of engaging the specificities of individual situations and environments. The image of the city vacillated between views from above and views from within the mind. The boundaries of the subject, the environment, and the interviewer compressed into one channel. Subjectivity turned into the very site of study. The space between the mental map, the trained observer's map, and the aerial map became the site of intervention. Lynch, like his mentor Gyorgy Kepes, treated perception as a pattern or algorithm that could be made material, visible, and instrumental. And like Kepes, Lynch also participated in a pedagogical and epistemological effort to turn data flow and memory into a capacity for design and a tool for social improvement. Interestingly enough,

however, it was the very discourse of society that disappeared beneath the discourse of images and perception, seemingly consumed into the interactive space between the individual and the environment. Ideas of structures that defined urban forms—like capital, modes of production, or even social psychologies—were relocated to ideas of personalization, perception, and local networked action.

Territories of Communication and Affective Spectacles

If we were to seek then the implications and effects of the emergence of this algorithmic optic, and the folding of identity and space into environment, what would we find? Linking together the training of the observer with the production of space, it might be helpful to take a final example.

One of the central spectacles of urban redevelopment in the early 1960s was New York City's ambitious and expensive plan to host a world's fair in Corona, Queens. The New York World's Fair is today famous for restructuring New York's racial and urban landscape through Robert Moses's aggressive redevelopment and highway production. The fair has also been cited as a final moment of universalism and technical optimism before the Vietnam War and the emergent countercultural revolutions. The mottos of the event, "Peace Through Understanding" and "Man's Achievement on a Shrinking Globe in an Expanding Universe," reflect this techno-fetishized and rosy picture of human improvement by way of better mobility, technology, and communication. This mix ended up proving to be popular—some 51 million people visited—making it one of the largest live events ever recorded.[74]

This popularity was by no means assured. Repressed beneath this emergent and optimistic discourse of scalability and globalization, increasing conflicts brewed. At the start of the fair, which came at the height of the civil rights movement, there were concerns that protests, even riots, critiquing discrimination in transportation, economic opportunity, and employment, would disrupt attendance. It is rumored by historians that initial figures for visitation were very low on account of concern about racial violence.

Critiques of the fair's discriminatory geography and development abounded. Robert Moses, New York's master builder and the manager behind this event for the city, had successfully barred any development of public transport to the site, instead encouraging the building of roads. His vision of New York at the time largely consisted of high-rises and highways, an attitude to urban form that has been highly criticized for its encouragement of suburbanization and the deliberate race and class segregation that resulted from that highway

construction that cut up the continuity of urban space and made mobility impossible for people with lesser means and without cars. Eventually, after lobbying by local city counselors, cheap buses were added to enable residents of boroughs such as Brooklyn to get to the Queens fairgrounds.[75]

The segregated geography of the expanding highway systems was not the only charge brought against Moses's and the city's practices in developing the site. The Urban League of Greater New York (ULGNY) in 1961 began to take the fair organizers to task for discrimination in hiring practices, resulting from the fact that Moses probably hired no African Americans, or Puerto Ricans for that matter, to work in any of the professional or technical jobs associated with planning or designing the fair. Throughout 1962 and 1963, and concordant with increased lobbying for the Civil Rights Act to be passed in 1964, the ULGNY, and the Joint Committee on Equal Employment Opportunity picketed the UN, with the fair as target, carrying slogans such as "End Apartheid at the Fair," and "African Pavilions Built with Lily White Labor," drawing parallels between American and colonial/neo-colonial European racism.[76] In the context of decolonization and the Cold War, the governor of New York State, Nelson Rockefeller, stepped in to attempt to resolve issues of employment discrimination and to ensure that concerns about race were addressed. Only days before the fair's opening, however, the NAACP, the Congress on Racial Equality (CORE), and other organizations were preparing to protest the content of some of the displays mounted by southern states as well as to use the event to focus more national and, perhaps more important, international attention on the demands for racial equality in the United States. Protests on the first day did indeed garner sizable national and international news coverage.[77]

While the city obsessed with finding the funds, building the infrastructure, and negotiating the turgid mix of national and international politics emerging from a combination of Cold War logistics and civil rights agitation in order to successfully host this event, the pavilions on the grounds, perhaps unsurprisingly, appeared to reflect little of this context. Science fiction, not current events, was the reigning topic and aesthetic in the attractions that garnered the most attention. The GM pavilion, for example, was the most popular, showing a "World of Tomorrow," complete with amazing gadgets, multimedia rides, and a curious absence of human beings.

The other centerpiece was the IBM pavilion, which contained an installation called "The Information Machine," consisting of an oval building designed by the architect Eero Saarinen and a twenty-two-channel installation designed by Charles Eames titled "Think." The entire space was dedicated to introducing analogies between how machines and people think. If today,

