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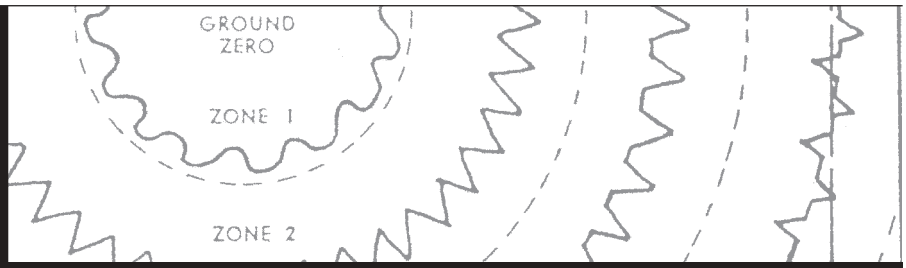


The Organizational Complex

Media organize. To be sure, they also communicate; they transmit messages, circulate signs. But to leave it at that is to fail to grasp the significance—for architecture—of Marshall McLuhan's dictum "The medium is the message." For in the cybernetically organized universe in which McLuhan made his home, it was precisely *organization* that was communicated—as both message and medium, image and effect, form and function—through the multimedia channels that never ceased to fascinate him. There, where architecture was both humbled and enchanted by its own status as one among many media, is where we begin, by reconstructing a small fragment of that tangled network I am calling the *organizational complex*.

In 1948 mathematician Norbert Wiener chose the subtitle *Control and Communication in the Animal and the Machine* for *Cybernetics,* a text that launched the interdisciplinary research program of the same name. The book itself is alternately limited

and far-reaching in scope, evidencing Wiener's reluctance to generalize his scientific research into other domains, even as he acknowledges the possibility of such an undertaking and its pursuit by many of his colleagues. But Wiener's reluctance to translate scientific hypotheses concerning natural or technological processes into an operative social theory stemmed from a practical rather than a theoretical problem: the difficulty of obtaining social data of sufficient breadth, depth, and objectivity. He does not hesitate to diagnose social imbalances as symptoms of communicative imbalances. Nor does he hesitate to suggest that the informatic devices constructed and studied by cybernetics—such as the hypothetical chess-playing machine he describes in his concluding comments—are capable of approximating the communicative intelligence of humans. Wiener merely notes that any endeavors to treat society as if it were such a machine would inevitably be confronted with insufficient, incomplete, or tainted data. Accordingly, "there is much we must leave, whether we like it or not, to the un-'scientific,' narrative method of the professional historian."[1]

The *theoretical* basis on which any "scientific" extensions of cybernetics might be undertaken is marked in Wiener's subtitle and implicit throughout the book as a common ground of "communication" regulating the behavior of both organisms and the new information-processing machines. In theory, the means by which social imbalances might be regulated—if that were practically possible—is what Wiener's subtitle identifies as "control." Symptomatically, in defining his terms here, Wiener himself has recourse to something resembling what he calls the "narrative method of the professional historian." Having declared that "the thought of every age is reflected in its technique," he goes on to suggest that "if the seventeenth and early eighteenth centuries are the age of clocks, and the later eighteenth and nineteenth centuries constitute the age of steam engines, the present time is the age of communication and control." And so he observes of the study of automata ("whether in the metal or in the flesh") that "scarcely a month passes but a new book appears on these so-called control mechanisms, or servomechanisms, and the present age is as truly the age of servomechanisms as the nineteenth century was the age of the steam engine or the eighteenth century the age of the clock."[2]

Forty years later, and in the wake of numerous studies of an emergent, technologically differentiated epoch,[3] Gilles Deleuze made a similar historical observation, with at least one important difference. For Deleuze, as for his colleague Michel Foucault, observable parallels between technological and social processes were based not on the instrumental application of scientific techniques or social theory but on their mutual imbrication in relations of *power* and *knowledge:*

> One can of course see how each kind of society corresponds to a particular kind of machine—with simple mechanical machines

> corresponding to sovereign societies, thermodynamic machines to disciplinary societies, cybernetic machines and computers to control societies. But the machines don't explain anything, you have to analyze the collective apparatuses of which the machines are just one component. Compared with the approaching forms of ceaseless control in open sites, we may come to see the harshest confinement as part of a wonderful happy past. The quest for "universals of communication" ought to make us shudder.[4]

1.1

Machines based on the conversion of energy to motor power occupied a privileged position within the nineteenth-century constellation that begat modern subjectivities and modern forms of collective experience, configuring relations of force around processes of displacement and aligning their trajectories in the railroad, the assembly line, and, eventually, the automobile. As Anson Rabinbach has shown, an energetics informed by the second law of thermodynamics provided the framework through which the bodies moving along these trajectories could be theorized as fields of force, and diagrammed by scientists like Etienne-Jules Marey, in what Rabinbach calls a "physiognomy of labor power."[5] These developments in turn flowed from the emergence of biology as a fully codified science, rearranging the terms of the earlier debate between mechanism and vitalism into a new and multifaceted organicism. Indeed, by the early part of the nineteenth century, *organization,* or the pattern of relationships binding the organs together and integrating their individual functions into a coordinated whole, was a privileged term, designating at least one condition of possibility for life itself. Such an attentiveness to the integration of structure and function within the organism was subsequently extended to the organism's relation with what Auguste Comte called its *milieu,* or environment. And with the work of the physiologist Claude Bernard, the notion of the *milieu intérieur,* or interior environment, was introduced to describe the internal space in which the regulatory functions of organisms are performed. The resulting tripartite assemblage—structure, function, environment—came to define the regulatory processes of organized (and thereby organic) bodies conceived as internal combustion engines.[6]

The field of comparative anatomy saw a related shift when Georges Cuvier broke down the totality of known organisms into four mutually exclusive branches on the basis of their organizational "plan," according to which each organ was seen to

perform a specific function in the service of the whole.[7] It is to this taxonomic fragmentation of life itself, in which the great continuous chain of being ramified into the unbridgeable discontinuities separating Cuvier's branches, that Deleuze refers when he reminds us (in his book-length essay on Foucault) that in the nineteenth century "the co-ordination and subordination of characteristics in a plant or animal—in brief, an organizing force—imposes a division of organisms which can no longer be aligned but tends to develop on its own."[8] A distributional imperative that proves constitutive of the postclassical *episteme* mapped by Foucault, this shift in the organism's status is coordinated around what we can call its spatiality. As the historian of science François Jacob puts it:

> What was radically transformed at the beginning of the nineteenth century, was, therefore, the way in which living beings were arranged in space: not only the space in which all beings were disposed, broken into separate islands and carved into independent series—but also the space in which the organism took up its abode, coiled round a nucleus, formed by successive layers that extended beyond the living being, linking it to its surroundings. It was both the relations established between the parts of an organism and those uniting all living bodies that were entirely redistributed.[9]

From cell to milieu, and notwithstanding the manifest distinctions between these various approaches, the organism was thus integrated into a bounded whole in which, as in the panoptic machines through which Foucault articulated the disciplinary epoch, everything was in its place.

This effort to think about the organism on its own terms—as an organic totality—thus yielded what Jacob calls a spatialization of organic bodies "in depth." Holding it all together was an invisible "secret architecture" (Jacob) or "hidden architecture" (Foucault)—what Jacob terms a "second-order structure" (organization) in which the parts are distributed and their individual functions coordinated. But this architecture also brings with it a degree of epistemological confusion. With Bernard and others, the biological notion of organic integration, particularly in the form of the cell theory, was initially articulated through an economic and political model that compared the integration of the unit (the cell) into the whole of the organism to the integration of the individual into society. While enabling biologists to accord priority to integration over simple mechanical assembly, this comparison was eventually challenged by a physiologically based project in which, in the words of Georges Canguilhem, "the organism is its own model," since "[f]or an organism, organization is a fact; for a society, organization is a goal."[10]

All of this was subject to revision with the emergence of cybernetics, communications theory, and systems theory during the middle of the twentieth century. The confusion remains, however. Social, biological, technological, and aesthetic space are networked together in Norbert Wiener's "age of communication and control." And architecture is right there with them, in more ways than one.

