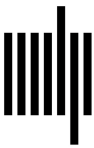
Art + DIY Electronics

By: Garnet Hertz

Citation:

Art + DIY Electronics
By: Garnet Hertz
DOI: 10.7551/mitpress/9324.001.0001
ISBN (electronic): 9780262361576
Publisher: The MIT Press
Published: 2023



The MIT Press

0.1 A History of Electronic Art in the Twentieth Century

This chapter is a story of a full century of "making" before the term emerged, how it evolved, and what trends materialized in the hybrid domain of electronics and art. It tells a narrative of artists as innovative technologists, hackers, and inventors, and in the process starts to sketch out a map for a general history of technology-oriented artwork in the twentieth century. In hindsight, the contemporary maker movement's key mistake was to think of itself as a revolutionary thing, when it was simply the continuation of a fascinating history of creative amateur technologists that reaches back at least a century.

Defining Electronic Art

Within this book, I use "electronic art" as a category that encompasses many different objects and practices. Before exploring specific case studies and themes within creative electronic DIY work, it is imperative to lay a bit of groundwork to explore the history around this field of practice. Part of the purpose of using a somewhat older term—*electronic art* as opposed to something like *new media art* or *digital art*—is to show that this category is still active and is a useful framework to help better understand the social-technological complexity of creative practice. Before information electronics emerged in the middle of the twentieth century, artists had been using simple electrical components since before the 1920s—and the fascinating lineage around this type of work reaches back over a hundred years. In many ways, electricity and artists are good old friends. It's not new media.

Artists gravitate to materials and techniques as soon as they are available—whether paint, sculptural materials, or imaging technologies. There have always been "emerging media" artists who seek out avant-garde materials to expand or redefine their work. As an extension of this

experimentation, artists creatively enjoy a century-old history of embracing electricity. Through this history we can understand that their attraction to electrical and electronic media is driven not just by the novelty of technologies, but also by their affordances—interactivity, motion, logic, and aesthetics. New technologies also reflect the changing landscape of popular culture, media, and sociality. As a result, many artists use electronic objects as materials or products to enrich their work by bringing it into contemporary conversations—interdisciplinary conversations that span engineering, design, culture, and other fields.

Objet Trouvé, Ready-Mades, and Picasso

The entrance of electricity into twentieth century contemporary art owes much of its lineage to the interjection of "everyday" found objects into the formal setting of a gallery. The use of everyday objects in contemporary art was initially pioneered by artists like Pablo Picasso, Carlo Carra, and other avant-garde artists of the early twentieth century—or at least this is how it is commonly understood in mainline art history through the narrative of *Objet Trouvé,* literally translated as "found object."[1] Notable pieces include Picasso's *Guitar* (1913), a still life composition of collaged paper, charcoal, ink, and chalk on blue paper mounted on cardboard that includes a front page of a printed newspaper glued onto the surface. This inclusion of day-to-day items marked a significant shift in artistic technique. Up to that point, art had primarily focused on representing exceptional objects on the canvas, rather than literally gluing everyday physical objects onto it. Other artists extended this collage technique to portray more intimate aspects of everyday life by incorporating maps, train tickets, and plastic packaging as materials.[2] The next move—to actually include machines and electronic devices—was propelled by two core ideas: the concept of the ready-made and Dadaism.

Marcel Duchamp coined the term "ready-made" (*Objet Trouvé*) in 1915 "to describe a work of art that consisted of an everyday object, which became a work of art for the simple fact that the artist had selected it."[3] When the term ready-made was introduced into the art world, it was commonly used in the United States to describe manufactured goods. "Ready-made" was synonymous with "off-the-shelf," "factory-built," "ready-to-wear," or "off-the-rack." This is in direct contrast to objects considered artisanal, hand-made, or bespoke—which prior to mass consumer product manufacturing

had been more prominent. Ready-mades, in contrast, were intentionally bland, blasé products.[4] While the Futurists of the same era were technologically engrossed in and in wonder of industrialization, Duchamp was already bored with it. He did not think of ready-mades as objects that praised contemporary industrial design and manufacturing, but quite the opposite. The ready-made was part of an effort to battle the aesthetic and "retinal" components of art. He sought to give taste, connoisseurship, and the entire art world the middle finger.[5]

Duchamp's ready-mades were driven by an angry nihilism toward manufactured objects and cultural institutions.[6] This drive was reflected in his first ready-made, the *Bicycle Wheel* sculpture from 1913, made the same year as Picasso's *Guitar* collage. *Bicycle Wheel* was an assembly of a front fork and rim of a bicycle mounted upside-down on top of a painted wooden kitchen stool.[7] Although this particular sculpture was built as a studio prototype and never exhibited, his later ones were installed in galleries. *Bottle Rack* from 1914 was a signed bottle drying rack, and *In Advance of the Broken Arm* from 1915 was a signed snow shovel. These pieces stripped away visual aesthetics and drove home the idea of art as a psychological and social construction. Two years later, Duchamp's *Fountain* (1917)—an inverted and signed ceramic male urinal—earned him notoriety after he controversially put it into an art exhibition.[8] It enraged people because it was drab, industrially produced stuff available at a store, not art.