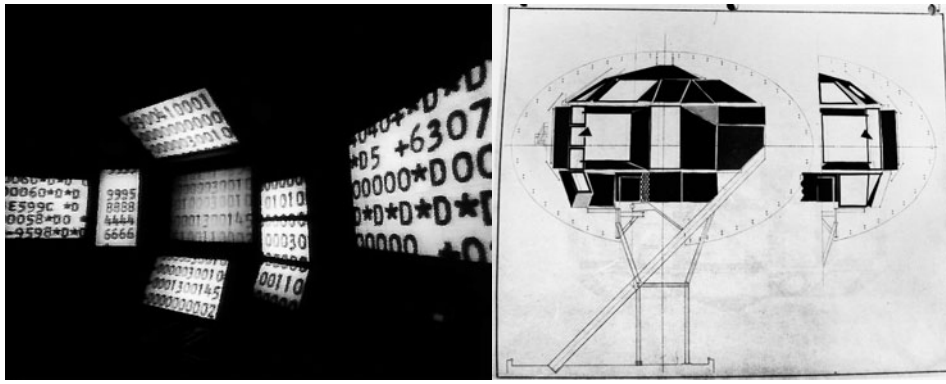
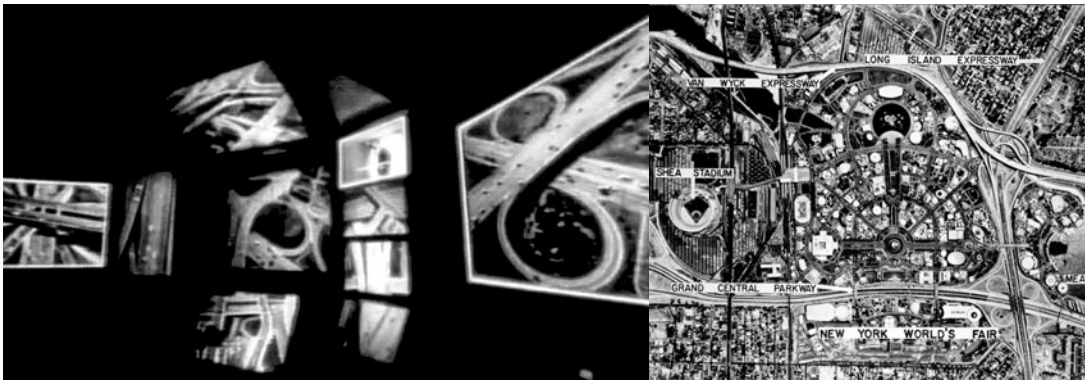


FIG. 2.14__Images from the exhibition and sketches of "Think" screens for the "Information Machine" Pavilion, New York World's Fair, 1964, designed by the Eames Office. Screen shots show the number of screens and varieties of information from numerical abstractions to highway infrastructure; the middle panel shows Eames interior architecture for the twenty-two-panel installation. The Work of Charles →

then, Apple urges its users to "Think Differently," it is only in negation of the history of this slogan's predecessor in computer science and corporations like IBM, who urged us simply to "Think." But what form of thought was it that would be introduced to the public at the dawn of an age of ubiquitous computing?

The ascendant computer company took the concept of thought quite literally. Viewers were lifted from the ground into a closed oval, and entered a space of multiple screens, filling the field of vision (fig. 2.14). On these screens of different shapes were projected a filmic flow of images from different sources and in different formats, including animation. The intention was to get viewers to make connections, by will, between the images; to actively navigate the informational field and, through choice, create new connections and thoughts.[78] The speed of the film, according to the architectural historian Beatriz Colomina, was intended to replicate the processes of thought. The multiple-sized screens arrayed in different locations and projecting varied types of discontinuous information forced the eye (at least in theory) to move rhizomatically, making unexpected and nonlinear connections.[79] The "host" welcomed the audience to the IBM Information Machine with the words "a machine designed to help me give you a lot of information in a very short time. . . . the machine brings you information in much the same way as your mind gets it—in fragments and glimpses . . . like making toast in the morning."[80] Inside this machine, which was now no different from the human self, the spectator was ex-



and Ray Eames, lot 13195, no. 187, Print and Photography Division, Library of Congress. © 2013 Eames Office, LLC; images from *IBM at the Fair* (1965), video transfer from *The Films of Charles and Ray Eames*, vol. 5, Image Entertainment (2005); World's Fair aerial view from September 2, 1963, courtesy of New York City Parks Photo Archive.

posed not to any singular piece of content but to a perceptual field. From the myriad screens, sequences of football games, train exchanges, dinner parties, and mathematical equations all flashed.

Reperforming the logic of Charles Eames' engineering courses, this installation, which was a "machine," brought to you "a lot of information in a short time" to model exactly how your brain worked—perhaps even to rewire your brain. Like Kepes's algorithmic design, this was a new design where finding the pathway through an overrecorded and infinitely available archive was what constituted "thought." It was not identification or recognition of subjects or objects that mobilized the eye and the brain of the spectator in this environment. The installation could be understood as a mimetic reenactment of the process of perceiving data in an information economy; a process that was now so automated as to be like making toast in the morning.[81]

Computational Space and Design

The pavilion, it must be mentioned, was designed in tandem with a radical reconfiguration of IBM itself as a corporation. Throughout the late 1950s IBM had been creating a more decentralized managerial bureaucracy, transforming the nature of its products and moving to selling systems, not machines, and constructing new laboratory facilities designed by the premier architects of the time and organized to facilitate interaction between scientists and managers.

The corporation relocated its headquarters to the suburbs of New York—Armonk—and built numerous large, stylish research complexes outside the urban center. The decentralization of management was seemingly followed by a networking and dispersal of research and operations. If New York City was contending with an increasing problem of dispersal, fueled by the policies of Robert Moses and a focus on highway construction, this was accompanied by a transformation in economy of which IBM was symptomatic[82]

Central to this reconception of IBM was the use of design. The 1973 lecture, at University of Pennsylvania, titled "Good Design is Good Business," by IBM chairman James Watson Jr. reflected back on this history of IBM and design. In a subsequent article, he wrote that it was a "story of a company's increased sense of design." Watson discusses the pivotal place that design had in rethinking IBM. He recalled that he "came to see design become one of the major reasons for the success of the IBM company." Initially inspired by a Fifth Avenue Olivetti showroom, Watson became convinced that the "Olivetti material fitted together like a beautiful picture puzzle." At a moment when IBM was hoping to expand into numerous services and markets, Watson desired a coherent aesthetic to join the machines, the services, the research, and the manufacturing of computational products.[83] He went on to hire many of the top names in modern design, including Eliot Noyes, Paul Rand, Charles Eames, Eero Saarinen, and many other designers (figs. 2.15 and 2.16).[84]

Design was particularly vital when one considers that IBM was moving from selling individual machines to entire enterprise solutions and systems. The machine to which we may assume that "think" was, in spirit, dedicated was the 360 series computer, introduced in 1964. This was the first machine built by IBM that separated the architecture of the hardware from the specific use of the machine. This separation allowed IBM to sell the series for different scales of businesses—from very large to small, and for different functions from commercial to scientific—since the system could be customized. It is the first time that a customer could change the configuration of the system without having to rewrite or discard older software. The system cost IBM billions of dollars and took at least a decade of effort (if not longer) to develop. As the former IBMer and historian Emerson Pugh notes, the 360 demanded entirely new manufacturing systems and a reorganization of how computers were designed. IBM released the machine not as a single unit but a "family," an innovation in computer retailing at the time, such that customers could purchase a smaller, cheaper configuration, knowing that in the future it could be expanded. The series was modular and scalable.