Returning to the "control society," we find that Deleuze also distinguishes control from the techniques of spatial confinement characteristic of disciplinary regimes, on the basis of a networklike spatiality: "Confinements are *molds,* different moldings, while controls are a *modulation* [e.g., the modulation of signals], like a self-transmuting molding continually changing from one moment to the next, or like a sieve whose mesh varies from one point to another."[11]

The irreducibility of this "control society" to its *technē*—even as certain network-based technologies are decisively implicated in it—or to its modulated structure suggests that along with cybernetic machines, certain aesthetic techniques might also belong to that collective apparatus dedicated to what Deleuze calls "the approaching forms of ceaseless control in open sites." Architecture's own *technē,* suspended between art and science in the discourse of the period, thus forms multiple, complex links with this apparatus. But in what way does a cybernetic regime modify what Jacob describes as "the way in which living beings [are] arranged in space"—the organicist integration of components in a milieu ranging from interior to exterior? And with respect to feedback loops that bring the outside back in, how do we confront the history and theory of communications networks from *within* the logic of these same networks? Unlike the confined, molded institutional spaces of disciplines (e.g., architecture), these are systems of modulation with no absolute inside or outside, interminably "open sites" where we perpetually traverse domains ("outside" architecture—e.g., cybernetics) in which we appear to have no business operating in the first place. In this supposedly postdisciplinary epoch, has not the discipline from which we write become itself merely a modulation of interconnected networks and knowledge banks?

1.2

In a letter dated 28 March 1951, a young Herbert Marshall McLuhan introduces himself to Wiener by declaring that "as a friend and student of Sigfried Giedion's I have paid special attention to your *Cybernetics* and *The Human Use of Human Beings,*"[12] Wiener's two most widely read books. Given the free use McLuhan would later make of cybernetic principles like feedback in his own work, it is not

surprising that he contacts Wiener at this early date. Slightly more surprising, perhaps, is his use of Giedion's name as a reference. Yet a year before McLuhan's letter, Giedion, too, corresponded with Wiener, thanking him for the opportunity to attend a meeting of the Inter-science Committee at the Massachusetts Institute of Technology (where Wiener taught), before which he was later invited to speak. In less than perfect English, he expresses solidarity: "I felt reconforted, because thoughts & ideas, which I had to work out lonely for many years are growing in your circle by the force of similar circumstances."[13]

By the time he wrote those words, Giedion had already conducted his own series of case histories of everyday mechanical objects and systems in *Mechanization Takes Command: A Contribution to Anonymous History* (1948), researched and written in the United States from 1941 to 1945. The book is an allegory that needs little decoding. It is unnecessary for Giedion even to name Hiroshima or Auschwitz, which, in the book as in history, actualized the mechanized death for which modernity had been preparing itself for an entire century.[14] For Giedion, ghostwriter of modern architecture's dreams, runaway mechanization could be controlled only by subordinating it to what he calls "human needs." Under such conditions, mechanization is forced to double back on itself—first by responding to rudimentary biological needs, such as the need for food and shelter, and second by recalibrating the human body to withstand the destabilizing effects of its own prosthetic supplementarity, in an adaptation to the constant change resulting from scientific and technological progress. This feedback loop is the basis for what Giedion calls "dynamic equilibrium," a balanced state of flux and interchange between individual and environment. Its prime agent, according to Giedion, is to be a new human type, a "man in equipoise," capable of balancing irreconcilable forces.

Cryptically, Giedion adds the caveat that "we should not have dared to suggest the new type of man our period calls for if physiology had not discovered astonishingly parallel trends," listing as evidence the work of a variety of scientists, including Claude Bernard and Walter B. Cannon.[15] Half a century after Bernard's studies of physiological self-regulation, Cannon had developed the notion of *homeostasis* to describe the body's ability to maintain certain functions (such as temperature) in a steady state and to restore its internal processes to equilibrium following moments of excitement or disruption. In doing so, he took up once again the analogy between biological and social processes, concluding his 1932 classic, *The Wisdom of the Body,* with an epilogue titled "Relations of Biological and Social Homeostasis."[16] Extrapolating from the biological to the technological domain, with the stage set by the biosocial hypotheses of figures like Cannon, Giedion thus (implicitly) uses "dynamic equilibrium" to invoke organic homeostasis as a model for the restoration of balance in an environment overrun with machines.

Dedicated to the neurophysiologist Arturo Rosenblueth, Wiener's collaborator and Cannon's colleague, *Cybernetics* is the first systematic exposition of the research conducted by Wiener, Rosenblueth, and others on parallels between communications networks and the human nervous system. Cannon's work represents an important precedent for this hypothesis, which explains in part Giedion's recognition of an affinity between his own work and that of Wiener. *Cybernetics* takes its title from *kybernētēs,* the Greek term for "steersman"; *kybernētēs* is also the root of the English term "governor," which is applied to devices that regulate the performance of machines (as in the governor of a steam engine). Extending concepts originating in nineteenth-century thermodynamics into systems of information measurement and management, Wiener defines information in relation to its opposite: entropy. The second law of thermodynamics holds that the overall level of entropy, or disorder, tends probabilistically to increase in any closed system. Wiener proposes that like energy, the amount of information, or "negentropy," within a system is subject to a similar process of breaking down and leveling off, also measurable as entropy.

Conversely, the degree of antientropic, informational *organization* in cybernetic systems is regulated through feedback, a continuous cycling of information (obtained by artificial "sense organs") back into a system to correct its course, consolidate its form, or modify its output. Wiener developed his theory of feedback through wartime research on electromechanical systems designed, in his words, "to usurp a specifically human function."[17] In an early project for an antiaircraft firing mechanism, for example, Wiener proposed a device, called an antiaircraft predictor, capable of obtaining information on the position and velocity of the aircraft and making the necessary calculations regarding its trajectory—a task previously performed by an individual known as a "computer"—as well as anticipating and factoring in the pilot's future behavior.[18] Although Wiener's proposal was never fully realized, the notion of machine-to-human and machine-to-machine feedback contained therein is central to his science of communication.

More generally, *Cybernetics* postulates morphological and functional parallels between the human nervous system and early information-processing devices by, among other things, comparing nerve synapses to vacuum tubes.[19] Thus the feedback loops and servomechanisms on which Wiener had begun working at the same time that Giedion was writing *Mechanization Takes Command* represented both the diagrams and the material components from which the "new type of man" announced by Giedion could potentially be assembled. There are no surprises here: since the 1920s, the "new man" and his organs had been appearing in avant-gardist discourse, including that of Giedion's friend László Moholy-Nagy (whose advice Giedion acknowledges in his preface). Moholy-Nagy, who died two years before *Mechanization Takes Command* appeared, had long been advocating conscious self-adaptation to technological advances in the form of a "new vision," and his mark is visible throughout

Giedion's book. Moholy-Nagy argued that the ubiquity of rapid movement in all aspects of modern life necessitated a biological adaptation of the human visual apparatus, aided by experimental photography, in order to process visual information received at greater speed than ever before (very much like Wiener's antiaircraft apparatus, with its proposed replacement of the human "computer" with a technological device).[20] Consequently, Marey's chronophotography was one point of departure for photographic work, such as that done by Harold Edgerton at MIT, that informed Moholy-Nagy's own aesthetic experiments with the human sensorium. Giedion, for his part, identifies Marey's documentation of the body as an integrated assemblage of functional vectors working in harmony as a basis for the links among science, social organization, and aesthetics forged in his chapter on the time and motion studies of Frank and Lillian Gilbreth and Frederick Winslow Taylor, and their counterparts in modern art.[21]

