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EDITED BY JOHANNA GOSSE AND TIMOTHY STOTT
FOREWORD BY JUDITH RODENBECK

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Foreword

Scratch the surface of postwar Western cultural production and you'll find, just a few layers down, systems thinking. Those aspects of *techne* that are embodied in the technocratic projects or communications devices that make up the most obvious referents have dominated discussion, but a newly invigorated discourse has returned attention to the complex phenomenologies of flow and feedback, of social dynamics recrafted, of emergent ecologies—of *poiesis*—that make up cultural complexity.

Doing history—that surface-scratching—more often than not has rested precisely there, at the surface as a technical exercise, its process held in check by intellectual filiation and ideological prescription, atavistic loyalties and ambitions, carefully bounded and bracketed discursive territories. But thinking about art in terms of systems requires we think of art as not just a formal, reflective, or ideological object—not simply as an object (or "object") emerging from an air-locked internal discourse or a tidy confirmation of some truism about its cultural moment or the fulfillment in allegorical form of a carefully crafted role in some grand totalizing theory. For it is never "simply" any one of those things.

For the historian of culture, stepping away from the prescriptions of grand narrative can mean going with the gut or the hunch, allowing open-ended exploration in the blind field rather than settling for closed sets generating confirmatory hypotheses: dwelling in the negative. In the past decade, a network of historians, artists, and cultural critics has gradually coalesced, with remarkable creative and collective energy, through a series of dialogues, exchanges, panels, and mutual discoveries. What is emerging is a new history of recent art that is radically transdisciplinary yet materially precise. This volume, *Nervous Systems*, presents a vital set of living core samples.

The systems approaches demonstrated here ask us to think in terms of flows and nodes, of dynamically linked discourses, materialities, persons, and locales, to grapple with and dwell in process—and to understand process itself as fully embedded in its environment. A systems approach demonstrates that

the feedback loops of individual works and projects are part of much larger historical and social dynamics—integral to the ecologies, if you will, of *culture* as a verb.

Judith Rodenbeck
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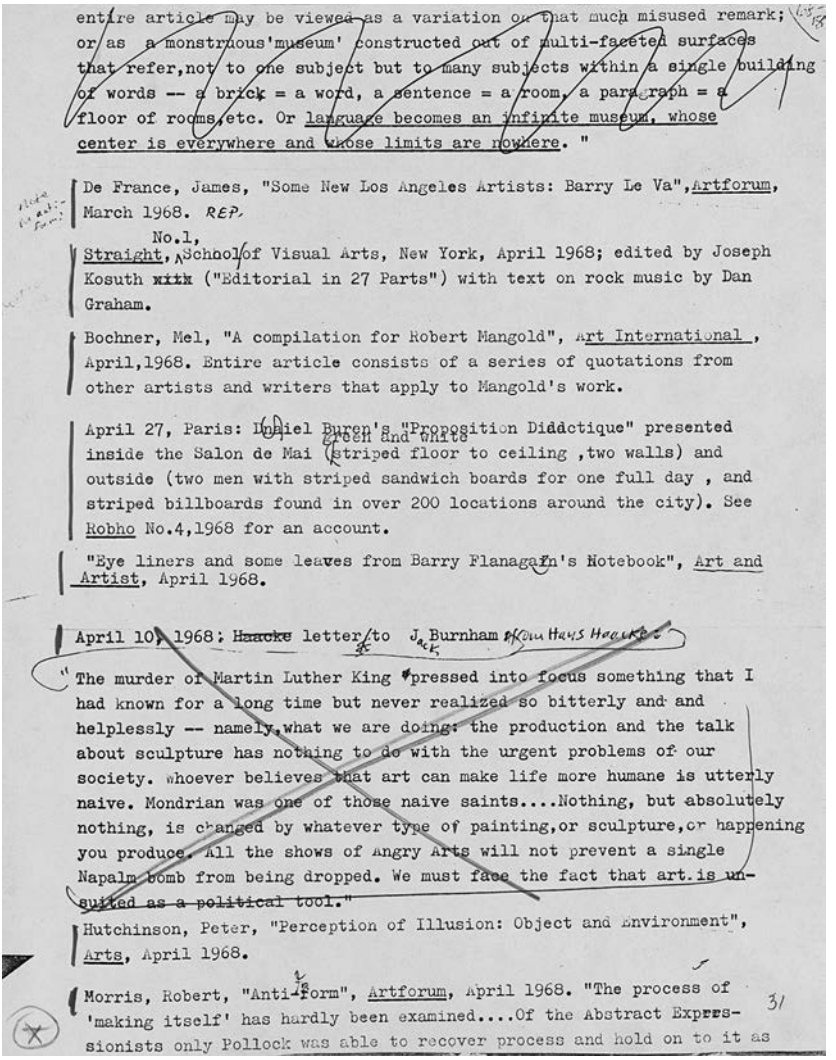
Sixty Years of Systems Art

JOHANNA GOSSE AND TIMOTHY STOTT

The murder of Martin Luther King pressed into focus something that I had known for a long time but never realized so bitterly and and [*sic*] helplessly—namely, what we are doing: the production and the talk about sculpture has nothing to do with the urgent problems of our society. Whoever believes that art can make life more human is utterly naïve. Mondrian was one of those naïve saints. . . . Nothing, but absolutely nothing, is changed by whatever type of painting, or sculpture, or happening you produce. All the shows of Angry Arts will not prevent a single Napalm bomb from being dropped. We must face the fact that art is unsuited as a political tool. —Hans Haacke, reproduced in Lucy Lippard, manuscript for *Six Years*

In an original typewritten draft of her book *Six Years: The Dematerialization of the Art Object from 1966–1972*, Lucy Lippard includes a transcribed passage from a letter written by the artist Hans Haacke to the artist, critic, and theorist Jack Burnham (figure I.1). Dated April 10, 1968, and sandwiched between two unannotated citations in the book's "1968" section, the letter conveys Haacke's pessimism and despair in the wake of King's assassination less than a week earlier, on April 4. The targets of Haacke's frustration are many. He dismisses the previous generation of modernists like Piet Mondrian as naïve utopians but is equally disappointed with contemporary activist efforts


entire article may be viewed as a variation on that much misused remark; or as a monstrous 'museum' constructed out of multi-faceted surfaces that refer, not to one subject but to many subjects within a single building of words -- a brick = a word, a sentence = a room, a paragraph = a floor of rooms, etc. Or language becomes an infinite museum, whose center is everywhere and whose limits are nowhere. "

De France, James, "Some New Los Angeles Artists: Barry Le Va", Artforum, March 1968. REP.

No.1,
Straight, School of Visual Arts, New York, April 1968; edited by Joseph Kosuth xxxx ("Editorial in 27 Parts") with text on rock music by Dan Graham.

Bochner, Mel, "A compilation for Robert Mangold", Art International, April, 1968. Entire article consists of a series of quotations from other artists and writers that apply to Mangold's work.

April 27, Paris: Daniel Buren's "Proposition Didactique" presented inside the Salon de Mai (striped floor to ceiling, two walls) and outside (two men with striped sandwich boards for one full day, and striped billboards found in over 200 locations around the city). See Robho No.4, 1968 for an account.

"Eye liners and some leaves from Barry Flanagan's Notebook", Art and Artist, April 1968.

April 10, 1968; Haacke letter to J. Burnham

"The murder of Martin Luther King pressed into focus something that I had known for a long time but never realized so bitterly and and helplessly -- namely, what we are doing: the production and the talk about sculpture has nothing to do with the urgent problems of our society. Whoever believes that art can make life more humane is utterly naive. Mondrian was one of those naive saints....Nothing, but absolutely nothing, is changed by whatever type of painting, or sculpture, or happening you produce. All the shows of Angry Arts will not prevent a single Napalm bomb from being dropped. We must face the fact that art is unsuited as a political tool."

Hutchinson, Peter, "Perception of Illusion: Object and Environment", Arts, April 1968.

Morris, Robert, "Anti-form", Artforum, April 1968. "The process of 'making itself' has hardly been examined....Of the Abstract Expressionists only Pollock was able to recover process and hold on to it as

FIGURE 1.1. Lucy R. Lippard, manuscript page 68-18 from *Six Years: The Dematerialization of the Art Object from 1966–1972*, c. 1972. Lucy R. Lippard papers, 1930s–2007, Archives of American Art, Smithsonian Institution.

like the Angry Arts week, a festival of antiwar performances and exhibitions staged in early 1967. To Haacke, both approaches exemplify art's inadequacy in the face of "the urgent problems of our society," from the imperialist war in Vietnam to racism, political assassinations, and violent unrest at home.[1]

Haacke's bitter indictment of art's political impotence is a provocative artifact of its historical moment. Yet, in her typescript, Lippard crossed out this entire passage with green marker. Ultimately, the passage was not included in the published version of *Six Years*, which Lippard described as "a cross-reference book of information" on "vaguely designated areas" of contemporary art, including "minimal, anti-form, systems, earth, or process art, occurring now in the Americas, Europe, England, Australia, and Asia (with occasional political overtones)."[2] This omitted excerpt then featured in a 1975 essay by Burnham, "Steps in the Formulation of Real-Time Political Art," to illuminate Haacke's role in cofounding the Art Workers' Coalition in 1969 and his subsequent turn to institutional critique, which extended his interest in social systems and generated some of the most confrontationally political moments in postwar art history.[3] The recurrence of this passage in both the literature on Haacke and within Lippard's canonical examination of post-1960s art prompts a reconsideration of the role that politics—and more specifically, political frustration—played in debates around the intersection of art and systems, a major theme in *Six Years* and in Haacke and Burnham's intellectual exchanges during this same period.

