Information, Communication, Systems

Cybernetic Aesthetics in 1960s Cultures

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> On the walls hang graceful, abstract designs that look like snail shells, plus computer variations on op designs by Jeffrey Steele and Bridget Riley. . . .
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> From the ceiling hangs a huge mobile by Britain's Gordon Pask that responds electronically to lights flashed on it by visitors. . . . Taped sounds of computer-composed music fill the air, and computer-made poetry is on view. Some of it reads rather like Alice in Wonderland as rewritten by Charles Olson.
>
> "CYBERNETIC SERENDIPITY," *TIME*, OCTOBER 4, 1968

In his 1979 global bestseller, *La Condition Postmoderne*, French philosopher Jean François Lyotard identified in the convergence of linguistics and cybernetics a crucial nexus for the configuration of postmodernism. This perspective implicitly shed a new light on the interpretation of the 1960s not as a decade primarily defined by movements of protest, liberation and emancipation, but as the epochal threshold of an epistemological paradigm

shift. Rooted in cybernetics and affecting the hard sciences and the humanities alike, such a shift entailed the decline of epistemologies based on the distinction between a subject of knowledge and an object to be known, and the parallel emergence of one based on the systemic relation between elements, information, function and communication. This new epistemology replaced a view of nature and society as "given" facts or entities existing in the world independently from our knowledge of them, with one in which both nature and society are inseparable from our ways of knowing and describing them. In the 1960s a cybernetic-derived understanding of nature and society as effects of information and communication started to circulate among the scientific and cultural élites and progressively extended across social zones to become generalized by the mid-1970s. Lyotard's seminal report on the status of knowledge in the late 1970s identified the information revolution as the crucial conceptual force governing the shift from a modern to a postmodern society. However, he did not discuss the set of cultural operations by means of which the new regime of signification that emerged as the discourse of cybernetics and information in the years around World War II gained currency and became progressively stabilized after the war. Indeed, by the mid-1950s the concepts of *information*, *communication*, and *systems* had grown common in the vocabulary of the hard sciences and were disseminated across social and aesthetic practices and discourses,[1] becoming, by the late 1970s, an epistemological dominant in the US and in Europe.[2]

This essay argues, first, that the epistemological revolution propelled by cybernetics in the 1940s and 1950s and its corollary redefinition of the concepts of information and communication prompted, from the early 1960s, a radical revision of art, literature, and aesthetics and a lasting transformation

1 According to art historian Jack Burnham, however, experiments and inquiries over the aesthetic potential of cybernetics took place, first, in Europe, while the US lagged behind by "five or ten years." Burnham, *Beyond Modern Sculpture*, 343, cited by Shanken, "Cybernetics and Art," 255.

2 The emergence of such regimes is one of the consequences of the massive program of techno-military-scientific investments that restructured the twentieth-century US scientific infrastructure in relation, first, to World War II and, second, to the Cold War competition for global political-scientific hegemony. On this and related issues, see Kay, *Who Wrote the Book*; Hayles, *How We Became Posthuman*; Clarke and Dalrymple Henderson, *From Energy to Information*; Heims, *Cybernetic Group*.

of their methodologies and conceptual apparati. Such a revision generated a shift in the concept of art and in the notion of the artwork from object to process, from static to performative, and from closed to open system. The understanding of a work of art as an open system was based on the concept of the feedback looping of information in meaning-systems cooperatively made by participants, objects, signs, and events.

Second, this essay claims that a shift parallel to the redefinition of the artwork in a systemic perspective also affected the reception of the artwork and the literary work. As a consequence, signification, reading practices, and textual interpretation were reconceived as a circular model of communication, where notions of information, medium, and user replaced notions of sender and receiver presupposed by linear, non-specialized theories of communication. These ideas, germinated within the cybernetic paradigm, had a crucial impact on the emergence of the notion of the "death of the author" and the "literature machine" formalized by structuralist poetics in the 1960s, thematized and explored in much experimental literature of the time, and expanded and developed in post-structuralist theories of meaning.

Third, this essay also suggests that the transformative impact of cybernetics on later reformulations of the Cartesian mind/body distinction as information/materiality (already implicit, for instance, in Marshall McLuhan's notion of the media as extensions of man) should be considered within the frame of non-essentialist claims about the relation between the body and subjectivities, so crucial to countercultural movements in the 1960s, from feminism to anti-racism, to anti-psychiatry. The non-essentialist edge of cybernetics is a further aspect of the progressive potential of cybernetic ideas, which, together with other aspects of this explanatory model, authorizes a reconsideration of the entire cybernetic paradigm that explains it away from the Cold War ideology and control paranoia and in relation to the broader epistemological shift that swept through the 1960s and 1970s.[3]

The cybernetic worldview promoted a systemic notion of meaning based on the ongoing interactions of human and nonhuman elements functionally connected in a communication circuit. This meant that the Cartesian epistemology based on the subject/object distinction, securing process-

3 See Galison, "The Ontology of the Enemy"; Aspray, "The Scientific Conceptualization of Information"; Beninger, *Control Revolution;* Turner, *From Counterculture to Cyberculture*; Clarke, *From Energy to Information*.

es of knowledge, was radically destabilized and reconfigured around the non-anthropocentric notions of input-output-communication-feedback loop-system. As a consequence, meaning-making processes and their descriptions were also reformulated, while cultural, social, and institutional practices as well as formal aesthetic innovations in the arts and in literature were modeled in relation to the cybernetic definitions of meaning and knowledge. For this reason, the fourth claim of this essay is that the cybernetic paradigm should be reassessed as a powerfully transformative conceptual paradigm which contributed to generating radical changes in how disciplinary subjects were studied and how knowledge was produced and disseminated within institutions of knowledge and in society at large. These practices were generally reoriented toward interdisciplinary approaches. The metaphorical potential of this paradigm shift was fully explored in experimental literature, art installations and performances, in radical architectures, critical pedagogies and in anthropology and family therapy. From this vantage point, a fresh look at some key fictional and theoretical literature from the 1960s in the US and in Europe will reveal the transnational and transatlantic dimension of the cybernetic paradigm and contribute to draft a more accurate map of the field of forces shaping the literary and cultural tensions of the decade.