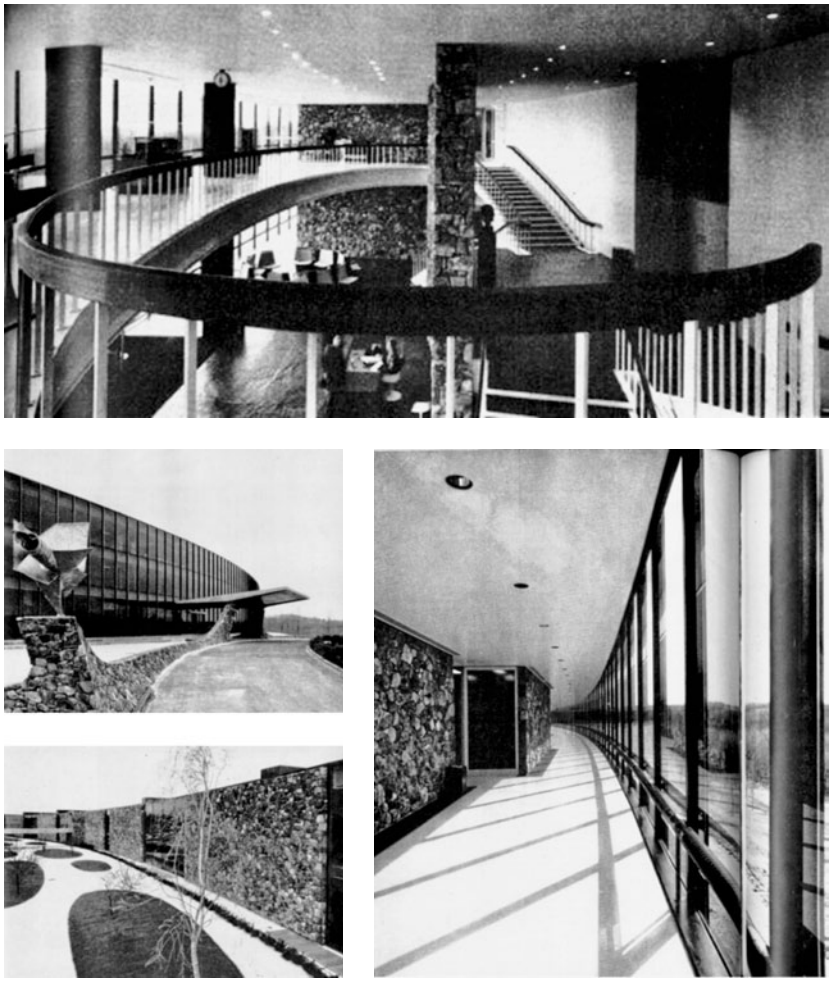


FIG. 2.15__IBM Laboratories, Yorktown, NY, designed by Eero Saarinen. From "Research in the Round," *Architectural Forum* 114 (June 1961): 80, 83. Note the windows on the outside and the laboratories pushed inward. The original prospectus is adjacent.

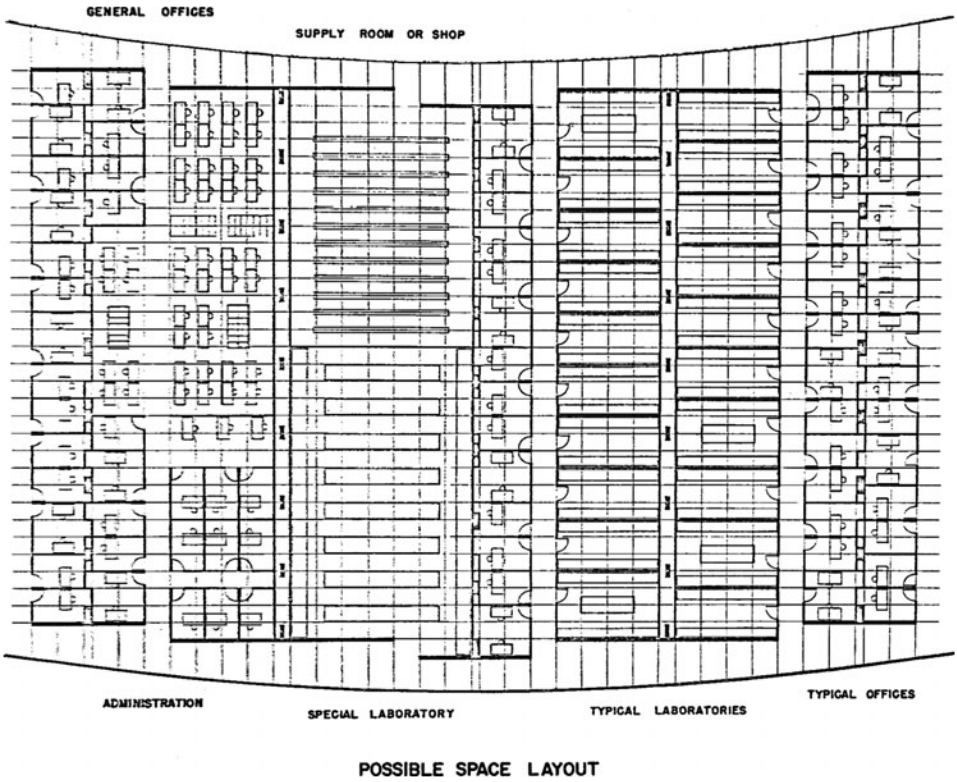


FIG. 2.16__"Possible Space Plan for Yorktown Laboratory Facility." From "The New IBM Research Center in Yorktown," project prospectus (1959–60). Courtesy of IBM Corporate Archives.

