

Machine Art in the Twentieth Century

Andreas Broeckmann

<https://doi.org/10.7551/mitpress/9780262035064.001.0001>

Published: 2017

Online ISBN: 9780262336109

Print ISBN: 9780262035064

CHAPTER

1 Introduction: The Phantom of “Machine Art”

Andreas Broeckmann

<https://doi.org/10.7551/mitpress/9780262035064.003.0002> Pages 9–46

Published: January 2017

Abstract

This introductory chapter maps the conceptual context for the treatment of machine art that follows in the other chapters of the book. The chapter first presents the most important, partly conflicting definitions of the term “machine art” that have been deployed by different authors in the twentieth century, including Vladimir Tatlin, Alfred Barr, Bruno Munari, and the Berlin Dadaists. The chapter then outlines the most important concepts of the “machine”, a notion that has been used to denote technical, sociopolitical as well as psychological phenomena. The author proposes a general conception of the “machine” as a particular type of relation between individuals and the structures, or apparatuses, that bring about human subjectivities. The introduction concludes with a section on the gender aspect of human relations with technology, using the myths of the bachelor machine and the cyborg to describe supposedly gender-specific forms of access to the construction and usage of technical systems.

Keywords: machine art, machine, apparatus, machine love, bachelor machine, cyborg, mega-machine, desiring-machine, feminism

Subject: History of Art

What is “machine art”? If we go by the historical use of the expression, there is no conclusive answer to this question. In fact, there are a surprisingly small number of instances when artists and writers have used the term explicitly in order to affirm the existence and relevance of some machine art, and among these few instances, there are several quite divergent and inconsistent definitions of the term. A short chronological review of the most relevant of these statements shows that the underlying concepts of the machine and of art both vary hugely.

“Tatlin’s Machine Art”

At the peak of their activities in the summer of 1920, the Berlin Dadaists organized the “First International Dada Fair” (Erste Internationale Dada-Messe). The humble exhibition space presented a large variety of works, paintings, collages, drawings, sculptures, and assemblages, all combined in an overwhelmingly congested installation. One of several slogans printed on white cardboard panels claimed: “Art is dead. Long live Tatlin’s new machine art [Die Kunst ist tot. Es lebe die neue Maschinenkunst Tatlins]” (figure 1.1). Vladimir Tatlin was, at this time, one of the most famous and internationally known Russian avant-garde artists who were influencing art and art politics in the young Soviet Union. However, it is not immediately apparent what George Grosz, Raoul Hausmann, John Heartfield, and their fellow Dadaists meant when they took Tatlin as a proponent of what they called “machine art.” It is unlikely that the Berlin Dadaists had seen any recent works by Tatlin when they printed their famous slogan.¹ Yet they had read a review by a young Russian art critic, writing in 1920 in a journal on recent trends in art that was titled after Moscow’s famous art district, Ararat. In his review “Der Tatlinismus oder die Maschinenkunst” (Tatlinism, or machine art), Konstantin Umanskij wrote what in Berlin was taken as a manifesto:

The beginnings of Tatlin’s “machine art” go back to the year 1915. Vladimir Tatlin, the founder of this direction, has not only created new words for the language of art, but also a new language of art. More ... The image is dead—thus the claim of “Tatlinism.” The image surface is too confined for

p. 10

↳

p. 11

↳ the three-dimensional, the solution of new problems requires more elaborate technical means, and finally the necessity to create “images,” “artworks” that merely entertain the layperson—or rather repel him—is considered critically. Art is dead—long live art, the art of the machine with its construction and logic, its rhythm, its constituent parts, its material, its metaphysical spirit—the art of the “counter-relief.” It regards no type of material as unworthy for art. Wood, glass, paper, sheet metal, iron, screws, nails, electrical appliances, glass splinters for sprinkling the surfaces, the mobility of individual parts of the work, etc.—all these are declared as legitimate means of the language of art, and its new grammar and aesthetics demand of the artist a broader technical training and a closer bond with his powerful ally—the grand machine.²



Figure 1.1 “First International Dada Fair” (1920), George Grosz and John Heartfield (“Art is dead. Long live Tatlin’s new machine art”).

Image courtesy of Berlinische Galerie, Berlin. © Estate of George Grosz, Princeton, NJ, and The Heartfield Community of Heirs/VG Bild-Kunst, Bonn, 2015.

The counter-reliefs that Umanskij mentions are small wall-mounted assemblages which Tatlin had created since around 1914. He used different materials, such as wooden boards, sheets of metal, and thread, and arranged them in three-dimensional configurations. Tatlin had trained as an artist, and in the revolutionary spirit of the day the counter-reliefs were his self-declared “Tatlinist” way of rejecting the hegemony of the flat surface of painting and its representational illusions. He had visited Paris in the spring of 1914 and had seen assemblages of paper and other materials in Pablo Picasso’s studio. But by integrating poor and industrially made materials into his assemblages, Tatlin was attempting to make a more radical break with artistic representation than he had found in Picasso’s cubism.³

Tatlin is one of those historical figures who have had to serve as projection screens for ideas that have, rightly or wrongly, become associated with their names.⁴ He initially promoted “Tatlinism,” i.e., the

innovation of art through the detachment of technical materials from their industrial context in order to turn them into artistic materials. This transfer of technical materials into artistic media, and the dispensation of the artist's subjective intention and control over the artwork, constitute the core of what the Berlin Dadaists understood as "Tatlin's Machine Art."⁵ Nevertheless, Tatlin himself soon rejected this approach because it preserved art as a practice outside of the overall processes of social production: as a teacher at the national art school, in the early 1920s, he therefore published the slogan, "Down with Tatlinism!"⁶

The Futurist Aesthetic of the Machine

Italian futurists had celebrated the arrival of the machine age ever since the publication of the first futurist manifesto by Filippo Marinetti in 1909. However, the most explicit treatment of the new "mechanical art" was formulated after the First World War by the second-generation futurist Enrico Prampolini in his manifesto "The Aesthetic of the Machine and Mechanical Introspection in Art."⁷ Prampolini posited the machine as a new symbol of aesthetic inspiration which could elucidate the way in which artistic invention and production took place. The functional features of machines—such as their productivity, their repetitive movements, or their automatism—should be adopted for artworks not as physical principles, he argued, but rather as conceptual aspects:

p. 12

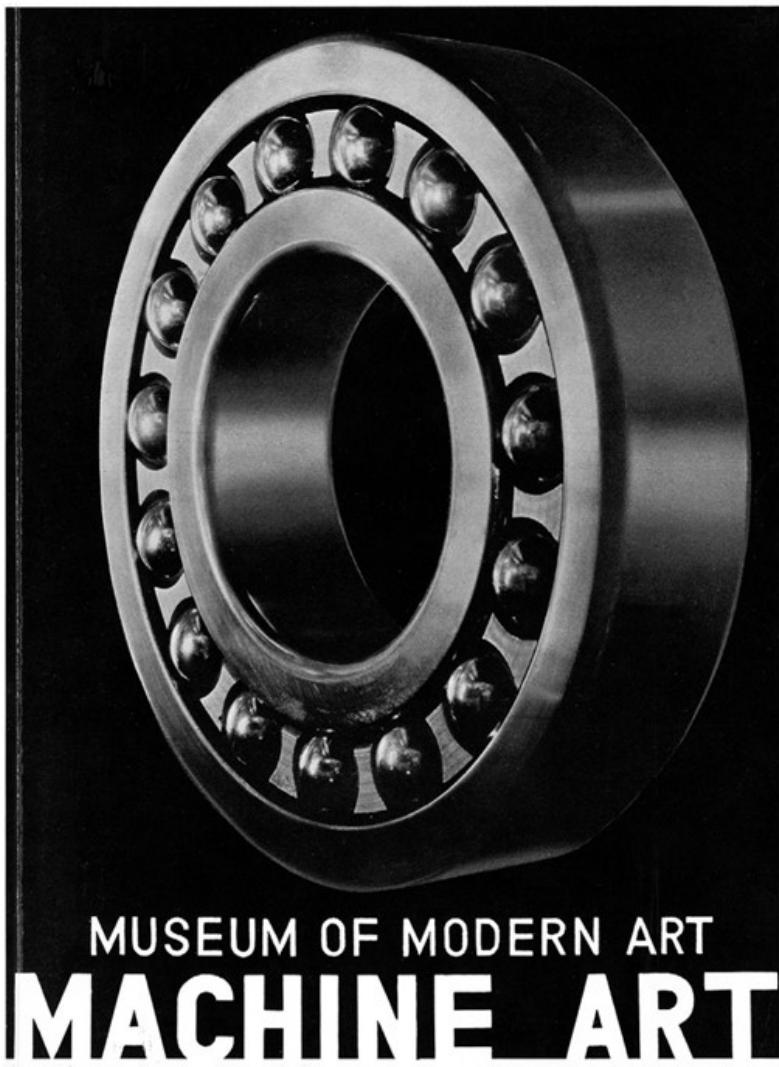
The aesthetic virtues of the machine and the metaphysical meaning of its motions and movements constitute the new fount of inspiration for the evolution and development of contemporaneous plastic arts. ... The plastic exaltation of *The Machine* and the mechanical elements must not be conceived in their exterior reality, that is in formal representations of the elements which make up *The Machine* itself, but rather in the plastic-mechanical analogy that *The Machine* suggests to us in connection with various spiritual realities.⁸

The futurists approached the notion of the machine by focusing on its symbolic meanings, with which an artistic practice would seek to associate. This machine would not produce art by itself, but would form a conceptual and metaphorical frame of reference for a new aesthetic.

Philip Johnson and Alfred H. Barr's Machine Art

In the spring of 1934, the Museum of Modern Art in New York City held the exhibition "Machine Art" curated by Philip Johnson, the founding director of the museum's Department of Architecture and Design since 1930 (figure 1.2). The show contained around 400 items of US industrial design from contexts such as the office, the kitchen and home, science, and industry. In his introductory text for the catalog, Johnson contrasts "the history of machine art" to that of handicraft, praising the machine-made designs for their "precision, simplicity, smoothness, reproducibility," aesthetically fitting "an age geared to machine technique."⁹ In a brief historical overview, Johnson denounced nineteenth-century attempts by designers to reproduce craftlike appearance in machine-made objects, and described the variety of European influences on American designs of industrial objects.

Figure 1.2



Josef Albers, cover of the exhibition catalog *Machine Art*, Museum of Modern Art (MoMA), New York (1934). Offset lithograph, printed in black, 25.4 × 19.1 cm.

The Museum of Modern Art Library. Digital image © The Museum of Modern Art, New York/Scala, Florence 2015. Cover Design © The Josef and Anni Albers Foundation/VG Bild-Kunst, Bonn 2015.