On the North American scene, for instance, Thomas Pynchon's *The Crying of Lot 49*, William Burroughs's *Nova Trilogy* (1961; 1962; 1964), and Marshall McLuhan's *Understanding Media: The Extensions of Man* (1964) should be considered as frontal explorations of the potential of cybernetic ideas in creative processes. Similarly, some of the works of Italian writer Italo Calvino, particularly his short stories from the early 1960s, *Cosmicomiche* (1963–64; 1965) and *Ti con zero* (1967), as well as his essay "Cybernetics and Ghosts" (1967), should be seen in the larger context of the impact of cybernetic ideas on the study of mental processes in linguistic translation and visual perception. All these works continued the concerns of Italian linguist and philosopher of science Silvio Ceccato, founder and director of the Centro di Cibernetica dell'Università di Milano (1957).[4] Cec-

4 Ceccato elaborated an original theory of the observer that anticipates some crucial epistemological implications subtending the shift from first to second order cybernetics in the late 1970s. He also collaborated with avant-garde artists based in Milan and Rimini, who were then investigating the potential of cybernetic ideas for aesthetic purposes and interactive, kinetic art. Ceccato authored several

cato introduced in Italy the cybernetic ideas of Norbert Wiener and collaborated with avant-garde artists based in Milan and Rimini who were then investigating the potential of cybernetic ideas for aesthetic purposes and interactive, kinetic art.[5]

Finally, on the British cultural front, cultural critics have already retrieved the significance of Roy Ascott's installations, as well as his art education programs for the dissemination of cybernetic ideas within the context of a systems aesthetics.[6] Far less frequently discussed in relation to the development of a cultural poetics of the 1960s in Europe is the near mythical exhibition Cybernetic Serendipity, which opened in London in 1968 and looped back to the US, traveling to Washington, DC, and San Francisco between 1968 and 1970. Similarly neglected is the contribution of anti-architect Cedric Price's experimental architecture. Both cases testify to the intellectual and popular appeal that cybernetics ideas were gaining across the 1960s. This series of permutations, contaminations, and aesthetic recon-

scientific publications but also wrote a number of non-specialized essays that crossed the academic/general public divide (La Cibernetica per tutti, and La mente vista da un cibernetico, both published in 1970–72 but based on experimental work done from the late 1950s).

5 In particular, Ceccato's research directly influenced the work of "Gruppo V," the Rimini-based group led by Pino Parini, but the discursive shift of cybernetics fully entered the poetics of all the North Italian avant-garde groups working on Arte Cinetica: the Milan-based "Gruppo T," founded in 1959, with the manifesto Miriorama 1, by Giovanni Anceschi, Davide Boriani, Gianni Colombo, and Gabriele Devecchi; the Milan-based "Gruppo MID"; the Padua-based "Gruppo N," which existed until 1966. All these groups participated, in different years, in the international exhibition on computing and art "Nove Tendencije" held in Zagreb from 1961 to 1973, as documented by Margit Rosen in the recently published documentary history of the exhibition, *A Little-Known Story*. For a more detailed account of the Centro di Ricerche Cibernetiche, see Parini, "Fra arte cibernetica e didattica." A fifth group "Ti.Zero" funded in 1968 was based in Turin. For this and for the Italian kinetic, interactive, and cybernetic avant-garde, see Mari, Gruppo N, and Gruppo T, "Arte e libertà." An entire chapter should be delivered here on the nexus of cybernetics, industrial production, the beginning of a national industry of calculating machines and kinetic art in Italy, but it would be outside the scope of this essay. See, in particular, the catalogue of the exhibition Arte Programmata. (Negozio Olivetti, Milano 1962). Milano: Officina d'Arte Grafica Lucini, 1962, now reprinted in Meneguzzo, Morteo, and Saibene, *Programmare l'Arte*; for a detailed account of the kinetic art scene in 1960s Italy, see Granzotto and Margozzi, *Arte programmata e cinetica*, and Vergine, *L'arte Cinetica in Italia*.

6 See Ascott, *Telematic Embrace*. For a historical survey of systems aesthetics, see Shanken, "Reprogramming Systems Aesthetics."

figurations reveal that cybernetics did not only haunt the visual and literary imagination of the decade. Neither did it simply provide the visual arts, literature, architecture and critical practices with the most powerful metaphor of the times for addressing contemporaneity in the shape of the massive financial and techno-scientific reorganization Western societies were then currently undergoing. In fact, the circulation of cybernetic ideas in the 1960s ignited a lasting, crucial transformation of our definition of literature, art, and society and provided the epistemological foundations for the radical politics of the 1960s, as it subtly revolutionized the notions of meaning, act, communication, information, and event both in their socio-political and aesthetic-literary manifestations.[7] This development occurred in spite of the fact that the discourse of cybernetics cannot be fully disarticulated from fantasies of technical total control spurred by the unexpected success of Wiener's bestseller *Cybernetics, or Control and Communication in the Human and the Machine* (1948), whose title reinforced the association between cybernetics, control, and the techno-military infrastructural complex that Wiener partly wrote against.

CYBERNETICS AND ITS DISSEMINATION

As historians of science and cultural institutions have pointed out, interdisciplinary collaboration among scientists, promoted in the war years by research centers involved in the war effort, had fostered a cross-disciplinary methodological approach toward science and knowledge based on the concepts of communication, control and functional performance.[8] Immensely popularized by Wiener's 1948 book*, Cybernetics, or Control and Communication in the Animal and the Machine*, cybernetics, defined as the "sci-

7 On Wiener's anti-military stance and on the critical impact of cybernetics, see also Triclot, "Norbert Wiener's Politics."