While in the United States researching *Mechanization Takes Command,* Giedion also wrote prefatory remarks for *Language of Vision,* a landmark effort to codify a new syntax for optical communication that was published in 1944 by Moholy-Nagy's friend and colleague at the Institute of Design in Chicago, the artist and visual theorist Gyorgy Kepes. In his comments Giedion commends Kepes, who utilizes numerous examples from contemporary graphic design and advertising, for attempting to introduce principles of formal coherence into the images saturating everyday life. In his own introduction, Kepes sounds many of the themes that Giedion would later reiterate in *Mechanization Takes Command.* Most notably, he laments the chaotic disorganization and formlessness of modern life, which he attributes to "our failure in the organization of that new equipment with which we must function if we are to maintain our equilibrium in a dynamic world."[22]

Giedion and McLuhan had met in St. Louis a few years earlier, in 1939. McLuhan later acknowledged his intellectual debt to Giedion, indicating that after the encounter "I naturally studied him more intensely and used his methods in my own work."[23] So when *Mechanization Takes Command* appeared, it became an important reference for McLuhan in his own research into the technologically generated by-products of modernity. This research was published in 1951 as *The Mechanical Bride: Folklore of Industrial Man,* a series of commentaries on advertisements found in newspapers and popular magazines. Like Kepes, McLuhan felt himself confronted with a visual landscape out of control, an entropic "maelstrom" of mechanically produced images used to manipulate an unsuspecting public rather than to communicate openly with them. In his words, such a "whirling phantasmagoria can be grasped only when arrested for contemplation. And this very arrest is also a release from the usual participation."[24]

It was at this time—upon the publication of *The Mechanical Bride*—that McLuhan first approached Wiener to solicit his opinion of the book, which had already been marked by McLuhan's encounter with Giedion, whose own earlier correspon-

dence with Wiener was noted above. Wiener had just published *The Human Use of Human Beings: Cybernetics and Society,* dedicated to elaborating to a nonspecialist audience his thesis that "the physical functioning of the living individual and the operation of some of the newer communication machines are precisely parallel in their analogous attempts to control entropy through feedback."[25] Here Wiener speculates on the capacity of the new machines, which he refers to as "communicative organisms," to regulate social relations by supplementing human intelligence. In doing so, he repeatedly invokes the well-worn analogy between biological organization and social organization, except that the organizational systems in question have now changed. The epistemological status of the two categories underwriting the comparison—the organism and the machine—has also changed. At both levels, the change is registered in specifically spatial terms.

Discussing what he calls "communicative behavior," Wiener argues that a community of ants is characterized by rigid, protofascistic social organization. He observes that the ant's lack of a respiratory system limits it to a certain size, beyond which it could not function with any degree of efficiency. He illustrates this constraint by comparing a cottage and a skyscraper. Whereas a cottage requires no specialized ventilation system, a skyscraper, with its rooms within rooms, is habitable only if equipped with a sophisticated means for circulating and exchanging air. The same goes for the nervous system. Wiener argues that what counts is not the size of the basic components (such as neurons, which are similar in humans and ants) but their organization, which determines the "absolute size" of an organism's nervous system—its upper limit of growth and index of social advancement. An organism's social potential, conceived in terms of its ability to organize into complex communications networks, is thus measured as a function of the size of its internal circulatory and communications systems, which is a function, in turn, of their own organizational complexity. The original analogy between the social and biological organism is thus collapsed, as the two become directly linked as part of the same network.

The organism's previous depth is also flattened out, as the distribution of the body's organs, or compartments (like the rooms within rooms of a skyscraper), becomes a function of the networks that service and regulate them. A relational logic of flexible connection replaces a mechanical logic of rigid compartmentalization, and the decisive organizational factor is no longer the vertical subordination of parts to whole but rather the degree to which the connections permit, regulate, and respond to informational flows in all directions. Furthermore, in a technologically mediated social environment, machines capable of performing such regulatory functions begin to assume a human character. According to Wiener (in the significantly revised second edition of *The Human Use of Human Beings*), if the ant's inability to learn and the relative perfection of its performance from birth make it comparable to a "computing machine whose instructions are all set forth in advance on the tapes," then the

human being is comparable to an information system able to learn and thus adapt to its environment based on feedback: "Theoretically, if we could build a machine whose mechanical structure duplicated human physiology, then we could have a machine whose intellectual capacities would duplicate those of human beings."[26]

"Organization as Message" is the title of the book's fifth chapter, in which Wiener proposes what he misleadingly calls a "metaphor" wherein "the organism is seen as message."[27] He begins the chapter by characterizing *homeostatic* processes as those by which an organism maintains its level of organization in an otherwise entropic environment. For Wiener,

> It is the pattern maintained by this homeostasis which is the touchstone of our personal identity. Our tissues change as we live: the food we eat and the air we breathe become flesh of our flesh and bone of our bone, and the momentary elements of our flesh and bone pass out of our body every day with our excreta. We are but whirlpools in a river of ever-flowing water. We are not stuff that abides, but patterns that perpetuate themselves. A pattern is a message, and may be transported as a message.[28]

What differentiates this cybernetic notion of the organism from its nineteenth-century predecessors is not so much the idea of the pattern as such, nor the flux of matter passing incessantly through this pattern, but rather the pattern's newly acquired status as "message." Ultimately, the organism's identity—its resistance to the entropic flood of de-differentiation, whereby it maintains a difference with everything that is not itself—is based not on its flesh, its material body, but on a materially transmissible body of information.

Wiener sees the physical body as nothing but pattern; moreover it is a pattern that can be transported (hypothetically) over telephone lines. To illustrate this point, he chooses the example of an architect:

> To see the greater importance of the transportation of information as compared with mere physical transportation, let us suppose that we have an architect in Europe supervising the construction of a building in the United States. I am assuming, of course, an adequate working staff of constructors, clerks of the works, etc., on the site of the construction. Under these conditions, even without transmitting or receiving any material commodities, the architect may take an active part in the construction of the building. Let him draw up plans and specifications as usual. Even at present, there is no reason why the working copies of these

> plans and specifications must be transmitted to the construction site on the same paper on which they have been drawn up in the drafting room. Ultrafax gives a means by which a facsimile of all the documents concerned may be transmitted in a fraction of a second, and the received copies are quite as good working plans as the originals. The architect may be kept up to date with the progress of the work by photographic records taken every day or several times a day; and these may be forwarded back to him by Ultrafax, or teletypewriter. In short, the bodily transmission of the architect and his documents may be replaced very effectively by the message-transmission of communications which do not entail the moving of a particle of matter from one end of the line to the other.[29]

This illustration is only a prelude for speculation on the telephonic transmissibility of the human body itself as an organizational pattern, speculation that Wiener readily admits contains heavy doses of fantasy but nevertheless sets a defining limit for his version of the organism as information system. It relies on a notion of embodiment grounded in patterned integrity rather than in spatial extension. The body as "communicative organism" is, for Wiener, to be understood as a vortex of data whose integrity is maintained homeostatically by virtue of its linkages to physical communications networks. Its materiality, and the materiality of all bodies, has *not* been superseded but has rather been reformulated.

Wiener's reformulation of the body's organizational logics as "message" also bears traces of a reflexivity—in the form of *feedback*—related to that of the "control society." For if the organism is fundamentally pattern (like the architect's design in Wiener's example), the instantiation and maintenance of this pattern depend not only on the availability of raw materials but also on the preexistence of a material substrate of communications systems (like the "Ultrafax" and the telephone lines). To the extent that bodies are understood as a function of their internal communications systems, which are in turn connected into social and technological networks to which they respond through feedback, the outer limits of the organism begin to erode even further than they did in the earlier *milieu intérieur*–external environment assemblage. The terms *interior* and *exterior* ultimately lose their meaning, since each point in the network is engaged in a two-way relationship with every other point, in what Deleuze calls a "modulation." This system, as well as any point within it, is reflexive to the degree that it is *self*-regulating and not merely acting in reciprocity with an external environment, having already incorporated the "environment" into itself through feedback.

