

Vehicles of Ætherial Fire

The Problem of every Act of Magick is then this: to exert a Will, sufficiently powerful to cause the required Effect, through a Menstruum or Medium of Communication. By the common Understanding of the Word Magick, we yet exclude such Media as are generally known and understood.

— *Liber Aleph Vel CXI*

The most fundamental concept in cybernetics is that of ‘difference,’ either that two things are recognizably different or that one thing has changed with time. . . . All the changes that may occur with time are naturally included, for when plants grow and planets age and machines move some change from one state to another is implicit.

— W. Ross Ashby, *An Introduction to Cybernetics*

Vehicles is a collection of prototypical machines (and assemblages and components of machines) born of conjoining mysticism and magic with computers and electronics to produce experiments in theoretical and applied sorcery. The exhibition’s title intentionally corresponds to the Tarot’s Chariot (a Key to the mysteries of cybernetics), and is also a nod to Valentino Braitenberg’s *Vehicles: Experiments in Synthetic Psychology*, which features a variety of machines that express diverse psychic or animal behaviors (henceforth when I name *Vehicles* I mean the exhibition, not the book). I say ‘express’ rather than ‘simulate’ because the similarities are more than metaphorical; they are “isophorical,” meaning they signify something in the same class.¹ The machines &c. presently exhibited are not merely simulations of divination and enchantment; they are new bodies for the genuine expression and transmission of occult power (*dúnamis* [δύναμις]). These bodies may surprise you if you are used to thinking that technology is antagonistic to or a counterfeit of magic, but I hope they inspire you to “Get used to a way of thinking in which the hardware of the realization of an idea is much less important than the idea itself.”²

I wish to discuss some ideas related to these machines &c. as being simultaneously magical, technological, *and* art objects, and what differentiates them from other objects of these kinds. Indeed, the notion of difference shall pervade all that I have to say on this topic.³ N.b., I use the word ‘object’ here archaically as something presented to the senses, rather than to mean a material thing. Spells and rituals, e.g., are not material things *per se* although they may include material components or physical actions, but inasmuch as they are sensible (i.e., capable of being seen, heard, &c.) they are no less objects than wands and grimoires, and we can think of them each as a unitary entity — a spell to do this, a ritual to do that, &c. — even though it may have many parts.

The magical object is already differentiated from other art objects by its magical purpose: a Tarot deck is not merely a collection of pictures but these are intended to be arranged so as to portend future events or communicate other occult knowledge; an idol is not merely a sculpture

¹ I have borrowed the word ‘isophorical’ from an interview with biologist Humberto Maturana, in which he discussed the automobile as a machine that has emotions. See “A Question of Desire” by Omar Sarrás Jadue (interviewer).

² *Experiments in Synthetic Psychology* (MIT Press, 1986), p. 6.

³ Consider the fence or palisade signified by the Hebrew letter Heth (h) — associated with the Chariot — as signifying the boundary separating inside from outside (as with the Circle of Art), organism from environment, &c., and which marks the perimeter of the sanctum and brings it forth into being. “A universe comes into being when a space is severed or taken apart” (G. Spencer-Brown, *Laws of Form*). The alchemy of computation does not begin with the *prima materia* but the *prima differentia* — the First Distinction, the Unity (1) as differentiated from the Void (0).

but is the material house of a spiritual agent; an amulet is not merely a piece of jewelry but is imbued with weird power to protect its wearer from harm; a banishing ritual is not merely a performance but prepares the sorcerer and the space she occupies, for further magics; &c. The aesthetics of such objects are often entangled with their utility, and even their embellishments may signify esoteric referents and thus transcend mere ornamentation. Most or perhaps all art objects have a semiotic dimension in addition to their material or physical dimensions, but this is especially so for magical objects, for in the world of sorcery, signs have real power.⁴