8 In this connection we should mention—at the very least—Vannevar Bush's Office of Scientific Research and Development and, later, Norbert Wiener (MIT) and John Von Neumann (Princeton) interdisciplinary methodologies in the environment of the Macy's Conferences on Cybernetics (1946–1953). See also Mendelsohn, Roe Smith, and Weingart, *Science, Technology, and the Military*; Leslie, *Cold War and American Science*; Edwards, *Close World*; Heims, *Cybernetic Group*.

ence of control and communication in the animal and the machine,"[9] provided both the conceptual framework and a basic vocabulary for the convergence of two distinct notions of information and communication. The first, crossing several traditions of communication theory, kept the two terms separate, casting information as a quantity of semantic content that can be transferred from sender to receiver, and communication as the act that transfers—more or less successfully—that content through a specific medium external to both.[10] The second binds information and communication together in three ways: first, by highlighting the convergence of medium, information, and communication in the coding/decoding act functional to the transfer of informational content; second, by defining the message as "a discrete or continuous sequence of measurable events distributed in time,"[11] and third, by considering the organization of all the elements constitutive of such communicational circuit. Both models combine semantic and quantitative aspects of communication, and both had been used in rather general terms in physics, biology, and mathematical logic in the late nineteenth and early twentieth centuries. But it was only in World War II engineering and information science that they became more specific.[12] As a result of Wiener's cybernetic explanation, they converged to define a purposeful communicative environment (cybernetic system), in which information is fed into the system (as input), and system behavior (output) is functionally steered by built-in servomechanisms that re-inject information (as new input) back into the system (feedback), thus redirecting its next operation toward functional success.[13] As Heinz Von Foerster would later comment, "It is this circular organization which sets cybernetic systems

9 Wiener, *Cybernetics*.

10 See on the several disciplinary traditions of communication studies, see Hartley, *Communication, Cultural and Media Studies*.

11 Wiener, *Cybernetics*, 7.

12 Clarke, in "Communication," has discussed Roman Jackobson's model of communicative functions in relation to Claude Shannon's Diagram of a Communication System (1940). This is also dicussed in Kay, *Who Wrote the Book*.

13 The notions of behavior, message, information, control and feedback were elaborated by Wiener together with Arturo Rosenblueth and Julian Bigelow, and appeared as systemically connected as the incipient discourse of cybernetics outside the anti-war effort from which it originally arose in a 1943 paper "Behavior, Purpose, and Teleology." See Rosenblueth, Wiener, and Bigelow, "Behavior, Purpose, and Teleology."

apart from others that are not so organized."[14] Wiener's quantitative definition of information was to find scientific support by Claude Shannon, the Bell laboratories engineer who was also a frequent guest at the Macy's Conferences and who authored, with Warren Weaver, the immensely influential *Mathematical Theory of Communication* (1948). From the vantage point of acoustic engineering, Shannon and Weaver were adamantly clear about what information was. First of all, they declared, "Information in communication theory is used *in a special sense that must not be confused with meaning*. It refers to what you could say, not to what you do say."[15] Second, they gave a systemic, relational definition of information that helped generating interdisciplinary convergence at that conjuncture of intellectual history. Shannon and Wiener's systemic definition of information—that is, what you could say in a potentially infinite set of possibilities—overlapped with other systemic definitions of information emerging from other fields of knowledge, such as, for instance, structural linguistics, which similarly emphasized the grammatical and systemic value of language rather than its semantic aspects. As Shannon and Weaver put it, "the concept of information applies not to the individual message, but to the situation as a whole."[16] Thus, the two mathematicians at once cast the semantic value of communication as technically irrelevant, established the value of information in systemic terms, and shed a new light on Wiener's formulation of a message as "a discrete or continuous sequence of measurable events distributed in time."[17]

Once it was established that messages carried information, not meaning, that information was a quantitative and not a qualitative measure, and that its value was systemic and not individual, two consequences ensued. First, it became conceptually possible to redescribe any system—whether living or nonliving—in the universal language of information, because, from a functional point of view, living organisms and machines were conceived as operators that transfer information in similar ways. After Shannon had demonstrated that information could be measured logarithmically, it was clear that by computing the transfer of information in quantitative terms, the behavior of humans and machines could be computed, automated, and

14 von Foerster, "Opening Address."
15 Shannon and Weaver, *Mathematical Theory of Communication*, 100. My italics.
16 Ibid.
17 Wiener, *Cybernetics*, 7.

controlled, and that living and nonliving organisms could be reorganized—descriptively if not ontologically—within a unified theory of information.[18] It is this quantitative notion of information that allows us to better understand the qualifying clause in Wiener's original formulation of cybernetics as the science of control and communication "in the animal and the machine." Second, systemic understandings of information, communication, and meaning shareable, to a certain extent, among distinct disciplines provided the ground for a productive overlapping of linguistics, semiotics, mathematics, sound and communication engineering, neurophysiology, and genetics. It also accounted for a significant degree of conceptual convergence among the disciplines across the science/humanities divide around the concepts of code, information, feedback, system, and communication. These concepts clustered in a powerful constellation of tropes that organized the discourse of cybernetics as the discourse of Information, Communication, and Systems. But it was the new notion of information which provided a sort of meta-code for translating all forms of knowledge as informational quantity, or information, recoding all knowledge in the language of machine communication, the binary code. This conceptual convergence also fed the fantasy of a possible re-unification of all knowledge as controlled flux of information across disciplinary domains, from information systems to biological systems to cultural systems, leaving no material leftovers. Recent inquiries in media studies, history and philosophy of science and literary criticism have disclosed the significant disunity and heterogeneity of positions within the cybernetic paradigm.[19] And yet, the semantic and terminological convergence it fostered across disciplines accounts for both the proliferation of cross-disciplinary projects and for the metaphoric association of cybernetics with art, literature and aesthetics. Information, communication, and systems became crucial operators from the early 1960s.

This moment in the history of ideas explains Lyotard's insistence on cybernetics as the crucial epistemological paradigm for the redefinition of knowledge, aesthetics and complex systems as systems that exchange information (Lyotard). It also clarifies the shift from objectual to processual

18 As is well known, genetic offered the most powerful terrain on which fantasies of total convergence between living and nonliving systems were projected. See Kay, *Who Wrote the Book*, and Roof, *Poetics of DNA*.

19 See, for instance, Geoghegan, "From Information Theory."

(or post-objectual) understandings of aesthetic expressions so ubiquitous in the 1960s poetics, a shift several critics have seen as a defining condition for the emergence of postmodernism.