By claiming that art was whatever an artist chose to be art, the idea of the ready-made gave birth to the entire field of conceptual art and "severed forever the traditional link between the artist's labor and the merit of the work."[9] This move dramatically upended the trajectory of contemporary art in the twentieth century. Beyond bicycle wheels and urinals, Duchamp laid a path for artists to incorporate other everyday materials into their work. After World War I, Duchamp experimented with machines that mechanically produced optical effects. His *Rotary Demisphere (Precision Optics)* machine from 1925 is an early example of electric motors in art. This device features a triangular base that supports tripod-like poles that hold a large plexiglass dome decorated with a nonconcentric circle pattern. A belt is strung between the dome and an electric motor near the base, and when the motor is set in motion, the plexiglass spiral appears to throb and pulsate toward the viewer.[10] Through Duchamp's embracing of ready-mades and found objects, electric motors and kinetics became a more prominent part of the artistic palette.

Dadaism and Good Taste: Shocking Common Sense through Technology

The acceptance of electronics into the formal world of contemporary art was accelerated by the Dada movement during the same period, which had similar antiestablishment motivations to Duchamp. Dadaists were a diverse group of poets, photographers, performers, sculptors, painters, and mashup artists that assembled to protest the violence of World War I in Zurich, Switzerland around 1916. During the First World War, artists, academics, and other left-leaning individuals converged on New York and Zurich to avoid being drafted into battle in their home countries. This concentration had the result of forming anti-war sentiment into distinct subcultures. In particular, many artists opposed nationalism and pride in established cultural institutions, which they saw as factors in precipitating mechanized violence. The First World War saw the deployment of many new military technologies, including grenades, poison gas, artillery, submarines, warplanes, and tanks.[11] When these twentieth-century technologies were combined with a nineteenth-century military strategy and mindset, it resulted in one of the deadliest conflicts in human history.[12] The violence of war upended logic and a belief in the standard way of doing things. As a result, this cluster of artists lost confidence in many of the social and cultural institutions of the time, and saw their work as demolishing the old and beginning again: "We began by shocking common sense, public opinion, education, institutions, museums, good taste, in short, the whole prevailing order."[13]

As the war dragged onward, the Dadaist movement became less of an anti-war protest movement and more of a rally against the conservative conventions of art. In the process, it spread internationally to cities including New York, Berlin, Hanover, Cologne, and Paris.[14] Like Duchamp, Dada artists were not interested in crafting aesthetically pleasing work that fit within the existing structure of art. Instead, they wanted to capsize and drown traditional and complacent artistic conventions. Dadaism's creative anarchy further opened the field of art to everyday objects—including electronics—in order to question the public's nationalistic pride and bourgeois taste. To everyday objects, Dada added the variables of chance, montage, "happenings," assemblage, automatism, and installation—core themes that artists carried forward into an age of electronic media and carried though later art movements like Fluxus. In this way, through people like Duchamp,

electricity entered the field of contemporary art as an everyday object, and was amplified by Dada as an antiestablishment force where it continued to challenge the idea of what art is for nearly a century.

From Electric to Electronic: The "End" of the Mechanical Age

"The machine" became a metaphor for modernization during the late eighteenth century and nineteenth century in Britain. It served as a core metaphor for envisioning technological change until the 1960s, when the "electronic age" emerged as a newer metaphor for the contemporary era. *Electrical* devices simply use electricity, while *electronic* devices use electricity to manipulate an information signal. For example, a standard light bulb is electrical, while a radio is both electrical and electronic because it has a considerably more complex ability to manipulate and modify electrical signals as information.

Electric components used in art up until the 1960s were primarily mechanical in nature. Duchamp's *Rotary Demisphere* is a fitting example of more mechanical applications of electricity. The system is mechanical and not informational: the device simply turns on and does not process information. Thinking about electrical systems as machines—in contrast to thinking of work as primarily information-oriented—typified much of the artwork that used such components before the 1960s. Consider Naum Gabo's *Kinetic Construction No. 1* from 1920, which is comprised of a single rod of vertical wire with a balancing weight near its base. The wire is set in motion with a clock spring that produces a slender volumetric shape as it resonates back and forth.[15] Instead of merely evoking motion, like the Cubists or Futurists, this work integrated mechanical movement into art. Similarly, László Moholy-Nagy's *Light Prop for an Electric Stage (Light-Space Modulator)* from 1930 (figure 0.1.1) expands on the concept of kineticism in art. By using an electric motor to rotate several vertically oriented pieces of reflective metal, he produced optic effects when its kinetic surfaces interacted with light.[16] This approach is representative of Kinetic Art, or "a genre of plastic art in which the movement of forms, colors, and planes is used to procure a totality in the process of change."[17]

Artists in the first half of the twentieth century thought of electricity as primarily electromechanical, as distinct from what we now call electronic. This can also be called *electric-mechanical* versus the newer

Figure 0.1.1
Kinetic mechanical movement of sculpture emerged as a key feature of art using technology that predated the emergence of information technologies. László Moholy-Nagy, *Light Prop for an Electric Stage (Light-Space Modulator)*, 1930. Photo © Hattula Moholy-Nagy / DACS 2007.

electronic-informational. I define an *electrical* device as one that simply turns on and off, such as a light bulb or an electric motor. The device may be able to be dimmed or slowed down, but it has no feedback or logic to regulate its own control. Electrical devices simply use electricity as a power source. In contrast, *electronic* devices are capable of changing behavior on their own or are able to represent and manipulate information. Electrical circuits have no decision-making capability, but electronic devices do. In this sense, televisions are electronic, while electric motors are not.