The company itself refocused on selling accompanying management strategies, control systems and supply chain solutions as part of an integrated package with its machines. In corporate architecture and management, as in the perceptual city of urban planners, environment and ecology replaced the focus on objects and discrete commodities. The IBM man with his classic suit and tie, with all IBM men dressed alike, imparted to clients a sense of coherence between many aspects of computing—from the machine, to the technical support, to the control and logistics softwares—that IBM would provide.[85]

The company's redesign of its laboratories followed suit (fig. 2.16). Note that the elements of the plan are often organized as "typical," assuming potential conversion in functions, and that labs are flanked by office and administrative facilities, assuming an integration between the research and the ad-

ministrative operations of the company. The corridors and windows are on the outside, to allow flow and contact between the labs inside the building.

Saarinen described the space as a self-contained world: "labs and offices today depend on air conditioning and fluorescent lighting for their air and light—not windows. Windows are like fireplaces, nowadays: they are nice to have but rarely used for their original purpose." The partitions between offices are a combination of glass and steel, innovated for the building, with the attribute that it is "translucent for visual privacy but it retains the psychological advantages of the glass." A walk between labs, however, is, in the words of *Architectural Forum*, "as spectacular as a Cinerama travelogue." If there is an "outside" in this architecture, it is already framed as being produced from a media mechanism, as though emanating from the technologies being made "inside" the building.[86]

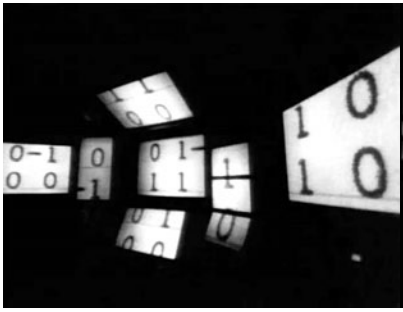
The data-filled worlds of the IBM pavilion refracted this changing nature of knowledge and commerce. Inside the pavilion, human perception was also treated as a channel and capacity to be extended, increased, and circulated. This "expanded" media (as later labeled by Gene Youngblood, discussed in chapter 4) not only reformulated perception but linked this form of seeing to forms of thinking. For simultaneously with these new machines also came a reformulation of what constituted knowledge, even truth, in engineering and science, as well as in design and business education, a reformulation whose principles were being developed aesthetically as well as technically.

What are we to make, then, of the suppression of one set of concerns over the role of the fair and its space for another set of interests in redundancy, reverberation, and information inundation? This affective education for the eye and, now, the mind negotiated the transformation of economies and spaces through the modulation of attention by way of a novel self-enclosed and self-referential space of data inundation framed as "choice."

The Exhibitionary Complex and the Training of the Observer

The promotional materials for the IBM exhibit strongly confirm the idea that this was a new form of entertainment and a new mode of spectatorship. The materials given to journalists announced: "here from 22 screens, a new kind of motion picture entertainment leaps out at the viewer. . . . The aim of Charles Eames and Eero Saarinen Associates, co-designers of the pavilion, was to create an entire environment." The purpose of this environment is that "after a number of seemingly unrelated scenes unfold the viewer discovers for himself that computers are not mysterious." Through these discontinuities—

FIG. 2.17__*Think* multi-channel projection film by Charles and Ray Eames for IBM Pavilion (1965). First image shows diagrams for the installation projection piece demonstrating the flow chart approach. The Work of Charles and Ray Eames, lot 13186–5, no. 31, Photography and Print Division, Library of Congress. © 2013 Eames Office, LLC. The following images, from the movie *IBM at the Fair* (1965), trace the presentation that made analogies between computers, modeling and life, family trees and corporate organization charts, all representable through flow charts and programs, to illustrate the prime point of the exhibition—"think"—with humor. Video transfer, from "IBM at the Fair," The Films of Charles and Ray Eames, Vol. 5, Image Entertainment (2005).




FAMILY TREE
ORGANIZATION CHART


THINK

"seemingly unrelated scenes" in the words of IBM, that replicate thought—the viewer will come to understand, or perhaps "think," like a machine.[87]

Eames and IBM took this very literally. Large portions of the presentation were dedicated to a hostess's planning of a dinner party. She needs to make many strategic decisions about whom to invite, and where they should sit so as to ensure social balance and harmony. The implication of this movie was that these decisions made by a hostess were just like those made by a machine. In fact, the Eameses created algorithmic diagrams of the hostess's decisions, demonstrating how her thinking and the machine's logic were the same.[88]

But, more significant, this machine would operate through random, "seemingly unrelated" sequences. From the hostess in the living room the film zoomed to vast infrastructural images of railroads and urban space, to numbers and equations, to football games and the strategic plans of a sports coach. There were no historical narrative structures for the presentation. With the users incorporated into a feedback loop, each being trained similarly to create a personalized pattern from the data, there was no predetermined order to the pattern. There was, however, an established method, process, or approach that was amenable to any linking points in any data set . . . even if "unrelated."

The image of the wall (fig. 2.17) demonstrates the kind of idiosyncratic connections the Eameses were making between numbers, people, diagrams, patterns in nature and society. Organizational charts and family trees are jointly displayed to demonstrate the idea of a "model" and abstraction. In the middle image, the screens are collectively organized around the mathematical number 2; this segment of the installation is timed to give the spectator an understanding of an idea of two-ness, not a description of any specific individual two things. Mobilizing this aesthetic strategy, the Eameses hoped to force the spectator to understand generalizable concepts, not to remember any specific data point.