In his text, Johnson used the term “machine art” only in the one instance just quoted, and otherwise focused on the emergence of a design equivalent of the International Style in architecture—to which he and MoMA director Alfred H. Barr Jr. had devoted an exhibition two years earlier. In contrast, Barr in his own text for the catalog made extensive use of the term in a provocative though not merely polemical attempt to propose “machine art” as a new art historical category. To support this proposition, Barr offered an aesthetic evaluation, a statement on the role of the human artist, and an art historical contextualization.

In his foreword, Barr emphasizes the aesthetic clarity of machine-made objects: “In addition to perfection of shape and rhythm, beauty of surface is an important aesthetic quality of machine art at its best. Perfection of surface is, of course, made possible by the refinement of modern materials and the precision of machine manufacture.”¹⁰ Barr explicitly confronts the art theoretical implications of elevating machine-made products to the status of art. While the shape and appearance of the objects are determined by their functions, the artist-designer is ascribed a passive and unheroic role:

Many of the finest objects in the exhibition ... are produced quite without the benefit of artist-designer [sic]. Their beauty is entirely unintentional—it is a by-product. Nevertheless they satisfy through their “integrity,” “due proportion” and “clarity,” the excellent thomistic definition of the

p. 13

↳

p. 14

↳ beautiful as “that which being seen, pleases.” Many other objects ... are the result of conscious artistic intention. For in a great many useful objects function does not dictate form, it merely indicates form in a general way. The role of the artist in machine art is to choose, from a variety of possible forms each of which may be functionally adequate, that one form which is aesthetically most satisfactory. He does not embellish or elaborate, but refines, simplifies and perfects.¹¹

Barr’s provocation lies in the fact that he proposes an art form that achieves beauty not through the artist’s intention and creation, but through the demands of functionality in industrial production, and without the influence of art history: “Good machine art is entirely independent of painting, sculpture and architecture. But it may be noted in passing that modern artists have been much influenced by machine art.”¹² He mentions the Italian, English, and Russian futurists who were “romantically excited by the power and speed of machines,”¹³ and comments in a footnote that the exhibition “Machine Age,” held in New York in 1927, had been inspired by the same romantic sentiment.¹⁴ In his list of contemporaneous artists who deal with aspects of machines, Barr does not mention the trope of “Tatlin’s machine art,” or the Berlin Dadaists’ antibourgeois appropriation, or American composer George Antheil’s machine music, but merely writes: “The Russian constructivists, Tatlin, Gabo, Pevsner, employed the technique, the materials and something of the structural feeling of machinery.”¹⁵

However, for Barr the machine is not only a functional object, but a force that has a direct impact on human life. The struggle with nature that romanticism addressed through the concept of the sublime has been supplanted by an analogous antagonistic struggle with industry and technology: “It is in part through the aesthetic appreciation of natural forms that man has carried on his spiritual conquest of nature’s hostile chaos. Today man is lost in the far more treacherous wilderness of industrial and commercial civilization. On every hand machines literally multiply our difficulties and point our doom. If, to use L. P. Jack’s phrase, we are to ‘end the divorce’ between our industry and our culture we must assimilate the machine aesthetically as well as economically. Not only must we bind Frankenstein—but we must make him beautiful.”¹⁶

Bruno Munari’s Art of Machines

p. 15

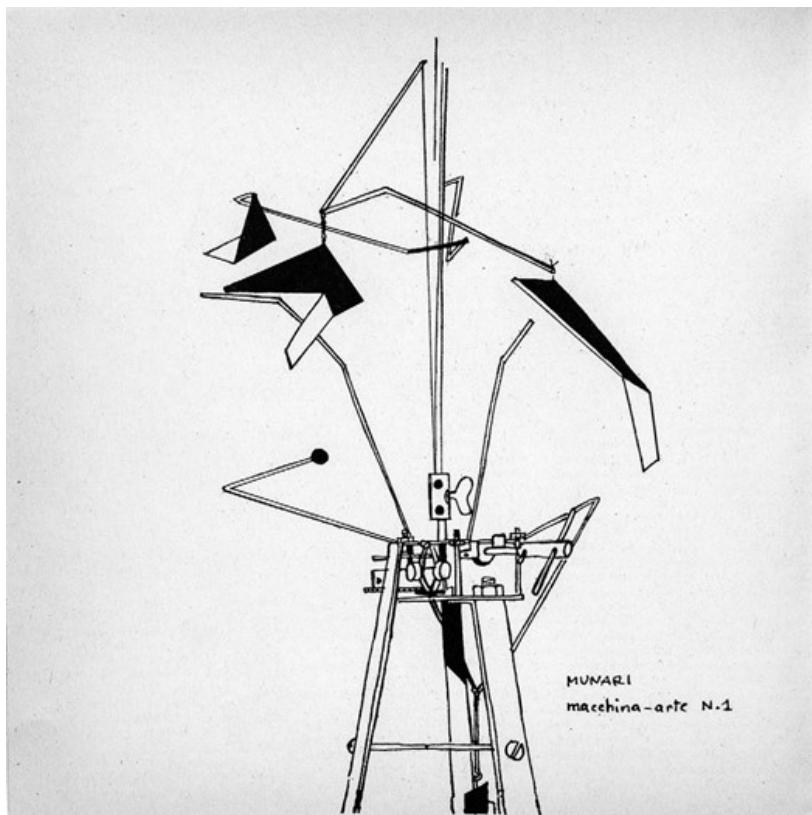
Barr’s concern about an increasingly powerful technological system was echoed by the Italian third-generation futurist Bruno Munari who, in his 1938 “Manifesto del Macchinismo,” warns of the dangers of an all-powerful machine for whom people will be “little slaves” “in a few years’ time.”¹⁷ Munari speaks about machines as though they were an animate and sentient companion species: “We live among machines, they help us with everything we do in our work and recreation. But what do we know about their moods, their natures, their animal defects, if not through arid and pedantic technical knowledge?” Munari worries about people’s lack of understanding of these alien beings and their behavior, and yet he also sees the danger of people’s imagination being “afflicted” by the utilitarian spirit of machines: ↳ “The machine of today is a monster! The machine must become a work of art! We shall discover the art of machines!”

Yet, unlike Alfred Barr’s acquiescent call for assimilating the machine and “making it beautiful,” Munari suggests a stronger, more active role for the artist who, he contends, should understand and change the mechanical world. And countering Prampolini’s plea for an artistic practice that submits to the aesthetic concept of machines, Munari argues for an oppositional aesthetics of dysfunctionality and uselessness:

Artists are the only ones who can save mankind from this danger. Artists have to be interested in machines, have to abandon their romantic paintbrushes, their dusty palettes, their canvases and easels. They have to start understanding the anatomy of machines, the language of machines, their nature, and to re-route them into functioning in irregular ways to create works of art with the machines themselves, using their own means.¹⁸

Munari's own delicate and playful kinetic sculptures, the *Macchine inutili* (Useless machines) of the 1930s and 1940s, are emblematic of such an attitude that is simultaneously critical and optimistic (figure 1.3). Understanding the aesthetics of machines meant, for Munari, developing the basis for an artistic counterpractice.

Figure 1.3



Bruno Munari, *Macchina-arte N. 1*, drawing, published in *Bollettino*, no. 11 (Movimento Arte Concreta, 1953).

©1953 Bruno Munari. All rights reserved to Maurizio Corraini srl. Mantova.

“Beyond Machine Art”

Twenty years after the 1967 founding of the Center for Advanced Visual Studies (CAVS) at MIT in Cambridge by György Kepes and others, the art association Badischer Kunstverein in Karlsruhe, Germany, organized an anniversary exhibition, “Otto Piene und das CAVS” (1988). In an essay for the exhibition catalog, German art historian and curator Manfred Schneckenburger described his recent visit to the center.

Schneckenburger had been the curator of Documenta 6 in Kassel in 1977, during which Piene and a whole team of artists and engineers from the CAVS had presented the large-scale *Centerbeam* installation performance.¹⁹

Schneckenburger used the phrase “Jenseits der Maschinenkunst [Beyond Machine Art]” as the title of his essay, and referred to “constructivist machine art” as the main historical counterpoint for the artistic research conducted at the CAVS:

The research here is not [as at other MIT departments] into mathematical formulas, the laws of physics, or chemical combinations, but into art, into the technical, aesthetic knowhow for new image worlds, beyond panel painting and woodcuts, but also beyond constructivist machine art, beyond the processes, attitudes, concepts, with which art has erupted into ever new morphologies and aggregate states.²⁰

While the focus of work at the CAVS lies on kinetic art, sky art, telecommunication, and media, Schneckenburger writes that “the utopia from the early, heroic time of modernity, the constructivists’ dream of the genuine creativity of new media and the beauty of technics, is over. Whether one shoots laser canons or communicates via satellite—these are no engineer-artists whose brain, as in Hausmann’s collage p. 16 *Tatlin at Home*, consists of cogwheels, ↴

screws, and wires. New media are not invented here ... but aesthetically researched. Art and technology are not celebrating a euphoric wedding, but they enter into a hopeful marriage of convenience.”²¹

What is significant for our current inquiry into concepts of “machine art” is that Schneckenburger rather inaccurately refers back to the Russian constructivists of the 1920s and interprets their aesthetic approach to machines and machine parts as “the dream of the beauty of technics”—an approach that was really p. 17 championed not by Tatlin *et alii*, but by Barr and ↴ Johnson in New York in 1934. And Schneckenburger’s suggestion that the constructivists’ search for new materials in art expressed “the dream of the genuine creativity of new media” has its historical place not in the 1920s, but in the post-Greenbergian art discourse since the 1960s. Even though the constructivists and their contemporaries did in fact experiment with “new media” such as film, photography, radio, and typography, it was not the technical novelty in and of itself that motivated their aesthetic exploration.

After the full affirmation of “machine art” in its different, iconoclastic variants by the Berlin Dadaists, by futurists, and by the design formalism of Barr and Johnson, and after the growing concern since the 1930s about the antihuman tendencies of machine systems, we can see how after the 1960s the notion of machine art would become associated with an (imaginary) art historical moment onto which the sense of a misguided techno-utopianism was projected. Rhetorically, and somewhat deceptively, Schneckenburger uses the assertion of the “constructivists’ dream” in order to contrast the claim that the engagement with lasers, satellites, and innovative materials at the CAVS was inspired *not* by that same dream, but by aesthetic curiosity and pragmatism.²²

The inconsistent use of the term “machine art” that can be gleaned from these few examples is symptomatic of the vagueness with which the artistic engagement with technology has been framed discursively throughout the twentieth century. In the second chapter, I will analyze a number of these practices in order to develop a more consistent and analytical description of an aesthetics of the machine in art, focusing especially on its associative, symbolic, formalist, kinetic, and automatic aspects. Before we get there, though, we will have to look more closely at the complex terminology of the “machine,” which itself is a rumor—and a symptom—rather than a well-defined concept.