For Deleuze, "the digital language of control is made up of codes indicating whether access to some information should be allowed or denied. We're no longer

dealing with a duality of mass and individual. Individuals become *'dividuals'* and masses become samples, data, markets, or 'banks.'"[30] Consequently, the mark of identity is transferred from the signature, the trace of the physical body, to the password—a code that connects the subject with its own externalized databanks. Progressive individualization, in the form of personalized codes through which the subject interfaces with the market, is really progressive "dividualization," or the internal splitting of subjectivity into subsets of data. And the "self"—what Wiener calls the human organism's "personal identity"—is constituted through the exchange of codes (in the form of organizational patterns circulating across the network), while the network *it*-self that supports the circulation is constituted reflexively through those very patterns. There is no outside, or inside.

At this point, we are reminded of Foucault's comments before the Parisian Architectural Studies Circle in 1967, when, having identified a new spatiality he calls "emplacement," he takes up a cybernetic idiom:

> Further, we are aware of the importance of problems of emplacement in contemporary engineering: the storage of information or of the partial results of a calculation in the memory of a machine, the circulation of discrete elements, with a random output (such as, quite simply, automobiles or in fact the tones on a telephone line), the identification of tagged or coded elements in an ensemble that is either distributed haphazardly or sorted in a univocal classification, or sorted according to a plurivocal classification, and so on.[31]

The text in which Foucault made these comments also articulated his notion of "heterotopia" in concretely spatial terms that would prove influential to the subsequent architectural reception of his thought. Central to this reception has been Foucault's later interpretation (in *Discipline and Punish,* 1975) of Jeremy Bentham's Panopticon as a diagram of spatial relations characteristic of nineteenth-century discipline. But already here, in Foucault's early comments to architects, we see another diagram emerging that, by the second half of the twentieth century, marks the dispersal of the panoptic model into diffuse networks of control.[32]

Like Wiener, Foucault does not differentiate between the circulation of physical bodies (automobiles) and the movement of information ("tones on a telephone line"). Both are submitted to a regime of coding that tracks and manages their movements through infrastructural networks whose dynamics are reducible to what he calls "the problem of knowing what relations of proximity, what type of storage, of circulation, of identification, of classification of human elements are to be preferentially retained in this or that situation to obtain this or that result."[33]

As is also implied by Foucault's choice of examples, the conversion of the organic domain into a problem of coding renders the boundary separating organisms from machines, and especially Deleuze's "cybernetic machines and computers," increasingly permeable. One effect of this permeability is to further destabilize distinctions between scientific, technological, and sociological knowledge, despite Wiener's reservations.[34] In describing the human organism as a node in an information system, cybernetics does not distinguish between human-to-human and human-to-machine communication. It also raises the possibility that humans could be left out of the loop altogether—a new version of the paranoid fantasy of machines dominating humans to which both McLuhan and Wiener allude. Moreover, cybernetics becomes the basis for renewed comparisons between organic bodies and social structures, in which technologically mediated social relations develop under the shadow of a pathological tendency toward entropy. Thus cybernetics is not just one more instance of a correlation between machines and the societies in which they exist. Despite its vaguely humanistic overtones, it *actively theorizes* the dissolution of the human organism's "humanity." It links up bodies, machines, and societies into one vast network, at precisely the same moment that the very existence of humanity is also threatened by its own scientific and technological development. This linking of organism, machine, and socius is so radically destabilizing that "organization" is called in to integrate the entire matrix into a self-regulating totality and to restore its homeostatic organicity. Unfortunately, the force of this organizational imperative leaves little room for an alternate, more volatile "body," for which Deleuze has another name: "If I call it the body without organs, it is because it is opposed to all the strata of organization—those of the organism, but also the organization of power. It is the totality of the organizations of the body that will break apart the plane or the field of immanence and impose another type of 'plane' on desire, in each case stratifying the body without organs."[35]

What is more, for Wiener as for Giedion—both writing in the context of the cold war and the arms race—not only had mechanization taken command, but there was a need to appeal to science for a defense against itself and the weapons it had produced. In Wiener's words, it mattered little "whether we entrust our decisions to machines of metal, or to those machines of flesh and blood which are bureaus and vast laboratories and armies and corporations."[36] Here emerge the full implications of Wiener's "human use of human beings," a title that further encodes the reflexivity of the entire situation. This is not about preserving the "human" by restricting its contact with machines. It is about steering the organized human-machines named by Wiener back toward something like "humanity." This "humanity," characterized by total communicational transparency, is to be reconstituted as a biosocial organism protected by its organizational robustness from weapons that are themselves produced

and deployed by highly organized "machines of metal" and "machines of flesh and blood," since for Wiener, "the effect of these weapons must be to increase the entropy of this planet, until all distinction of hot and cold, good and bad, man and matter have vanished in the formation of the white furnace of a new star."[37]

1.3

With the above concerns in mind, we can now consider the peculiar moment when urbanism makes an appearance in Wiener's public career. In the 18 December 1950 issue of *Life* magazine, an article under the title "How U.S. Cities Can Prepare for Atomic War" outlined a proposal by Wiener and two of his colleagues at the Massachusetts Institute of Technology, political theorist Karl Deutsch and historian of science Giorgio de Santillana, for the decentralization of urban infrastructures to mitigate the aftermath of a nuclear strike.[38] Arguing that the panic and chaos caused by the breakdown of transportation and communication lines would potentially be far more devastating than the direct effects of the explosion itself, the plan called for the construction of exurban "life belts"—infrastructural networks in radial patterns around every major American city. These networks were designed to control and direct the flow of traffic toward safe areas at the urban periphery during the hours immediately following a nuclear detonation aimed at the concentration of people, goods, and services in the city centers, while also providing bypass routes for major railroads and highways.

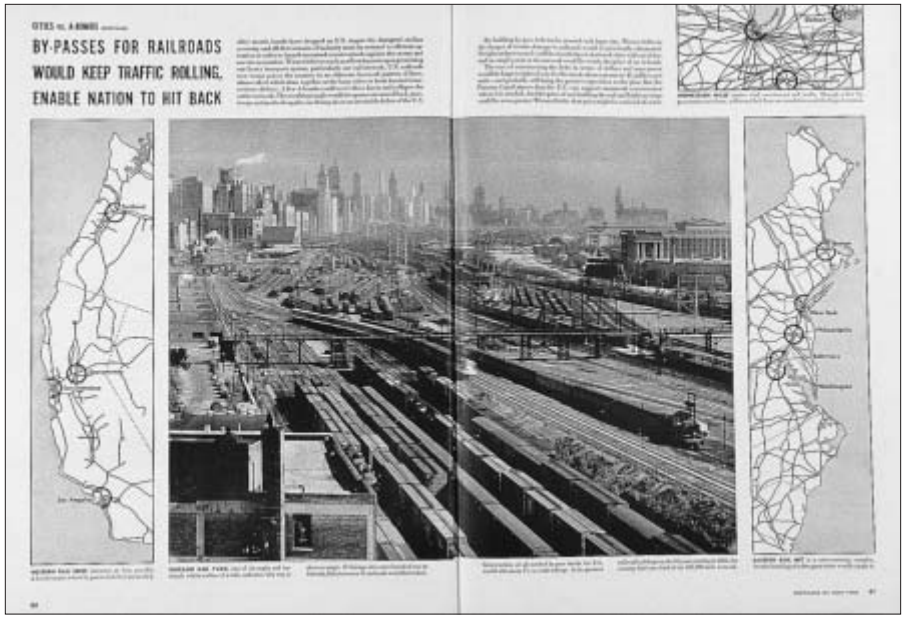
Wiener was the primary author of the plan, which appeared soon after *The Human Use of Human Beings* as a strategic deployment of that work's organizational principles. Indeed, a draft version of the explanatory text written partly in Wiener's hand declares: "We have conceived the city as a net of communications and of traffic. The danger of blocked communications in a city subject to emergency conditions is analogous to the danger of blocked communications in the human body."[39] It follows, then, that just as a skyscraper is a more developed organism than a cottage, and humans are socially more advanced (in principle) than ants, so too this proposed city is to be understood as a giant "communicative organism." The city extends the human nervous system in the name of what Giedion would have called "equipoise," reaching outward to maintain equilibrium and to overcome the entropic effects of traffic jams and communications breakdowns in the wake of nuclear bombardment by providing multiple, redundant pathways.