Cybernetics, Communication, and the Birth of the Information Age

The advent of cybernetics was a key paradigm shift that ushered in the idea of the information age. Cybernetics, as defined in 1948 by Norbert Wiener, is "the scientific study of control and communication in the animal and the machine."[18] This idea emerged out of communication, which was concerned with how information could be encoded, transmitted, received, and decoded in systems like telephone networks.[19] Wiener's breakthrough was that cybernetics envisioned information as an independent thing—in other words, a signal that was independent of the transport medium. As a result, information became understood as a malleable and transferable entity. Art historian Edward Shanken astutely notes: "By disembodying information from its material substrates and reducing it to a generic signal (as in analog waveforms or the binary code of digital computers), information theory offered a flexible and practical method that could be applied to immediate engineering concerns . . . Cybernetics used it to theorize parallels between the exchange of signals in electromechanical systems and in the neural networks of humans and other animals."[20] Information became a thing that could be electrically transmitted, manipulated, encoded, and decoded through different devices.

Cybernetics also marked a shift in the understanding of how information works on a network level. Information could now be viewed as circulating and dynamic, able to be sculpted, governed, and fed back to control system behavior—what communication scholars would call a "feedback loop." The etymology of the word "cybernetics" points to this. The term was coined from the Greek word for "steersman," or *kubernetes*—the same root of the English word "governor."[21] This ability to "govern" information is a fundamental difference between the electric and the electronic. On its own, an electric device cannot process information or data—only an electronic device can. With this in mind, the electronic age is contiguous with the information age. In 1982, for example, Walter Ong referred to the electronic age as including the media technologies of radio, television, telephones, and satellites that harkened, "the electronic processing of the word and of thought."[22]

The start of the electronic-informational age was also reflected throughout the 1960s in the mainstream art community. By the end of the decade, The Museum of Modern Art (MoMA) claimed that the mechanical age was drawing to a close. On November 27, 1968, a major exhibition titled "The Machine as Seen at the End of the Mechanical Age" was launched.[23] This

exhibition looked back on the machine in art through a sprawling collection of artists from Leonardo da Vinci to the contemporary video artist Nam June Paik.[24] Swedish curator Pontus Hultén saw this retrospective as a commentary on how artists of the Western world viewed technology, and as an exploration of how humans have regarded machines as alternately utopian or dystopian.[25] The title, however, indicated that this era of machines was at its tail end. This desire to identify the new information-oriented epoch spanned museums internationally. At virtually the same time, the Institute of Contemporary Arts (ICA) in London launched an exhibition titled "Cybernetic Serendipity" that was curated by Jasia Reichardt. Instead of just alluding to an electronic future, this exhibition fully embraced it. The show featured algorithms and devices for generating music by Peter Zinovieff, artistic computer projects by Gustav Metzger, computers that could generate essays and poetry, and radio-controlled robots by Bruce Lacey and Nam June Paik. "Cybernetic Serendipity" also featured computer-generated movies and computer graphics by John Whitney, and interactive sculpture projects with complex sensors and feedback systems.[26] Electronic and informational media were rising as the new paradigm.[27]

It is also worth emphasizing that the rise of information technologies did not result in the disappearance of electromechanical systems: electromechanical systems simply worked alongside information systems, and artists continued to work with both electrical and electronic materials. The considerable amount of excitement around the processing of information through computers and interactive systems that incorporated feedback is historically monumental, however.

Art exhibitions in the 1960s were also driven by the crucial role that electronics and information systems had in popular culture. Stewart Brand, founder of the *Whole Earth Catalog*, wrote that "the counterculture saw in cybernetics a vision of the world built not around vertical hierarchies and top-down flows of power, but around looping circuits of energy and information."[28] This widespread interest was precipitated by advances in consumer electronics and the rise of cybernetic theory in the 1950s that envisioned information as a transferable and malleable object. Consider Jimi Hendrix's iconic, squealing "The Star-Spangled Banner," where electric guitar feedback took the role of a counterculture anthem at Woodstock. The year 1968 was a pinnacle for protest worldwide, and these moments of political upheaval also influenced the artistic understanding of electronics

in art. As a result, the information age erupted into the art world during the second half of the 1960s and continued in the subsequent decades.

Electronic-Information Overload: Too Technical for Aesthetics, Too Artistic for Science

Electronics were adopted by Gary Hill, Doris Totten Chase, Shigeko Kubota, Bill Viola, and other artists using video. Artists also continued to use simple electrical (not electronic) objects in their work, like Dan Flavin making minimalist installations using off-the-shelf fluorescent lights (figure 0.1.2).[29] However, many in the art world were not swept up in this shift toward embracing electrical and electronic media. Although it launched several electronic artists into the mainstream art world, most artists that primarily used electrical and electronic technologies remained within their own subcultures of festivals, galleries, curators, and publications. Although the ICA and MoMA shows of 1968 were significant, they were more of an indication of a shift in popular culture toward consumer electronics and industrial and academic research in information systems—they did not mark a wholesale shift in the art world toward embracing electronic media.