Concepts of the Machine in the Twentieth Century

The notion of the machine has many interpretations and is applied in many contexts. A complicated tension exists between the word's use and its meaning: when the term "machine" is used, it most often appears to designate a particular thing, an object, a mechanism, or a process, and yet in many of these cases the concept actually designates not a particular class of objects, but a relationship that human subjects have to the world. I will try to explain this relationship in the following pages by briefly reviewing different types of machines, and by showing how the concept of the machine is connected to the constitution of the modern subject. In the present context, this can only be done in a cursory fashion, but the discussion should provide us with a basis for a differentiated approach to the forms and meanings of art practices that engage with technics.

A word about the terminology that I employ. The semantic field of machine, technology, apparatus, device, medium, etc. is complex, inconsistent, and often contradictory. It would not make sense to try to correct this, because the murkiness of the field merely emphasizes the multilayered and contradictory ways in

p. 18 which people speak about and make sense of the ↳ technical aspects of their world. There is a constant blending of technical, social, psychological, biological, etc., registers in our language, and the notion of the machine is indicative of the translation of concepts between these areas. Later I will discuss in more detail my own suggestion for how the concept of the "machine" can be understood in a more or less precise way. Suffice it to say now that I try to use the term restrictively and present it primarily in contexts where it is used by others. The same applies for "apparatus," which is an ambivalent term used either for a concrete, circumscribed mechanism (or "device"), or for complex concatenations of such mechanisms into what others have referred to as "machinery" or a "mega-machine." We will revisit some of these usages in a moment. The terms "technical" and "technics" refer to the concrete structures, material or conceptual, of making things work. "Mechanics" and "mechanical" indicate that force is conveyed in these structures by physical elements—a concept that is sometimes also used metaphorically to describe a simple, transparent effect. Technics are invented, conceptualized, and built by "engineers," whereas machines are operated and tended by "machinists." Somewhat unusually, I reserve the term "technology" for the theoretical reflection on technics and for its ideological preparation. Put simply, technology is the abstract form in which people think about technics, and it is the ideological form that makes people think about their world in technical terms. While the machine operates and conveys force, the "medium" enables communication and conveys meaning.

A useful entry point into a discussion of different machine types is the philosopher and logician Gotthard Günther's essay "Die 'zweite' Maschine" (The "second" machine).²³ Günther employs a concept of the machine that is derived anthropologically and with reference to German philosopher Arnold Gehlen, who, for instance in his book *Der Mensch* (1950), had dealt with the relation of humans to their environment (*Außenwelt*) and with the transformation of this environment by means of tools. Animals also use certain parts of their environment to improve the functions of their own bodies in specific situations, but only humans produce a tool for a specific future purpose. While the animal, at best, uses its environment in a tool-like manner, Günther explains, the human develops "an autonomous tool as an independent form of existence between himself and the environment [*Umwelt*]. Such a creation requires that the creator relinquishes something and fixes it in an objective medium."²⁴ The refinement of the techniques of tool making and the increasing use of synthetic materials "lead to an obvious detachment of the tool from the natural context of the world."²⁵ The machine is a technical appliance that assumes a form of autonomy from its human creator. Günther continues:

Our language very precisely expresses this process of autonomization which takes place in this development: a tool is handled. A machine is tended. At least this is true of the older types of machines. A new type of machine, like the servomechanism, does not even require tending any

more, but only occasional maintenance. A thermostat which controls the temperature in a modern apartment does not have to be tended in order to function properly. This mechanism directs its working mechanism itself. It possesses a spontaneity that is independent of the human.²⁶

p. 19 Günther distinguishes between what he calls the “first” or “Archimedean-classical machine,” which can be traced back to the lever and which works with mechanical and moving parts, and the “second,” “transclassical machine,” which has no moving parts and which, like a thermometer or an electrical transformer, works through the exchange of atoms, electrons, or electromagnetic fields.²⁷ This non-Archimedean machine Günther also calls a “cybernetic machine,” “which no longer generates physical work procedures (this is left to the classical mechanism), but conducts and ‘critically’ steers such work procedures.”²⁸

Günther emphasized that at the time he was writing his text, in the early 1950s, such cybernetic machines did not yet exist: “Thus the idea of the cybernetic machine aims at the realization of a mechanism which can record data from the external world, process them as information and then pass them on as control impulses to the classical machine. Besides, the latter is not absolutely necessary. A calculating machine, for instance, provides arithmetic information directly.”²⁹ As analogies for the “first” or classical-Archimedean machine and the “second” or transclassical machine, Günther proposes the human arm and brain, respectively. An important aspect of the “second” machine is that it not only processes but also “produces” information.³⁰ And in a further characterization of such transclassical machines, Günther’s colleague at the Biological Computing Lab, the cybernetician Heinz von Förster, developed the distinction between the “trivial” machine, whose output can be deducted expectedly and unambiguously from the input, and the “nontrivial” machine, whose output cannot be predicted because it is determined by variable internal states of the machine.³¹

In addition to these two machine types—the isolated technical object with a limited functional autonomy, and the cybernetic, controlling and self-controlled device or system—we can easily identify at least three other conceptions of machines that are used in the course of the twentieth century. The mega-machine, alternatively referred to as machinery, apparatus, or state machine, is associated with authors such as Lewis Mumford, Karl Marx, and Louis Althusser; the machine of mathematical calculations and algorithms was described by Alan Turing; and the abstract and autopoietic machines of desire and heterogenesis were conceptualized by Gilles Deleuze and Félix Guattari, following Humberto Maturana and Francisco Varela.³²

The US historian and critic Lewis Mumford spoke about machines extensively in his books *Technics and Civilization* (1934) and *The Myth of the Machine* (1967–1970), both of which express his skeptical attitude toward the influence of technology on human life. Mumford distinguishes between specific machines, like the printing press or the power loom, and “the machine” in general: “When I use the term ‘the machine’ I shall employ it as shorthand reference to the entire technological complex. This will embrace the knowledge and skills and arts derived from industry or implicated in the new technics, and will include various forms of tool, instrument, apparatus and utility as well as machines proper.”³³

Based on such a generalized understanding of the machine complex, Mumford develops the concept of the “mega-machine,” which encompasses political, economic, military, and bureaucratic techniques. For p. 20 Mumford, the mega-machine is a regime that subordinates humans through a multiplicity of individual procedures, yet remains invisible as a total structure.³⁴

While Mumford thus applied the concept of the machine to the workings of large, socio-technical infrastructures, mathematician Alan Turing, also working in the 1930s, proposed the concept of a “machine” which could solve all calculable problems by a limited number of programmed steps of calculation. From this conception emerged the idea of a “Universal Machine” that would be able to simulate all other machines. Turing understood the mathematical relation of numbers as an abstract form of

mechanics, and thought of the algorithm that determines the operational steps as a computational machine, in the sense of a single-purpose apparatus. In his 1950 text describing what has become known as the Turing test, which asks whether a distinction can be made between machines and humans, Turing made an important qualification: all machines except digital computers were excluded from this test, and the machines that the Universal Machine could simulate were supposedly only the mathematical machines of the Turing type.³⁵

In the 1960s, Chilean biologist and cybernetician Humberto Maturana introduced another application of the notion of the machine, which was later developed as a philosophical concept by the French philosophers Félix Guattari and Gilles Deleuze in the 1970s. Maturana and his colleague Francisco Varela described living systems as autopoietic machines. These machines form systems of elements that are always already connected in comprehensive and multiple couplings.³⁶ Guattari and Deleuze took this understanding of the autopoietic self-production and reproduction of machinic systems, which Maturana and Varela had chiefly applied to explain the viability of living systems, and applied it first to psychological contexts—especially through the concept of “desiring machines”—and later to a broad range of social, natural, technical, and psychic phenomena. Rather than by the noun “machine” and its connotation of a given structure or assemblage of parts, Guattari and Deleuze’s understanding is best represented by the adjective “machinic,” which describes the heterogenetic, open, and dynamic processes of coupling and decoupling that can occur in such diverse environments. In the micromechanisms of these machinic processes, there is, as historian of science Henning Schmidgen outlines, “always one machine which brings forth an energy flow, and another machine which is coupled with it and which makes a cut, tapping into the energy flow.”³⁷ This cut (*coupure*) of one machine into another takes the form of an event or incident, and it happens immediately. It is significant insofar as it transposes expressive material from one machine to another and ruptures the semiosis of the second. The machinic cut is the interface; it is a field of potential agency and a field of potential subjectivation.

p. 21

Unlike Günther’s conception of the machine as an autonomous mechanism, Mumford’s image of the machine as a totalizing structure, and Turing’s focus on the rational functionality of arithmetics, Guattari and Deleuze’s goal in adapting the machine metaphor was to find a description for processes of subjectivation and desire that would wrest these processes free from Freudian or other fixations, connect them to social and ecological strata, and open ↴ them up to polyvalent realizations and transformations. The Austrian theorist Gerald Raunig concludes:

From this perspective, Guattari’s extensive concept of the machine is a strategy to pitch the machine both against the danger of structuralization and state apparatization, and against the effects of identitarian closure of concepts of community: instead, the machine is taken as a nonidentitarian conceptual container for everything that escapes stratification and identification, and that at the same time invents new forms of the concatenation of singularities.³⁸

This conception of the machine is a deliberate attempt at unhinging the dichotomous understanding of “human and machine” or “organism and mechanism.”³⁹ Raunig explains:

The issue is no longer the confrontation of human and machine, or their possible and impossible correspondences, extensions and replacements of one by the other, or ever new relations of similarity or metaphors between humans and machines, but the concatenations and the question of how humans can constitute a machine together with other things. These “other things” may be animals, tools, bodies, utterances, signs, or desires, but they become machine only in a process of exchange.⁴⁰

While the motivation for such an appropriation is understandable, we can question how successful this bending of the machine concept and the reversal of its connotation have been. After a flurry of adaptations

of the term in the 1990s, especially in the immediate wake of Deleuze and Guattari's *A Thousand Plateaus*, the machine's technical and mechanical connotative undercurrents have persisted.⁴¹ In their respective contexts and discourse communities, the five machine concepts summarized here—the mechanical, the cybernetic, the totalitarian infrastructure, the mathematical, and the heterogenetic—exist side by side, and people deploy them for their respective conceptual and ideological impact.