The Eameses were thinking about connections between data, not individual screens. In their films often multiple types of data would be shown simultaneously to express a mathematical concept, or they would use repetitive patterns of scaling—going from micro to macro images of a phenomenon or environment—to make this point. Charles said of his filmic installations that "you get a feeling about relationships you didn't have previously. In thinking about decision making in the future—whether it be recombinant DNA or what have you—we believe some attention should be given to honing the techniques of showing critical things simultaneously. We had hoped that by now this might be a rather general procedure."[89] This language already evokes a future, generated out of a structure, like DNA, emerging from the re-

lationships between images. Eames wants this to become a "procedure." He desired a new technology for seeing. He viewed attention as related to DNA: a perception offered autonomy to self-reproduce. As the language of DNA and the discourse of "decision making in the future" suggests, one can also assume that this is an aesthetics of truth and knowledge on which reasonable, perhaps rational, spectators might act.

Affective Rationality

These analogies between objectivity and sensation, modulation, vision, and memory should also force us to consider commonly articulated beliefs often ingrained (even if through dispute) in our theories and histories of media that separate objectivity, science, and rationality from embodiment, sensory affect, and emotion. If we have long correlated rationality with objectivity and modernity in the sciences, the work of these designers challenges us to define what we speak of. For here is a sense configured to be both affective and logical. As interior and exterior were reconceived in terms of communication, the sensual, perceptual, and cognitive became part of a single order, a rational and algorithmic set of processes or logical patterns that could be studied, built, modulated. This point takes significance when viewed as the very infrastructure for interactivity. It is the reformulation of abstraction as material, of perception as cognition, of sense as logic that makes possible our contemporary interactive environments. Deferring concern with documentation, and refocusing on process, facilitated a vertiginous reformulation of the relation between mind, body, and machine that made seeing and thinking both material for a communication architecture.

This procedure, a new DNA of vision, would rest on an endless genealogy of infinitely recombinable data, using the past to generate the future. This archival discourse redirected previous discourses of indexicality and objectivity into a technical drive to accumulate more data in order to encourage more analysis. The very concept of information was in transition, balancing between older histories of photographic and image capture, that still correlated information with the past and the documentation of an external and "real" world, and an emerging redefinition of information from the *Mathematical Theory of Communication*, which was always in the future tense and based on mathematics of chance and probability. Never resolving this friction, these designers utilized the imbalance between the past and the future to produce another pedagogy, at once familiar and entirely novel, that shifted the discourse away from organizing data to producing organizations.[90] In deferring the problems

of recording, design shifted to a focus on process that could make thinking and seeing part of one channel.

Control

For Eames this was, indeed, a scalable form of nonconscious reason. Eames always spoke of himself as an "architect." In a letter addressed to Ian McCallum, the editor of *Architectural Review* in 1954, Eames wrote of his initial foray into the realm of feedback and communication theory, the film "Communication Primer":

> one of the reasons for our interest in the subject is our strong suspicion that the development and application of these related theories will be the greatest tool ever to have fallen into the hands of the architects or planners. . . . If ever an art was based on handling and relating of an impossible number of factors, this art is architecture. One of the things that makes an architect is the ability to include in a concept the effect of and affect on many simultaneous factors—and a precious tool has been his ability to fall back on his own experiences, . . . If however, a tool should be developed which could make possible the inclusion of more factors—and could make calculable the possible results of relationships between combinations of factors.—then it would become the responsibility of the architect and planner to use such a tool . . . We may have the possibility of such a tool in the "Theory of Games."[91]

Relating intuition (see also chapter 3 on reason) to computation, Charles Eames believed that linear programming and game theory might be tools to direct architecture. These were in his opinion "pure mathematical systems that can be used in relation to human problems."[92] For Charles, who adored the idea that complexity could be translated into ones and zeroes, these principles were concepts for producing architecture and planning. He argued that "it is unfortunate that in this time much of the really creative thinking . . . is shrouded with the panic of secrecy."[93] But, he wrote to McCallum who was also editor of a section called "Townscapes" involving urban planning, the application of such concepts will change the townscape, and must be included in architectural practice.

Eames regularly discussed the management of urban space in terms of control, communication, and the logistics of game theory (fig. 2.18). His installations of perceptual manipulation were also imagined as encoding mobile tactics for the management of territories:

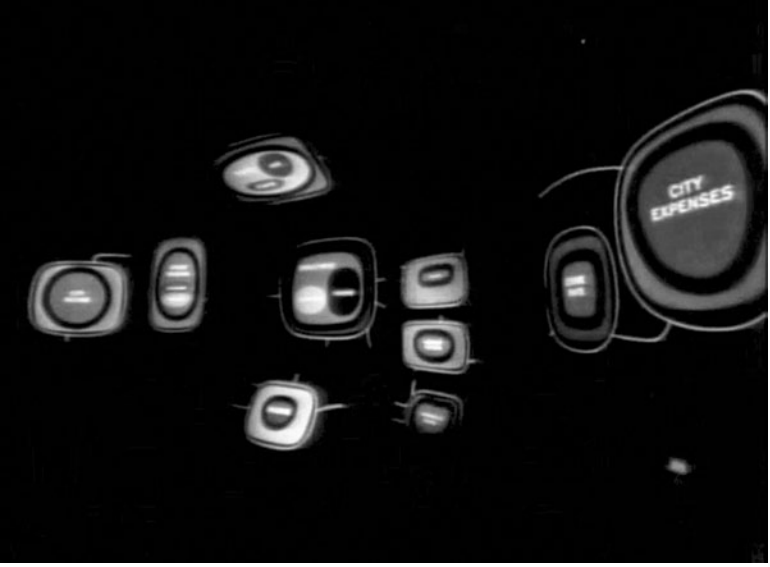


FIG. 2.18__City flow chart. Screen shot from *Think*. Video transfer, from "IBM at the Fair," The Films of Charles and Ray Eames, Vol. 5, Image Entertainment (2005).