CYBERNETICS AND AESTHETICS: AT THE BEGINNING WAS POSTMODERNISM

In his long 1953 poem, "The Kingfishers," the American poet Charles Olson explicitly referenced the the shift in focus, from object to process, implied in cybernetic epistemology, and subjected the technical jargon of mathematics and Wiener's formulations to metaphoric suggestions:

> To be in different states without a change
> is not a possibility
>
> We can be precise. The factors are
> in the animal and/or the machine the factors are
> communication and/or control, both involve
> the message. And what is the message? The message is
> a discrete or continuous sequence of measurable events distributed in time[20]

The lines ventriloquize Wiener in order to exploit the tension between a formal and a semantic definition of message and to emphasize the potential of poetry as a generator of formal ambiguities. Poetry here softens the rigidity of the mathematical formulation by redistributing its terms across the poetic lines, subjecting each element of the citation to new syntactical and semantic pressure. This act of suspension, de-signification and re-signification generates ambiguities and irregularities within the poetic form, injecting instability in the hermeneutic process. The explicitly evoked cybernetic circuit is disrupted by means of ironic suspensions and inversions, which force the process of signification beyond the formal boundaries of the poem. Irony and inversions highlight the impossibility of pure self-reference and point instead to meaning as the impermanent emergence of a systemic relation between the formal organization of the poem and its ma-

20 Olson, *Selected Writings*, 170–71.

terial and immaterial outside, the former exemplified, for instance, by sounds, printed words, the reader as a concrete person, and the latter by grammar and syntax, or by the reader as a reservoir of mental processes and associations. Wiener's formulation is destabilized by the poetic form, closed by internal organization and semantically open to the outside and to the irreducible complexity of the world. Each word—different states, change, possibility, communication, control, message, events, time—becomes the generator of new poetic tension interminably activated and reactivated at each reading. The poem exploits the epistemological consequences of the relation between art and society conceived after the cybernetic paradigm and turns it into an element of its own form: information and behavior, message and meaning are the contingent events of ongoing processes of communication among interconnected systems.

This dialectics of closure and openness sheds light on one of the key formal consequences of the poetics of cybernetics: art is no longer conceived as the manifestation of the autonomous and self-sufficient object, but as a cybernetic system operating in/as a network of feedback loops in the cultural sphere and in society at large. The poetic and political implications of this renewed understanding of art, which shifts the burden of aesthetic attribution and evaluation from artifact to process, from object to performance, from author to cooperative communication, and from intention to indetermination, cannot be overestimated. Indeed, the interactivity between systems implied by the cybernetic view of art and society depends on cooperation and may potentially generate a more democratic approach to both the processes of composition, and the actualization of and fruition of the artistic event and to the fabrication of the social environment more generically.

The aesthetic and political implications of interactivity were clear to European avant-garde intellectuals and artists. In the early 1960s, for instance, the Italian novelist and literary critic Italo Calvino was exploring the relationship between scientific knowledge, mythology and storytelling. He investigated the potentialities of nonlinguistic codes (mathematical and biological codes, mainly) and nonanthropomorphic relations and concepts (such as distance; time; geometry) as propellers of the imagination and generators of semantic, rhetorical and figural disturbances that creatively

disrupt the automatisms of myth and storytelling.[21] It was specifically in the essay "Cybernetics and Ghosts" published in 1968 but referring to a series of conferences he delivered in 1967 in different Italian cities, that Calvino discussed the hypothesis of a computer-generated literature and its aesthetic consequences.[22] Calvino's interest in the concept of a "writing machine" that the discourse of cybernetics opened to the imagination does not focus on its successful performances, but on its potential for generating chaos, disorder, and noise. And noise, in Shannon and Weaver's mathematical theory of communication, increases uncertainty, and information, provided that information be understood as "a measure of the freedom of choice in a system."[23] As Calvino puts it in the essay, "the true literature machine will be one that itself feels the need to produce disorder, as a reaction against its preceding production of order."[24] Calvino is not troubled by the dissolution of the authorial function in a computational network, but is committed to ask a question: what would replace the trope of originality that rhetoric and literary theory hadve traditionally assigned to the figure of the author? He is concerned with finding a conceptual device that could both substitute the myth of the author and be a vector of genuine alteration in language and in the imagination. He points to the void at the heart of the compositional process and to the aesthetic and rhetorical labor necessary to cover this void over with the figure of the genius—as in Romanticism—or under the function of consciousness. At the same time, Calvino denounces the failure of aesthetic as a philosophical discourse to address the void without always begging the further question. Authorship, in Calvino's view, is always already dissolved in writing:

> The so-called personality of the writer exists within the very act of writing: it is the product and the instrument of the writing process. A writing machine that has been fed an instruction appropriate to the case could also devise an exact and unmistakable "personality" of an author, or else it could be adjusted in such a way as to evolve

21 For a detailed accounts of this stage of elaboration and creativity in Calvino's career, see Belpoliti, *L'Occhio di Calvino*; Blazina, "Italo Calvino"; Bucciantini, *Italo Calvino*.

22 The full title in Italian is, "Cybernetics and Ghosts (Literature as a combinatorial practice)."

23 Shannon and Weaver, *Mathematical Theory*, 109.

24 Calvino, "Cybernetics and Ghosts," 11.

or change "personality" with each work it composes. Writers, as they have always been up to now, are already writing machines; or at least they are when things are going well. What Romantic terminology called genius or talent or inspiration or intuition is nothing other than finding the right road empirically, following one's nose, taking short cuts, whereas the machine would follow a systematic and conscientious route while being extremely rapid and multiple at the same time.[25]

Anticipating a problem that only second-order cybernetics and systems theory would beginstart to address, what Calvino asked is actually asking here is: "Hhow do consciousness and communication relate? Is literature a fact of consciousness or one of communication?" Clearly, in his study, Calvino assumes the cultural, logical, and even technological nature of the "I" as an effect of discourse. And yet, he highlights the gap between the self-assertion of the "I" and its non-coincidence with itself, displacing onto the act of reading and onto "the eye of the reader" the decisive ground for the production of meaning. "Once we have dismantled and reassembled the process of literary composition," he writes, "the decisive moment of *literary life* will be that of reading."[26] In Calvino's cybernetic vision, reading does not only activate the potentialities of a given textual artifact, but also carries the circular logic of cybernetic systems that actualize meaning in the medium of language. That is why, in Calvino's view, machine-generated literature will continue to be "a place of privilege" within human consciousness, because it is "a way of exercising the potentialities contained in the system of signs belonging to all societies at all times. The work will continue to be born, to be judged, to be destroyed or constantly renewed on contact with the eye of the reader."[27] Reading, in thisway, is the cognitive function that connects and reconnects the literary work in each contingent actualization to the open and indeterminable reservoir of sensuous, incarnated meaning that coincides with the total possibilities of communication. It is the fundamental form of interaction integrating the literary work into society and to individual readers through a network of feedback loops connecting processes, objects, and systems of consciousness and communication.