The objects exhibited in *Vehicles* are likewise made for magic, which makes them unique (or rare) among machines, and being machines, they are unique (or rare) among magical objects. Some of them function like familiar machines, while others function like machinic familiars. As with all machines, they undergo changes;⁵ as sorcerous machines, these changes illuminate their numinous interiors. Some of these machines may be thought of as moving occult images, their designs being more or less informed by traditional image magics, but they may not all move in the usual sense of a change of place, position, or posture. The Greek word *kínēsis* [κίνησις] chiefly means motion but can also mean any change. Aristotle identified six kinds of movement, only one of which was a change of place; the others are generation, destruction, increase, decrease, and alteration. The key idea here is that these machines are active in the physical space in ways that cause something to become exoterically different in an esoterically meaningful way. This is not fundamentally different from the movements of traditional objects through ritual spaces. The appearance of a sword (and its kin such as the dagger or athame), e.g., may mean various things,⁶ many of which follow from the fact of the blade as an instrument that cuts, but the act of cutting, too, may signify, such as when a ribbon is ceremonially cut to inaugurate a new building or enterprise, or when a knotted

⁴ John Michael Greer wrote, “Although there is more to magic than ritual, the art of ritual makes up the heart of magical technique in nearly all the world’s traditions. We can define ritual as *symbolic action*” (*Circles of Power*). Semiotically speaking, all symbols are signs but not all signs are symbols, and not all ritual actions (nor magical objects) are, strictly speaking, symbolic (some are iconic or indexical, and many involve more than one type of signification). However, the relationship between a magical act and its intended effect peculiarly resembles the relationship between a signifier and that which it signifies. Consider, e.g., the voodoo doll trope: the act of stabbing the doll with a pointed object is instrumental, not merely symbolic, in that it is intended to do real damage to the doll and, more to the point (pun intended), to the entity the doll represents, but it is not the same as directly stabbing the entity. The doll *means* the entity and the act of stabbing the doll *means* injuring the entity, but in a way that — if the act is successful — compels real injury to occur beyond the doll’s or act’s exoteric sphere of influence.

⁵ “A ‘machine’ is that which behaves in a machine-like way, namely, that its internal state, and the state of its surroundings, defines uniquely the next state it will go to” (W. Ross Ashby, “Principles of the Self-Organizing System,” 1962). Louis Couffignal defined a machine as “a set of material elements disposed in such a way as to permit the execution of some definite operation” (“La mécanique comparée,” 1951), but Ashby’s definition includes immaterial machines — see *An Introduction to Cybernetics* (Chapman & Hall, 1957), p. 2.

⁶ “Seen lying upon a battlefield, the blade signifies one thing; seen sheathed at the side of a cavalier, it conveys yet another. The sword fixed within a stone relays one mystery, and a broken sword an arcanum entirely different.” — Daniel A. Schulke, *Lux Haeresis* (Xoanon, 2011), p. 63.

cord is ritually cut to signify the end of a romance. Here it is the change from the unsevered to the severed state that signifies; the *function* (performance), contra the *form* (appearance), is the sign.⁷

The sword is not the only thing that can cut; saws, scissors, lasers, &c., can also make incisions. Moreover, cutting is an action that can be performed by a machine that replaces the human actor as manipulator of the instrument that cuts. Whereas tools extend human actions, machines more often replace them. A chainsaw, e.g., is a hand saw augmented by a mechanism that replaces the need for someone to move the blade to and fro. The realization that two things can have different forms but similar functions allows one thing to be substituted for another — such as substituting a coffee tin in lieu of a silver censer,⁸ or a flashlight in lieu of a wand.⁹ But whereas many machines are invented to make life easier (by replacing or supplementing human labor or intellect), the machines in *Vehicles* were invented to make life *stranger*.¹⁰

Their weird ways are made possible by electricity, the “ethereal fire” that inspired one Georgian physician to assert: “The electrical effluvia is far more subtle than air, is diffused through all space, surrounds the earth, and pervades every part of it; and such is the extreme fineness, velocity and expansiveness of this active principle that all other matter seems to be only the body, and this the soul of the universe.”¹¹ Electrical energy empowers these objects to be uniquely kinetic (κινητικός) or dynamic (δυναμικός), vs. static (στατικός), in the physical space. It is especially the digital computer, using electricity to store and process units of binary arithmetic and logic, that brings them to life.