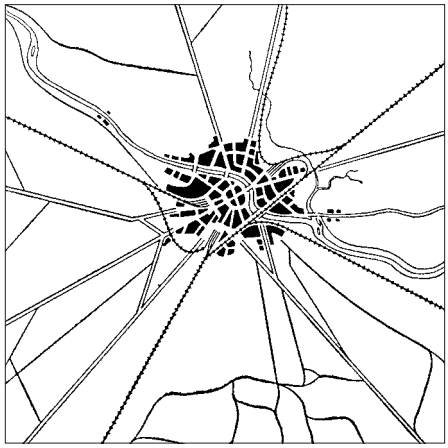
1.1

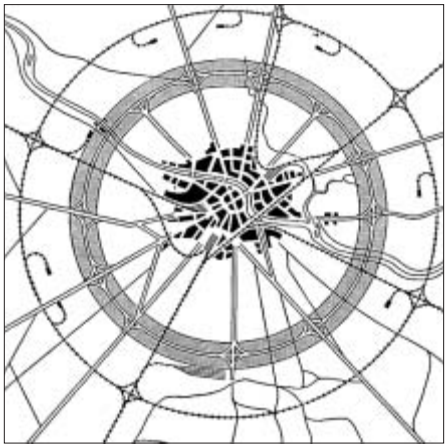
Norbert Wiener, Karl Deutsch, and Giorgio de Santillana, opening page of "How U.S. Cities Can Prepare for Atomic War," *Life,* 18 December 1950, 76–77.

1.2

Norbert Wiener, Karl Deutsch, and Giorgio de Santillana, "life belts." From "How U.S. Cities Can Prepare for Atomic War," *Life,* 18 December 1950, 78–79.







1.3

Norbert Wiener, Karl Deutsch, and Giorgio de Santillana, existing urban hubs. From "How U.S. Cities Can Prepare for Atomic War," *Life,* 18 December 1950, 80–81.

1.4

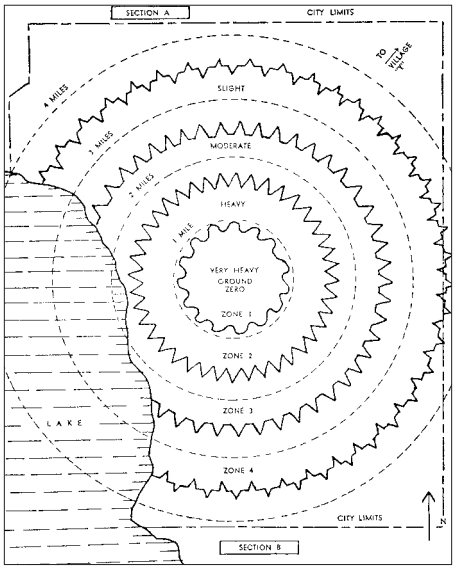
(bottom left) Norbert Wiener, Karl Deutsch, and Giorgio de Santillana, typical city. From "How U.S. Cities Can Prepare for Atomic War," *Life,* 18 December 1950, 78.

1.5

(bottom right) Norbert Wiener, Karl Deutsch, and Giorgio de Santillana, proposed city. From "How U.S. Cities Can Prepare for Atomic War," *Life,* 18 December 1950, 79.

What the plan's authors call "defense-by-communications" is also what distinguishes this project's schematic urbanism from other postwar civil defense planning strategies advocating decentralization.[40] As Wiener's revised notion of entropy indicates, the focus is not on the direct effects produced by the energy expended in a nuclear detonation but rather on the ensuing interference in communicational flows. Proposals such as the physicist Ralph Lapp's diagrams for linear or satellite cities or Ludwig Hilberseimer's decentralization plans, vividly illustrated with diagrams showing the geographic extent of an atomic blast, all defend against the thermodynamic effects of the bomb.[41] In contrast, the strategy proposed by Wiener and his colleagues defends primarily against the breakdown of the information and transportation systems regulating the city's equilibrium.

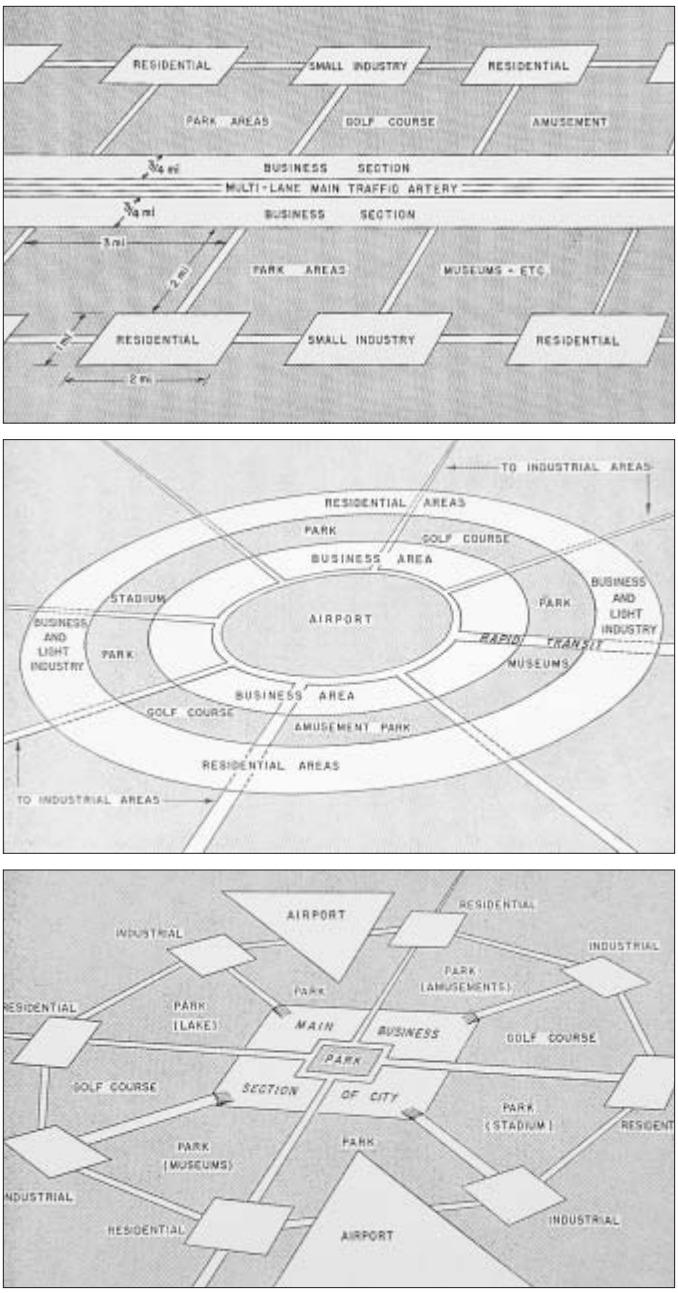
For Wiener, the nuclear arms race was also the very figure of a science out of control, a runaway technological juggernaut riding a wave of mistrust and deceit. Like many scientists, he was shocked by Hiroshima; after the bomb was dropped he actively resisted involvement in military projects. Though somewhat fatalistic about the complicity of science in domination, Wiener continued to insist that science use its own knowledge and techniques to regulate itself and the society in which it exists. In *The Human Use of Human Beings,* he quotes from a critical French review of *Cybernetics:*



1.6
City "X" diagram. From Ralph E. Lapp, "Atomic Bomb Explosions—Effects on an American City," *Bulletin of the Atomic Scientists* 4, no. 2 (February 1948): 51.