25 Ibid., 13.
26 Ibid. My italics.
27 Ibid., 14.

We can now better understand Calvino's optimism toward the vanishing of the figure of the author, "that personage to whom we persist in attributing functions that do not belong to him."[28] He addresses the author as the "exhibitor of his own soul in the permanent Exhibition of Souls, . . . the exploiter of sensory and interpretive organs more receptive than the average. . . . That anachronistic personage, the bearer of messages, the director of consciences, the giver of lectures to cultural bodies."[29] Thus framed, the dispersion of the author does not only not appear as a tragic loss, but rather a positive asset, as it inaugurates a self-conscious paradigm shift in western aesthetics, opening its formulations to more undetermined cooperative practices among the elements of the cybernetic circuit.The British artist Roy Ascott theorized (and practiced) the relation between cybernetics and aesthetics along similar lines to Calvino's own inquiry.[30] As Edward Shanken has argued, Ascott noted in retrospect "that the 'recognition that art was located in an interactive system rather than residing in a material object . . . provid[ed] a discipline as central to an art of interactivity as anatomy and perspective had been to the renaissance vision.'"[31]

But what is an art of interactivity? In the apt formulation of Luis Arata, it is one that "favors multiple points of view that can coexist even if they appear mutually exclusive; it celebrates the creative value of play; it is a catalyst for emergence; and it tends to be ultimately pragmatic."[32] In other words, it is a mode of production, a perspective and a methodology for navigating the hyper-complex environment in which humans coexist with living and nonliving systems and heterogeneous materials and discourses in flows of communication. An art of interactivity can be described, with cybernetician Gordon Pask, as an art capable of generating "an aesthetically potent environment," which "encourages the hearer or viewer to explore it,

28 Ibid.

29 Ibid.

30 Shanken reports that Ascott claimed precedence as the artist responsible for first introducing cybernetic theory into art education and for having disseminated the concept of a cybernetic vision in the UK. See Shanken, "Cybernetics and Art," 259.

31 The letter is quoted in Shanken, "Cybernetics and Art." Usselmann, in "The Dilemma of Media Art," reports a letter written by Ascott to Ealins in which Ascott claims his pioneering role in disseminating cybernetic ideas in the UK art scene.

32 Arata, "Reflections on Interactivity," 219.

to learn about it, to form an hierarchy of concepts that refer to it; further, it guides his exploration: in a sense, it makes him participate in, or at any rate see himself reflected in, the environment."[33]

CYBERNETIC SERENDIPITIES

According to its curators, reviewers and cultural historians, the first comprehensive European exhibition entirely dedicated to the convergence of cybernetics and aesthetics, *Cybernetic Serendipity: The Computer and the Arts*, which opened in London at the Institute of Contemporary Arts on August 2, 1968, allowed viewers to experience what it meant to be in aesthetically potent environments. In the words of its curator, Jasia Reichardt, it was the first exhibition that attempted to demonstrate "all aspects of computer-aided creative activity: art, music, poetry, dance, sculpture, animation. The principal idea was to examine the role of cybernetics in contemporary arts."[34] The exhibition, an immense success attracting over 40,000 visitors across social classes and cultural zones, was organized around three main sections: the first dedicated to computer-generated and interactive graphics design, films, music and poetry; the second, to "cybernetic devices as works of art, cybernetic environments, remote control robots and painting machines"[35]; and the third, to machines demonstrating the use of robots, automation, and to the history of cybernetics. The exhibition included robots, poetry, music and painting machines, as well as all sorts of works emergent from the convergence of computation, chance, and interactivity. In this respect, the curator's emphasis on the organizational and epistemological aspects of the exhibition should be taken seriously. As she wrote, the exhibition "was an intellectual exercise that became a spectacular exhibition in the summer of 1968."[36]

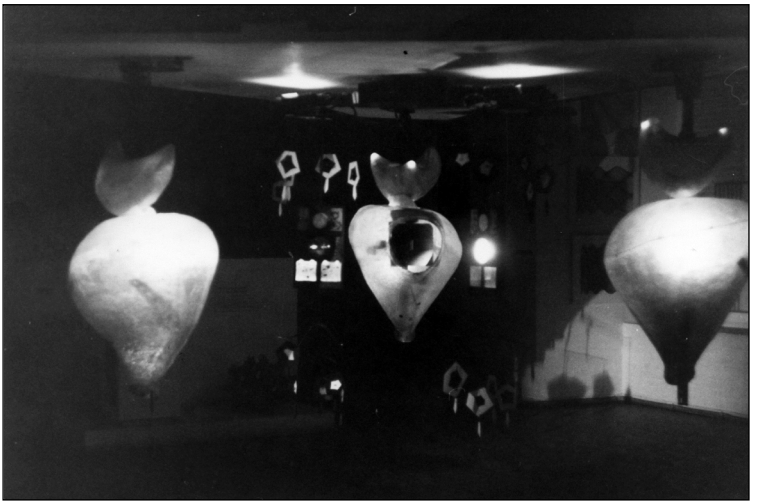
33 Pask, "Colloquy of Mobiles," 34; Pask was present at the exhibition with his interactive installation "The Colloquy of Mobiles" (see figure 1). See also Pask, "A comment, a case history and a plan."