⁷ “According to the *Tabula Smaragdina*, the threefold principle of the analogy between the outer and the inner world is: (i) the common source of both worlds; (ii) the influence of the psychic upon the physical; (iii) the influence of the physical world upon the spiritual. But the analogy lies not only in the relation between the inner and outer world, but also in the relation between various phenomena in the physical world. Material or formal resemblance is only one of the many possible analogies, for analogy can also exist in connection with function.” — J. E. Cirlot, *A Dictionary of Symbols* (Routledge, 1971), p. xxxix.

⁸ “When the 70's occultist says ‘there's no point in using a silver censer when a coffee tin serves just as well’, the OTTO [over-the-top occultism] initiate replies ‘there's no point in using a coffee tin when a 800 year old human skull looted from the ruins of a Mexican temple serves just as well.’” — Lionel Snell, “Paroxysms of Magic.”

⁹ N.b, the differences between two forms sharing the same function are not absolutely arbitrary; some qualities on which the function depends must exist in both forms. A wand is a wand that mediates the activity of wand-ing or evokes the experience of wand-ness, which is why you can substitute a flashlight, pen, or index finger for a wand, but not a pillow, dinner plate, or clump of dirt. A length of uncooked spaghetti pasta may suffice, but a wet noodle no longer points the way forward.

¹⁰ But not *too much* stranger; the uncanny requires a certain quantity of the familiar.

¹¹ Thomas Gale, *Electricity, or Ethereal Fire* (Moffitt & Lyon, 1802), p. 13. This passage appears to be paraphrased (or plagiarized) from earlier books by other authors, including John Wesley's *The Desideratum: Or, Electricity Made Plain and Useful* (1790). The earliest version I have found is in William Pine's *A Survey of the Wisdom of God in the Creation*, Vol. 2, 1763, s.v. “Meteors.” Cf., “All round the world was an envelope of the fiery ether, pure and unmixed, but it also penetrated the whole mass, as its soul,” Edwyn Beven, *Stoics and Sceptics* (Oxford, 1913), p. 43.

Although people today commonly use computers for a variety of non-arithmetical activities, it is still not uncommon to conflate computation with calculation, but as Margaret Boden indicated, “It is essential to realize that a computer is not a mere ‘number cruncher’, or supercalculating arithmetic machine . . . Computers do not crunch numbers; they manipulate symbols.”¹² Cf., Heinz von Foerster:

Harmlessly enough, computing (from *com-putare*) literally means to reflect, to contemplate (*putare*) things in concert (*com*), without any explicit reference to numerical quantities. Indeed, I shall use this term in its most general sense to indicate any operation (not necessarily numerical) that transforms, modifies, rearranges, orders, and so on, observed physical entities (“objects”) or their representations (“symbols”). For instance, the simple permutation of the three letters *A, B, C*, in which the last letter now goes first – *C, A, B* – I shall call a computation; similarly the operation that obliterates the commas between the letters – *CAB* – and likewise the semantic transformation that changes *CAB* into *taxi*, and so on.¹³

Brenda Laurel said the computer’s “interesting potential lay not in its ability to perform calculations but in its capacity to represent action,”¹⁴ and that we should “think of the computer not as a tool, but as a medium” — including an art medium. Computer art first emerged in the 1960s, shortly after the invention of the first graphic image displays — descended from lamps that alternated on and off to tell of the computer’s internal states, they evolved into electronic show-stones of machine dreams. In 1967, A. Michael Noll of Bell Labs declared the computer “a new active medium for art,”¹⁵ meaning the computer was differentiated from other artistic media by its capacity to act not only automatically (from αὐτόματος, “self-moving”) but to some degree autonomously (from αὐτόνομος, “self-governing,” implying independence from external control). Indeed, Noll exalted the computer to the role of collaborator with the artist, even as he acknowledged that it cannot do anything it has not been programmed to do. His key to conflating creation and creator was realizing that the computer can be programmed to do things the human artist (or programmer) could not have predicted, thus the computer can, in a sense, genuinely *create*. Four decades later, Matt Pearson reaffirmed that the two hard-and-fast rules of so-called generative art are autonomy and unpredictability.¹⁶ We might imagine a continuum

¹² *Artificial Intelligence and Natural Man* (Basic Books, 1977), p. 15.