> in the management of a city, linear discourse certainly can't cope. We imagine a City Room or a World Health Room (rather like a War Room) where all the information from satellite monitors and other sources could be monitored. . . . The city problem involves conflicting interests and points of view. So the place where information is correlated also has to be a place where each group can try out plans for its own changing needs.[94]

Eames's concepts were never developed in urban planning, but were continually reaffirmed in his many movies and multimedia installations. The idea of visually displaying information and attenuating attention was his concept of "architecture." The very idea of architecture here becomes despatialized, and instead involves the production of complexity. The "art" of architecture is about the ability to handle an "impossible number of factors," and good design is about the "inclusion" of more factors in the interest of making outcomes "calculatable."[95]

For Eames, unlike Lynch, control is about predicting future outcomes, and the city is reconceived as a calculating machine for managing and resolving multiple conflicts. Urban planning and design should be a simulation exercise where different outcomes and goals can be tested in relationship to one another. Counter to Lynch, Eames appropriated a notion of changing needs but systemic homeostasis. Implicit in his discourse is an assumption that minimax solutions between highly complex interests are the goal of urban management.

At the time Eames was not alone in seeking to apply the logistics of the war room and game theory to urban space. The RAND Corporation by 1969 had a

specific division labeled "urban center," focused on examining problems of New York City's police, hospitals, and fire. In a 1970 report, RAND determined that it was necessary to convert military-oriented research for civilian use and that urban planning might provide a major site of interest. In earlier reports from 1963, RAND had proposed system analysis for urban planning.[96] The city was increasingly discursively rendered as being in a state of insecurity and crisis analogous to a state of war. But if analysts at RAND created endless statistical documents, the Eameses proposed the training of attention as a fundamental element to being able to administer these networked territories. The trained engineer, architect, or planner was one whose attentive capacities were enabled to cull patterns from vast data.

In this moment, where the future of territories, populations, and identities were being negotiated through the increased application of computational methods and the automation, if not autonomy, of sensory experience, what are we to make of these varied understandings of communication, cybernetics, and feedback? Kepes, Lynch, and Eames all contributed in complicated ways to producing perception as a channel to scale between individuated bodies and vast networks, and a pedagogy and epistemology that reworked space through a new territory of algorithmic logics and cognitive processes. As urban space was being reformulated in a context of massive changes in economy and race relations, designers and social scientists increasingly turned toward new strategies of modulating sense.

Disorientation

There is nothing, however, inevitable or obvious about these contemporary forms of interactivity and ubiquitous computing; a great deal of work, and imagination, went into convincing us that vision could be designed and machines and minds both "thought" while organizations were reformulated as organisms with unclear boundaries or interiorities.

This smooth, self-referential world built of multiscreens and "glass" psychologies was not, therefore, without its own self-induced conflicts. At some point the logic of data inundation appeared to fold back onto a history of meaning and representation. Not all spectators found these tactics successful, and it may be a marker of historical change that what we now take as given was once potentially disorienting. One reviewer, Mina Hamilton, on seeing the Eames installation remarked in *Industrial Design*, "visually the show is a sensation." But, she added, sometimes the show was a "deluge," implying that there might be a threshold beyond which too much information became

threatening. While the writer was astute in noting that: "Eames did not expect everybody to see everything. Quite the contrary, he expected each person to come away with separate sets of information and experience." Ultimately, "the pace of the show, however, is so fast that a person does not have enough time . . . to weed out what he wants to see or not. . . . The Kaleidoscope-like result is overwhelming and 'spectacular' but too fragmented to be entirely successful." This reviewer immediately identified the individuating aspects of the show, the element of giving a sufficient data field, allowing each user to come out with "separate sets" of information and experience while deploying the same tactics as everyone else of pattern seeking and connection making.[97]

What are we to make of this sudden deluge, where the user cannot reduce the data field, fails to find the pattern, and is "overwhelmed"? The reviewer implied, even if in critique, that this mode of viewing was contingent on a capacity within the viewer to assimilate certain quantities of data, denoting that the Eameses were producing an observer understood as possessing thresholds for information processing that could be enhanced or overwhelmed. Hamilton also noted that the show was "sensational" and provoked affect but without linear narrative or space for identification. ("The person does not have enough time . . . to see what he wants to see or not.")

It might be concluded after reading such an account and surveying the data-dense, and temporally and spatially disorienting, displays of these classrooms, labs, and installations, that the implied observer of this environment must be an interdisciplinary observer, capable of relating to the significance of a statement by a famous author and a scientific image simultaneously, but no Renaissance man in the colloquial understanding of the term. This was an observer who might be able to recognize, but not necessarily identify, or authoritatively define, what he or she was looking at, immersed as he or she was in pedagogical and spectacular environments offering no establishing shots of stable perspectives on the data field. In keeping, perhaps, with the idea of camouflage, these designers opted for the mimetic perspective, the perspective from within the machine, not the perspective of or the perspective external to the information field. It might even be suspected that the observer here might be psychotic in his or her inability to find stable points of reference, lacking a clear boundary between stimulus, perception, and cognition, and without any clear emotional or affective relationship to objects in the world. If so, and this observer was quite logically and algorithmically psychotic, the pattern was stable, even if the subject was not.

Kepes made an interesting statement to this effect. He wrote that the purpose of good design and art "is to bring the outer and inner world in corre-

spondence," implying that the psychic space was now flattened into a perceptual process that was also cognitive and structural, a "vision of felt order."[98] Order, which was implicitly defined here as stable, rational, patterned, and logical, was equivalent to sense, while the subject was envisioned as a smooth space for the transfer of information between the inner and the outer worlds, between the registers of analysis and stimulus. Kepes's intimated observer was like the user of the Memex or the envisioned future user of the computer, privately scanning data in the interest of participating in an innovative process without any clear-cut end. This subject was both rational and orderly and was affective, touchable, seeable, visible—a subject whose consciousness, cognition, perception, and memory were now envisioned as part of one interactive process. A flat space, without inside or outside, only feelings and order; a subject who is, perhaps, also a channel, a conduit for the ongoing circulation and reorganization of data.