34 Reichardt, Press release.

35 Reichardt, Cybernetic Serendipity, 6. For a retrospective assessment of that moment of cultural history, see also Reichardt, "In the Beginning." On the institutional history of the exhibition, see Usselmann, "The Dilemma of Media Art"; MacGregor, "Cybernetic Serendipity Revisited."

36 Reichardt, Press release.

Figure 1: Gordon Pask, Colloquy of Mobiles. *A version of the installation presented at Cybernetic Serendipity.*



Gordon Pask Archive at the Department of Contemporary History, University of Vienna

The list of contributing artists remains impressive today, and reveals that Gordon Pask may have been one of the lynchpins connecting cybernetics across the Atlantic (fig. 1). In any case, by 1968 the intellectual appeal of cybernetics had ramified across several disciplinary domains, and across cultural practices and cultural formations.[37] The list of contributors included Gordon Pask, Bruce Lacey, Wen Ying Tsai, James Seawright, Nam June Paik, Jean Tinguely, John Cage, Lowell Nesbitt, Eugenio Carmi, Nanni Balestrini, Bryon Gysin and many others. As the first great display of systems aesthetics, the exhibition was particularly keen to document and expose the engagement of computer-generated events with the material and infrastructural conditions of their occurrence. Similarly, the intense preoccupation

37 Further discussion of the aesthetic elaboration of Gordon Pask's cybernetics exceeds the purposes of this essay. However, it develops issues so far discussed, as can be inferred by a close reading of his essay "A Comment, a Case History and a Plan" in which he details the installation "A Colloquy of Mobiles." On Pask, see also Fernandez, "Aesthetically Potent Environments." See also Haque, "The Architectural Relevance of Gordon Pask."

with audience interactivity and involvement shed light on the epistemological and creative potential of cybernetics and on the radically democratic impulse inscribed in its systemic understanding of art as the manifestation and realization of a communicative circuit. Significantly, by transforming experience into information, the material, embodied quality of phenomenal experience did not vanish, but was reorganized, re-synthetized, and resignified in the communication continuum connecting users, equipment, and cultural conditions. In a 1968 essay published in *Artforum*, art historian Jack Burnham claimed that "A systems viewpoint is focused on the creation of stable, on-going relationships between organic and non-organic systems."[38] As Mitchell Whitelaw observes in a retrospective review of Cyberentic Serendipity in light of Burnham's incipient insights into systems art, "What emerges is a sense of a moment in history when artists, working with and without high technology, were engaged in a post-representational, post-object practice concerned with provoking an awareness of the real as an extensive, relational, dynamic network of processes."[39]

A similar concern for and interest inthe aesthetic potential of participatory social practices served to foreground several examples of avant-garde art in the 1960s: Cedric Price's planning for The Fun Palace (1964) and Potteries Thinkbelt (1967), which were projects for complex, interactive systems in which light, low-impact, highly adaptable and inexpensive building materials could be used to assemble, disassemble and reassemble space in relation to the needs, desires, and preferences of users, in a sort of real-life building block game.

Initiated in 1962 as a collaborative project between Architect Cedric Price and avant-garde, agit-prop theater director, Joan Littlewood, the Fun Palace project displayed the principles of constructivist epistemology and exemplified the performative quality of avant-garde theater. By collapsing the boundaries between performer, performance and audience, and by physically embodying transformation as a structural principle, the Fun Palace became paradigmatic of a constellation of concepts of space, place and art thoroughly dependent on the cybernetic definition of communication and its related concepts: feedback loop, information, function, process.[40] In his

38 Quoted in Whitelaw, 1. For an assessment of the evolution of cybernetic into digital aesthetics, see Gere, "New Media Art."
39 Whitelaw, 2.
40 Littlewood, "A Laboratory of Fun."

reconstruction of the Fun Palace project, Stanley Mathews writes that the collaboration with Littlewood worked as a frame for Price's revolutionary ideas. Littlewood wanted to create a theater of pure performativity, a space of "cultural bricolage" where people could experience directly the intense transformative power of drama as actors. Together, the two intellectuals developed the plan of the Fun Palace as a site of permanent education for the East London working classes and as "an interactive environment, a new kind of architecture capable of altering its form to accommodate the changing needs of the users."[41] Gordon Pask participated in the planning, the most ambitious aim of which was to create an improvisational architecture capable of "learning, anticipating, and adapting to the constantly evolving program. An array of sensors and inputs would provide real-time feedback on use and occupancy to computers which would allocate and alter spaces and resources according to projected needs."[42] After much planning and bureaucratic defeat, the project failed: in 1975 Price declared the Fun Palace project obsolete, but its legacy was reinvested by Price in the InterAction Center in Kentish Town (1976). The lasting influence of the Fun Palace is disseminated across late twentieth-century and contemporary architecture, testifying—I would argue—to the cultural and aesthetic success of the cybernetic paradigm and to the socially transformative impact of avant-garde ideas it contributed to nurturing.[43]

POTENT AESTHETIC ENVIRONMENTS AND THE COOPERATIVE PRODUCTION OF MEANING

That an entire zone of Cybernetic Serendipity was dedicated to proto-digital poetics and textual composition should be no surprise. Among the items on display in that section of the exhibition was Nanni Balestrini's "Tape Mark I," the first Italian example of experimental, computer-generated, combinatorial poetry, exhibited in Edwin Morgan's translation, and a detailed re-

41 Mathews, *From Agit Prop*.

42 Mathews, *From Agit Prop*. See also Mathews, "Fun Palace"; Lobsinger, "Cedric Price"; Lobsinger, "Cybernetic Theory"; Wilken, "Calculated Uncertainty."

43 Mathews, *From Agit Prop*. For an explanation and a comment on Cedric Price's groundbreaking ideas on the relation between social, technical, and aesthetic environments, and innovative architectural concepts, see Mathews, "Cedric Price."

production of its compositional flowchart. The poem is composed out of material from three citations from three separate texts: Michihiko Hachiya's *Hiroshima Diary*, Paul Goldwin's *The Mystery of the Elevator*, and Lao Tzu's *Tao Te Ching*. It was first performed on an IBM 7070 computing machine at the Electronic Center of the Lombard Provinces Savings Bank in Milan, in October 1961.[44] Series of sentence segments were assembled according to basic syntactical rules to connect into regular, four-beat lines, and the lines into regular stanzas. The sequences were then translated into an algorithm and fed into the machine (fig. 2).