¹³ “On Constructing a Reality,” *Understanding Understanding: Essays on Cybernetics and Cognition* (Springer, 2003), p. 216. This essay was earlier published in *Observing Systems* (Intersystems Publications, 1981 & 1984), and is an abridged version of a lecture Heinz gave in 1973.

¹⁴ Brenda Laurel, *Computers as Theatre* (Addison-Wesley, 1993), p. 1.

¹⁵ “The Digital Computer as a Creative Medium” (1967).

¹⁶ *Generative Art: A Practical Guide Using Processing* (Manning, 2011), p. 6.

from computer-*assisted* art that is made using software that primarily simulates other art forms (drawing, sculpting, developing photographs, composing music, &c.), to computer-*generated* art that is made using algorithms that would have been impractical or impossible without computers. The latter more fully occupies the liminal spaces between organic and mechanical, natural and artificial, &c., by embodying chaos, complexity, and randomness — qualities we typically do not desire of our machines, but which we recognize as characteristic of natural or living things.¹⁷

For Myron Krueger, another computer artist in the 1960s and a pioneer of augmented and virtual realities, it was interactivity that most distinguished computation as a medium: “A computer-controlled art work could perceive its viewer and respond to his behaviour in real time. Response was the medium!”¹⁸ Such interactivity is related to what Joseph Deeken called the “sensation/action paradigm” of computing: “a framework of dynamic contact with the environment, and internal feedback processes, in which a brain, whether human, animal, or silicon ‘wakes up’.”¹⁹ Sensation is made possible by electronic sensors that transduce various energetic phenomena (light, sound, heat, touch, &c.) into electrical signals that can be represented digitally — *caput draconis*. Action is made possible by the inverse operation of converting digital data and electrical signals to light, sound, motion, &c. — *cauda draconis*. Whether the machine’s output is an array of colored pixels on a screen or the locomotion of a robotic body across a plane, these are kinds of animation (from *anima*, “air, breath, soul, vital principle,” cognate with άνεμος, “wind”), and I maintain that they are kin to the automatons (αὐτόματον) of any age, which John Dee included under the rubric of thaumaturgy:

Thaumaturgy is that art mathematical, which giveth certain order to make strange works, of the sense to be perceived, and of men greatly to be wondered at. By sundry means this wonder-work is wrought. Some by pneumatics, as the works of Ctesibius and Hero. Some by weight, whereof Timaeus speaketh. Some by strings strained, or springs, therewith imitating lively motions. Some by other means, such as the images of Mercury, and the brazen head, made by Albertus Magnus, which did seem to speak.²⁰

Krueger’s responsive environments, or “artificial realities” as he called them, were a precursor to what we call today *physical computing*: using computers and electronics to interact with physical objects and make physical objects interactive. In contrast to the general-purpose,

¹⁷ Shortly after writing that, I encountered this label on a box of slate tiles: “Attention valued customer: The tile/slate inside is a natural material that is processed by hand. The beauty of natural materials is that no two pieces are exactly alike. Tiles will vary in color, texture, size, and thickness.”

¹⁸ “What Should You Wear to an Artificial Reality?” (1991).

¹⁹ *The Electronic Cottage* (Bantam, 1983), p. 95.

²⁰ My paraphrasing of Dee’s “The Mathematicall Præface to Elements of Geometrie of Euclid of Megara” as transcribed by Project Gutenberg <<https://www.gutenberg.org/files/22062/22062-h/main.html>>.

multimedia computers such as desktops and tablets, physical computing often involves microcontrollers and single-board computers that are designed for embedded applications and for interfacing with electronic sensors and actuators. Although something with a screen and keyboard may be the first thing that comes to mind when you think of a computer, the majority of microprocessors are manufactured for embedded systems: home appliances (washer, dryers, microwave ovens, etc.), consumer electronics (watches, cameras, MP3 players, &c.), automated teller machines, heaters and air conditioners, airplanes, automobiles, traffic lights, &c., all have computers hidden within to make them interactive, autonomous, or both. Indeed so many *things* today are computerized that they have been given an Internet of their own, viz., the Internet of Things. As Philip K. Dick observed: “our environment, and I mean our man-made world of machines, artificial constructs, computers, electronic systems, interlinking homeostatic components — all this is in fact beginning more and more to possess what the earnest psychologists fear the primitive sees in his environment: animation. In a very real sense our environment is becoming alive, or at least quasi-alive, and in ways specifically and fundamentally analogous to ourselves.”²¹