A few months after he received Haacke's letter, Burnham published an essay in the September 1968 issue of *Artforum* in which he declared: "A 'systems esthetic' will become the dominant approach to a maze of socio-technical conditions rooted only in the present."[4] To most readers, this invocation of "the present" would not have been interpreted as an abstract phenomenological condition, akin to the "presentness" famously described by Michael Fried in "Art and Objecthood," the landmark critique of minimalism published in *Artforum* the previous year. Rather, to speak of "the present" as a "maze of conditions" in the fall of 1968 would immediately gesture toward the heightened sense of urgency, tension, and uncertainty that attended the fraught sociopolitical atmosphere of the moment. The year 1968 was a political watershed punctuated by protests, sit-ins, uprisings, riots, high-profile assassinations, government surveillance, and violent repression, events animated in no small part by the escalating US war in Vietnam, which signaled a breaking point in the Cold War era's so-called culture of consensus. To many, 1968 also signified the beginning of the end of the 1960s, at once the climactic

culmination and unsatisfying conclusion to a decade marked by dramatic cultural and political upheaval.

Just as Burnham's invocation of "the present" requires historical contextualization, so, too, does his use of the term "systems." In 1968, this was less likely to prompt considerations of aesthetics than to conjure the ominous figure of "the system," a popular euphemism for the "establishment" and its representative institutions, such as government, organized religion, the military-industrial complex, the mass media, corporate America, and mainstream Cold War ideology more broadly. As an umbrella category, "the system" offers a shorthand for mutually reinforcing structures of domination, including capitalism, heteropatriarchy, racism, militarism, surveillance, and imperialism. While "the system" is often personified by "the man," or, per bestselling corporate journalist William H. Whyte, the "organization man,"[5] it is also feminized insofar as it functions as a metonymic reference to coercive, intrusive, emasculating bureaucracies and social obligations that infringe on individual (and thus artistic) freedom—hence, the "nanny state," or, in the lyrical imaginary of a leading voice of the 1960s counterculture, Bob Dylan, "Maggie's Farm" (1965). Whether one props up, defends, supports, resists, critiques, drops out of, or smashes "the system," it is impossible, today as much as in 1968, to ignore or avoid its reach.

Importantly, rather than the hegemonic thrust of "the system," Burnham uses the plural, "systems," which suggests the distribution and dispersal of power across multiple arenas rather than its consolidation and coordination into a single monolithic body. As the art historian Pamela M. Lee notes, framing social issues in terms of "systems" allowed 1960s artists (and members of the counterculture more broadly) to generate "a more ecological perspective on the world at large: the sense of interdependence or mutual causation organizing operations of both the social and biological."[6] Furthermore, by observing the ways in which various systems connect and overlap, artists who engage in systems thinking reveal "how one system exists by dint of the other it critiques or excludes, in an ongoing process of mutual differentiation."[7] Similarly, James Nisbet shows how the spread of systems thinking among artists in the 1960s and 1970s transformed their art from "artificially confined environments and simplified allegories of the planet" to art that engaged the complexities and entanglements of "global ecologies of information and power."[8] This ecological perspective provided artists and the counterculture more broadly with an opportunity to observe, analyze and then transform systems. For example, during the well-publicized 1968 protests over the curriculum at Hornsey College of Art and Guildford School

of Art in London, demands to "smash the system" functioned as calls for institutional reform. Hornsey students proposed to replace the closed, "linear system" of education with a "network system," based on open and nonspecialized pedagogy.[9] These key distinctions—between open and closed, linear and networked systems—help clarify the stakes behind Burnham's prescription, which called on artists to turn toward the real world rather than distance themselves from it. A direct disavowal of modernist autonomy's demand for distance and separation, Burnham's systems aesthetics demanded that artists adopt the logic of, and even directly infiltrate, existing systems to transform them from within. In this, Burnham participated in the emergence of a late 1960s "systems counterculture," one which Bruce Clarke has described as an interdisciplinary contingent that sought to "detoxify the notion of 'system' of its military, industrial, and corporate connotations of command and control and to redeploy it in the pursuit of holistic ideals and ecological values."[10]

The second-order cybernetics of anthropologists Gregory Bateson and Margaret Mead, and of physicist Heinz von Foerster, offered an integrative model of planetary ecology along with an epistemology of consciousness that was ripe for psychiatric and, at times, hallucinogenic experimentation. The experimental and speculative potential of cybernetics evolved into numerous "weird" interpretations of open, nonlinear, and observer-dependent systems. Weird systems became a central feature of the counterculture and various subcultures—folk, outsider, mystical, spiritualist, underground, new age, and cult. Neurophysiologist John Lilly, for example, expanded cybernetic theories of communication to nonhuman minds such as dolphins in his *The Mind of the Dolphin* (1967), then to cosmic beings in *The Scientist: A Novel Autobiography* (1978).[11] From the 1950s on, Stafford Beer was the first to apply cybernetics to the study of firms, production lines, and management structures, and by 1972, he had introduced a cybernetic model of organization called the viable system model.[12] Alongside his more straitlaced management cybernetics, however, Beer also developed an animist understanding of nature and an interest in tantrism, which led him in 1974 to retire to a frugal life in a remote stone cottage near Lampeter in Wales. Beer's evolution connects cybernetics to the many other weird systems aesthetics, imaginary taxonomies, and personal cosmologies that were invented by reclusive outsider artists, underground iconoclasts, and schools-of-one, from Henry Darger's Vivian Girls, James Hampton's assemblages, and Simon Rodia's *Watts Towers* to the queer systems of Jack Smith's loft performances and Ray Johnson's mail art network, the New York Correspondence School. In turn, systems aesthetics allows us to better understand practices that are often reductively

understood in terms of individual eccentricity; for instance, as Gloria Sutton has suggested, Yayoi Kusama's patterned, mirrored, immersive interiors make sense not as the result of some personal pathology but as explorations of the new understanding of cognition and networked intelligence provided by cybernetics.[13]

Thus, the migration of systems scientists into nonacademic, subcultural, mystical, or just weird applications of systems, and the systems thinking demonstrated by art-world outliers and outsiders, mutually demonstrate the heuristic utility of "nervous systems" as an interdisciplinary interpretive category. Yet, divorced from broader cultural and historical contexts and situated strictly within the disciplines of art history and criticism, the sociopolitical valence of systems aesthetics, as well as its weirder dimensions, tends to get lost in translation. More reductively, artistic engagement with systems is often reduced to a passing technophilic fascination with cybernetic feedback and computing, which sparked a temporary fashion for "art and technology" collaboration and residencies across powerful industries, from public broadcasting to research universities to major corporations like Bell Labs and RAND. As a result, systems aesthetics is often associated with an uncritical stance toward the Cold War corporate military-industrial complex rather than with artistic efforts to undermine it. We argue that such depoliticized interpretations run afoul of Burnham's use of the compound adjective "sociotechnical" in his original formulation, by disproportionally privileging technical research to the detriment of the "social." Furthermore, we contend that this technocratic bias has obscured the diverse range of artistic practices that has utilized systems thinking to critique and transform the perceived political impotence of art in the wake of widespread social tension and uncertainty post-1968. Such practices are the focus of this volume.

The aim of this collection is to reassess the theorization and implementation of systems aesthetics by artists and critics since the 1960s and to demonstrate the continuing relevance of systems aesthetics within contemporary art. Our title, *Nervous Systems*, builds on the integrative spirit of early cybernetics and systems thinking, especially its attempts to forge an analytical and explanatory framework applicable across organic and nonorganic systems. It also expands on the transformed understanding of objects, bodies, and structures brought about by postwar information theory, systems theory, and cybernetics. No longer isolated, objects, bodies, and structures became communicative and mutable systems in networked complexes with other systems. This transformed art, design, and architecture into extended nervous systems. For example, already in 1957 the architect and industrial designer

George Nelson observed how "building is becoming less of a traditional art and more an integrated, sheltered network of 'nervous systems' for communication."[14] The "nervous systems" studied in this collection, however, expand beyond the informational to the affective, economic, and atmospheric, revealing, for example, the political valence of weather in the work of Haacke, the organization of affect in participatory art installations, and the mapping of global logistics infrastructures. Referring to these systems as "nervous" points to their informational character but also the cultural anxieties and social tensions that fueled these projects, as well as their implicit response to what Luke Skrebowski—following Mel Ramsden of the British conceptual art group Art & Language—frames as modernism's "nervous breakdown." This breakdown, Skrebowski argues, is exemplified by Haacke's dispirited diagnosis of art's predicament in 1968 and his dismissal of modernist utopianism.[15] Framed less as a breakdown than a turn outward toward systems, this nervousness, we argue, forms a line of continuity, not just between modern and contemporary art, but from the Cold War winter to the scorched Anthropocene summer.[16] Systems aesthetics, then as now, enables artists to respond to these political, cultural, and environmental anxieties, offering an integrative, intermedial, cross-disciplinary methodology that retools art for sociopolitical purposes.