The great variational potential of the machine, the selective operations of the poet, and the capacity of readers to impose order or project meaning on random combinations of words exemplify—in spite of and beyond Balestrini and Italo Calvino's many divergences on issues of aesthetics and literature—Calvino's claims about literature as the privileged manifestation of the coupling of communication and consciousness, and of reading as "a way of exercising the potentialities contained in the system of signs belonging to all societies at all times."[45]

In the early 1960s, avant-garde literature and arts were starting to self-consciously process the mutation of the relation between texts and readers/users by employing metafictional devices to signal interruptions, divergences, textual meanderings, and all sorts of interference in the narrative and in the reading process. The excess of data, information, and signs derived from the proliferation of technology for the recording, storing and sorting out of information operated as an ongoing source of interference in the communication system, and of disturbance in the reading process. This new configuration of the media system forced the novel to refashion itself into what Steven Connor sees as a template for the re-synchronization and

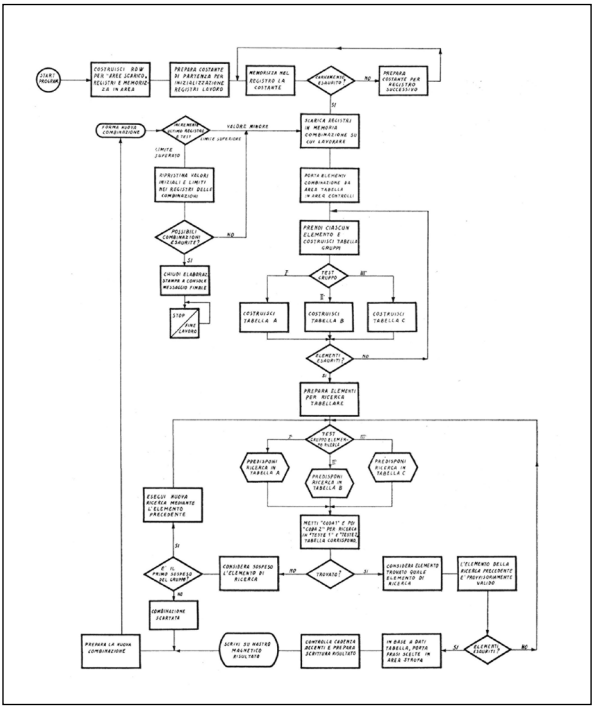
44 Balestrini, "Tape Mark I." A small, exemplary selection of poems was published in *Almanacco Letterario Bompiani 1962*, and ignited an intense discussion about the end of art, machine-poetry, the death of the author, etc. The 1962 issue, published in November 1961 and focused on the aesthetic and linguistic potential of computers, displayed a cover illustrated by Bruno Munari and several illustrations by members of Gruppo T. On May 15, 1962, Munari, who was then working for Olivetti whom also displayed installations in the celebrated cybernetic exhibition, "Arte Programmata" at the Olivetti Store in Milan Sergio Morando, ed., *Almanacco letterario Bompiani: 1962. Le applicazioni dei calcolatori alle scienze morali e alla letteratura*. (Milano: V. Bompiani & C., 1962).

45 Calvino, "Cybernetics and Ghosts," 14.

actualization of cognitive, communicative, and technical possibilities activated in the act of reading.[46]

Thomas Pynchon and Donald Barthelme recorded early the cybernetic moment and delivered a literature of interaction that assumed the transformation of reading practices within multiple communication circuits. Pynchon's short story "Entropy" (1960), for instance, traces the sentimental failure of a relationship as a communicative block and represents it as the

Figure 2: Nanni Balestrini, Algorithm for Tape Mark I



Nanni Balestrini, Algorithm for Tape Mark I, on display in the exhibition Cybernetic Serendipity. This reproduction is from Almanacco Letterario Bompiani 1962, Valentino Bompiani, Milano, 1962, 146. Courtesy of Nanni Balestrini.

46 Connor, "Postmodernism and Literature," 77–78.

disorganization of an entropic system comparable to a closed cybernetic circuit. In his first novel, *The Crying of Lot 49* (1966), the trope of entropy, a crucial concept in Shannon's Mathematical Theory of Communication and in Second Order cybernetics, provides the ground for questioning theories of communication, meaning production and actualization, and technologies of memory. The novel's protagonist, Oedipa Maas, is to recover her defunct ex-husband Pierce Inverarity's stamp collection. Because of its obscure iconography, the collection works as a reservoir of historical and geographical exoticism left behind Inverarity's "own annihilation." It dramatizes the relation between meaning and memory as a tension between disorder and order in a sequence of metaphoric permutations around the figures of meaning as specter and signs as spectacle. In the stamp collection, meaning is suggested as a possibility that requires the decoupling of sign from referent in order to allow Oedipa to track new patterns of visual consumption. As implied by the temporal and spatial exoticism foregrounding the "spectacular" windows of the stamps, the stamp collection is not different in kind from the serial production of Hollywood historical melodramas, or from a freeway view of San Narciso. In all cases, Oedipa is haunted by the intuition that all the figures she encounters might hold some retrievable pattern, some incorporated desire to communicate. But what message, if any, she cannot grasp, as she clearly states in her vista over San Narciso:

> The ordered swirl of houses and streets, from this angle, sprang at her now with the same, unexpected, astonishing clarity as the circuit card had. Though she knew less about radios than about Southern Californians, there were to both outward patterns a hieroglyphic sense of concealed meaning, of an intent to communicate. There'd seem no limit to what the printed circuit could have told her.[47]

In the metaphor of the hieroglyphic, the materiality of inscription and the abstraction of coding are collapsed and recast in a spatial figuration of outside and inside that, at first sight, seems to suggest that meaning is the result of a process of decoding, of bringing to the surface of things the hidden significance they encapsulate. However, what becomes clearer in the course of the narrative is that the problem of meaning Oedipa Maas has to face is not so much one of resolving equations among signs. She is not called on to

47 Pynchon, *Crying of Lot 49*, 14.

discover the meaning of inscriptions, how they are all equally meaningful and how they circulate and create order by pointing out to the outside, to a reference that exists already out there. On the contrary, she is to produce order and generate meaning by shattering inscriptions, signs, and words and by reorganizing their mutual relation. Indeed, she has to deconstruct the apparent unity between meaning/sign symbolized by inscriptions and reactivate the semantic potentialities repressed by their code.