Figure 0.1.2
Dan Flavin regularly built minimalist light installations using off-the-shelf fluorescent components. Dan Flavin, *Alternating Pink and Gold*, 1967. Photo © Estate of Dan Flavin / SOCAN (2021).

Art historian Edward Shanken, for example, believes that electronic art was "too technological to be appreciated under conventional canons of aesthetics, and too artistic to be appreciated according to the criteria of science or engineering."[30] It essentially remained a small-scale, do-it-yourself endeavor that operated on the edges of many disciplines, including art, commercial technological development, and hobby electronic culture, with an occasional intersection with experimental computer science or robotics.

There are also pragmatic curatorial reasons behind the history of electronic art being left out of the art canon. Experimental interactive systems and custom-built electronic projects pose many problems for museums and galleries that primarily exhibit and maintain static paintings and noninteracitve sculptures. Electronic-oriented art projects frequently break down and require maintenance due to their cutting-edge and underfunded DIY development processes. "Cybernetic Serendipity," for example, racked up $40,000 in repairs and technical maintenance between shows, which prevented it from being exhibited at the Smithsonian Institution.[31] As a result, the electric and electronic media that permeated the mainstream exhibition system were primarily noninteractive and fit well within the traditional infrastructure of white-walled galleries. This small number of electronic art successes were easy to install, maintain, and repair. Jon Ippolito argues that an artist like Dan Flavin was able to navigate and succeed in the mainstream art world because he used simple electrical components that were inexpensive and easy to install (figure 0.1.2). In Flavin's case, he was proud that his ethereal lightscapes were built out of low-priced fluorescent tubes available at any well-stocked hardware store.[32] Electronic devices came into contemporary art in the 1920s by way of the ready-made item, and this is the level of consumer-grade commitment that most art institutions were willing to provide. However, the bespoke electronic projects spawned many new opportunities for creation, participation, and collaboration for those willing to bend or build institutions.

E.A.T. in the 1960s and 1970s: The Experimental vs. the Ready-Made in Art and Technology

One approach to addressing the technical difficulty of building custom electronic devices was to connect artists with industrial, mechanical, and electrical engineers. The group Experiments in Art and Technology (E.A.T.)

was formed in 1966 to serve as a matchmaking service between these two universes. The initiative was driven by Billy Klüver, who worked as an engineer at Bell Labs on crossed-field backward-wave magnetron amplifiers. He had already provided technical support to a number of high-profile contemporary artists in New York City, including Andy Warhol, John Cage, Jean Tinguely, Robert Rauschenberg, and Jasper Johns.[33] Klüver had helped them make self-destructing machines, custom-built wireless audio units for sculptures, neon sign paintings, and floating sculptures. E.A.T. was set up to facilitate more artist/engineer partnerships in this spirit.[34]

Experiments in Art and Technology grew out of a collaborative artist/engineer event titled *9 Evenings: Theatre and Engineering* that Klüver and Rauschenberg organized during October 1966 at the 69th Regiment Armory in Manhattan. The project consisted of ten artists and approximately thirty engineers that worked over the course of ten months to develop a mixture of new technologies with avant-garde theater and performance. The event was eviscerated in the popular press with headlines like "Audience Endures a Depressing Spectacle" and statements like "It was such a sad failure, such a limp disaster. . . . It is merely depressing to see such pioneering being done by what appear to be bumbling amateurs."[35] Although the individuals were arguably "expert" artists and engineers, the drastically interdisciplinary collaborations were thoroughly "DIY" in spirit: projects often struggled to function at all, and the ruggedness of the systems and the mode of the audience interaction was not thoroughly developed. Not dissuaded, Klüver and Rauschenberg formed E.A.T. about a month later with the help of Bell engineer Fred Waldhauer and artist Robert Whitman.[36] The organization rapidly expanded in size, and by 1970, E.A.T. had twenty-eight regional chapters throughout the US with approximately 5,000 members, half of whom were artists and half of whom were engineers.[37]

At its core, E.A.T. believed that artist/engineer collaborations would help society by humanizing emerging technologies. This echoes Marshall McLuhan's prompt for artists to act as "antennae" to evaluate new technologies.[38] Artists could add "individual variety, pleasure and avenues for exploration and involvement in contemporary life" through new technology in collaboration with engineers.[39] This humanization was not primarily aesthetic but oriented around the idea that the "artist expands our vision of the world and inspires the content of the communication media as well as the form of the media themselves."[40] As a byproduct, it was also proposed

that these collaborations could help industrial partners generate future-oriented thinking within their companies and ameliorate fears the public had over rapid technological change. Accordingly, E.A.T. pitched itself as a cultural middle ground between the progressive countercultural left and industry, as "a mutual agreement in order to avoid the waste of a cultural revolution."[41] However, even for projects that had funding to make the work more technically robust—like E.A.T.'s development of the Pepsi Pavilion at the 1970 Osaka World Exposition—the close ties to large multinational corporations led to a clash of ideals.[42] The relationship between Pepsi's management and E.A.T. disintegrated after a disagreement over having a structured schedule of events or an open-ended and experimental series of happenings in the space.[43]

Electronic art, for the most part, is a theater of do-it-yourself practitioners experimenting with technically unstable devices. Although E.A.T.'s intentions were organized and ambitiously professional, the delivery of their projects was widely derided by art reviewers as being a mess: "If the American engineers and technologists participating in this performance were typical of their profession, the Russians are sure to be first on the moon."[44] Critics felt that the work fell technically and artistically short. The E.A.T. organization thus illustrates a larger trend that has challenged the popularization of electronic art. Projects that are defined as small-scale and experimental tend to succeed in subcultural settings, while larger-scale projects are reviewed positively only when they meet the same technical stability requirements as consumer electronics. As a result, much of this work has thrived as a subcultural DIY practice.