Conclusion

Remaking the boundaries of subject, the definition of rationality, and reconceptualizing the screen, these older midcentury environments have complex relations to the present. The critical reviewer still perched between different histories of visuality gives us insight into a moment of potentiality and vacillation. She apprehended the display not as a given and desired form of life but as a choice, and not one defined by a mathematical communication theory. This choice would be contingent on the relationship between the interface and the older histories of storage and representation on which it rested. It is still not clear, even in our present, how this deluge that "overwhelms" the subject will be organized—do these communicative forms of interaction offer the possibility to remake the body, self, and other? Or to descend into a self-referential vortex of consumption without any imaginary of futurity or the possibility of encounter with difference? At this moment in history when a new hyperindividuated yet networked observer emerged accompanied by a transformation of discourse from one of planning and images to one of environment and cognition, we are forced to ask about the possibilities of such a condition. These architectures of labor, pleasure, and education found themselves superimposed on older histories or representation, politics, and structure; the relationship between these strata would become a matter of concern for both ethics and politics.

The designers of these spectacles also had reservations. In a moment reflecting on the events of the war that had precipitated his revision of vision,

Kepes ended his first book, and most famous design text, *The Language of Vision*, on a very strange note. After a book dedicated to advertising for the nascent information economy, he turned in one of the final moments to the ideal of art. Kepes ends one of the final chapters with a discussion of Picasso's *Guernica*. His language is affective. "*Guernica*," he writes, "evokes an optical fury" and "the shrieks of a danger siren." This opticality that shrieks warning—what, might we ask, does it warn us of?[99]

Guernica itself, of course, was a reference to the Fascist bombing of civilians in the Spanish Civil War. It bears witness to an event that Picasso himself never saw, an event perhaps that was never in the realm of the visible, ignored by much of the Western world—an event that speaks to the limits of the infinite archive that is so readily assumed to be always/already available for recombination in the postwar period.

In looking at this image, Kepes argues that it succeeds because it creates contact between a plastic, modular structure and the trace of history—"social events" in his language. Kepes writes: "Picasso, stirred to a fury of indignation by a human drama caused by the regressive social forces and their significance today, in a visual projection of the discrepancy between life as it is and life as it should be, represents human figures in a distortion of pain and suffering. . . . Tears are in action like a bursting bomb. The plastic interconnection of the lines, planes, and texture surfaces acts as do suffering individuals. . . . Two contradicting systems, plastic organization—the message of order—and the organization of a meaningful whole—the messages of chaos are wielded in an indivisible whole."[100] This image works in a manner different from advertising, in his argument, because of the disjunction between what has happened ("life as it is") and what should happen ("life as it should be").

Kepes returns here to interrogate a theme that has largely gone undiscussed in this chapter but that preoccupied him throughout his work: signification. In his expression, concerns about time, language, and translation are returned to the smooth world of communication theories. Kepes perhaps hopes to utilize the very substrate of this communicative objectivity—the assumed recordability of the world—to produce speech. This speech emerges at the moment when each medium has reached its capacity and encounters another form of action. The visual and the aural pressure each other in the inability to render either complete.[101] Rather than seek to suture the time between the infinity of recording and the impossibility of representation, Kepes hopes to explore it. He seeks to ask which histories will inform the future. Kepes wants to produce images of temporal disjunction.

His concept of temporality infused his logic of action. The work of art, for

Kepes, was not to make engineering more playful or creative, in his parlance, but to challenge our imagination of life and technology.[102] He desired, and demanded, that differences and translations must exist between the arena of artistic practice, which must not serve functional purposes, and the work of technologists. In his development of an integrated art and science curriculum and center at MIT, he took an alternative path to other art and science collaborations of the time, such as E.A.T. His organization did not valorize corporate structures and technology but rather more timid and minute actions, adherence to older institutions, more sustainable structures. Kepes appeared to literally fantasize a space between life as it is and should be by asserting a distance between practices of nonfunctional fantasy and those of documentation and authority. Kepes relied on and supported artists who were less oriented to engineering and more oriented to environment, nonfunctionality, and other practices that rethought the boundaries of the sense and bodies.[103]

Simultaneously conservative and institutional, while ethical and concerned, his organization, CAVS, while in service of a classic industrial military space, MIT, highlights the variety and internal complexities that emerge from inside institutions and from within the structure of our contemporary information networks.[104] Kepes offered sense autonomy and produced a new form of scanning seeing and communicative objectivity, but he sought to recuperate this now embodied and mobile eye for many purposes. In his work he separated himself always from the more essential and often pure search for form following function that preoccupied Gestalt psychology and the original Bauhaus.[105] This "abandonment" opened him to conceive of art and science as intimate lovers, but never unitary subjects. Kepes insisted on a translation between the discourse of truth and that of imagination.

This conservative and progressive logic reveals to us something about history. The discourses of cybernetics and communication were enacted by individuals who were often conservative. Their own innovations were attacking their own pasts. In their efforts to recuperate their memories of previous organizations of sense, art, and vision, however, we can trace the binding and unbinding of meaning to action; and recognize the subtle possibilities that exist between the total amnesia of the present, often radically embraced in 1960s countercultural responses to art and technology, or the absolute reactionary return of nostalgia, identity, and nation that marked the rise of the conservative politics of the time. In place of these extremes, we find more subtle configurations and recombinations of past and future.

Kepes was not alone in seeking to excavate the subjective, interactive, and temporal nature of perception for ethical purposes—the not yet familiar

future. Lynch in 1972 released another landmark book on planning, summarizing much of his research, titled *What Time Is This Place?* Covering examples from London's Great Fire in 1666 to the place of revolution in Havana in 1959, Lynch sought to introduce the dimension of time into place in order to match the internal state of the human biology and psychology with the external space of the city. The desirable image of the city, he wrote, "is one that celebrates and enlarges the present while making connections with the past and the future."[106] Lynch studied multiple sites, from Ciudad Guyana to London to Boston, in the attempt to refine his method of mapping perception onto space with time as a variable.