To date, much of the art historical discourse on systems aesthetics traces how early computer art, telematics, and art and technology experimentation anticipated the emergence of contemporary digital and new media art. For instance, art historian Edward Shanken aims to "suture the wound" of art history's persistent omission of "science, technology, and new media from mainstream contemporary art discourses."[17] Shanken's intervention, and especially his recovery of Burnham's criticism from art historical obscurity, was an indispensable contribution that added key dimensions to the story of systems aesthetics and its legacy in the contemporary.[18] And yet, the recuperative tenor of this and parallel efforts often run the risk of reinscribing traditional medium-specific separations between new media, telematics, conceptual art, video, performance, and so forth, distinctions that the artists and artworks in question deliberately sought to destabilize. In this regard, the "wounded" relation between so-called mainstream contemporary art and new media art persist, we contend, due to the historical emphasis on technology that characterizes discourses on the latter.

The art historian Judith Rodenbeck clarifies the stakes for recovering and expanding the art historical scope of systems aesthetics beyond artworks that utilize advanced technologies:

> Contemporary recuperation of systems theory and cybernetics has provided rich ground for the analysis of some of the most vital art and criticism of the 1960s. But this renewed interest has generally been arrived at recursively, that is, through thinking about systems-dependent technological means such as television, computers, and the networks that sustain them, and doing so from a position structured by ubiquitous computing. If much of this new digital-era scholarship privileges concept and machine, it just as often sidesteps the messier realms of feeling, sensation, and meat-space.[19]

Rodenbeck's insight into the neglected, "messier" dimensions of systems aesthetics is a common thread in the essays gathered in this collection, which highlight the eclectic, pluralistic, and idiosyncratic dimensions of artistic engagement with systems. Belonging not so much to institutions or an established movement than to outliers and radicals, we argue that this critical paradigm was and is buttressed by experimental, amateur appropriations, (mis)applications of advanced technologies and, at times, productive (mis)readings of systems theory rather than expert applications of the latest technoscientific research. In this sense, the project of this collection is less historiographical or teleological than genealogical, in the spirit of Michel Foucault's influential formulation, by demonstrating how artists have adopted and elaborated systems aesthetics "in piecemeal fashion from alien forms," as they sought to match their political concerns with the productive, distributive, and communicational systems available to them at the time.[20]

Nervous Systems historically expands systems aesthetics beyond the politically charged moment of the late 1960s to bridge two generations of art and systems thinking—the postwar and the contemporary. In doing so, it unravels some of the more reductive, technodeterminist connotations of this discourse. Building on a growing body of criticism and scholarship that places systems-based thinking and methodologies at the center of art historical and theoretical inquiry, the essays collected here propose an alternative genealogy by raising questions related to race, gender, class, sexuality, labor, embodiment, affect, subjectivity, ecology, extraction, and colonialism (all prominent concerns within the scholarship of contemporary art) and by linking them to discussions of systems.[21] Yet, rather than subsume social and political concerns under the master discourse of "systems aesthetics," the essays contained here consider how the sociopolitical was always already present, if latent or obliquely articulated, in systems art of the late 1960s and in subsequent systems-based approaches in contemporary art. Moving beyond the

idea of systems art as a coherent, periodized movement, our contributors show how the intersection of artistic practice and systems thinking forged an evolving research methodology that prioritizes process over product, relations over autonomy, and which, in the words of Mitchell Whitelaw, signals a "turn outward" to the world.[22] More recent articulations of systems aesthetics by contemporary artists continue this turn outward, by building on and adapting the social and political commitments of an earlier generation of systems artists.

Here, we must add a proviso to our own "turn outward" in expanding a systems art genealogy, which is far from complete but is instead offered as a first step. In our attempt to disentangle systems art from the technophilic biases of most of its chroniclers to date, we have neglected some of its weirder and minoritarian practitioners, as noted above. We and our contributors also face an archive, extant discourse, and set of primary literatures that remain predominantly white and male, especially for the first generation of systems artists. As such, the turn outward remains a work in progress. For instance, if we turn our attention to Afrofuturism, a field of practice committed to multiple forms of spatiotemporal, perceptual, and archival expansion, we find an exemplar in Black Audio Film Collective's 1995 film essay *The Last Angel of History*. The director John Akomfrah and scriptwriter Edward George took inspiration from John Corbett's 1993 essay "Brothers from Another Planet," which unearths the origins of Afrofuturism in Sun Ra and the Arkestra, Lee "Scratch" Perry's studio the Black Ark, and George Clinton's music collective Parliament-Funkadelic. "Each (group) is working with a shared set of mythological images and icons such as space iconography, the idea of extraterrestriality and the idea of space exploration," writes Corbett.[23] Building from Corbett's account, Kodwo Eshun notes how, from 1997 through to 2003, he and other members of the Cybernetic Culture Research Unit in Warwick University's Philosophy Department sought to radicalize Donna Haraway's "Cyborg Manifesto" in order to wrestle alternative technofutures from the "corporate utopias that make the future safe for industry," including cyberculture, science fiction, and other capitalist media.[24]

Afrofuturist formations involve writers, artists, filmmakers, and musicians of the African diaspora who have appropriated and transformed those same cybercultures—reworking their gendered imaginaries, colonial logics, technological fetishes, and speculative fictions—that were central to many of the systems artists gathered in this collection. Insofar as Afrofuturism is a critical discourse that remaps the relationships between art and other systems—colonial, musical, economic, planetary—and seeks to uncouple futures from

the technologies of prediction and control, any expanded conceptualization of systems aesthetics must account for it. Like many of the systems artists discussed in this collection, Afrofuturism too opens the discourse of modern science to speculative fiction that is feminist, queer, decolonial, and antiracist.[25] If, at first glance, artists like Sun Ra and Akomfrah might seem remote from Burnham and Haacke, one of the purposes of this collection is not to reassert the centrality of the latter but, rather, to insist on the inclusion and legibility of the former within a more capacious and politically attuned reconceptualization of systems aesthetics in contemporary art. We insist that expanding this genealogy is not merely a symbolic show of inclusivity. It yields hermeneutic value, for example, by illuminating the connections between the Afrofuturism of *The Last Angel of History* and the posthumanism of Akomfrah's more recent moving-image work *Vertigo Sea* (2015). Fusing the sublime aesthetics of nature documentary with the ethnographic gaze of found and archival footage, this multichannel installation renders visible the complex historical interconnections between the transatlantic slave trade, European imperialism, migration and refugees, the whaling industry and the ecology of oceans, and the history of cinema itself, analyzing them not as independent or isolated histories and phenomena but as co-constitutive, mutually entwined, and intrinsically social *systems*.[26]

Systems Genealogies

As we attempt to show here, an expanded genealogy of systems aesthetics requires, first and foremost, that the concept be uncoupled from Burnham, who was by no means the first or the only thinker of his day to adopt systems as a critical lens on cultural production. Two years prior to Burnham's *Artforum* essay, in the fall of 1966, the British critic and curator Lawrence Alloway curated *Systemic Painting* at the Solomon R. Guggenheim Museum in New York. The exhibition reframed the work of the painters Jo Baer, Frank Stella, Kenneth Noland, and Agnes Martin, among others, as *systemic*, thus displacing the label of "post-painterly abstraction" that had been applied by Clement Greenberg.[27] Most importantly for Alloway, the concept of systemic painting suggested that artworks operating as systems could develop from "human proposals" rather than from absolute, fundamental aesthetic principles. Systemic order, Alloway insisted, could be "as human as a splash of paint."[28]

Such was the popularity of systems thinking in the visual arts at the time that in a review of *Systemic Painting* Dore Ashton criticized Alloway's use of "systemic," which to her was no more than a marketing buzzword, a "brand

name" to grab the attention of the museum-going public.[29] Undeterred, Alloway extended his systems thinking in an essay titled "Network: The Art World Described as a System," published in the September 1972 issue of *Artforum*, four years after Burnham's "Systems Esthetics" appeared. Alloway's essay drew from systems theory and cybernetics to describe how the social organization of the art world had changed due to rapidly expanding information technologies and distribution networks. His diagnosis of the postwar art world as a networked and multimodal but closed system anticipated the ways that the contemporary art world has adapted to meet the demands of global digital capitalism. Thus, whereas Burnham's call for artists to respond to "socio-technical conditions rooted only in the present" provides a foundation for this collection's inquiry, Alloway's analysis shows how the contemporary art world operates as a system among systems. Hence, our third section, "The Contemporary Art World Described as a System," which riffs on the title of Alloway's 1972 essay. In addition to performing genealogical work, the chapters contained in this final section (by Halsall, Boetzkes, Cohen, and Hamilton Faris) collectively identify a systems turn within post-1990s global contemporary art, as it grapples with increasingly networked conditions of artistic production under globalization.