Antenna: Artists as Sociotechnical Researchers

The work of Marshall McLuhan during the 1960s was also influential in shifting mindsets from the electric and mechanical to the electronic and informational. McLuhan's written work in media and communication centers on the rising tide of the electronic in Western civilization over the decade. In his popular books, he argues that this flood of electronic communication is radically reconfiguring society. In *The Gutenberg Galaxy*, for example, McLuhan suggests that the visually and individually oriented culture of print is in the process of being replaced by electronic media. As a result, a more collectively oriented "global village" has emerged, focused

on sound and speech.[45] *Understanding Media* further outlines the immense impact that electronic systems have on culture. McLuhan goes so far as to proclaim that they upend the existing global order: "After more than a century of electric technology, we have extended our central nervous system itself in a global embrace, abolishing both space and time as far as our planet is concerned."[46]

McLuhan's influence impacted several practitioners in the arts, especially the field of artists working with new technologies. McLuhan specifically steered artists away from self-expression and toward exploring new technologies in an effort to predict social problems. In the introduction of his second edition of *Understanding Media* published in 1964, he put forward the argument as follows: "Ezra Pound called the artist "the antennae of the race." Art as radar acts as an early warning system, as it were, enabling us to discover social and psychic targets in lots of time to prepare to cope with them. This concept of the arts as prophetic contrasts with the popular idea of them as mere self-expression. . . . We can afford to use portions of them [the arts] that enhance the perception of our technologies, and their psychic and social consequences."[47] In turn, several artists adopted this exploratory, antenna-like approach to researching new communication technologies regardless of their professional technical experience. In addition to experimental organizations like E.A.T. that encouraged radical interdisciplinary collaborations, McLuhan's approach of artists as technical researchers inspired and fueled many organizations that emerged in the 1980s, like Ars Electronica, V2_, Transmediale, Interaccess, ZKM, and others.

The 1980s: An Institutionalization of the Technologically Tentative

As time passed, the genre of electronic art—lacking formal institutional representation—congealed into international subcommunities. The period of the 1980s saw the experimentation of the 1960s and 1970s congeal into a number of relatively stable local organizations that encouraged technologically oriented practices. In Austria, for example, the yearly Ars Electronica Symposium exhibition and conference began in Linz in 1979. During the same period, other similar organizations began to emerge to foster artists that wanted to significantly engage with information and media technologies. Other initiatives include the V2_ Organization / Institute for the Unstable Media. It started in 1981 in the Dutch town of 's-Hertogenbosch as an

interdisciplinary artists' squat. Out of frustration at the visual arts community, in 1987 it began to focus exclusively on electronic art and other "unstable media."[48] Founders Alex Adriaansens and Joke Brouwer saw the instability of electronic art as an advantage. Happenings and installations became their core strength and brought these artists more in touch with playful and interactive mass culture (figure 0.1.3).

In Canada, InterAccess in Toronto grew out of the Artculture Resource Centre (ARC), founded in 1981. The organization brought together artists that were using Telidon, a Canadian pre-web interactive telecommunications system somewhat similar to videotex or Minitel. Initially launched with a solo show by Brian Eno in 1981, the organization grew to include a core group of artists including Nancy Paterson, Tom Leonhardt, Jeff Mann, Graham Smith, Nell Tenhaaf, Paul Petro, Doug Back, and David Rokeby.[49] Other institutions founded during this period include the Transmediale festival in 1988 in Berlin and the Zentrum fur Kunst und Technologie (ZKM, "Centre for Art and Technology") in 1989 in Karlsruhe, Germany.

These organizations were driven by the frustration electronic artists had with being neglected by mainstream visual art during the 1970s and 1980s. Alex Galloway notes that the contemporary art journal *October*, which can be viewed as a yardstick for artistic and intellectual trends, did not even cover the field of art and technology until 1985.[50] And, as previously mentioned, museums were reluctant to embrace projects that incorporated electronic media. As a result, electronic artists often labored in silent obscurity. According to Edward Shanken, "even Paik, the most celebrated artist associated with Art and Technology, struggled well into the 1980s."[51] Organizations such as Ars Electronica, V2_, and InterAccess supported artists, helping them to continue making groundbreaking interactive and intentionally unstable work that bucked institutional demands. These organizations often worked as collection points for DIY practitioners—a bit like proto-hackerspaces—that aided in the production and distribution of this work.