It is, he argued, the subjective nature of time that offers planners an opportunity to avoid either historical preservation or creative destruction as the only options for urban planning. He fantasized a sense optic that, like Picasso's painting, would bring the future and past into contact, allowing new forms of life to emerge. "But surely," he implored, "we can envision public devices—films, photos, signs, diagrams—that could bring those invisible processes [of change] within everyone's grasp. There might then be 'mutoscopes' on the streets, which speed up past and future changes or slow down present vibrations so that we can see them, just as public microscopes and telescopes would extend our perceptual reach."[107] This perceptual reach that would map the environment to our interior states and bodies would be the infrastructure for the future city. "Our earthly environment is a very special and perhaps unique setting for life. It should be conserved; it cannot be preserved." Writing against preservation but in support of ecological conservation, Lynch sought to produce change and create the possibility, and space, for many forms of life—human and otherwise.

This mandate could only emerge, he thought, by modulating the time of spatial existence. His fantasies of a new optic, an extended perception, eerily invoke our present of ubiquitous sense and computing devices, our fantasies of sentient cities; but he also sought to produce a world of "dynamics" where human beings might encounter each other in new ways, and the urban space might be, in his language, made "humane." "Our real task," Lynch wrote, "is not to prevent the world from changing but to cause it to change in a growth conducive and life-enhancing direction."[108] He embraced change if it could be diverse and nonhomogeneous. While turning away from classic discourses of class, race, or structure, Lynch evokes environment, sensation, and time as the frontier on which the future of urban life is to be developed. He offers an ideal of a fuller temporality for development, a speed that might, perhaps, not be as homogeneous as the speculative time of development in such spaces as Songdo.

These efforts to recuperate certain pasts of history, sentiment, and affiliation transformed the engagement with planning and the vision of the city. While Eames reenvisioned urban space, and attention, as a control center, with game theory as the central model for planners, Lynch deliberately misconstrued communication theories, Fourier transforms, and other computational tricks to smooth over the space between the binary logic and the continuum of space and instead insisted on making the disjuncture between these models, rather than their convergence, a tool for social science. For Lynch the world could not be perfectly broken down into ones and zeroes, but ideas of communication and computation could enliven our understandings of complexity. Whether one views Lynch's work as more ethical than RAND's reports to New York City and Los Angeles throughout the 1960s is a matter of perspective. I would argue that they were—that Lynch's models opened to the world, and produced a series of mobile methods that could still be reattached innovatively to history. These models work on multiple scales, both temporal and spatial; allowing planners to both consider global conditions, while creating subjective and contextualized understandings of the environment.

This statement is made in full consciousness that Lynch's work corroborates our contemporary discourses of local action and antagonism to large, governmentally sponsored programs. Such planning strategies would be defined as neoliberal by many geographers. Perhaps ethnographic observation and urban gardening are not the ideal tools for city improvement. But at the time when systems theories and social science were arguing against any forms of planning intervention, either on the grounds that the city was too complex for planning intervention, and that urban plans never took into account social forms, or on the basis of approaching the city in absolutely computable models, as in the logic of IBM as smooth space for the extension of consumption and computation, Lynch provided an alternative model. In his work, planning is simultaneously conceived of as cognitive, process oriented, and data driven, but capable of attaching data sets to context in tying individuals to environments to create new sites of intervention without recourse to overwhelming structures.

History troubles our present. These designers and planners, without question, demonstrate historical transformation in the organization of power, knowledge, and vision. They contribute to our contemporary forms of governmentality and territory. But as Foucault notes, governmentality is productive of new spaces, technologies, and subjects. As Deleuze argues, the purpose of philosophy is always to excavate the "homogeneity" but also the "irreducible differences" between the images that induce thought within any historical

strata.[109] One of the most regularly repeated arguments about information design at this period is its relationship to an amorphous concept of "control" and "organization," usually implied negatively. Rheinhold Martin, for example, identifies an "organizational complex," which he views as an extension of the "industrial-military complex" and as derived from cybernetics: "networked, systems-based, feedback driven—this organicism, and the circuits of power that it serves, sustains myths of dynamic deregulation, corporate benevolence, and dispersed, de-hierarchicized interactivity."[110] For Martin, the "pattern-seeking" endemic to Kepes's practice was part of creating the architecture for this space.

I wish to extend and complicate Martin's discussion to attend not to architectural space but to epistemology and to biopolitics. What needs to be elucidated in the study of organizational spaces is how systems complicate and self-differentiate. What types of organizations and networks are emerging—are different assemblages coming into being? And finally, how do these assemblages interact with older forms of territory, subjectivity, power, and social hierarchy? These questions are absent in the architectural discourse on Kepes or Eames.

These stumbling efforts to articulate a discourse of temporality can be said to constitute an effort to give voice to what might constitute politics and ethics under such conditions. Kepes and Lynch both adhered to a pragmatic ethics of the image—of perception and self—seeking to build accumulation through time, rather than just encourage circulation. They highlight that numerous options were produced from within these logics, and different practitioners mobilized different histories to reformulate and understand the technicization of vision and the nature of communication.

This historical interface between design, aesthetics, and communication sciences and discourses reveals an important fact. Our contemporary media environments were not technically determined; aesthetic practices were central to the production of the condition of possibility for the acceptance not only of computing but also of our contemporary ideas about psychology, attention, and space.[111]

The critical work of scholarship now is to make this network between vision and cognition haunt our contemporary present. How do we activate the internal possibilities, collapses, and fissures—between the archive and the interface, between the assumption of an already recorded world and the memory of capture, between cognition, perception, and action—all simultaneously encoded into our lived environments and pedagogical spaces?

We are left to ask what other dreams for our perceptual future emerge from

our interfaces . . . where we believe sense, perception, and cognition have been compressed into process, program, and algorithm to be regularly fed-back to us at every click and choice made at the screen. Every day we negotiate this question in front of our many screens and interfaces, through our communication networks and channels, in our massive spatial product "smart" cities, in the very architectures of our contemporary perceptual field.