Yet, more than two decades before Alloway and Burnham adopted the rhetoric and logic of systems to analyze the art of their moment, cyberneticians and systems theorists were developing a general theory that would be applicable across the sciences and the humanities. In March 1946, the Josiah Macy Jr. Foundation began a series of conferences to bring mathematicians and engineers into discussion with anthropologists and psychologists. The subject of the first meeting was circular causal systems, followed by a second and third later in the year on "Teleological Mechanisms in Society" and "Feedback Mechanisms and Circular Causal Systems in Biology and Society," respectively. These Macy conferences were largely responsible for the consolidation of cybernetics as a discipline and for its expansion to sociology and anthropology. In subsequent decades, cybernetics would extend from literature to architecture to art and design education.[30] Before describing in more detail their significance within art history, let us pause and provide some background on the development of these discourses.

Cybernetics is a science of organization for organic and inorganic systems that rose to prominence in the immediate postwar years. Norbert Wiener coined the term in his 1948 book *Cybernetics: Or Control in the Animal and Machine*: "We have decided to call the entire field of control and communication theory, whether in the machine or in the animal, by the name Cybernetics,

which we form from the Greek κυβερνήτης or steersman."[31] Wiener's work from the 1940s and 1950s, alongside that of his contemporaries in cognate fields like information theory, falls under the heading of first-order cybernetics, with second-order cybernetics emerging later in the 1960s.[32] For first-order cybernetics, a system is linear and predictable, and it must be observed passively and objectively in order to be controlled or "steered." By contrast, second-order cybernetics understands that systems, far from being predictable, develop through nonlinear, recursive interactions between elements, which includes the observers of those systems. In sum, second-order cybernetics "stresses the recursive complexities of observation, mediation, and communication with regard to nonlinear and emergent systems."[33] A minor change in a system can thus have major consequences, and the future behavior of a system can be probable but not entirely predictable.

A further key development in systems thinking was the concept of "open systems," initially outlined by the Austrian biologist Ludwig von Bertalanffy. A decade prior to Wiener's theorization of cybernetics, von Bertalanffy theorized the "openness" of systems in terms of interdependence with the environment.[34] Before von Bertalanffy, systems theorists understood systems as closed, insofar as they reacted to changes in their environment but did not interact with them.[35] Von Bertalanffy demonstrated that the second law of thermodynamics, according to which all closed systems tend toward maximum entropy, did not adequately describe biological systems, which maintain their order and delay entropy by remaining open to their respective environments. In departing from the classical conception of systems as whole entities that preserve a closed organization, von Bertalanffy moved toward our current understanding of systems as complex, emergent, and in a state of what he calls "dynamic equilibrium" (*Fließgleichgewicht*), in which a system, open to its environment, continually changes its components in order to maintain its organization. In this view, only a general systems theory can account for this organizational model of complexity and change.[36] Von Bertalanffy's general systems theory provided a "general science of 'wholeness'" that studied isomorphisms across systems in order to integrate the otherwise disparate fields of biology, robotics, information theory, sociology, economics, and psychology.[37] This "new worldview of considerable impact" analyzed the world through wholes and interactions rather than discrete parts, and it provided tools for analyzing systems that are open, complex, dynamic, and unpredictable, and therefore difficult to manage and govern.[38]

Both cybernetics and general systems theory were influential on postwar artists who aimed to destabilize the ontology of the work of art, defined not

as a discrete object but as an integrated and dynamic complex of elements—semiotic, visual, graphic, discursive, mechanical, or affective—and acting in relation to other artworks and to its environment. Disseminated through reading groups, lecture programs, and art and design schools from the late 1950s on, a generation of emerging artists believed that open, complex systems could offer a corrective to a technocratic and automated postwar society that was largely controlled by what Peter Galison has called the "Manichean sciences" of operations research, game theory, and military-industrial applications of cybernetics.[39] In the late 1960s, cyberneticians began to argue that art uniquely offered holistic knowledge of systems. In 1967, Gregory Bateson argued that artists, by modeling and observing open systems, could redirect a purposive but limited analysis of the world toward a more holistic, "wiser" view of the "circuits of contingency" on which life depends.[40] Three years later, the architect Sim Van der Ryn, founder of the Farallones Institute, wrote that "the purpose of life is to attain the state of full participation again—the state of the whole. Man has lost the totality of being because culture destroys it. We have made art the system that recombines fragments because our lives are not art."[41] In a similar vein, the architect Christopher Alexander described systems in 1967 as "not a special kind of thing, but a special way of looking at a thing," a holistic model for thinking about relationships and codependencies between things.[42] In 1969, psychologist Michael Apter declared cybernetics to be "a development in science which holds out the promise of taking art seriously" and which carried the potential to blur "the traditional distinctions between the work of art and the system which creates the work of art, and between the work of art and the system which observes the work of art."[43]

Along with Lippard, Haacke, Burnham, and Alloway, numerous other artists and critics contributed to this critical mass of discourse on the relationship between art and systems from the late 1960s onward. For them, systems offered a modus operandi distinct from the prevailing discourses of postformalism, dematerialization, and postmodernism that were also highlighted in *Six Years*. For instance, Haacke wrote of the importance of thinking "in terms of systems" in an untitled statement for the catalog to the 1970 exhibition *Conceptual Art and Conceptual Aspects* at the New York Cultural Center, which reveals the strong influence of von Bertalanffy's general systems theory on his thought: "The working premise is to think in terms of systems; the production of systems, the interference with and the exposure of existing systems. Such an approach is concerned with the operational structure of organization, in which the transfer of information, energy and/or material

occurs. Systems can be physical, biological or social; they can be man-made, naturally existing, or a combination of any of the above."[44]

For his part, Burnham declared in his landmark 1968 essay: "We are now in transition from an *object-oriented* to a *systems-oriented culture*. Here change emanates, not from *things*, but from *the way things are done*."[45] In his book from that same year, *Beyond Modern Sculpture*, Burnham elaborated on this insight by arguing that artists had abandoned the "cultural obsession with the art object" in favor of a "systems consciousness," in turn signaling the decline of medium-specific paradigms for artistic production and critical evaluation that had dominated art discourse for centuries.[46] This "refocusing of aesthetic awareness . . . onto matter-energy information exchanges and away from the invention of solid artifacts," Burnham argues, prompted artists to look beyond the "skin of objects" to their systemic interactions and relations.[47] What is more, Burnham wrote, this "systems consciousness" transformed the status and ontology of the artist, who now considered "goals, boundary, structure, input, output, and related activity inside and outside the system," and who was, knowingly or not, a function of the "metaprograms" of the art world, itself framed, as Alloway later would, as a system.[48] In this sense, systems theory and cybernetics enabled artists to find analogies and isomorphisms between domains of social life, institutions, economies, and infrastructures that had previously been considered separate and distinct, freeing them to work not only with objects but to intervene directly into what the Brazilian conceptual artist Cildo Meireles called "the body of society."[49]

Art and systems thinking also converged in Great Britain during the late 1950s and 1960s, principally through the field of cybernetics. For example, the Independent Group's interest in information, telecommunications, and mass media led them to integrate various types of systems thinking. In 1955, for the cybernetician E. W. Meyer's address to the Independent Group (IG) at the Institute of Contemporary Arts, "Probability and Information Theory and Their Application to the Visual Arts," the artist John McHale made a first foray into information design. McHale recalled that having found an expert on cybernetics, his ideas would have to be explained to the IG through several diagrams on coding, information, and probability.[50] The previous year, McHale had already begun to make collages based on information processing, such as *Transistor* (1954), which reworked Claude Shannon's famous diagram from his "Mathematical Theory of Communication," published in 1948. Jacquelynn Baas describes *Transistor* as a "visual equivalent for the processing of information."[51] These works show McHale's interest in how data is

processed, ordered, and reconfigured through both electronic and organic systems.

A decade later, cybernetics would provide an account of art that privileged participation and testability over expression or affect.[52] In a two-part essay published in 1966 and 1967, the artist Roy Ascott noted that the interdisciplinary and integrative character of cybernetics allowed a "cybernetic vision in art" to extend beyond a mere set of technical procedures or devices to become a "fundamental attitude toward events and human relationships."[53] For Ascott, modern artists constructed "a field of behavior" into which spectators were drawn as participants.[54] Ascott's student Stephen Willats, who by the late 1960s had developed a quasi-ethnographic and collaborative art practice based on cybernetic principles, exemplifies this best. To capture the "reality" of life in inner-city social housing schemes and to challenge the bureaucratic planning and architecture that rendered residents inert, dependent, and incapable of critical consciousness, Willats developed models of nested, adaptive systems to celebrate the "richness and complexity" of residents' lives. Willats understood that any work of art (or sign or image) produced collaboratively by him and the residents was entangled within complex systems of communication, observation, self-organization, and control.