There have been other analytical attempts at reaching a conclusive understanding of what a machine really is. In his comprehensive study of the cultural history of the “spirit of the machine,” *Vom Geist der Maschine* (1999), German cultural historian Martin Burckhardt describes the machine’s relation to the human unconscious, and thus elucidates its phantasmatic significance in an extensive sweep from the prehistoric time of the Mesopotamian civilization to Charles Babbage, Ada Lovelace, and Alan Turing. Burckhardt points out the tendency to conceive of machines as things, even though they are always preceded by “a blueprint, a construction plan”:

Accordingly, one could understand the machine as a “constraint of thought” [Denkzwang] which has only taken the form of a thing. This objectification has turned the “constraint of thought” into a “practical constraint”—and thus into what we call a “machine” in the more narrow sense of the word. Such a constraint of thought does not necessarily have to get articulated in the form of a material automaton; it can just as well be realized in a social organization, or it can take the form of a sign system, i.e. of a merely symbolic machine. If we look for a point of intersection of all of these phenomena, it would probably be the aspect of intrinsic necessity [Zwangsläufigkeit] which provides the impression that we are confronted with a machine.⁴²

p. 22 There is a clue at the end of this passage to the aspect that I want to highlight here: the machine always seems to be something that “we are confronted with.” It is not only a metaphorical concept that can relate to many different constellations of intrinsic necessity, but the machine always has the human subject as a companion, and highlights the relation that human subjects have toward technology.

In his study of metaphor as a rhetorical form, German philosopher Hans Blumenberg points out that in order to understand the speculative considerations of an author, it is important to retrace his or her frame of reference from which certain ideas and metaphors are taken. Such “background metaphors” (*Hintergrundmetaphorik*) grounds what can be comprehended and known.⁴³ The chapter which Blumenberg introduces with these reflections deals with the pair of opposites of the organic and the mechanical, and especially with the metaphor of the machine whose history Blumenberg follows from Greek antiquity to the Enlightenment.

Blumenberg's brief presentation of this history is sketchy and breaks off before the chronology reaches La Mettrie's *L'Homme machine* (1748)—where the story, as Blumenberg suggests, gets “too thick” (*wo es zu dick wird*).⁴⁴ But Blumenberg can nevertheless show how the application of the machine metaphor, from the antique *machina mundi* through the image of the world as a clockwork to that of the human body as machine, appears in multiple and at times conflicting variations. According to Blumenberg, two critical questions are always who or what sets the rules of the mechanism, and whether this mechanism is animated from within or directed from outside. Until the eighteenth century, these questions had a mainly theological inflection, but they have become mainly anthropological questions since then.⁴⁵

This anthropological aspect of the machine is associated with seventeenth-century French philosopher René Descartes, who not only formulated the dictum of *cogito ergo sum* as the core of a modern and self-reflexive subjectivity but also likened nature to a clockwork, and described the human as well as the animal body as machines made by God in a manner more complex and more miraculous than all the machines and automata that humans could build.⁴⁶ The beginning of the modern machine discourse is thus marked by the theoretical constructability of humans and their similarity to machines. Since Descartes, the assimilation of

machines to the human form—anthropomorphism—is complemented by the idea of the assimilation of the human to machine form—mechanomorphism.

p. 23

The Cartesian assumption that the functions of an organism can be explained mechanistically is, as the historian of science Georges Canguilhem has argued, historically based on the construction of automata. The comparison of the body with a machine presupposes human-made apparatuses and the physical detachment of these apparatuses, which are no longer held and handled as tools and extensions of the body. Canguilhem explains: “As long as the concept of the human and animal body is inextricably ‘tied’ to the machine, it is not possible to offer an explanation of the body in terms of the machine. Historically, it was not possible to conceive of such an explanation until the day that human ingenuity created mechanical devices that not only imitated organic movements ... but also required ↳ no human intervention except to construct them and set them going.”⁴⁷ From this early moment onward, humans associated with machines the danger of being submitted to an alien, nonhuman entity, or the danger of becoming a machine or like a machine and losing one’s humanity. Inversely, the machine is the manifestation in which technology can become like humans. The troubling thought of such a confusion, or fusion, of human and technology generated disgust and resistance.

In his text on “Machine and Organism,” Georges Canguilhem criticizes Descartes’s theory of a mechanomorphic conception of the human organism and instead argues that the machine is predicated on the principles of the organism. Canguilhem shows that the Cartesian conception of the organism as a machine is based on the instantiation of a fundamental distinction between body and soul, between matter and the ability to make distinctions. The use of animals, like the use of humans as slaves, and the mechanization of life are predicated on their devaluation as inanimate.⁴⁸

Canguilhem’s text, published in 1952, presents a philosophical and epistemological argument that responds to its contemporary political context. Canguilhem refers to developments in industrialized labor and to efforts of rationalization which are “for all intents and purposes, a mechanization of the body.”⁴⁹ In his view, Taylorism has reached a limit and requires instead an adaptation of machines to the human organism. Canguilhem insists on a human-centered conception of the machine as produced by humans for humans, with a particular purpose.⁵⁰ In the same year that Gotthard Günther announced the imminent arrival of a “second machine” that would fundamentally change technology, Canguilhem insisted that cybernetic machines, servomechanisms, or electronic automata would “shift the relationship between human and machine, without however changing its meaning.”⁵¹ Fundamental to this relationship, Canguilhem argues, is the idea that the machine has a fixed and definite finality and no creative power, so that one machine cannot replace another, nor can it repair itself. Whereas life endures monstrosities, technology does not: “There are no monstrous machines. There is no mechanical pathology.”⁵²

Others begged to differ, including two with whom we are already familiar. Two decades earlier, Alfred Barr had warned of the Frankensteinian nature of machines, and Bruno Munari’s manifesto, written in 1938 but published in the same year as Canguilhem’s essay, directly contradicted him by claiming, “the machine of today is a monster.” Munari also constructed the *Useless Machines* which, like the purposeless mechanisms that Jean Tinguely was beginning to build around this time, precisely sought to pathologize the mechanical.

p. 24

A more comprehensive theory that denounced the systemic monstrosity of machines was the critique of capitalism by philosopher and economic theorist Karl Marx. Formulated a century earlier than the ideas of Canguilhem, Barr, and Munari, Marx’s thinking was still prevalent in the mid-twentieth century, at a moment when not only the Cold War but also the struggle between socialist and liberal capitalist ideologies were at their peak. In the face of the industrial revolution of the nineteenth century, Marx had written a seminal text, “Fragment on Machines” (1857–1858), in which he describes the “machinery” of tools, human ↳ workers, and technical apparatuses that are articulated to form “fixed capital,” the machine being a means for the production of surplus value.⁵³ Labor and knowledge—physical, mental, and

mechanical work—are all subsumed in the machinery, as well as in the modes of subjectivation and socialization. In Marx's reading, it is not the machine that serves the worker, but the worker who serves the machine:

[Once] adopted into the production process of capital, the means of labour passes through different metamorphoses, whose culmination is the machine, or rather, an automatic system of machinery (system of machinery: the automatic one is merely its most complete, most adequate form, and alone transforms machinery into a system), set in motion by an automaton, a moving power that moves itself; this automaton consisting of numerous mechanical and intellectual organs, so that the workers themselves are cast merely as its conscious linkages.⁵⁴

Conspicuously, Marx equates the metabolism of the human body with that of the machine. The human body is fully integrated into the machine, which operates autonomously and is subjected to and animated by capital:

In no way does the machine appear as the individual worker's means of labour. Its distinguishing characteristic is not in the least, as with the means of labour, to transmit the worker's activity to the object; this activity, rather, is posited in such a way that it merely transmits the machine's work, the machine's action, on to the raw material—supervises it and guards against interruptions. Not as with the instrument, which the worker animates and makes into his organ with his skill and strength, and whose handling therefore depends on his virtuosity. Rather, it is the machine which possesses skill and strength in place of the worker, is itself the virtuoso, with a soul of its own in the mechanical laws acting through it; and it consumes coal, oil, etc. (*matières instrumentales*), just as the worker consumes food, to keep up its perpetual motion. The worker's activity, reduced to a mere abstraction of activity, is determined and regulated on all sides by the movement of the machinery, and not the opposite. The science which compels the inanimate limbs of the machinery, by their construction, to act purposefully, as an automaton, does not exist in the worker's consciousness, but rather acts upon him through the machine as an alien power, as the power of the machine itself.⁵⁵

While there is dissent among scholars of the machine on whether such integration is a dehumanizing form of submission or a positive form of cooperation between human and machine, the direct and necessary coupling and companionship of human and machine are undisputed. Unlike Marx, who claims that knowledge and intellectual work also become subsumed into the machinery, Canguilhem distinguishes technics from knowledge and claims that they are in dialogue and borrow solutions and questions from each other. Similarly, the research of experimental psychologists like Hugo Münsterberg, Frank and Lillian Gilbreth, or Alexei Gastev into the “scientific management” of labor and “psychotechnics” at the beginning of the twentieth century explores the movements and behavior of humans with the aim of optimizing work processes in industrial production. Gastev's Institute for the Scientific Organization of Work and the Mechanization of Man, founded in Moscow soon after the Russian revolution, conducted physiological experiments toward the ergonomic improvement of the human body, putting the needs of the machine and of the human body on a par: “We have to put the living work machine under equally favorable conditions as the automatic machine,” Gastev wrote.⁵⁶

p. 25

The same conflict was addressed by the architecture and art historian Sigfried Giedion in his epochal study *Mechanization Takes Command* (1948). Trying to avoid moral judgment for or against mechanization, Giedion focused on the progressive technical development in handicrafts, agriculture, and the home. His treatment of mechanization implies that it externalizes and replaces human work and human activity. The concept of the machine is conspicuously absent from Giedion's text. His study is primarily dedicated to the design and improvement of procedures, and he presents individual devices or technical installations as

agglomerations and materializations of procedural knowledge. Giedion mentions the ethical problems associated with the assembly line and the scientific management of labor which, he writes, can be deployed in opposite economic systems: “Their implications, like those of mechanization as a whole, are not unilaterally tied to any one system. They reach into the depths of a basic human problem—labor—and the historical verdict will depend on how far one may expect of the human being to become part of an automaton.”⁵⁷

Once again, human and machine walk hand in hand—whether harmoniously or handcuffed.