Electronic art started to ride on separate circuits through distinct exhibition styles, approaches, and events. Many artists that used electronic technologies viewed their work as part of a dynamic process, rather than part of the "serious and stable" institutional model. This process-based view often clashed with galleries interested in the preservation and presentation of static objects. Instead of maintaining a hermetic white gallery, electronic art organizations created spaces where projects were designed to be touched, make

(a)

(b)

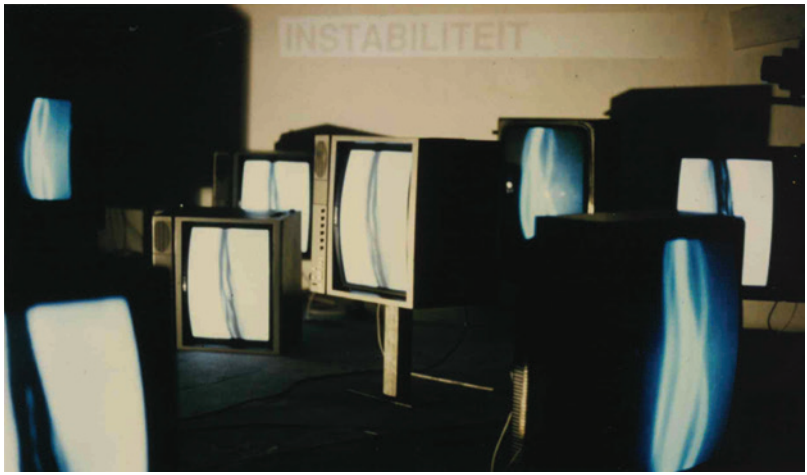


Figure 0.1.3
An example of one of the numerous projects at V2, which operated as an organization, exhibition and performance space for "unstable media" in the Netherlands since 1981. Joke Brouwer and Alex Adriaansens, Installation for the Unstable Media, 1988. It consisted of a number of interactive monitors in two different rooms. In one space at V2_, the audience charged a virtual capacitor, which was discharged upon entry into the second space. This change impacted the display of the sideways-positioned CRT screens scattered through the environment. The title gives reference to V2_'s new vision (circa 1987) of focusing on electronic art and other forms of "unstable" media. Courtesy Jan Sprij.

noise, and break down.[52] At times, these electronic art performances more closely resembled a music venue than a gallery. These performative and interactive spaces required electrical infrastructure and staff to help start up projects, keep them running, and shut them down. With an emphasis on interactivity, these initiatives often drew historical inspiration from avant-garde and interventionist art movements like Fluxus and Dada along with technology-minded theorists like Marshall McLuhan. To this day, numerous art festivals focus exclusively on electronic art, like Ars Electronica, the International Symposium of Electronic Art (ISEA), the Dutch Electronic Art Festival (DEAF), and the *Festival Internacional de Linguagem Eletrônica* (FILE) in Brazil. In response, some mainstream institutions invested in substantial support for art and technology initiatives in a museum setting. For example, the Centre Pompidou in Paris integrated engineers as part of their maintenance and preservation efforts by the late 1990s.[53] Inclusion of DIY electronic work in larger institutions happened occasionally, but the work primarily thrived in small, subcultural communities that regularly blended art with engineering, design, science, and information technologies. Through a slow grassroots evolution over the course of the twentieth century, electronic art has developed a distinct cultural approach to doing and appreciating art; most of it is best understood as a *variegated* DIY process and *mindset* instead of a stable and institutionalized canon.

Electronic / Media / Digital / New Media

Many seemingly interchangeable terms are used to describe artworks that incorporate technology: "electronic art," "media art," "digital art," and "new media art." Although there is considerable overlap, it is worthwhile to pause and consider what the specific term "electronic art" captures in comparison to seemingly similar concepts. As I have argued above, electronic art is the oldest of this cluster of terms, and it encompasses all work that primarily uses electronics as the medium of studio production.[54] Media art, on the other hand, is defined as artwork that uses communication technologies like video. The Canada Council for the Arts, for example, refers to media art as artwork that depends on a technological component to function. Harkening back to the informational turn of the 1960s, they particularly consider new media and moving image technologies used to transmit and store information to be media art.[55] In art and technology circles, the "media" of

media art is often viewed in a McLuhanesque sense as any new technology that extends perception.[56] In more mainstream galleries and institutions, "media" refers to a general understanding of forms of mass communication. By comparison, digital art refers to any work that relies on computation, and new media highlights work after approximately 1990 that is computer-oriented, interactive, or Internet-based.[57] Sarah Cook and Beryl Graham define new media art as "art that is made using electronic media technology and that displays . . . interactivity, connectivity and computability, in any combination."[58]

These flexible labels necessarily build on each other, overlap, and are hybridized. Cook and Graham's definition of new media art highlights how these terms are constructed from earlier iterations. From a material perspective, new media is made out of digital technologies, the digital is built with media technologies, and media technologies are built from electronics. However, in social contexts and in wider culture, labels and categorizations shift, depending on who is seeing the work. In other words, the same piece of DIY technology can be both a piece of electronic art and a work of critical design; it often simply depends on the audience. In large part, this branding is more the domain of curators, writers, and gallerists than artists. Often, the coining of a new term—like "Holopoetry," "Biotelematic Art," or "Transgenic Art"—is used to lay claim to a niche subdomain. The person that invents the term often advantageously positions themselves as the first pioneer of the new genre.[59] As a result, these micro-labels are of little general use because they only include a few people across the planet. Although the term "electronic art" could apply to any project incorporating electronics, I use it to refer more specifically to individuals that use electronics as a medium or material, and use their art to question technology's role in culture. As a result, I argue that electronic art is still useful as a category—especially with the increased interest in creative electronics that has emerged since 2005 under the banner of maker culture.