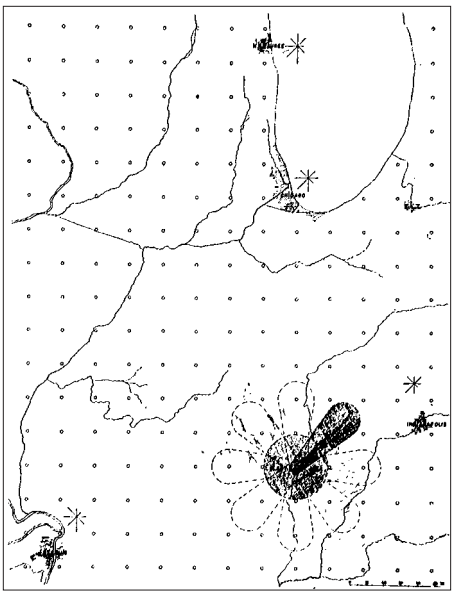
1.7

Ralph Lapp, New York City diagram. From *Must We Hide?* (1949), 83.



1.8

Ralph Lapp, "rodlike" city, "doughnut" city, and "satellite" city (top to bottom). From *Must We Hide?* (1949), 162–164.



Can't one even conceive a State apparatus covering all systems of political decisions, either under a regime of many states distributed over the earth, or under the apparently much more simple regime of a human government of this planet? At present nothing prevents our thinking of this. We may dream of the time when the *machine à gouverner* [the cybernetic machine] may come to supply—whether for good or evil—the present inadequacy of the brain when the latter is concerned with the customary machinery of politics.[42]

In citing this reviewer, Wiener evokes the same communicative transparency between science and society promoted by groups such as that formed immediately after the war around the *Bulletin of the Atomic Scientists.*[43] But in the United States, there exists a more familiar marker for the realignment of power within the "state apparatus" that followed the technological, logistical, and economic rupture of the Second World War.

On 17 January 1961, in his farewell speech to the American people, President Dwight D. Eisenhower warned against the "unwarranted influence" of the "conjunction of an immense military establishment and a large arms industry," becoming the first in a long line of theorists of what he called the "military-industrial complex." As Eisenhower put it, "the potential for the disastrous rise of misplaced power exists and will persist."[44] The irony of these remarks is not confined to Eisenhower's biography as

1.9
Ludwig Hilberseimer, radius of hydrogen bomb blast. From *The Nature of Cities* (1955), 283.

both an agent and a symptom of the very forces he identifies, including his early support for a national science foundation that would formalize the close ties developed among science, business, and the military during the war.[45] What is more significant is the way in which Eisenhower's formulation brought together institutions, technology, and power.

Inscribed in the expression "unwarranted influence" is a relation wherein power works instrumentally in the interest of a shadowy elite operating outside the parameters of everyday civil society. But as is demonstrated by the extensive scholarship that has arisen on the topic, the membership of the military-industrial complex is, if anything, characterized by a certain brazen visibility.[46] It was Eisenhower's own secretary of defense, former General Motors president Charles E. Wilson, who flatly declared that what was good for General Motors was good for the country. Even more, the corporations vying for defense contracts during the 1950s, and the various government agencies distributing them, relied heavily on public relations to construct the sense of self-evident necessity that legitimized their very existence. The instrumentality of "unwarranted influence" conceals a mutation in which cross-disciplinary knowledge banks and interinstitutional transmission systems—systems existing precisely *between* institutions like the military and the corporations—become the locus and the test site for the new forms of sociopolitical regulation that both Wiener and Deleuze call "control." In this sense, Eisenhower's spectacularization of the military-industrial complex, by resorting to the oddly reassuring terminology of central command, serves to obscure rather than reveal the relevant power-knowledge dynamic.

Among those most often credited with contributing to the critical resonance of such terminology is the sociologist C. Wright Mills, who, in *The Power Elite* (1956), announced (and denounced) the existence of an increasingly centralized concentration of power at what he called "command posts" within that stratum of American society occupied by corporate executives, military "warlords," and political leaders.[47] One of Mills's harshest critics was his fellow sociologist Talcott Parsons, who viewed Mills's assessment of an uneven distribution of power as exceedingly conspiratorial. Moreover, Parsons found Mills indifferent to the possibility that even should such a nexus exist, nothing prevents it from integrating its goals into those of society as a whole.[48] This organicist subordination of the individual will to the imperatives of the whole underlies the bulk of Parsons's own theory of social organization, of which his critique of Mills constitutes a part. By 1960 Parsons's neo-Weberian studies of integrated organizational systems had also absorbed the cybernetic lexicon. For example, he lists a "communicative complex," saturated with "feedback" and "noise," as one of four components in the "principle structures of community," reflecting "a sense in which human personality and society must be fitted into the ancient concept pair of biological theory: organism and environment."[49] Nevertheless, it was Karl Deutsch, Wiener's

collaborator on the *Life* project, who most explicitly extended cybernetic principles into a theory of sociopolitical regulation.

In *The Nerves of Government: Models of Political Communication and Control* (1963), Deutsch outlines a political theory based on what he calls a "limited structural correspondence" between a cybernetic command-control nexus and "political communication," proposing a state steered by the "nerves" of the body politic rather than governed by "muscular" power relations.[50] He characterizes his approach as transforming the static "ideal types" of Max Weber into "relatively full-fledged models of communication and control," or as adding "search criteria," in the form of "particular patterns of goal-seeking and goal-setting, self-steering and feedback," to the structural-functional approach of Parsons and his contemporary Robert K. Merton.[51] Furthermore, Deutsch extends the "general interchange model" of Parsons, in which a social system is made up of four functional subsystems—internal pattern maintenance, adaptation to environmental conditions, goal attainment, and integration of functions into a coordinated whole—to a theory of political power. As a result, power quantifiable as "force" is converted into a kind of "currency" merely flowing through the system, thereby reducing its claim on what Deutsch calls the "essence of politics." The new essential that replaces it, which for the most part Deutsch *also* designates as "control," is underwritten by a cybernetic organicism: "the dependable coordination of human efforts and expectations for the attainment of the goals of the society."[52]

Thus the hierarchical power structure identified by Mills and absorbed into the discourse on the military-industrial complex is overlaid with a systemic notion of power—as control—theorized by figures such as Parsons and Deutsch.[53] Control, naturalized by the organism, becomes the linchpin of a technocratic program of diagnosing and correcting societal imbalances through an organizational dynamics. But the totalizing imperatives of organization, and the attendant project of optimizing performativity through a feedback-based responsiveness, remain untouched.[54] As an externalization of the homeostatic apparatus of the human nervous system, the antinuclear city appearing in *Life* can thus be said to correspond to the state apparatus foreseen by Wiener (and his critics) and celebrated by Deutsch, as it attempts to supplement human intelligence during a moment of profound disorientation and to steer society out of its scientifically induced confusion. But this urban planning project also represents an early convergence of cybernetic spatial and technological strategies that would work to supplement the institutions of the state with the more diffuse organizational protocols of the control society.