A third example from the same mid-century period when Canguilhem and Giedion were thinking about machines and bodies also testifies to the intimate companionship of the human subject with the machine. Norbert Wiener, the founder of cybernetics, published the book *The Human Use of Human Beings* in 1950, in which, as suggested by historian N. Katherine Hayles, he carefully sought to distinguish the dehumanizing oppression afforded by the “first machine” from the cooperative interaction with the cybernetic machine. Hayles writes:

Reinforcing the boundary work that assimilates the liberal humanist subject and the cybernetic machine into the same privileged space are the distinctions Wiener makes between good and bad machines. When machines are evil in *The Human Use of Human Beings*, it is usually because they have become rigid and inflexible. Whereas the cybernetic machine is ranged alongside man as his brother and peer, metaphors that cluster around the rigid machine depict it through tropes of domination and engulfment. The ultimate horror is for the rigid machine to absorb the human being, co-opting the flexibility that is the human birthright.⁵⁸

The same formation of a tense intimacy was also replicated in discussions, beginning in the mid-twentieth century, about the possibilities of artificial intelligence and machine consciousness. Gotthard Günther ends his 1952 essay by considering the technical realizability of cybernetic machines, and critically dismisses the idea that machines can achieve a form of self-consciousness.⁵⁹ Two years earlier, Alan Turing had stated: “I believe that at the end of the [twentieth] century, the use of words and general educated opinion will be altered so much that one will be able to speak of machines thinking without expecting to be contradicted”—imputing, as David Rokeby has remarked, not that machines would be able to think ↴ like humans, but that the conceptions of thought and computation would have converged so much that they could no longer be meaningfully distinguished.⁶⁰

p. 26

Such a convergence lies at the base of cybernetics, “a science which thinks, without immediately thinking that it is a human who thinks,” as media historian Claus Pias has commented.⁶¹ In a seminal study, “A Logical Calculus of the Ideas Immanent in Nervous Activity” (1943), Norbert Wiener’s colleague Warren McCulloch developed a notational mix of mathematical expressions and neuronal interactions, and concepts which were at the same time neurophysiological, philosophical, and computer-technical—“concepts that work and function, that confound theoretical and practical entities at the same time, that model neuronal structures and simultaneously construct artefacts.”⁶² In McCulloch’s theory, Pias continues, “both simply coincide. The human as a special case of the information machine, and the information machine as a special case of the human. Thus, both of these categories collapse.”⁶³

The meaning of the term “machine” in examples like these slides between the technical-concrete, and the metaphorical. Yet, while other terms are regularly brought into play when specific technical details have to be described, the concept of the “machine” is always deployed in contrast to the human. Whereas the “technical,” in its different guises, exists independent of the human, “the machine” is invariably coupled to “man.” Two aspects are therefore constitutive for the notion of the machine: its coupling to the figure of the human, and its conception as a condition of human self-definition. Historians of science Erich Hörl and Michael Hagner make this point in relation to Canguilhem’s considerations on machine and organism: “As

early as 1953 Georges Canguilhem expressed the assumption that all machines might possibly have been designed after the prototype of organs and organisms. This assumption would not only imply that in human history the biological is characterized by the prosthetic, but it also shows that there is nothing beyond the inextricable relationship of human and machine, irrespective of the question which of the two is the prototype for the other.”⁶⁴

This tight linkage has a technological dimension in terms of the interdependency of machine and organism, and it has at the same time a psychological condition. Like Canguilhem, Gotthard Günther identifies the moment of detachment between human and tool or mechanism as constitutive of modern subjectivity, a moment which, in Günther’s account, engenders the possibility of the modern machine:

The same process of detachment takes place *on the subjective side*. The tool makes itself independent from its creator. The lever that primitive man pushed under a rock still needed the arm that pushed it down. The mill wheel that is driven by the water in the village stream is already independent of the human source of power. While the detachment of the tool from nature resulted in the creation of synthetic materials, i.e. in a wholly new type of physical existence, *on the subjective side* this detachment of the tool leads to the machine. A wind or water mill is not a tool any more, but a machine. A machine is nothing other than a tool that has become autonomous—within certain limits.⁶⁵

- p. 27 Günther thus describes the modern subject and the machine as originating from the same moment of detachment, and the machine as a result of this process of subjectivation.

It is an open question whether this formation of subject and machine is supplanted by the technological paradigm introduced by cybernetics and the computer. The historian of science Andrew Pickering has claimed that cybernetics has been a watershed that has drawn up a separation from modernity and the unquestioned validity of its distinctions between spirit and matter, soul and body, nature and culture, human and machine.⁶⁶ My own preliminary answer would be that there has indeed been such a rupture in the conception of technology, even though it did not happen all at once but has been taking place over a period of decades. But part of this rupture is also the gradual devaluation of the concept of the machine, so that, unlike Pickering, I would argue that the modern distinction between human and technics has passed away, and that human and machine have been jointly transformed into new, posthuman forms of subjectivation. The mechanical conception of the machine persists in many areas of technology, including cybernetics and computing: even references to Turing’s and Norbert Wiener’s notions of the machine inherit the mechanical conception of its workings. In that sense, even the cybernetic notion of the machine remains symbolic of a mechanical machine.

There is a surprising contradiction between the passionate determination with which the notion of the machine has been used throughout the last century and the striking diversity of its meanings. Each instance of its use seems to have had the potential of generating a new facet of not only what a machine *can be* but what it actually *is*. An important conclusion that can be drawn from the polyvalent and metaphorical use of the term “machine” is that the machine can never be taken for granted. The machine is not given, but it has to be constructed, made, built. My exploration here is an attempt to put the machine between quotation marks and to see how it is being constructed in different instances, and as what.

A more general conception of the machine that I want to propose here attempts a formal description of the relationship between humans and technology, and of the role that the machine plays in that relationship. For a long time, I had thought that “a machine” is not just a particular type of technical device or conceptual mechanism, one that must have specific features in order to qualify as a machine proper. If this were the case, the use of the term would be so chaotic and unreliable that it would be a more or less redundant term—its meaning swamped in noise. However, people speak of machines with so much insistence and passion

that there seems to be something particular that they want to express. My first interpretation was, therefore, that “machine” is the word we use in the face of technical systems that are too complex to grasp and too all-encompassing to address, threatening humans to subside in an uneven, overwhelming encounter. Thus, when confronted with a technical system whose automatism is, by its very nature, beyond intuitive human understanding, we would say, “ah, a machine,” making it appear as if there were “one thing” that we had in front of us, something that can be used and switched off, something that is domesticated, at least through this act of naming, even if its functions are beyond comprehension and direct control. This interpretation would work for classical, mechanical machines like steam engines, power looms, and airplanes, and it would also explain why people sometimes speak of postmechanical electronic and digital systems as “machines”—trying to get a symbolic handle on something that is, on a physical level, unfathomable.

There is a similar terminological difficulty with the concept of the “apparatus.” Like “machine,” the term “apparatus” is used in a variety of ways, not least in various European languages, but two different interpretations stand out. The first is that of a relatively simple technical device that does not have the complexity and autonomy of a machine, while in the second interpretation “apparatus” is used for the complex assemblage of multiple machines and systems, technical or social. This second conception was worked out by Louis Althusser when he spoke about the “ideological State apparatuses” (*appareils idéologiques d’État*) which interpellate human individuals as subjects. Michel Foucault discussed this same conception as the *dispositif* (translated as “apparatus”) that is composed of technical, social, and institutional infrastructures and practices.⁶⁷

In an essay on the question “What Is an Apparatus?” (2006), Italian philosopher Giorgio Agamben analyzes and extends Foucault’s conception of the *dispositif*.⁶⁸ In his explanation, Agamben suggests a diagrammatic relation between apparatuses, living beings, and subjects, which—as I want to suggest—can also serve to pinpoint the appearance of the “machine.” Agamben writes: “I shall call an apparatus literally anything that has in some way the capacity to capture, orient, determine, intercept, model, control, or secure the gestures, behaviors, opinions, or discourses of living beings.”⁶⁹ The effect of this working of apparatuses on living beings are, “between these two, as a third class, subjects. I call a subject that which results from the relation and, so to speak, from the relentless fight between living beings and apparatuses.”⁷⁰ Similar to Althusser’s concept of interpellation, subjectivation here emerges as a product of the *dispositifs* at work. In Agamben’s interpretation, technology is one of the ways in which this production of subjectivity takes place, where apparatuses crowd the spaces of social practice with “instruments, objects, gadgets, odds and ends, and various technologies. Through these apparatuses, man attempts to nullify the animalistic behaviors that are now separated from him, and to enjoy the Open as such, to enjoy being insofar as it is being. At the root of each apparatus lies an all-too-human desire for happiness. The capture and subjectification of this desire in a separate sphere constitutes the specific power of the apparatus.”⁷¹

A more thorough analysis of this passage would have to look closely at the relation between apparatuses and technologies, and at the references to the “desire for happiness.” In our current context, I would only like to adopt the diagram proposed by Agamben (figure 1.4).

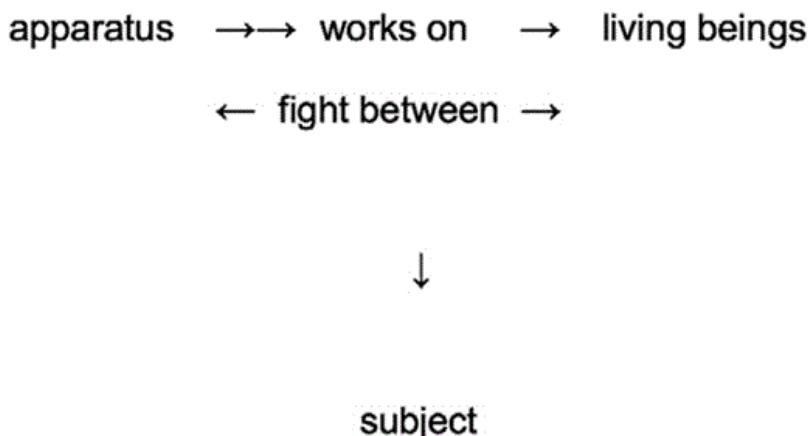
Figure 1.4

Diagram a (A. Broeckmann, after Agamben, "What Is an Apparatus?", 2009).

I propose adding the concept of the machine to this diagram: if the "subject" wants to address the "apparatus," if it wants to say something about the apparatus and its workings, it will in all likelihood choose the concept of the "machine" (figure 1.5). ↴

p. 29

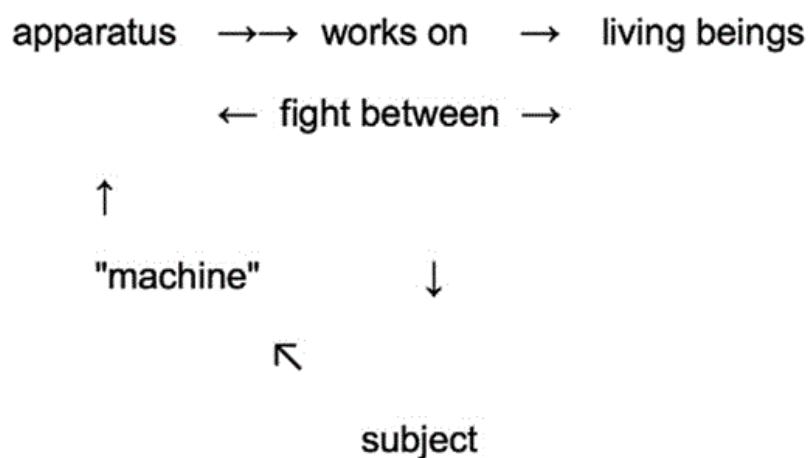
Figure 1.5

Diagram b (A. Broeckmann).

The "machine" does not occupy the position of a technological Other, but it is, like the "subject," a product of the "apparatus," named and constructed by the subject. The subject (which usually identifies itself as a "living being") speaks of the machine as though it were on the Outside, an Other, yet it is the subject's technological *doppelgänger*, a complementary product of the workings of the apparatus.