The "Effect" Effect of New Media

In many senses, the term "new media" is worn out and is no longer of much practical use. Beyond this, the term can be counterproductive in highlighting historical trends in art and technology that span back at least a century.

A focus on the term "new media" skews our perception of this work, and reverting back to the older term "electronic art" maintains more continuity in the field of practice. This is not to say that newer fields—like computation in the arts, algorithms, blockchain, or networks—are not of consequence in contemporary art practice. My point is more to emphasize the continuity of electricity in art as a significant field of practice for about a century. The medium of electronics is *both old and new*. However, continuing to refer to this work as "new" media fails to consider its longer history.

The term "new media" was deployed in the 1990s to differentiate electronic and digital work from noninteractive and nonnetworked pieces, both in traditional studio art and in noninteractive works using electrical components. Although the term "the new media" was used as early as 1966 to describe computer-based media within the framework of educational technologies (Rossi & Biddle), by the time the World Wide Web became popularized through the release of the Mosaic browser in 1993 and Netscape Navigator in 1994, the term had dropped the "the" and was simply "new media."[60] With the ascent of the Internet in the mid-1990s, the field of electronic art largely embraced *new media* as a term and a mindset. Digital newness was the best way to differentiate electronic media from older forms of artistic expression. This orientation toward newness resulted in what Rafael Lozano-Hemmer termed "the 'effect' effect": technological novelty and special effects became the core object of the artwork and its primary incentive.[61] Artwork using new technology is often an exploration of the new effects available within the medium.

Exploring the potential of new technologies is not new. In some ways, it is a well-worn and significant tradition within art practice. Special visual effects have been implemented in art for centuries through Mannerist anamorphism, Baroque ornateness, Modern collage, and Op Art. The criticism that Lozano-Hemmer brought forward to new media art in the 1990s was that this work is often arrogantly superficial and lacks reflective distance from the technology it is using. It perpetuates the myths that new technology is "(1) providing a truly global culture; (2) introducing infinite creative possibilities; (3) to be trusted with the management of resources both 'natural' and 'human'; and (4) eradicating discrimination on the basis of gender, race, or class."[62] In other words, new technology is often portrayed as a cure-all for human problems, and during the early 1990s when information technologies, computer networking, and virtual reality were rapidly

expanding, these technologies were often sold with the promise of being able to radically expand human creativity and to bring about social equality. This was partially true, but was a drastic oversimplification and a "technosolutionist" approach to complex human problems.[63] Lorne Falk referred to this in conversation with Lozano-Hemmer as being "technologically correct," alluding to the pejorative term "politically correct" that the Right coined to describe the Left's attempts to be inoffensive in America since the 1980s.[64] The technologically correct, or technosolutionist approach, generally believes that more technology is better for society—that technology is the answer to human problems—and is often a sales technique promoted by commercial technology companies that is still prevalent today.

Exploring the expressive potential of new technology is not negative on its own. In fact, such experimentation crucially uncovers how emerging technologies impact how we perceive the world, communicate with each other, and shape our identities. For example, E.A.T.'s mission in 1966 was described as helping to "guide the artist in achieving new art through new technology." The problem arises when artists and curators uncritically buy into the emancipatory narrative of technology; their work lacks a reflective depth. There is often little difference between new media artwork and a commercial technological demo where we are invited to admire a computer system's improved capabilities, resolution, or speed. Worse, new media can reinscribe existing divisions in who gets to benefit from technology. It can resemble "toys for boys"—reviving the worn-out colonial archetype of the masculine pioneer. The first (usually male) person to smash through a new technological boundary is rewarded, irrespective of whether their work has anything culturally interesting to say.[65] Sarah Diamond sees this style of work as providing "an ecstasy of technical effects, formal functionality, and coolness, without social context."[66] In my mind, this is part of what new media art represents.

An overemphasis on the newness of media creates lackluster art projects that are also overwhelmingly mediocre from an engineering standpoint. Artists have horrible difficulty making technologies at the level of industrial engineers and commercial industry. As a result, they need to either employ a DIY approach to build new tools or use consumer-grade technologies that are available to the general public. The former is often technologically frail, and the latter is more an innovation of use than a radical technical development. Several artists are equally talented at engineering;

David Rokeby, Char Davies, Seiko Mikami, Natalie Jeremijenko, Krzysztof Wodiczko and Myron Krueger were innovative artist-engineers active in the 1990s. However, as historian Edward Shanken states, independent artists are generally "unable to compete on a technological basis with the spectacularity of scientific demonstrations, mass media, or Hollywood special-effects."[67] New media art that falls into the "effect" effect often sells us on novelty and neglects McLuhan's prompt to help society understand and rethink its complex relationship to technology.

The Web 2.0 Pivot: The Art Formerly Known as New Media

If a 2005 exhibition at Walter Phillips Gallery at the Banff Centre was any indication, the post-Y2K period saw a reevaluation of new media. "The Art Formerly Known As New Media," cocurated by Steve Dietz and Sara Cook, provided a retrospective of electronic artwork on the tenth anniversary of the Banff New Media Institute. The exhibition marked a clear shift in electronic art and new media elsewhere. In particular, 2003 saw the Walker Art Center, the Guggenheim, and SFMOMA scale back their new media initiatives. In a wider social context, the Internet had started to shift into its "Web 2.0" phase of user-generated content and social networking: for example Wikipedia was released in 2001, MySpace came in 2003, Vimeo and Facebook arrived in 2004, and YouTube launched in 2005.[68]

It should not have come as a surprise that the early 2000s were when digital new media began to lose its status as an avant-garde form. In 1999, critic and educator Peter Lunenfeld proposed that the whole rubric of new media should only be temporary. He argued that "the very term 'new media' is ambiguous. . . . In the end, the phrase 'new media' turns out to be yet another placeholder, this time for whatever we eventually agree to name these cultural productions."[69] New media is a temporal term, now dated and reminiscent of the Y2K era.