In the summer and fall of 1968, the ICA showed *Cybernetic Serendipity*, a seminal exhibition of computers, painting machines, and other interactive devices curated by Jasia Reichardt. In her 1971 book *The Computer in Art*, Reichardt noted that the concept of cybernetic feedback "has entered the world of happenings as well as various environmental constructions, where audience participation and reaction can alter the appearance and even the content of the work in due course." Reichardt further noted that artists had begun to produce works that had "no significant aesthetic value" but were "do-it-yourself platform[s] [with an] important sociological implication," because they organized a field of complex social behavior.[55]

So far, this genealogy of systems aesthetics has privileged a familiar cast of Anglo-American figures, from Lippard to Ascott to Reichardt. However, artists from a wide range of national and political contexts have adopted systems thinking to organize public participation in dynamic environments. As contributor Christine Filippone has convincingly argued, feminist artists of the 1960s and 1970s such as Martha Rosler, Carolee Schneemann, and Agnes Denes were early adopters and adapters of theories of open systems as a means of critiquing patriarchal Cold War cultural values.[56] Filippone's chapter in the current collection argues that prominent Argentinian performance collective Grupo

de artistas de vanguardia de Rosario (also known as the Rosario Group) used open systems as a "model for process-oriented, multisensory, collaborative works that not only engaged but infiltrated social and political contexts in the midst of dictatorship." Here, systems art was a "political-cultural action" aimed at radically dissolving "into the social." Argentina was in fact a central hub for postwar artists engaged in systems thinking, as evidenced by Centro de arte y comunicación, a group founded by Jorge Glusberg in 1968 in Buenos Aires, which used cybernetics to model and critique political oppression, most evident in the 1971 exhibition *Arte de sistemas* and in the "metabiotic" labyrinths of Luis Benedit.[57]

Two other key examples—the Russian arts group Dvizhenie and the Italian art movement Arte programmata—similarly reimagined the environment of art as a social space organized around interaction and exchange.[58] In 1967, Dvizhenie proposed the large-scale interactive and immersive *Cybertheatre*, a cybernetic environment that participants and programmed "cyber creatures" could modulate using light, movements, smoke, and gas. Lev Nusberg, the unofficial leader of Dvizhenie, described *Cybertheatre* as "one model of our man made world and the relationship between man and machine."[59] Arguing that Dvizhenie was the first Russian artist collective to adopt cybernetics, the art historian Margareta Tillberg details the group's plans for an *Artificial Bio Kinetic Environment* (1968), which, though strictly theoretical, imagined a fantasy future city attached to an artificial environment.[60] The artists envisaged participants' interactions with their surroundings as guiding the "management" of the city, by modifying the "plot of the game" in a continuous feedback loop.[61]

During the 1960s, Arte programmata explained its environments—composed of carefully chosen lights, colors, and simple wires—as organizational experiments. Organization, the group claimed, was "the necessary condition for all constructive engagement"[62] and went hand in hand with the new idea of the artist as "programmer" or systems planner, as described by member Bruno Munari: "In the works of programmed art, the fundamental elements . . . are in a free state or are arranged objectively in geometrically ordered systems so as to create the greatest number of combinations, often unpredictable in their mutations but all programmed in accordance with the system planned by the artist."[63]

The art historian Lindsay Caplan observes that Arte programmata did not consider its work hierarchical but rather as a flattened and reciprocal interaction between artists and participants.[64] Yet, by transforming artists into programmers, and therefore managers, of a field of social behaviors and

relations, Arte programmata's practice inevitably reproduced certain operational and reputational hierarchies.[65]

In the examples above, systems aesthetics enabled artists to engage spectators in "a field of behavior" and recast them as participants. In this sense, systems thinking is a rarely acknowledged antecedent to the concept of "relational aesthetics" and the broader "social turn" in contemporary art noted since the early 1990s. Coined by French curator Nicolas Bourriaud in 1995, the term *relational aesthetics* describes a set of artistic practices that adopt a direct, one-to-one relation to social conditions, composing and authoring the work of art with and through these relations rather than depicting them representationally or metaphorically. Bourriaud writes, "The possibility of a *relational* art (an art that takes as its theoretical horizon the sphere of human interactions and its social context, rather than the assertion of an autonomous and *private* symbolic space) is testimony to the radical upheaval in aesthetic, cultural and political objectives brought about by modern art."[66] For Bourriaud, these practices are political because they occupy a "territory" that brings social conditions and relations to the fore: "Art, by modeling social functions through the amplification of those tensions and contradictions that hallmark the world of art, has been consigned to the sphere of politics."[67] Though he does not deploy the rhetoric of systems, we maintain that the arguments and concepts put forth in *Relational Aesthetics* correspond closely to earlier theorizations of art as system, particularly by Burnham, Alloway, and Ascott. Without citing systems aesthetics, Bourriaud nevertheless reiterated its central terms and approach and, most importantly, diagnosed its ongoing elaboration within contemporary art.[68]

Bourriaud's formulation has prompted much debate among art historians and critics in the intervening decades, most notably in Claire Bishop's 2004 article "Antagonism and Relational Aesthetics," which charges that relational aesthetics valorizes socially engaged art without offering any evaluative criteria, aesthetic or political, with which to assess the significance and experiential texture of this engagement.[69] Bishop warns that social engagement, pursued for its own sake and drained of conflict and friction, actually performs an affirmative function vis-à-vis existing structures of power rather than a democratic intervention or disruption. To substantiate this critique, Bishop targets many of Bourriaud's exemplars of relational aesthetics, pointing out that their work lacks political antagonism. As compelling as Bishop's polemic is, her critique aims more at Bourriaud's misapplication of "relational aesthetics" to a set of art practices that do not fulfill the concept's political promise, rather than at the logic of the conceptual formulation itself.

We propose our expanded genealogy of systems aesthetics as a response to this critical impasse. Rather than debate the political merits of works of contemporary art or the category of "relational aesthetics," this book helps to historicize Bourriaud's concept by demonstrating that his was not an entirely new paradigm but, in fact, a contemporary recuperation of the post-1960s discourse of art and systems.[70]

In the decades immediately preceding Bourriaud's coining of this signature concept, a more urgent contemporary elaboration of systems aesthetics emerged, one that responds directly to environmental and ecological crises. Here, systems thinking allows artists to include nonhuman agents, to join human history with geologic history, or "deep time," to combine human and natural ecologies, and to think across spatial and temporal scales, from a planetary "shared sense of catastrophe" to more local historical and cultural contingencies.[71] This integrated, *eco*-systems aesthetics, so to speak, is exemplified by Agnes Denes, who participated in the first wave of feminist artists invested in open systems, as identified by Filippone.[72] Through systemic diagrams, maps, drawings, and charts, Denes sought to create a language of perception that facilitated the flow of information among discrete systems and disciplines, eliminating their boundaries in favor of association and analogy. As Denes states, "Art is a specialization that need not feed upon itself. It is capable of imbibing key elements from other systems and unifying them into a unique, coherent vision."[73] For Denes, information design performs an epistemological function, enabling the artist to identify patterns normally hidden by "superfluous or erroneous information," to synthesize intellect and intuition, and to unify systems of knowledge into a "unique, coherent vision." As described by Giampaolo Bianconi, Denes's contributions to the 1970 exhibition at the Jewish Museum curated by Burnham, *Software: Information Technology; Its New Meaning for Art*, demonstrated her attempt to "map her artistic system of philosophical inquiry onto computer programs and exploit computation interactivity."[74] The two 1970 works included in that show, *Matrix of Knowledge* and *Trigonal Ballet*, thus functioned as "computational analogue(s) for the 'Philosophical Drawings' she was simultaneously creating."[75] Nevertheless, Denes's primary interests in these works were conceptual, linguistic, affective, ecological, and corporeal, not technical. Computing offered a language and a tool for developing her ecosystemic approach, not an end.

More recently, contemporary ecoartists have revived the concerns Denes initially explored in the 1970s. The art historian T. J. Demos compares contemporary artists who adopt a "systems ecology" approach to the "restorationist eco-aesthetics" of much first-generation environmental art, such as

that surveyed in the exhibition *Fragile Ecologies*, curated by Barbara Matilsky at the Queens Museum of Art in 1992.[76] A systems-ecological art, by contrast, expands the definition of ecology to include not strictly environmental but also social, technological, and economic systems. Demos illustrates this approach through a discussion of Ursula Biemann's five-channel video installation *Egyptian Chemistry* (2012), which examines the Nile River as a "hybrid interactive system that has always been at once organic, technological, and social" instrumentalized for human benefit.[77] Biemann maps out a network of "water politics, hydraulic energy systems, the damming of the Nile, fish ecologies, nitrate industries, social revolution," in which "agency is distributed beyond humans to systems, infrastructure, ecologies, and so on; and these things and systems exist beyond anthropocentric epistemologies or determinations."[78]

In light of contemporary artists' interests in systems ecology, a more expansive genealogy of systems aesthetics enables art history to contribute more fully to the emerging field of environmental humanities, an early twenty-first-century response to the rise of ecologically minded cultural production and a renewed emphasis on connecting the humanities to biological, earth, and environmental sciences. A direct demonstration of the "turn outward" prescribed by Whitelaw, the environmental humanities emerged in response to the STEM fields' and social sciences' dominance over environmental scholarship. While these remain the principal disciplines for researching natural environments, it has become strikingly evident that fighting the combined specters of climate change, mass migration, biodiversity loss, pollution, fossil-fuel dependency, and other features of the environmental crisis will demand an analysis of cultural and aesthetic factors, a role that suits systems aesthetics perfectly.