By the time the project was published in 1950, the existing state apparatus was already conditioned by the networks organizing the military-industrial complex named by Eisenhower a decade later. For example, in 1949 the Soviet Union—to the surprise of the American military establishment—tested its first nuclear device, and by 1950 it was rumored that the Soviets had overtaken the United States in the arms

race. Concerned that its preemptive policy of "prompt use" of nuclear weapons would be ineffective against a strengthened enemy, the United States began to explore early warning defense options. The result was a comprehensive, computer-controlled air defense network called the Semi-Automatic Ground Environment, or SAGE. Implementing this system required the combined efforts of the U.S. military, International Business Machines, Western Electric, Bell Laboratories, MIT's Lincoln Laboratories, the Rand Corporation, and many other organizations, with numerous technical innovations in the areas of computer hardware, software, interface, and networking, including digital transmission over telephone lines. SAGE was described by one Air Force colonel as "a servomechanism spread over an area comparable to the whole American continent."[55]

In this sense, the infrastructure of weapons systems like SAGE materialized many of the key components in the communications networks that Wiener saw as theoretically necessary to realize the full organizational potential of cybernetics. Conversely, Wiener's own "defense-by-communications" proposal must also be counted among these weapons systems, at two levels. First, it uses many of the same techniques—decentralization, redundancy, information management, feedback—to defend against and regulate the entropic effects of imminent atomic catastrophe that constitute the primary justification for the collaboration of science, industry, and the state embodied in the very idea of the military-industrial complex. But second, in a kind of cybernetic feedback loop, it also uses scientific concepts, developed in the laboratories and testing grounds of the complex, to defend against science itself. The project's dream of communicative transparency maintained by a network of roads, highways, train lines, and telephone wires constitutes a "defense-by-communications" not only against the bomb but against the specialized, incommunicative discursive environment that created it. Through the fissures of a bipolar cold war there thus emerged a logic of control so encompassing that it aspired to the status of both material *and* discursive regulator, an organizational "pattern" encoded in images circulating through the same mass-media networks (including *Life* magazine) that McLuhan analyzed in *The Mechanical Bride*.

Thus, while Wiener himself was often skeptical about the possibility of applying cybernetic principles to other domains, especially to the so-called human sciences, his urban planning project—with its sociopolitical overtones—is nevertheless representative of large-scale efforts on the part of cyberneticists to forge an interdisciplinary research program designed to overcome the isolating loss of perspective that they attribute to such highly specialized realms as atomic science. This dream of communicative transparency, including what Deleuze calls the quest for "universals of communication," in fact presides over nearly all of cybernetics' early adventures. Numbered among these is its institutionalization as an interdisciplinary science in the

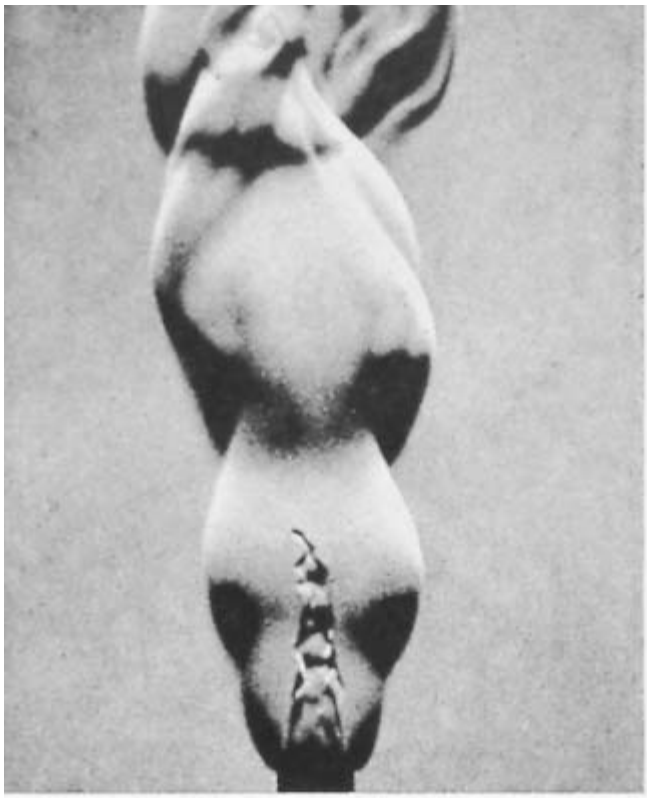
conferences sponsored by the Josiah R. Macy, Jr. Foundation that were held regularly between 1946 and 1953 and attended by leading representatives in diverse fields, from Wiener to such figures as anthropologist Margaret Mead, ethnologist Gregory Bateson, sociologist Paul Lazarsfeld, mathematician John von Neumann, and linguist Roman Jakobson.[56]

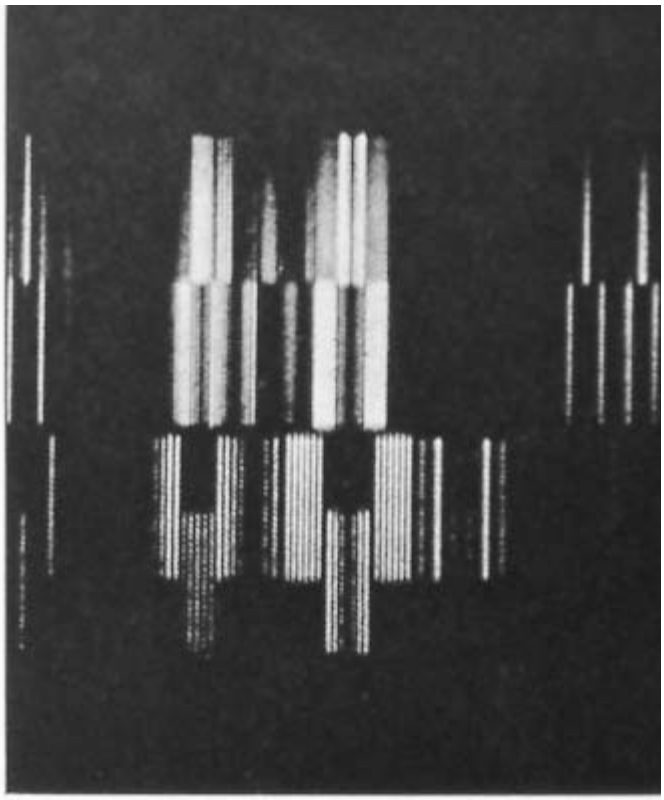
As always, architects and theorists of architecture were noticeably unwilling to be left out of such enterprises. Thus, writing to Wiener in early 1954, Richard Neutra lines up behind the others, declaring himself "a grateful reader and owner of your two books."[57] That same year, Neutra published *Survival through Design,* his own guide to the nuclear age, in which he cites both Wiener and Walter Cannon;[58] he also sent Wiener a copy. In 1956 an article by Neutra titled "Inner and Outer Landscape" appeared in *The New Landscape in Art and Science,* edited with commentary by Gyorgy Kepes; in it, the architect announces that the continuity between microcosm and macrocosm celebrated by Kepes in his compilation of scientific images reaches "right into our own innermost physiology, the processes within our skin, within our organism, our nervous system," and must be served by a designer who "switches on currents and cross-currents which continuously flow through the individual, the group, the physical surroundings."[59] Included in the same volume are texts by Giedion and by Walter Gropius, with Giedion again deploring the chaos and lack of coordination in modern life, Gropius adopting Giedion's terms—"equipoise" and "dynamic equilibrium"—to call on architecture as a means of reorienting the bewildered postwar subject, and Kepes quoting from transcripts of the Macy conferences in his commentary.[60]