Critical Design: The "Effect" Effect is the Enemy

Emphasizing the novelty of new media has done significant damage to art practices that strive to comment on the role of technology in everyday life. Critical designer Anthony Dunne, for example, dismisses the entire category of electronic art as a useful place for reflection about the impact

of technology on everyday life. He sees the field as driven by glamorization, "concerned only with the aesthetic expression of technology for its own sake."[70] This is what Lozano-Hemmer refers to as the "effect" effect. I agree that criticizing the glamorization of technology is worthwhile. After all, Dunne and Lozano-Hemmer are, by proxy, expressing wariness about easy promises of utopianism and the progressiveness intertwined with concepts like new media. However, to describe all of electronic art as being concerned only with technological aesthetics is blatantly inaccurate.[71]

Art is a porous category. The history of electronic art that I have outlined shows how electronic objects can float between communities in art, design, computer science, the humanities, and industry. For this reason, grassroots organizations of electronic artists vigorously carved out their own subcultural terrain in the 1980s and 1990s. As a result, I see that electronic projects themselves have a form of agency and can act as a meeting point between disciplines.[72] Here, Dunne's term "electronic objects" is useful in order to draw attention to individual projects instead of disciplinary distinctions. He writes that "the electronic object is a confusion of conceptual models, symbolic logic, algorithms, software, electrons, and matter." However, it is false to think that these designed objects cannot also function as art. The inverse is also true: many artists also clearly do engineering.

The remainder of this book takes Dunne's dismissal of the category of electronic art as a challenge. The field is stacked with groups and projects that question the role technology plays in contemporary society. Accordingly, I work to reframe electronic art by subtracting technological novelty from the narrative. When the progressiveness and optimism of new media is subtracted from the narrative, a different form of electronic art emerges—one that is critically engaged with technology, technically uncertain, and often a do-it-yourself endeavor.

Conclusions: Electronic Art as DIY Practice

Electronic art can be thought of as encompassing and including any piece of art that has both electricity and information flowing through it, including video art, work with computers, custom electronics, or electronic music. Despite being a historical term, the term is still useful in highlighting work that focuses on the medium of discrete electronics and "device art," especially within the contexts of the rise of the Arduino and consumer 3D printers,

and the rejuvenation of electronic prototyping through maker culture since 2005.[73] Having had at least a half century of lead time ahead of the concept of the maker movement, electronic art provides a rich and varied field of creative practice in making and electronics.

In summary, electricity has been part of the sphere of art by way of artists incorporating ready-made consumer items into their work since at least the 1920s. A cybernetic shift from the electric and mechanical to the electronic and informational occurred in the mid-1960s, and the formation of organizations solely focused on art and technology took hold from the 1960s through the 1990s. The term "new media" was mobilized in the 1990s, but this term—and the novelty of interactivity and the Internet—began to be widely adopted by mainstream institutions around 2005. At the same time, 2005 gave birth to the archetype of the "maker," which integrated and popularized some components of DIY electronic culture. However, the maker movement provides us with few details about history, sparse details on why we should make something beyond technical curiosity, or where we should go in the future.

Art and design, on the other hand, are relatively obsessed with their own histories and futures, and provide a plethora of ideas, concepts, and terms that point a clear path forward when combined with scholarship on technological development. In hindsight, it is useful to historicize and rethink the work done in electric and electronic art over the past century through the lens of amateur-developed and "punk" technologies: it provides many useful signposts for contemporary maker culture and gives important clues about the unexpected and surprising advantages of technological design from artistic and nonindustrial perspectives.

The MIT Press would like to thank the anonymous peer reviewers who provided comments on drafts of this book. The generous work of academic experts is essential for establishing the authority and quality of our publications. We acknowledge with gratitude the contributions of these otherwise uncredited readers.

This book was set in Stone Serif by Westchester Publishing Services.

Library of Congress Cataloging-in-Publication Data

Names: Hertz, Garnet, 1973– author.
Title: Art + DIY electronics / Garnet Hertz.
Other titles: Art and DIY electronics
Description: Cambridge, Massachusetts : The MIT Press, [2023] | Includes bibliographical references and index.
Identifiers: LCCN 2022026917 (print) | LCCN 2022026918 (ebook) | ISBN 9780262044936 (paperback) | ISBN 9780262361583 (epub) | ISBN 9780262361576 (pdf)
Subjects: LCSH: Art and electronics. | Maker movement. | Arts—Experimental methods. | Technology—Social aspects.
Classification: LCC N72.E53 H47 2023 (print) | LCC N72.E53 (ebook) | DDC 702.8—dc23/eng/20220727
LC record available at https://lccn.loc.gov/2022026917
LC ebook record available at https://lccn.loc.gov/2022026918