Just as artists continue to adapt varieties of systems thinking to model, organize, and represent their projects, art historians have worked to recover systems thinking as a central theoretical discourse. Foremost among them is Pamela M. Lee, whose seminal book *Chronophobia: On Time in the Art of the 1960s* (2004) examines the role of seriality, duration, and process during this pivotal decade.[79] Lee's 2012 book, *Forgetting the Art World*, revisits systems theory to think through the increasingly complex set of infrastructures, economies, institutions, media, and distribution methods that constitute what she terms "the *work* of art's world."[80] Returning to Alloway's description of the postwar art world as a network, Lee challenges his characterization of this network as a closed system: "The purported integrity of this system enabled the work of art to function as a coherent and autonomous

thing within that 'negotiated environment'—transparent to those who inhabited that system's still well-policed borders. Alloway's theorization of the art world, in other words, continues to authorize the language and secret handshakes that grant membership into a closed society."[81] Here, Lee asks whether the contemporary art world qualifies as an open (if nonetheless exploitative and hierarchical) system, in keeping with the rapidly shifting imperatives of neoliberal financialization and digital capitalism. If so, Lee wonders, is it still possible to distinguish the "negotiated environment" of the art world from the broader environment, or do "the theories and protocols that were once the exclusive purview of the art world take on the status of a new cultural and mental labor"?[82] Lee's questions provide a critical point of departure for our present collection. Analyzing a set of alternative convergences of art and systems thinking from the 1960s to the present day, our contributors reveal the broader and often unexpected influence of systems thinking on the social aspirations and political investments that have motivated artists to explore questions of infrastructure, affect, social relations, and environment. These case studies also enact a more capacious and politicized approach to systems aesthetics by transgressing disciplinary, medium-specific, historical, and geographic boundaries in order to question the status of art as just one system among many.

Chapter Summaries

The first section, "Systems Aesthetics to Systems Politics," consists of case studies on art, politics, and systems in the late 1960s and early 1970s, opening with Luke Skrebowski's insightful and overdue reassessment of the political underpinnings of Burnham's systems aesthetics, focusing on his indebtedness to the writings of the Marxist critical theorist Herbert Marcuse, an intellectual touchstone for the 1960s counterculture. John Tyson investigates what he calls Haacke's "systems politics," specifically in relation to the artist's interests in weather and the environment and his role as "critical meteorologist." Lastly, Christine Filippone provides an in-depth examination of the Rosario Group's adoption of "open systems" thinking to disrupt informational circuits and to critique the Argentine dictatorship's propaganda mechanisms during the late 1960s.

The second section, "Nervous Interfaces," examines art systems that encompass bodies, experience, interfaces, and environments in complex and often tense arrangements. Kris Cohen analyzes how African American artist Charles Gaines uses systems as a framework for his inquiry into subjectivity,

labor, and racial blackness. Dawna Schuld examines a specific installation by California light and space artists Robert Irwin, Doug Wheeler, and Larry Bell and analyzes their phenomenological analysis of audience experience in terms of the emerging discourse of institutional critique. Cristina Albu investigates the role of sensory experience and visualization in participatory art projects by Gina Czarnecki, Mariko Mori, and Tomás Saraceno, which similarly emphasize complex phenomenological systems. Together, these essays think through the ways systems organize and reproduce experience—of users, participants, players, performers, and subjects.

The third and final section, "The Contemporary Art World Described as a System," references the title of Alloway's 1972 essay and updates his diagnosis of the art world for the contemporary moment. Francis Halsall considers how the work of the artist Liam Gillick, long associated with the concept of "relational aesthetics," deploys an aesthetics of disappointment to generate a mirror image of the contemporary art world as a system. Amanda Boetzkes discusses the recent work of the conceptual artist Mel Chin, focusing on *The Arctic Is . . .* (2015), in which the artist photographed two Inuit hunters wearing sealskin coats and carrying harpoons on the streets of Paris on the occasion of the 2015 Paris Climate Change Conference. Boetzkes argues that Chin's practice exemplifies new modes of contemporary artistic practice that accept ecological entanglements as political and economic realities that are aesthetically actionable. Brianne Cohen analyzes Singaporean artist Charles Lim's *SEA STATE* (2005–present), a ten-part multimedia project that maps the infrastructural and extractive changes occurring along the country's expanding shoreline. Cohen shows how Lim's "ecosystemic" approach seeks to counter the deleterious policies and practices that occur within this extractive zone. In conclusion, Jaimey Hamilton Faris examines "containerization" and how its invisible networks of global distribution are integral to the contemporary art market. Together, the contributions to this section reflexively examine the contemporary art world itself as an increasingly networked system.

Nervous Systems gathers these contributions at a moment when algorithmic governance and infrastructural inertia clash with the demands of multiscalar ecological thinking, and when the art world's operational closure (as one system among many) tends to disappoint art's claims to political efficacy. In light of these conditions, our contributors elucidate the diversity and theoretical generativity of systems aesthetics in the present. Far from an isolated art historical moment, passing technoutopian fad, or exercise in formal innovation, systems aesthetics constitutes, then as now, a political commitment

to "turn outward" and again, quoting Denes, to develop a "unique, coherent vision" as urgent at the end of the 1960s as it is today.

NOTES

1 As just one system among many, the art world was not insulated from this pervasive atmosphere of violent unrest. In June 1968, Valerie Solanas infamously shot Andy Warhol at his New York Factory, just days before presidential hopeful Senator Robert F. Kennedy would be gunned down in Los Angeles.

2 Lucy R. Lippard, *Six Years: The Dematerialization of the Art Object from 1966 to 1972* (New York: Praeger, 1973), cover image and frontispiece. Since Lippard has never shied from discussions of politics, her parenthetical aside about "occasional political overtones" should be read as tongue-in-cheek.

3 Toward the end of 1968, large cross sections of the New York art world organized meetings and direct actions to protest the policies of major institutions like the Museum of Modern Art. These activities led to the founding of organizations like the Art Workers' Coalition (AWC) and the Women Artists in Revolution (WAR), which called for these powerful entities to enact reforms on issues like racial and gender equity, community access, and institutional complicity in the Vietnam War. See Julia Bryan-Wilson, *Art Workers: Radical Practice in the Vietnam War Era* (Berkeley: University of California Press, 2009).

4 Jack Burnham, "Systems Esthetics," *Artforum* 7, no. 1 (1968): 35.

5 William H. Whyte, *The Organization Man* (New York: Simon and Schuster, 1956).

6 Systems thinking is a central concern of Pamela M. Lee, *Chronophobia: On Time in the Art of the 1960s* (Cambridge, MA: MIT Press, 2004), 62.

7 Lee extends her use of systems theory, in particular the social-systems theory of Niklas Luhmann, in her analysis of Nancy Holt's work. See Pamela M. Lee, "Art as a Social System: Nancy Holt and the Second-Order Observer," in *Nancy Holt: Sightlines*, ed. Alena J. Williams (Berkeley: University of California Press, 2011), 58.

8 James Nisbet, *Ecologies, Environments, and Energy Systems in Art of the 1960s and 1970s* (Cambridge, MA: MIT Press, 2014), 12.

9 Lisa Tickner, *Hornsey 1968: The Art School Revolution* (London: Frances Lincoln, 2008), 51.

10 See Bruce Clarke, "From Information to Cognition: The Systems Counterculture, Heinz von Foerster's Pedagogy, and Second-Order Cybernetics," *Constructivist Foundations* 7, no. 3 (2012): 197. Besides Clarke, a rich body of literature has emerged over the past two decades around the intersection of systems theory, cybernetics, and postwar counterculture. See also Ron Eglash, "Cybernetics in American Youth Subculture," *Cultural Studies* 12, no. 3 (1998): 382–409; and the work of Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago: University of Chicago Press, 2006) and *The Democratic Surround: Multimedia and American Liberalism from World War II to the Psychedelic Sixties* (Chicago: University of Chicago Press, 2013). In addition, two exhibitions, 2013's *The Whole Earth* at

the Haus der Kulturen der Welt, curated by Diedrich Diedrichsen and Anselm Franke, and 2015's *Hippie Modernism: The Struggle for Utopia*, curated by Andrew Blauvelt, were both accompanied by extensive catalogs that demonstrate the extent and variety of this systems counterculture. For instance, see Hugh Dubberly and Paul Pangaro, "How Cybernetics Connects Computing, Counterculture, and Design," in *Hippie Modernism: The Struggle for Utopia*, ed. Andrew Blauvelt (Minneapolis, MN: Walker Art Center, 2015), 126–41.