This latter diagram (figure 1.5) is useful for explaining the awkward relationship that people, as human subjects, maintain with machines.⁷² It makes it clear that "machine" is not a technical category but a social one, and that it is a symbolic concept rather than the descriptive term for a concrete class of technical items. Another aspect of the diagram is that it shows clearly that it is always a subject that speaks of a "machine"; what it designates as the "machine" is a projection in the direction of the very apparatus that brings forth the subject.

With this notion of the machine in mind, we might even be able to construct a tentative definition of "machine art"—namely, as those artistic works and practices that implicitly or explicitly articulate the

relation between subjects and machines—their relation understood

- p. 30 in the sense of the diagram explained above. If a machine can never be taken for granted but needs to be constructed, and if a machine is actualized in the very instant when it is addressed, machine art does just that: it constructs machines (these screens that subjects set up in front of the apparatuses that construct them) and makes them explicit.⁷³ Works of machine art encourage us to not take the apparatuses for granted, but to problematize them by making the sibling ties between subjects and machines visible, or feelable—in the modes of comfort, pain, or humor. The artistic encounter with machines is therefore characterized by strangeness (and familiarity), by distance (and proximity), by rejection (and love, or intimacy).

Machine Love

Given all the humanistic worries about overly powerful and dehumanizing machines, it is no wonder that we can find a significant number of cases in which people provocatively express love for machines or a desire to be a machine. The avant-garde attitude of dispelling the myth of the artist as a creative subject is given an existential twist. Pop artist Andy Warhol repeatedly lay claim to such an image of the self as a machine: “The reason I’m painting this way is that I want to be a machine, and I feel that whatever I do and do machine-like is what I want to do.” This attitude combines a postmodern melancholia with Warhol’s branded pose of indifference: “I think everybody should be a machine. I think everybody should like everybody. [Being a machine means] … you do the same thing every time. You do it over and over again.”⁷⁴

Similarly, German playwright Heiner Müller, in his text “Hamletmaschine,” refers to the machine as a condition of escape. It is the escape of man from woman, and the escape from sociality and a public sphere that is represented in the play by three TV sets which are set up on stage, playing live programs.⁷⁵ Their monitors turn black after this statement: “My thoughts are wounds in my brain. My brain is a scar. I want to be a machine. Arms for grasping legs for walking no pain no thought.”⁷⁶

Such a scenario of a robotic contraption with arms and legs, unsensing and unthinking, is the counterimage to the vision of a machine consciousness that has haunted many discussions about information technologies since the middle of the twentieth century. We find the *topos* of “being a machine” in Alan Turing’s 1950 speculations on “Computing Machinery and Intelligence,” on which Roland Puccetti commented in 1967: “[Anyone] who wants to claim machines can think must be willing to ascribe consciousness to them: which is supposed to be fantastic. In his classic essay on the subject Turing tried to counter this objection by arguing that the only way to know whether a machine is conscious is to be the machine, and either have or not have conscious thoughts. One can deny consciousness to other humans, he went on, on the same solipsistic grounds one denies it to machines.”⁷⁷ Yet, in his search for an answer to the question of whether machines can think, Turing undertakes ↴ not so much an existential quest as a logical speculation, writing: “The only way by which one could be sure that a machine thinks is to *be* the machine and to feel oneself thinking.”⁷⁸

Closer, however, to our previous discussion of the tense relationship between humans and machines, closer than these cases of wanting to become a machine, are the declarations of love toward machines that we find throughout the twentieth century. One area in which such intimacy is desirable is in the scientific management of labor, which seeks to initiate close encounters with machines and tools. For instance, Alexei Gastev, the Russian activist of optimizing bodies, wrote that the contemporary craftsman—and not only the future machinist—could be guided toward a close relationship with his working instruments: “We will not only feel love toward the machine—that machine which for us is often [yet] a theoretical fantasy—but also toward the tool.”⁷⁹

At the close of the twentieth century, and in continuation of Gastev's and the Gilbreths' work, sociologists struggled with the changes that the computerization of industrial work processes was bringing to the relationship between workers and machines. While processes of automation were earlier assumed to cause a dramatic abstraction and alienation from labor, sociologists now thought of a new type of learning and working that was ecological, adaptable to changes, and responsive to the limitations of the specific machine or installation at hand. The key phrase of this method is "subjectivating labor agency" (*subjektivierendes Arbeitshandeln*), a form of working that addresses the unique specificities of tools and products. As sociologists of labor Fritz Böhle and Brigitte Milkau write, "Importantly, in the context of this form of agency, things (including for instance machines) are construed as 'subjects.' ... This does not necessarily imply that human characteristics get projected into them; rather, they are not only regarded as determined by external or internal influences and thus predictable, but they are accorded a certain momentum of their own (or this is presumed)."⁸⁰ Subjectivating labor agency takes into account the peculiarities and moods of materials, tools, and machines, and suggests a conception of machine love that the sociologist Dieter Hoß describes as "sensuous or 'participative' perception, a sympathetic attachment to the environment, an empathy for, or feeling oneself into things and processes, i.e. a 'mimetic and identificatory comprehension of movements and forms,' and possibly an emotional tie to the things ('my machine')."⁸¹

The writer C. S. Lewis, in his book *The Four Loves* (1960), deals with the many different forms of loving relationships that are characterized by giving and taking, by beauty and appreciation, by need and pleasure, by passion, fury, and sickness. Lewis distinguishes between four main types of love: storge (or the affection that exists, for instance, between family members), philia (friendship), eros (romantic, or sexual attraction), and agape (unconditional love, charity). "Philia" perhaps best typifies the feeling that Hoß advocated for the sensuous new laborer.⁸²

p. 32

Whereas Lewis, like many other theorists of love, considered emotions or relationships only between humans, philosopher Max Scheler insisted that love is a human sentiment that one can have not only in relation to other humans. True love, according to Scheler, is ↴ not "anthropopathic" but is originally directed at "objects of value" (*Wertgegenstände*), and is thus also possible, for instance, toward nature, or works of art, or God.⁸³

In other instances, love toward machines is expressed in rather casual and far less dramatic and provocative ways than Warhol's or Müller's claims of wanting to be a machine. Maybe the declarations of love are not always taken seriously, but the affirmative way in which they are made suggests that the claim in itself is not seen as outrageous, but rather as a normal, factual statement. Curator Pontus Hultén, for example, remembers artist Jean Tinguely's passion for hardware stores in Manhattan:

At the time when Tinguely began to build machines of this kind [1960], he was living on Walker Street in New York, close to Canal Street, the former headquarters and main outlet for the great American mechanical industry from the eighteenth century on. There were still many old shops with a glorious past dealing in machines and accessories. It would be a mistake to believe that Tinguely scorned them; it would be more correct to say that he loved them.⁸⁴

Hultén also quotes Tinguely as having said, in 1962: "For me the machine is above all an instrument that permits me to be poetic. If you respect the machine, if you enter into a game with the machine, then perhaps you can make a truly joyous machine—by joyous, I mean free. That's a marvellous thing, don't you think?"⁸⁵ It is hard not to read erotic undertones into such joyous and liberating play between the artist and his machines.

In other instances, such as discussions of creative work with computers, the figure of the hacker has been described as "the intimate admirer of new technologies,"⁸⁶ while the Internet and software artist Cory Arcangel is described as "[devoting] all his love to machines and code," and as "[fitting] in [in] an age in

which people stroke their iPhones, iPads and iPods at least as tenderly as their lovers.”⁸⁷ And media researcher Saul Albert uses the words of love to describe his first experience with the iconoclastic website of the Dutch-Belgian artist couple JODI, in his “Introduction: How My Computer and I Fell in Love with Jodi” (1998):

What? Damn!, you ... you ... (I jump up from my desk and start hurling abuse at the computer which looks like it is in the middle of a big, juicy crash.) It's ... Oh! mmmmm! And that was it, we were smitten. It slowly dawned on me that my computer, far from crashing, was whispering sweet bytes down my modem to a server it truly identified with: at www.jodi.org.⁸⁸

p. 33

Importantly, all of these examples describe emotions toward technical objects that do not pretend to be something other than they are. The understanding of machine love proposed here is reserved for the sentiments toward apparatuses that do not mimic humans. It therefore does not include the automata with which, in the tradition of the myth of Pygmalion, romantics have been falling in love precisely and only because they are not immediately recognized as artificial beings. E. T. A. Hoffmann’s Olimpia is loved not because she is a machine, but despite the fact that she is a machine. This view of machine love also leaves aside the broad spectrum of mediated love, as in the electronic music band Kraftwerk’s song “Computer Love” (1981), which refers to the use of bulletin board systems that, since the late 1970s, also offered sexual content.⁸⁹ Or the “Love Letters” which the MARK I, one of the ↴ early 1950s computers, was programmed to output as an exercise in artificial text production.⁹⁰ In these cases, the computer is not the object or the subject of love but its medium. The same applies to a third type of love-related machines, those whose function is to induce orgasms, like Andrei Platonov’s “Anti-Sexus,” the “Orgasmatron” in Woody Allen’s movie *Sleeper* (1973), or the “Excessive Machine” that Jane Fonda enjoys in *Barbarella* (1968). These are utilitarian apparatuses, and not themselves the objects of love.⁹¹

At least in the precybernetic world, machine love is genuinely human, and in fact destructive to the machine world. The robots in Karel Čapek’s play *R.U.R.—Rossum’s Universal Robots* (1920) realize their superiority and destroy all humans, save for some slaves for maintenance services. In the epilogue between two of the robots (named Primus and Helena), feelings begin to emerge and lead to a tender love scene. Like a virus, the new sentiment spreads among the robots and makes them take on human nature. A human onlooker foresees the end of the machine dictatorship, and the return of human life: “Our buildings and machines will fall to ruin, the systems and the names of the great will fall like leaves, but you, love, you flourish in the ruins and sow the seeds of life in the wind. ... Life will not perish!”⁹²

In contrast to this salutary vision of love, Lewis Mumford is sure that machine love is altogether pathological: “The point is that the machine is not a substitute for the person; it is, when properly conceived, an extension of the rational and operative parts of the personality, and it must not wantonly trespass on areas that do not belong to it. If you fall in love with a machine there is something wrong with your love-life. If you worship a machine there is something wrong with your religion.”⁹³

Media theoretician Marshall McLuhan shares Mumford’s view that love of machines is a sign of human pathology, though he is less damning with regard to its consequences. In a short chapter of *Understanding Media* (1964), McLuhan discusses the “Gadget Lover” and his “narcissism and narcosis.” He describes how medial and prosthetic extensions of body functions are externalized by the human and thus experienced as outside one’s own body. As an example, McLuhan refers to the myth of Narcissus who fell in love with his mirror image because he did not realize that it was in fact his own image. McLuhan calls this type of self-induced ignorance “narcosis”:

It is this continuous embrace of our own technology in daily use that puts us in the Narcissus role of subliminal awareness and numbness in relation to these images of ourselves. By continuously embracing technologies, we relate ourselves to them as servo-mechanisms. That is why we must,

to use them at all, serve these objects, these extensions of ourselves, as gods or minor religions. An Indian is the servo-mechanism of his canoe, as the cowboy of his horse or the executive of his clock.