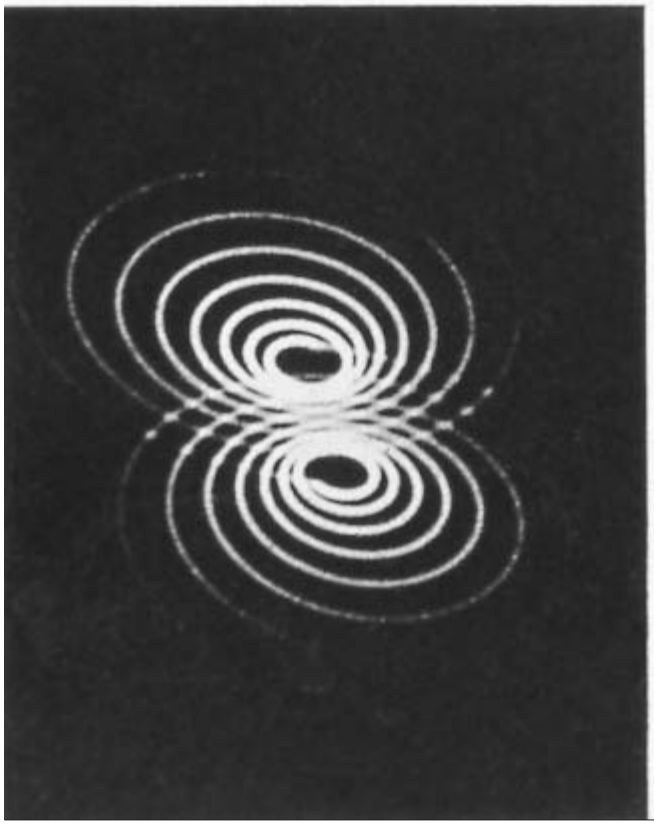
The New Landscape in Art and Science also includes an essay by Norbert Wiener titled "Pure Patterns in a Natural World." In this brief reflection on the mathematical elegance of the patterns embodied in a number of the photographs published by Kepes, Wiener insists—again, despite his own initial hesitancy to pursue such comparisons—that "the significance of the processes of breakdown is great not only in physics, but even in the study of sociological processes."[61] Upon receiving this text in mid-1951, Kepes wrote back to Wiener enthusiastically requesting that he elaborate further. Wiener refused, and Kepes apologetically tried again, declaring, to no avail, that "after reading your essay I saw that your contribution could be the focal point of my book."[62]

But although Kepes never succeeded in extracting from Wiener more details on the correlation between aesthetic form (patterns) and resistance to social entropy, the infrastructure of the military-industrial complex around which the entire discussion was coiled makes a pointed appearance in aesthetic discourse here, when Kepes compares the human sensorium, navigating through feedback, to intelligent weaponry: "We ourselves are self-regulating systems; when we put out our hand for an apple, our movement sends back to us a continuous indication of where we are; similarly to the

1.10
(following page) Illustrations provided by Gyorgy Kepes for Norbert Wiener's "Pure Patterns in a Natural World." In Kepes, *The New Landscape in Art and Science* (1956), 276.







341 Fig. 4

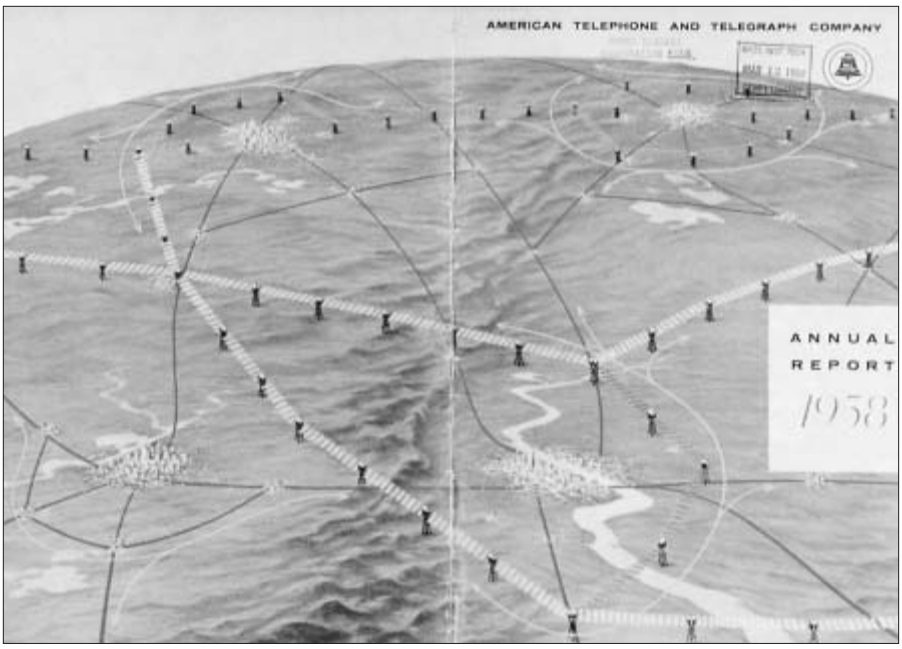
342 Fig. 5

343 Fig. 7

guided missile, we continuously correct for error as we seek our destination."[63] Just as McLuhan observes that the delirious overproduction of advertisements unfolds into a "single landscape" possessed of its own internal logic, so Kepes sees the new landscape made visible by scientific imaging as a communicative topography made up of relational patterns whose naturally occurring equilibrium can be incorporated into art and architecture. The images themselves are used as a kind of feedback mechanism, in another effort to deploy the techniques of the "control society" to regulate its own militarism, by converting the output of science into organizational input fed back into the guided missile of the human sensorium to correct its course. This new landscape also belongs to what Kepes calls a shift from "thing-seeing" to "pattern-seeing," where the body into which this sensorium is embedded is decisively flattened. What was once a "thing" in space, an organism made up of carefully arranged functional organs, has become, for Wiener as well as for many biologists, a communications network linked to other networks in all directions, a "pattern."[64]

This reduction to the degree zero of organized patterns also seeks to resolve the conflict implied by the conjunction of art and science in Kepes's title. If Foucault succeeded in extending the epistemological hypotheses of historians of science such as Gaston Bachelard and Canguilhem into multiple aspects of human endeavor, including the production of "man" in the "human sciences," aesthetic questions still seem to resist formulation in epistemological terms so rooted in scientific discourse. In a sense, this resistence could impose an immediate limit on our effort to explore the implications of Foucault's theses, and those of Deleuze, in an interdisciplinary network capable of including architecture. Conversely, it could cause us to limit our architectural inquiry to questions of technique. But here we find Kepes seeking precisely to unify art and science on the common ground of control and communication, with architecture represented as an agent of homeostatic regulation, maintaining what Giedion called "dynamic equilibrium."

It is exactly a new, aesthetically advanced biomechanical, sociotechnical "organism" that Kepes is attempting to theorize and to build with his stunning compilation of patterns in *The New Landscape in Art and Science*. For him, these "pure patterns in a natural world" are revealed to art by science, only to be fed back into science by art. Architecture is merely one of many media enabling the exchange. The informatic reduction on which the entire process depends is, in the long run, essentially the reduction of all biological, technological, and aesthetic input and output to patterns of ones and zeroes. It is also constitutive of what we can call the "organizational complex," or the discursive formation from which both the technomilitarism of control systems *and* proposed antidotes to this militarism—including the technocratic prospect in Wiener as well as the aesthetic prospect in Kepes—sprang during the 1950s and early 1960s in response to the tendency toward entropy exhibited by those same systems.



What remains for us to study, then, is the vast patterned network of networks left behind by this complex, an "open site" (Deleuze) wherein scientific knowledge and aesthetic strategies constantly change places in an epistemological blur. Periodically, each node in the network contributes its own modulation to the organization of "control," such as when the American Telephone and Telegraph Corporation proved itself an equally accomplished theorist of antientropic techniques, using the occasion of its 1958 annual report to echo Wiener's doctrine of "defense-by-communications." As part of what the company called "building communications for a strong defense," it revealed a strategy whereby "new telephone routes bypass critical areas to insure that essential nationwide communication will be maintained in case of disaster." A diagram on the cover shows telephone lines being routed around major cities, so that "if these cities are destroyed, communications can bypass them."[65] The basis of this strategy was made clear three years later in another AT&T annual report that contained a manifesto, also titled "Communications for Defense," which declares ominously that "in communications, defense of the nation comes first."[66] Here is confirmed Deleuze's assertion that the quest for universals of communication should make us shudder. The much-advertised resilience and scope of the so-called Bell System is mobilized as a guarantee that the lines will be kept open in the face of all imaginable forms of interference, nuclear or otherwise.

1.11
Cover of the American Telephone and Telegraph Corporation, *AT&T Corporation Annual Report* (1958).