The power to animate matter and bring it to life is that of the sorcerer and necromancer,²² and stories about the machines turning against us are not unlike admonishing tales of the occult such as “The Sorcerer's Apprentice” and “The Monkey's Paw”: they tell of our fear that the sorcery or technology we implement in order to effect some measure of control over our circumstances and improve our lives will go out of control in ways inimical to our living. Related are ethical considerations about ends and means, intentions and unintended consequences, and evoking non-trivial forces for trivial effects. Computers are intelligence amplifiers: they “extend, amplify, and enrich our own capacities to think, feel, and act.”²³ They allow for the magic-like transportation of language and ideas, and so they are, in more than one sense, a manifestation of *lvx in extensio*: “where a man's word goes, and where his power of perception goes, to that point his control and in a sense his physical existence is extended. To see and to give commands to the whole world is almost the same as being everywhere.”²⁴ But ‘to see and give commands to the whole world’ could describe the panopticon and totalitarian state as well as it might suggest sublime dreams of cybernetic apotheosis. The word ‘cybernetics’ stems from a Greek word meaning to pilot or steer a ship, whence ‘governor’ (κυβερνάω → L. *guberno*), but the cybernetic notion of control is much more about the freedom afforded by self-control and autonomy than it is about oppression, and although computers may be employed in the service of extending the eyes and hands of an abusive authority, they also “reduce the barriers of time

²¹ “The Android and the Human” (1972).

²² Continuing to paraphrase Dee on thaumaturgy (op. cit.): “And for these, and such like marvelous acts and feats, naturally, mathematically, and mechanically wrought and contrived, ought any honest student and modest Christian philosopher be counted and called a conjurer? . . . He that seeketh (by St. Paul's advertisement) in the creatures' properties and wonderful virtues, to find just cause to glorify the eternal and almighty Creator by: shall that man be (in hugger mugger) condemned as a companion of hellhounds, and a caller and conjurer of wicked and damned spirits?”

²³ Laurel, op. cit., p. 33.

²⁴ Norbert Wiener, *The Human Use of Human Beings: Cybernetics and Society* (Free Association Books, 1989), p. 97. Cf., omniscience, omnipotence, and omnipresence.

and space when playing with and rearranging ideas. As a result, they better depict the changing and manifold relationships between ideas in human thought, and they can be more egalitarian in giving voice to multiple versions of those relationships.”²⁵ As Von Foerster said: cybernetics’ ethical imperative is to “act always so as to increase the number of choices.”²⁶

The notion of ‘changing and manifold relationships’ features greatly in my understanding of both magic and computers, and it is essential to the conception of what I call *magical-computational assemblages*. The word ‘assemblage’ means a gathering or a bringing or coming together. In the arts it typically denotes a work of visual art assembled from diverse kinds of media and often incorporating found objects. In philosophy it means an ontological framework developed by Gilles Deleuze and Félix Guattari, which in its original French (*agencement*, from *agencer*, “to arrange, to lay out, to piece together”) means an arrangement or layout of heterogeneous elements including semiotic, material, and social flows [*fluxes*] that are acted on simultaneously.²⁷

Following Deleuze and Guattari (and Manuel DeLanda, who advanced their notion of the machinic phylum), John Johnston coined the term “computational assemblage” to denote the conjunction of a computer (i.e., a material or physical device that computes) and a body of discourse about the computer that “explains and evaluates its function, purpose, and significance,” and that “[embeds its] computations in a meaningful context.”²⁸ Not only has the word ‘computer’ evolved to mean different things (it originally denoted a person who makes calculations), today’s computer is different things in various contexts: to the manufacturer of computing machines it is one thing, to the mathematician it is another, which differs from what it is to the office worker, and to the airplane pilot, the HVAC technician, the luddite, the hacktivist, &c., it is yet other things. The material composition of one computer can vary greatly from that of another, and the impact of computers on society needs no comment. The computer, then, is a shifting, uncertain thing having local, temporary stabilizations.