Above and beyond the signs saturating the communicative space in which the protagonist moves, there seems to linger some "unexpected" possibility that threatens to disrupt the visible (or predictable) configuration of signs and patterns and to open the way to a new trail of meaningful associations. Such a possibility can be triggered only, in Oedipa's vocabulary, by a "revelation"; it is a pure virtuality always on the verge of happening, but never with certainty. At least so much is suggested, for example, in Oedipa's struggle to decode the Tristero system by way of an accumulation of revelations, but also, in earlier moments of the narrative, by her observation of the finale of the "Baby Igor" movie, when Oedipa describes the surprise of the unlikely ending as "one of those Hollywood distortions in probability."[48] This distortion would not terminate the "uproar from the TV set. She could imagine no end to it."[49] Instead, it would temporarily interrupt TV-generated noise by inserting a noise of a different order in the noisy randomness of media communication. It is only in this way that Oedipa can imagine possibilities for unprecedented, if contingent, articulations of new "patterns" in the signifying chain.

The semantic overlapping between linguistic and control science, or information, also encouraged a rethinking of the relation between technology, consciousness and knowledge as the contingent effect of the ongoing process of exchange of information between machine and living organism; or, to put it differently, as the ever changing result of communication between the central nervous system and the media. In his groundbreaking *Understanding Media: The Extension of Man* (1964), Marshall McLuhan offered a view of the media as an extension of human consciousness beyond the physiological limits of the body, conceptualizing them as an electric extension of the central nervous system. As he put it, "The personal and social

48 Ibid., 28.
49 Ibid., 24.

consequences of any medium—that is, of any extension of ourselves—result from the new scale that is introduced into our affairs by each extension of ourselves, or by any new technology."[50] This perspective allowed for the reintegration of every element caught in mental and communication processes (physiological, material, abstract, symbolic, affective) in a single circuit of signification stemming from flows of data. At the same time, it also emphasized the immanent, systemic, and technological substratum of human mental processes and linguistic practices, thus downplaying the explanatory force of anthropocentric theories of consciousness and subjectivity.

The writer who best incorporates Marshall McLuhan's theories about the extension and externalization of consciousness as a technological organization of data is perhaps William Burroughs, whose work foregrounded both the language of information and communication theory and the development of an anti-aesthetics of reception. By casting noise as proper to communication, irreducible to meaning, and unresolved by the signal to noise ratio of information theory, Burroughs's poetics of the 1960s—especially his so-called cut-up trilogy, *The Soft Machine* (1961), *The Ticket That Exploded* (1962), and *Nova Express* (1964)—shows the relation of noise to communication and meaning akin to the discourse of information, which conceptualizes it as the emergence of "order out of noise". But it is especially his famous definition of language as a virus feeding on human life to replicate itself that can be best understood as an embodiment and an aesthetic manifestation of the continuity between flows of information and the materiality of the body implied in McLuhan's own definition of the electric body. For, in Burroughs's view, the carriers of viral attacks are not specific kinds of code, such as the alphabetic code or human language, but coding itself as a sheer possibility—as information. It is coding as the potential for communication that extends beyond language to all communicative supports, gets manifested as the control of information and as the manipulation of codes, is maximized by the mass media, and becomes coextensive with human consciousness. In Burroughs's world, if coding is viral, communication is totalitarian because it imposes its own forms and patterns of control on human consciousness, which is literally "spoken" by language. The only way out of this entropic condition is to develop strategies of defamiliarization that make the parasitical nature of language visible by

50 McLuhan, *Understanding Media*, 16.

producing noticeable counter-signals, disturbances, noise. Noise, through its presence and absence, produces intermittence of the signal that disturbs linearity and generates uncertainty and oscillation, thus creating the conditions for the emergence of new hermeneutic possibilities.

By resisting rhetorical conventions, grammar, and syntax, it becomes possible to conceive of the liberation of individuals from the tyranny of preestablished meanings and to imagine a poetics of decomposition that does not aim at recreating new, well-ordered objects or well-organized, linear narratives. On the contrary, this poetics leaves around visual and sonic leftovers, statics, word-objects, all viral material that cannot be recontained in conventional narrative objects, but can only be reused by receptors or readers. Cut-ups and fold-ins are the key recombinant strategies devised by Burroughs to generate a guerrilla warfare aimed at maximizing semantic disturbances, noise, statics in the system. Noise interrupts a sedimented or unidirectional system of relations by disrupting the position of elements within a cybernetic circuit and by recursively generating negative feedback. Noise in the novels is produced by the breaking down of the grammatical, syntactical, rhetorical, and semantic elements of communication with other elements of communication.

As we have seen in the other instances of cybernetic aesthetics discussed so far, the adoption of a systemic understanding of communication implies that meaning always emerges as an effect of the feedback-looping of information among the elements of the cybernetic circuit. Thus, the role of the user, the viewer, or the reader, becomes crucial to the activation of processes of signification, because it works as the mediator between aesthetic systems and the open environment in which they are situated. This observation allows us to conclude by reconnecting writers as dissimilar as Calvino and Burroughs on the terrain of the mediation between what Calvino called "the eye of the reader" and "an expanding universe." Although their poetics are immensely different, with Calvino's universe expanding into the totality of all signs of all time, and Burroughs's universe contracting into the radical decomposition of language as noise, both authors insist on the value of the unfamiliar, the mechanical, the nonhuman element of the cybernetic circuit as a means to training perception in order to open many unexpected venues of awareness, and to keep open the "eye of the reader" toward the potentially of an expanding universe.

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