11 See Bruce Clarke, "John Lilly, the Mind of the Dolphin, and Communication Out of Bounds," *communication+1* 3, no. 1 (2014): article 8. Clarke presented on Lilly's "cosmic weirdness" on the Weird Systems panel at the Society of Literature, Science, and the Arts 30th Annual Meeting in Atlanta, Georgia, November 2016. The panel was convened by Timothy Stott. The other panelists were Philip Thurtle and Francis Halsall.

12 See Stafford Beer, *Brain of the Firm* (London: Penguin, 1972).

13 Gloria Sutton, "Between Enactment and Depiction: Yayoi Kusama's Spatialized Image Structures," in *Yayoi Kusama: Infinity Mirrors*, ed. Mika Yoshitake (New York: Prestel, 2017), 140–57.

14 George Nelson, "The Enlargement of Vision," in *Problems of Design* (New York: Whitney, 1957), 71. See Justus Nieland, "Happy Furniture," *Places Journal*, January 2020, https://placesjournal.org/article/happy-furniture/.

15 See Skrebowski, in this volume. Ramsden first used the phrase in a talk, "Remembering Conceptual Art," at the conference Who's Afraid of Conceptual Art (March 19, 1995, Institute of Contemporary Arts, London), 9–10. The phrase has been widely cited since, including by Charles Harrison, *Conceptual Art and Painting: Further Essays on Art & Language* (Cambridge, MA: MIT Press, 2001), 27; and as the epigraph to Steve Edwards, "Art & Language's Doubt," in *Art & Language in Practice*, vol. 2, *Critical Symposium*, ed. Charles Harrison (Barcelona: Fundació Antoni Tàpies, 1999), 249. However, in a later interview Ramsden expressed his regret, stating, "We wish we'd never said this," adding that the expression was intended to point to Conceptual art as a "disorder" within the history of modernism. See Ann Stephen, "Some More Questions: Interview with Mel Ramsden," *1969: The Black Box of Conceptual Art* (Sydney: University Art Gallery, University of Sydney, 2013), 81. Thanks to J. Myers-Szupinska for helping us unravel this genealogy.

16 Our use of *nervous* echoes the title of anthropologist Michael Taussig's book *The Nervous System*, a collection of essays that pursue a Frankfurt school–inspired critique of capitalist modernity and control society. Evoking an appositely conspiratorial worldview in which everything is connected, Taussig characterizes modernity as "a System, all right, switchboard of the commanding heights, delicate in the power of its centrality. But there was no System. Just a Nervous System, far more dangerous, illusions of order congealed by fear—an updated version of what the poet Brecht had written in the 1930s, obsessed with ordered disorder, the exception *and* the rule." Michael Taussig, *The Nervous System* (New York: Routledge, 1992), 2.

17 See Edward Shanken, "The House That Jack Built: Jack Burnham's Concept of 'Software' as a Metaphor for Art," *Leonardo Electronic Almanac* 6, no. 10 (1998), http://www.artexetra.com/House.html; and Edward Shanken, "Reprogramming Systems Aesthetics: A Strategic Historiography," *UC Irvine: Digital Arts and Culture 2009*, http://escholarship.org/uc/item/6bv363d4. Shanken has also authored a textbook survey, *Art and Electronic Media* (London: Phaidon, 2009), and a reader, *Systems* (Cambridge, MA: MIT Press; and London: Whitechapel, 2015).

18 See also Etan J. Ilfield, "Contemporary Art and Cybernetics: Waves of Cybernetic Discourse within Conceptual, Video, and New Media Art," *Leonardo* 45, no. 1 (2012): 57–63.

19 Judith Rodenbeck, "Poeisis in Bali: Notes on Feedback," *Media-N: Journal of the New Media Caucus* 10, no. 3 (2014), http://median.newmediacaucus.org/art-infrastructures-information/poeisis-in-bali-notes-on-feedback/.

20 Michel Foucault, "Nietzsche, Genealogy, History," in *Michel Foucault: Aesthetics, Method, and Epistemology*, ed. James D. Faubion (London: Penguin, 2000), 371. Originally published as Michel Foucault, "Nietzsche, la généalogie, l'histoire," in *Hommage à Jean Hyppolite*, ed. Suzanne Bachelard (Paris: Presses universitaires de France, 1971), 145–72.

21 See, for instance, Lee, *Chronophobia*; Pamela M. Lee, *Think Tank Aesthetics: Mid-century Modernism, the Cold War, and the Neoliberal Present* (Cambridge, MA: MIT Press, 2020); Francis Halsall, *Systems of Art: Art, History and Systems Theory* (Oxford: Peter Lang, 2008); Eve Meltzer, *Systems We Have Loved: Conceptual Art, Affect, and the Antihumanist Turn* (Chicago: University of Chicago Press, 2013); and Christine Filippone, *Science, Technology, and Utopias: Women Artists and Cold War America* (New York: Routledge, 2017).

22 Mitchell Whitelaw, "1968/1998: Rethinking a Systems Aesthetic," *ANAT Newsletter* 33 (May 1998): n.p. Marga Bijvoet makes a similar point in *Art as Inquiry: Toward New Collaborations between Art, Science, and Technology* (Bern: Peter Lang, 1999), 7.

23 John Corbett, "Brothers from Another Planet," in *Extended Play: Sounding Off from John Cage to Dr. Funkenstein* (Durham, NC: Duke University Press, 1994), quoted in Kodwo Eshun, "Further Considerations on Afrofuturism," *CR: The New Centennial Review* 3, no. 2 (2003): 295. See Mark Dery, "Black to the Future: Interviews with Samuel R. Delany, Greg Tate, and Tricia Rose," in *Flame Wars: The Discourse of Cyberculture*, ed. Mark Dery (Durham, NC: Duke University Press, 1994), 179–222.

24 Eshun, "Further Considerations," 292.

25 See Marleen Barr, ed., *Afro-Future Females: Black Writers Chart Science Fiction's Newest New-Wave Trajectory* (Columbus: Ohio State University Press, 2008).

26 The art historian T. J. Demos has written extensively on Akomfrah's *Vertigo Sea*. See Demos, "From the Postcolonial to the Posthumanist: Moving Image Practice in Britain and Beyond," in *Artists' Moving Image in Britain since 1989*, ed. Erika Balsom, Lucy Reynolds, and Sarah Perks (New Haven, CT: Yale University Press, 2019), 31–50.

27 Lawrence Alloway, introduction to *Systemic Painting* (New York: Solomon R. Guggenheim Foundation, 1966), 19. See also Clement Greenberg, "The Case for Abstract Art," *Saturday Evening Post*, August 1959, republished in Clement Greenberg, *Clement Greenberg: The Collected Essays and Criticism*, vol. 4, *Modernism with a Vengeance*, ed. John O'Brian (Chicago: University of Chicago Press, 1993), 80–81.

28 Alloway, *Systemic Painting*, 17.

29 Dore Ashton, "Marketing Techniques in the Promotion of Art," *Studio International* 172, no. 884 (1966): 270.

30 This history is helpfully summarized by Fred Turner in *The Democratic Surround*.

31 Norbert Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine* (Cambridge, MA: MIT Press, 1948), 11.

32 Alongside Wiener, another early theorist of cybernetics was the Austrian American scientist Heinz von Foerster, who defined first-order, linear, and predictable systems as "trivial machines," which maintain equilibrium through negative feedback and can be predicted due to the determinate relation between input and output. By contrast, second-order cybernetics examines "nontrivial" or historical machines, which are highly sensitive to changes in their internal states and to their environment, and which include other systems. The distinction between first- and second-order cybernetics is influentially detailed in N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: University of Chicago Press, 1999). Other important scholarship on cybernetics includes Charles François, "Systemics and Cybernetics in a Historical Perspective," *Systems Research and Behavioral Science* 16 (1999): 203–19; Steve Heims, *Constructing a Social Science for Postwar America: The Cybernetics Group, 1946–1953* (Cambridge, MA: MIT Press, 1991); Ronald Kline, *The Cybernetics Moment: Or Why We Call Our Age the Information Age* (Baltimore, MD: John Hopkins University Press, 2015); Andrew Pickering, *The Cybernetic Brain: Sketches of Another Future* (Chicago: University of Chicago Press, 2010); and Stuart Umpleby, "A History of the Cybernetics Movement in the United States," *Journal of the Washington Academy of Sciences* 91 (2005): 54–66.

33 Bruce Clarke and Mark B. N. Hansen, "Introduction: Neocybernetic Emergence," in *Emergence and Embodiment: New Essays on Second-Order Systems Theory*, ed. Bruce Clarke and Mark B. N. Hansen (Durham, NC: Duke University Press, 2009), 6.

34 See Ludwig von Bertalanffy, *Lebenswissenschaft und Bildung* (Erfurt, Germany: Stenger, 1930); Ludwig von Bertalanffy, "Untersuchungen über die Gesetzlichkeit des Wachstums, I. Teil: Allgemeine Grundlagen der Theorie; Mathematische und physiologische Gesetzlichkeiten des Wachstums bei Wassertieren," *Wilhelm Roux Archiv für Entwicklungsmechanik der Organismen: Organ für d. gesamte kausal Morphologie* 131, no. 4 (1934): 613–52; and Ludwig von Bertalanffy, "An Outline of General System Theory," *British Journal for the Philosophy of Science* 1, no. 2 (1950): 134–65.