We could say the same for ritual magic;²⁹ we might conceive of magical rituals as assemblages of heterogeneous elements gathered together to do the work at hand according to this or that theory about how magic works and what it involves. These include material and physical factors (objects, actions) as well as a network of signs (semiotics) both situated within and helping to constitute a discourse of magical thinking that describes and prescribes how the components work together to do magic. Discussing ritual as an abstract category of human activity tends to trivialize, marginalize, or exclude actual examples of ritual in the world, whereas

²⁵ Dan O’Sullivan and Tom Igoe, *Physical Computing: Sensing and Controlling the World with Computers* (Thomson, 2004), p. xviii.

²⁶ Von Foerster, op. cit. Cf., Peter J. Carroll: “Hell is the condition of having no alternatives” (*Liber Kaos*).

²⁷ See Deleuze and Guattari’s *A Thousand Plateaus* and Manuel DeLanda’s *Assemblage Theory*, for more about assemblage.

²⁸ John Johnston, *The Allure of Machinic Life: Cybernetics, Artificial Life, and the New AI* (MIT Press, 2008), p. 8.

²⁹ I do not mean ‘ritual magic’ in the academic sense of ‘ceremonial’, ‘high’, or ‘learned’ magic, but something much more inclusive. I regard ritual as the major component of the *praxis* of magic.

considering specific rituals and why, how, when and where they are performed, who performs them, and what they are performed with, reveals a rich variety of diverse forms that may not all *con*-form to one superordinate view of what ritual is. Seeing rituals as spatiotemporal arrangements of multiple, heterogeneous elements in flux, rather than as eternal and fixed things, facilitates examination of their elements' interfaces and interactions with each other, and how the components of one assemblage might drift to become components of another — *solve et coagula*.

Magical assemblages involve rituals and *materia magica* in the same way that computational assemblages involve computers and computation. Magical-computational assemblages are the multiversal progeny of two seemingly disparate universes of discourse and their concomitant ontologies from which pairs of elements find expression in monstrous hybrids with their own attendant discourses.³⁰

All evolution proceeds by heredity and variety, and the evolution of magic as an art and a technology is no exception. "A technical system forms when a technical evolution stabilizes around a point of equilibrium concretized by a particular technology."³¹ Consider the occult sigil, e.g.: when Austin Osman Spare published his techniques for generating a sigil from the sorcerer's statement of intent and communicating it to her subconscious mind,³² quite new ways of designing and performing magical rituals followed. The discourse about sigils and about magic involving sigils changed, and so did the magic involving sigils, simultaneously. Emphasis shifted from appropriate correspondences to draw down celestial powers, to appropriate states of consciousness required to "charge" these newer sigils. New theories emerged about how magic works. Over time, what had once been novel and ingenious became (in some circles) the new dogma, and today there are countless books, articles, tutorials, &c., that describe more or less similar techniques for making and using sigils in the manner of Spare and his acolytes. Indeed, his sigil technology has become so common that many sources do not attribute it to him. Despite its proliferation, earlier means of constructing and working with sigils, such as those instructed by the Hermetic Order of the Golden Dawn, are still practiced today, perhaps more widely than Spare's.

The Golden Dawn system of magic is a fine example of stability, having changed very little in a hundred years or more. By contrast, all magic involving computers is a recent development; none of it is older than a few decades, and computer technology itself is continuing to rapidly grow and mutate. So-called technomancy, cybermagic, &c., are not *more* evolved than traditional forms of the art (any more than humans are more evolved than apes —

³⁰ "When two seemingly disparate elements are imaginatively poised, put in apposition in new and unique ways, startling discoveries often result." — Marshall McLuhan and Quentin Fiore, *The Medium is the Massage*. Cf., Arthur Koestler's bisociation of matrices, and Gilles Fauconnier and Mark Turner's conceptual blending.

³¹ Johnston, op. cit., p. 7.