Physiologically, man in the normal use of technology (or his variously extended body) is perpetually modified by it and in turn finds ever new ways of modifying his technology. Man becomes, as it were, the sex organs of the machine world, as the bee of the plant world, enabling it to fecundate and to evolve ever new forms. The machine world reciprocates man's love by expediting his wishes and desires, namely, in providing him with wealth. One of the merits of motivation research has been the revelation of man's sex relation to the motorcar.⁹⁴

- p. 34 McLuhan lays out this maze of metaphors to suggest that it is virtually impossible to distinguish between man and his technical extensions and environment, and that man and machine are caught in a reciprocal relationship in which one appears as the extension, prosthesis, and image of the other. (We will return shortly to the question of gender and how this scenario might differ for women.) What is experienced individually as love of a machine or gadget is instead a narcissistic entanglement of human and machine in which the machine clouds its erotic agency in the form of practical or economic gratification.

Claus Pias has criticized this conception as an inappropriate representation of the concept of the cybernetic machine, which McLuhan discusses later in his book. Pias writes: "The question is not, who is the extension or supplement of what, or who—by being more original—can be more powerful or legitimately narcissistic. This is not about a possible hierarchy of the two terms, but about the knowledge, the operation or the medium that brings forth and maintains both. It is about the cybernetic collapse of the hypothesis of extension itself, when human and extension or apparatus and extension *can* no longer be distinguished because they no longer *have to be* distinguished."⁹⁵

The machine that McLuhan has in mind, and man's loving entanglement with it, is pre-cybernetic. In contrast, the erotics of cyberlove—as proposed by Pias—appears more cerebral: "The apparatuses of cybernetics with which one can maybe fall in love are ... not projections of the human, but projections derived from such machines themselves."⁹⁶ Pias even questions whether cybernetic machines can be the objects of love at all, if they cannot be addressed and used directly, but operate at the interstices: "Machines are not used, but they themselves organize the borders or interfaces between those units which one may want to call human and nature, human and apparatus, subject and object, *psyche* and *techné*."⁹⁷

According to Gotthard Günther, cybernetics assumes, unlike classical metaphysics, that the matter of the world is *not* originally ruled by chaos, which would have to be designed and formed, whether by divine creation or engineering, and through which an Other could emerge, a machine that could confront us. Instead, cybernetics assumes that all matter always already contains (all) information.⁹⁸ Can we deduce from this that, for cybernetics, the world is an autoerotic machine? Günther suggests, "In the retort, nature plays with itself. But in the creation of the electronic brain, man yields his own reflection to the object and learns to recognize his function in the world in this mirror of himself."⁹⁹

Machinists and Engineers

p. 35

In the context of the social meaning of technology, the convention of referring to the modern human subject as “man” has a particular inflection, since the relations of men and women toward technology seem to be conspicuously different. The field of technological art is a case in point: the engagement with technology seems to be an almost exclusively ♂ masculine endeavor, while examples of female “machine artists”—understood in a more narrow sense of the term—are few and far between. It is somewhat embarrassing to reiterate such clichés, but throughout the nineteenth and twentieth centuries women are often identified with machines, while such machines are conceived and built by men. To cite only the most famous examples, we have Villiers de l’Isle-Adam’s novel *Ève future*, in which the hero falls in love with the machine-woman Hadaly, an “electrical phantom” from which he can later liberate himself, or the female machine creatures in E. T. A. Hoffmann’s novella *Der Sandmann* and in Fritz Lang’s movie *Metropolis*. And before Alan Turing developed the idea of a test to determine the indistinguishability between human and machine, the first version of this test was conceived, as Katherine Hayles reminds us, to distinguish between man and woman. The Turing test that we know of today thus resulted from a simple replacement of woman by machine.¹⁰⁰

An exemplary text that combines the tropes of machine love, male creativity, and the equating of woman and machine was written by the French-American photographer Paul Haviland and published in New York in Alfred Stieglitz’s journal *291* in the fall of 1915. Haviland’s text, “We Are Living in the Age of the Machine,” read in its entirety:

We are living in the age of the machine.

Man made the machine in his own image. She has limbs which act; lungs which breathe; a heart which beats; a nervous system through which runs electricity. The phonograph is the image of his voice; the camera the image of his eye. The machine is his “daughter born without a mother.” That is why he loves her. He has made the machine superior to himself. That is why he admires her. Having made her superior to himself, he endows the superior beings which he conceives in his poetry and in his plastique with the qualities of machines. After making the machine in his own image he has made his human ideal machinomorphic. But the machine is yet at a dependent stage. Man gave her every qualification except thought. She submits to his will but he must direct her activities. Without him she remains a wonderful being, but without aim or anatomy. Through their mating they complete one another. She brings forth according to his conceptions.

Photography is one of the fine fruits of this union. The photographic print is one element of this new trinity: man, the creator, with thought and will; the machine, mother-action; and their product, the work accomplished.¹⁰¹

The blandness with which Haviland presents the equation of man as creator, engineer, lover, and of woman as creature, machine, mother, leaves one somewhat dumbfounded. But these generalizations are not merely a cliché, but indicative of a pattern which appears to be powerful enough to infuse even twenty-first-century cyberfeminist manifestos, as we will see shortly. I have no suggestion for how to best explain the operations of these patterns. But to illustrate some of the parameters that contribute to the three-valued logic of man, woman, and machine, here are two stories, one about the bachelor machine, and one about the cyborg.

Bachelors

When the French literary scholar Michel Carrouges worked out the concept of the “bachelor machine” for his publication *Les Machines célibataires* in 1954, he borrowed the term from artist Marcel Duchamp to pool a number of artistic and literary conceptions which tie together motifs of love and death, and which always contain sexual and mechanical as well as female and male components. Carrouges called the bachelor machine “a fantastic image that transforms love into a technique of death.”¹⁰²

In one of the notes in the *Green Box* (1934), a collection of Duchamp’s remarks about the forms to be used in his major artwork *The Bride Stripped Bare by Her Bachelors, Even* (*La mariée mise à nu par ses célibataires, même*), also called *The Large Glass* (1915–1923), Duchamp had casually referred to the structure in the lower part of the work as “the bachelor machine”:

The *principal forms* of the bachelor machine are imperfect: rectangle, circle, parallelepiped, symmetrical handle, demi-sphere = i.e. they are measurable (relation of their dimensions among themselves. and relation of these principal forms to their destination in the bachelor mach.) In the bride, the *principal forms* are *more or less large* or small, have no longer, in relation to their destination a measurability: a sphere, in the bride will be of some radius or other (the radius given in the representation is fictitious and dotted.)¹⁰³

This is the only explicit mention of the term “bachelor machine” in Duchamp’s writings, a rather remarkable fact given the concept’s career in the course of the following decades.

In picking up the term, Michel Carrouges sought to generalize the concept by relating it not only to Duchamp’s image but also to literary examples from a whole spectrum of writers, including Franz Kafka, Raymond Roussel, Alfred Jarry, Jules Verne, and the Comte de Lautréamont. In comparison to Duchamp’s casual remark, Carrouges’s description reads like a fully worked-out concept:

Contrary to real machines and even contrary to imaginary but rational and useful machines (like the Nautilus of Jules Verne or science-fiction rockets) the Bachelor Machine appears to be impossible, useless, incomprehensible, insane. At times she is not discernible at all, in those cases where she is one with the surrounding landscape. The Bachelor Machine can therefore consist of only one peculiar, strange and unknown machine, or of an apparently useless arrangement of parts. It can unify a lightning rod, a clock, a bicycle, a train, a dynamo, and even a cat or any part of an object or its remains. It is of no importance.

The Bachelor Machine is not connected with any purpose, like a machine that is subject to the physical laws of mechanics or the social demands of usefulness. The Bachelor Machine is a simulacrum, one encounters in a dream, in the theater, in cinema or at the practice sites of Cosmonauts.¹⁰⁴

This generalizing and broadening of the scope of the term brought an understanding of the bachelor machine that it would not have had based on Duchamp’s remarks alone. When the concept was used by philosophers Gilles Deleuze and Félix Guattari in 1972 for their seminal study *Anti-Oedipus*, their main reference for conceptualizing the bachelor machine ↴ as a particular type of desiring machine was therefore Carrouges, not Duchamp. The modern myth created by Carrouges was then further fleshed out in an exhibition that Swiss art curator Harald Szeemann organized, under the title “Junggesellenmaschinen/Les Machines célibataires,” for the Venice Biennial in 1975.¹⁰⁵ This exhibition, which traveled to seven other European cities through 1977, also provided a visual narrative for what had mainly been a literary theme in its treatment by Carrouges.

In a critical appraisal of the bachelor machine, art historian Hans Ulrich Reck and artist-philosopher Oswald Wiener highlighted three main aspects that characterize the concept. First, Carrouges's understanding of the bachelor machine relies on the rejection of generative or procreative sexuality, and thus on a rejection of the woman.¹⁰⁶ More generally speaking, the bachelor machine is conceived as a solipsistic "replacement of the Other."¹⁰⁷ Second, the celibate status of the machine suggests the dream of an ultimate creativity, namely that of an immaculate procreation, and of transcending the limitations and imperfections of one's own genotype.¹⁰⁸ And finally, fear of death is implied in the bachelor machine's promise of overcoming death in a world without pain.¹⁰⁹

While Hans Ulrich Reck objects to Szeemann's use in his exhibition and catalog of machine metaphors without reflecting on contemporary technical developments,¹¹⁰ Oswald Wiener more globally insists that it does not make sense to consider as a "machine" something that does not have a material substrate; it is possible, he claims, to do this in art and literature, but there it amounts to nothing more than "metaphysical enthusiasm."¹¹¹

For Wiener, the main fuel of the bachelor machine is not "the mistrust against artificiality and mechanization," as Reck contends, but "the fear to be such an artificial thing oneself." The bachelor machine is fueled by the desire to hold onto something human that cannot be mechanized: "In the sense of a vague self-conception, one trusts the feeling of not being a machine oneself."¹¹²

In contrast, Dieter Daniels, in his comparison of Turing's Universal Machine and Duchamp's bachelor machine, concludes from his analysis of *The Large Glass* that the work shows "how closely the wish to build machines is linked to becoming a machine oneself."¹¹³ Daniels identifies as a core theme of *The Large Glass*, "this human wish to play the part of a machine, even perhaps to become one, in order to dispose of the incapacity for physical fulfillment in a sexual encounter, in order to encompass it in a form that is separable from one's own agony of impotence."¹¹⁴