35 John Bednarz, "Complexity and Intersubjectivity: Towards the Theory of Niklas Luhmann," *Human Studies* 7, no. 1 (1984): 57.

36 Ludwig von Bertalanffy, *General System Theory: Foundations, Development, Applications* (London: Allen Lane, 1971), 31.
37 Von Bertalanffy, *General System Theory*, 36.
38 Von Bertalanffy, *General System Theory*, vii.
39 Peter Galison, "The Ontology of the Enemy: Norbert Wiener and the Cybernetic Vision," *Critical Inquiry* 21, no. 1 (1994): 228–66. In one relevant example of such dissemination, in a lecture given at the ICA, London, in April 1960, titled "Art and Communication Theory," the British psychiatrist and cybernetician W. Ross Ashby discussed the advantages of cybernetics for understanding art. W. Ross Ashby, transcript of the lecture "Art and Communication Theory," delivered at the ICA, April 7, 1960, Tate Gallery Archives 955/1/7/30, London.
40 Gregory Bateson, "Style, Grace, and Information in Primitive Art," first presented at the Wenner-Gren Conference on Primitive Art, Burg Wartenstein, Austria, 1967; reprinted in Gregory Bateson, *Steps to an Ecology of Mind* (Chicago: University of Chicago Press, 1972), 145–47.
41 Sim Van der Ryn, quoted in "Advertisements for a Counter Culture," *Progressive Architecture* 51, no. 6 (1970): 72.
42 Christopher Alexander, "Systems Generating Systems," in *Systemat* (Berkeley, CA: Inland Steel Products Company, 1967).
43 Michael J. Apter, "Cybernetics and Art," *Leonardo* 2, no. 3 (1969): 257.
44 Hans Haacke, "Untitled Statement" from "Information 2," in *Conceptual Art and Conceptual Aspects*, exhibition catalog, ed. Donald Karshan (New York: New York Cultural Center, 1970), 32.
45 Burnham, "Systems Esthetics," 31. See also Luke Skrebowski, "All Systems Go: Recovering Hans Haacke's Systems Art," *Grey Room*, no. 30 (2008): 54–83; and Caroline A. Jones, "Hans Haacke 1967," in *Hans Haacke 1967* (Cambridge, MA: MIT Press, 2011), 6–27.
46 Jack Burnham, *Beyond Modern Sculpture: The Effects of Science and Technology on the Sculpture of This Century* (London: Allen Lane, 1968), 369.
47 Burnham, *Beyond Modern Sculpture*, 369.
48 Burnham, "Systems Esthetics," 32; and Burnham, "Real Time Systems," 49. See Mathew Rampley, "Systems Aesthetics: Burnham and After," *vector* 12 (2005), http://www.virose.pt/vector/b_12/rampley.html.
49 Cildo Meireles, *Cildo Meireles* (Valencia, Spain: IVAM Centre del Carme, 1995), 174.
50 Discussion between Mary and Reyner Banham and Magda Cordell and John McHale, in *Fathers of Pop* (dir. John McHale, 1979).
51 Quoted in David Robbins, ed., *The Independent Group: Postwar Britain and the Aesthetics of Plenty*, exhibition catalog (London: Institute of Contemporary Arts, 1990), 87.
52 See María Fernández, "Detached from HiStory: Jasia Reichardt and *Cybernetic Serendipity*," *Art Journal* 67, no. 3 (2008): 6–23; and Timothy Stott, "When Attitudes Became Toys: Jasia Reichardt's *Play Orbit*," *Art History* 41, no. 2 (2018): 344–69.
53 Roy Ascott, "Behaviourist Art and the Cybernetic Vision" (1966–67), in *Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness*, ed. Edward

Shanken (Berkeley: University of California Press, 2003), 111. Originally published in two parts: "Behaviourist Art," *Cybernetica: Journal of the International Association for Cybernetics* 9 (1966): 247–64; and "The Cybernetic Vision in Art," *Cybernetica: Journal of the International Association for Cybernetics* 10 (1967): 25–56.

54 Ascott, "Behaviourist Art and the Cybernetic Vision," 110. See also Nick Lambert, "The Cybernetic Moment: Roy Ascott and the British Cybernetic Pioneers, 1955–1965," *Interdisciplinary Science Reviews* 42, nos. 1–2 (2017): 42–53.

55 Reichardt, *The Computer in Art* (London: Studio Vista, 1971), 35.

56 See Filippone, *Science, Technology, and Utopias*.

57 See Jorge Glusberg, *El Grupo de los trece en arte de sistemas* (Buenos Aires: Centro de arte y comunicación, 1971).

58 Frank Popper, *Art Action Participation* (London: Cassel and Collier Macmillan, 1975), 7–9.

59 Lev Nusberg, "Cybertheatre," *Leonardo* 2, no. 1 (1969): 61.

60 Margareta Tillberg, "You Are Now Leaving the American Sector: The Russian Group *Dvizhenie*, 1962–1978," in *Place Studies in Art, Media, Science and Technology: Historical Investigations on the Sites and the Migration of Knowledge*, ed. Andreas Broeckmann and Gunalan Nadarajan (Weimar: VDG, 2008), 147.

61 Tillberg, "You Are Now Leaving the American Sector," 158.

62 Enzo Mari, quoted in Emanuel Quinz, "From Programme to Behaviour: The Experience of Art Programmata in Italy 1958–1968," in *Practicable: From Participation to Interaction in Contemporary Art*, ed. Samuel Bianchini and Erik Verhagen (Cambridge, MA: MIT Press, 2016), 95.

63 Bruno Munari, quoted in Lindsay A. Caplan, "Open Works between the Programmed and the Free: Art in Italy 1962–1972" (PhD diss., City University of New York, 2017), 69, emphasis added. Original quotation from "Arte Programmata," in *Arte Programmata: Kinetic Art*, exhibition catalog, ed. Bruno Munari and Riccardo Musatti; trans. Lindsay A. Caplan (Milan: Officina d'Arte Grafica A. Lucini; Washington, DC: Smithsonian Institution, 1964), n.p.

64 Caplan, "Open Works," 69.

65 We are indebted to Gráinne Coughlan for these insights. See Gráinne Coughlan, "An Organisational Analysis of Participatory Art in Art Institutions" (PhD thesis, Dublin School of Creative Arts, Technological University Dublin).

66 Nicolas Bourriaud, *Relational Aesthetics* (Paris: Les Presses du réel, 2002), 14. First published in French as *Esthétique Rélationnel*, Bourriaud's text focuses primarily on a group of mostly male European artists that includes Gabriel Orozco, Rirkrit Tiravanija, Félix González-Torres, Pierre Huyghe, Liam Gillick, and Maurizio Cattelan.

67 Nicolas Bourriaud, "Modelized Politics," *Flash Art* 26, no. 171 (1993): 142–43.

68 Francis Halsall has noted the compatibility of systems and relational aesthetics, which both work to "radically [reconceive] the purposes and effects of art practice. . . . This reconceived understanding locates art in a system of relationships between art and its environment; its viewers and art discourse." Halsall, *Systems of Art*, 121.

69 Claire Bishop, "Antagonism and Relational Aesthetics," *October*, no. 110 (2004): 51–79.

70 Beyond the gallery-based "relational" works that Bourriaud promotes, we identify a contemporary systems aesthetics in art practices that are durational, quasi-ethnographic, and/or infrastructural. Here, the "social turn" gives way to an "organizational turn," meaning a turn to large-scale experiments in collaborative organization initiated and managed by artists. To take only one example, systems thinking informs the "co-creation" methodology of Artway of Thinking, the nonprofit arts organization founded in Venice in 1992 by Stefania Mantovani and Federica Thiene, which develops and implements creative strategies for social engagement and collaboration. See Artway of Thinking, "Co-Creation Methodology," accessed at http://www.artway.info/.

71 Dipesh Chakrabarty, "The Climate of History: Four Theses," *Critical Inquiry* 35, no. 4 (2009): 222.

72 Filippone, *Science, Technology, and Utopias*.

73 Agnes Denes, "The Dream," *Critical Inquiry* 16, no. 4 (1990): 920.

74 Giampaolo Bianconi, "Agnes Denes in the 1970s: Toward the Hologram," in *Agnes Denes: Absolutes and Intermediates*, ed. Emma Enderby (New York: The Shed, 2020), 166.

75 Bianconi, "Agnes Denes," 167.

76 T. J. Demos, *Decolonizing Nature: Contemporary Art and the Politics of Ecology* (Berlin: Sternberg, 2016), 26.

77 Demos, *Decolonizing Nature*, 216–20.

78 Demos, *Decolonizing Nature*, 220.

79 Lee, *Chronophobia*, 67.

80 Pamela M. Lee, *Forgetting the Art World* (Cambridge, MA: MIT Press, 2012), 3.

81 Lee, *Forgetting the Art World*, 21.

82 Lee, *Forgetting the Art World*, 21.