³² *The Book of Pleasure*, 1913, reprinted in 1975.

both are well-adapted to their respective niches, apes perhaps moreso); they are simply different. To those for whom it is a difference that makes a difference:

I hope you find something here that transmogrifies you.

Joshua Madara
Seattle, Washington
mmxvii

Bibliography & Reading List

Ascott, Roy. *Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness*.

Bell, David and Barbara M. Kennedy (Eds.). *The Cybercultures Reader*.

Broeckmann, Andreas. *Machine Art in the Twentieth Century*.

Davis, Erik. *TechGnosis: Myth, Magic, and Mysticism in the Age of Information*.

De Landa, Manuel. *War in the Age of Intelligent Machines*.

Decken, Joseph. *The Electronic Cottage*.

Dewdney, A. K. *The Armchair Universe: An Exploration of Computer Worlds; The Magic Machine: A Handbook of Computer Sorcery; and The Tinkertoy Computer and Other Machinations*.

Dixon, Steve. *Digital Performance: A History of New Media in Theater, Dance, Performance Art, and Installation*.

Dukes, Ramsey. *Words Made Flesh: Information in Formation: Virtual Reality, Humanity and the Cosmos*.

Farber, Philip H. *Brain Magick: Exercises in Meta-Magick and Invocation*.

Fries, Jan. *Visual Magick: A Manual of Freestyle Shamanism*.

Hansen, Mark B. N. *New Philosophy for New Media* and *Bodies in Code: Interfaces with New Media*.

Hillis, W. Daniel. *The Pattern on the Stone: The Simple Ideas that Make Computers Work*.

Hine, Phil. *Condensed Chaos: An Introduction to Chaos Magic* and *Prime Chaos: Adventures in Chaos Magic*.

Husbands, Phil, Owen Holland, and Michael Wheeler (Eds.). *The Mechanical Mind in History*.

Imaz, Manuel and David Benyon. *Designing with Blends: Conceptual Foundations of Human-Computer Interaction and Software Engineering*.

Johnston, John. *The Allure of Machinic Life: Cybernetics, Artificial Life, and the New AI*.

Kwasktek, Katja. *Aesthetics of Interaction in Digital Art*.

Laurel, Brenda. *Computers as Theatre*.

Muri, Allison. *The Enlightenment Cyborg: A History of Communications and Control in the Human Machine, 1660–1830*.

O'Sullivan, Dan and Tom Igoe. *Physical Computing: Sensing and Controlling the Physical World with Computers*.

Packer, Randall and Ken Jordan (Eds.). *Multimedia: From Wagner to Virtual Reality*.

Parrika, Jussi. *Insect Media: An Archaeology of Animals and Technology*.

Pickering, Andrew. *The Cybernetic Brain: Sketches of Another Future*.

Pickover, Clifford A. Nearly everything he has written deserves to be included here, but his first five books are an especially appropriate pentateuch: *Computers, Pattern, Chaos, and Beauty*; *Computers and the Imagination*; *Mazes for the Mind*; *Chaos in Wonderland*; and *Keys to Infinity*.

Popper, Frank. *From Technological to Virtual Art*.

Reas, Casey and Ben Fry. *Processing: A Programming Handbook for Visual Designers and Artists*.

Reichardt, Jasia (Ed.). *Cybernetics, Art and Ideas*.

Rid, Thomas. *Rise of the Machines: A Cybernetic History*.

Schulke, Daniel A. *Idolatry Restor'd: Witchcraft and the Imaging of Power and Lux Haeresis: The Light Heretical*.

Sconce, Jeffrey. *Haunted Media: Electronic Presence from Telegraphy to Television*.

Sörensen, Jesper. *A Cognitive Theory of Magic*.

Stiny, George and James Gips. *Algorithmic Aesthetics: Computer Models for Criticism and Design in the Arts*.

Taylor, Grant D. *When the Machine Made Art: The Troubled History of Computer Art*.

Truitt, E. R. *Medieval Robots: Mechanism, Magic, Nature, and Art*.

Wardrip-Fruin, Noah and Nick Montfort (Eds.). *The New Media Reader*.