The dissent between Wiener and Daniels, and the question of whether the bachelor machine signifies the desire for, or perhaps rather the fear of, being machinelike, point to the two sides of the same coin. What is significant is that the relationship of man and machine to which both writers point is symbolic, and that their conceptions consider the machine as an aspect of masculine psychology. The notion of the bachelor machine inflects the understanding of the machine as subjectified Other as a discourse on a neurotic self-conception of the male subject which presupposes the negation of the female and its replacement by a ↴ machine. What a feminine equivalent to this relationship with machines might be is up for debate.

p. 38

Machinists

The bachelor machine is a male myth. In contrast, Donna Haraway's discussion of the cyborg in her text "A Cyborg Manifesto" (1985) is a deliberate attempt to create a female myth, a political myth that helps to transform women's relationship to technology.¹¹⁵ The cyborg is a cybernetic organism combining machine and organic aspects in a figure that Haraway traces both in science fiction novels and in the social reality of the late twentieth century. The claim to technology that Haraway makes for women is based on an identification with it, not on a distinction from it: "For us, in imagination and in other practice, machines can be prosthetic devices, intimate components, friendly selves. ... The machine is not an *it* to be animated, worshipped, and dominated. The machine is *us*, our processes, an aspect of our embodiment. We can be responsible for machines; *they* do not dominate or threaten us. We are responsible for boundaries; we are *they*."¹¹⁶

An important difference between Haraway's view and Haviland's equation of machine and woman is that whereas Haviland used the clichés of male superiority over women to describe men's relationship to

technology, implying that “the machine is like a woman,” Haraway reverses this claim and says, “woman is like a machine.” Haraway addresses the discourse on the relation of machine and organism which has occupied theorists from Descartes to Canguilhem, but she argues that the borders between human and animal, between animal-human and machine, and between the physical and the nonphysical, have been transgressed:

By the late twentieth century, our time, a mythic time, we are all chimeras, theorized and fabricated hybrids of machine and organism; in short, we are cyborgs. The cyborg is our ontology; it gives us our politics. The cyborg is a condensed image of both imagination and material reality, the two joined centres structuring any possibility of historical transformation. In the traditions of “Western” science and politics—the tradition of racist, male-dominant capitalism; the tradition of progress; the tradition of the appropriation of nature as resource for the productions of culture; the tradition of reproduction of the self from the reflections of the other—the relation between organism and machine has been a border war. The stakes in the border war have been the territories of production, reproduction, and imagination.¹¹⁷

p. 39

Haraway argues for a deliberate, pleasurable, and responsible confusion and reconstruction of such boundaries. She makes her argument within the historical horizon in which computation emerged and electronics were miniaturized, as epitomized by the integrated circuit. But the image of “women in the integrated circuit”¹¹⁸ is not all positive because, in Haraway’s view, the old forms of domination are replaced by network technologies that engender new forms of power: “The actual situation of women is their integration/exploitation into a world system of production/reproduction and communication called the ↴ informatics of domination.”¹¹⁹ She argues that we need to understand “what it means to be embodied in high-tech worlds,” and one way of reaching such an understanding might be to look at another such confusion of boundaries: “Perhaps, ironically, we can learn from our fusions with animals and machines how not to be Man, the embodiment of Western logos. From the point of view of pleasure in these potent and taboo fusions, made inevitable by the social relations of science and technology, there might indeed be a feminist science.”¹²⁰ Such a cyberfeminist perspective could, Haraway suggests, “be about lived social and bodily realities in which people are not afraid of their joint kinship with animals and machines, not afraid of permanently partial identities and contradictory standpoints.”¹²¹

The techniques that Haraway proposes for this reconstruction of relations and boundaries are networking, weaving, writing, and coding. “Weaving,” she says, “is for oppositional cyborgs.”¹²² The cyborg is a new personal and collective self that needs to be coded.

Given the scarcity of women artists in the field of “machine art,” it’s striking how many of those who engage with technology also work with textiles and weaving. We can think of artists like Varvara Stepanova, Gunta Stölzl, Anni Albers, or Ingrid Wiener,¹²³ but also of Orlan’s surgical reconfiguration of her own body, or of Tania Ruiz Gutierrez’s deconstruction and layering of video material in ways that open it up to symbolic meanings by visually coding or weaving multitemporalities into the texture of electronic images.¹²⁴ The figurehead of such female coding and networking practices is Ada Lovelace, who was the first coder to write a program for Charles Babbage’s Analytical Engine.¹²⁵ The point of my argument is not to say that men are hunters and women are gatherers—not least because among such artists as Lynn Hershman Leeson, Rebecca Horn, Seiko Mikami, or Steina Vasulka, we find women who do things other than weave, code, and network.¹²⁶ But it is somewhat irritating that even in one of the founding documents of cyberfeminism, Haraway’s “Cyborg Manifesto,” a pattern is repeated that seems to permeate the discourse on modern technology: women use machines, but they don’t build them; and they are addressed as users, even programmers, of technology, as machinists but not as engineers.

Toward the end of her essay, Haraway reiterates the need for women to empower themselves through embracing the cyborg as a form of gaining technical skill:

What about all the ignorance of women, all the exclusions and failures of knowledge and skill? What about men's access to daily competence, to knowing how to build things, to take them apart, to play? What about other embodiments? Cyborg gender is a local possibility taking a global vengeance. Race, gender, and capital require a cyborg theory of wholes and parts. There is no drive in cyborgs to produce total theory, but there is an intimate experience of boundaries, their construction and deconstruction. There is a myth system waiting to become a political language to ground one way of looking at science and technology and challenging the informatics of domination—in order to act potently.¹²⁷

However, nowhere in the "Cyborg Manifesto" is there a challenge to attain what men seem to have access to, i.e., "knowing how to build things, to take them apart, to play." The essay ends with the famous plea to embrace the cyborg myth: "It is an imagination of a feminist speaking in tongues to strike fear into the circuits of the supersavers of the new right. It means both building and destroying machines, identities, categories, relationships, space stories. Though both are bound in the spiral dance, I would rather be a cyborg than a goddess."¹²⁸ But this "building and destroying" remains vague and general, and the impression that the "Cyborg Manifesto" leaves us with is that technology is not something that women/cyborgs can make, build, and engineer, but rather something they use, code, and recode. My point here is not to reiterate an essentialist argument, but to point out that in this powerful myth on the relation between women and technology, the concept of "building things and taking them apart" remains the preserve of men.

This does not seem to have changed for the next generation of feminists, for whom it remains difficult to imagine themselves as engineers, rather than as weavers and machinists. In a manifesto on "Xenofeminism," published by an international collective of feminists in 2015 under the name of Laboria Cuboniks, the authors argue for a new feminism that embraces the social and technological conditions of the twenty-first century.¹²⁹ In a paragraph devoted to a xenofeminist attitude to technology, the approach is, as in Haraway's manifesto thirty years before, one of empowered users:

The radical opportunities afforded by developing (and alienating) forms of technological mediation should no longer be put to use in the exclusive interests of capital, which, by design, only benefits the few. There are incessantly proliferating tools to be annexed, and although no one can claim their comprehensive accessibility, digital tools have never been more widely available or more sensitive to appropriation than they are today. ... Just as the invention of the stock market was also the invention of the crash, Xenofeminism knows that technological innovation must equally anticipate its systemic condition responsively.¹³⁰

The drive for technological empowerment is not a core argument of the manifesto, so it may well be that this section is less developed than other parts. Yet it is striking to see that the default position for the women addressed here is not to build machines and reinvent technology, but to take technology as a given and seek to operate innovatively and responsibly within its regimes.

The foundations of this mythical structure run deep. With the aim of critical analysis—and the prospect of ending with an example of the myth's being successfully thwarted—British cultural theorist Nina Power comments on the integration of women into industrial production processes: "Women have always been desired by the machine. It needs them for their deftness, their smaller hands, their capacity to work quickly and, initially at least, to demand less for doing so. ... Any appeal to the supposed 'naturalness' of women, or some sort of privileged relation to nature is as historically inaccurate as it is banal: Women make the best robots, as *Metropolis* shows us."¹³¹ Power's reference to a second movie from the 1920s suggests that the fusion of woman and technology—and thus also the gendered myth of the modern machine—is closely tied up with the labor regimes of industrialization:

There's a scene in Dziga Vertov's 1929 film *Man with a Movie Camera* which combines footage of women doing a variety of different activities: sewing, cutting film (with Elizaveta Svilova, Vertov's wife and the film's actual editor), counting on an abacus, joyfully making boxes, plugging connections into a telephone switchboard, packing cigarettes, typing, playing the piano, answering the phone, tapping out code, ringing a bell, applying lipstick. The cut-up footage speeds up to such a frenzy that at one point it becomes impossible to tell which activity is done for pleasure, and which for work. This is a vision, long before desktops, mobiles, call-centres and the invention of temp agencies, of the optimistic compatibility, perhaps even straightforward identification, of women with the boundless manifestations of technology and artifice.¹³²

Confirming the impression that women are not expected to be engineers, Power observes: "Rarely, of course, have women ever been on the side of construction (though Waterloo Bridge, the longest bridge in London, rebuilt by women during World War II, magnificently undermines the idea that women's work is 'small-scale')."¹³³ But Power also offers the example of a woman, noise artist Jessica Rylan, who crosses over to the side of construction by building her own analogue synthesizers which Rylan uses in her live performances:

If the subterranean history of the relation between women, machines and noise has finally emerged overground as a new Art of Noise that seeks to destroy the opposition of the natural and the artificial, what performers like Rylan represent is an expansionist take-over of the territory. No longer will the machines dream through women, but will instead be built by them. They will be used not to mimic the impotent howl of aggression in a hostile world, but to reconfigure the very matrix of noise itself.¹³⁴

In relation to the myth of the machine, the radicalism of Power's statement lies in the fact that, as a rare exception, she lays claim to the possibility of women constructing machines, and to the reconfiguration of the technological matrix. Because her machine examples are all precybernetic, Power does not address the crucial issue raised by Donna Haraway, namely how the gendered regimes of technology are changed by computational and networked technologies. Thus, the question remains open about which subject positions can be constructed in such a reconfigured matrix that abandons the specter of the mechanical machine.

In the twentieth century, the meaning of machines is closely tied to the histories of masculinity and femininity. The experience both of industrial labor and of the fragmentation and prosthetization of male bodies in the First World War played a crucial role in the constitution of machine metaphors and the machine system. This gendered foundation thus also sustains artistic work with technology, and the construction of machines by artists in particular.

Overview

p. 42

The direct references to the notion of “machine art” quoted earlier in this introductory chapter give only a first impression of the aesthetic dimensions that have been associated with it. An analysis of the basic aspects of such an aesthetics of the machine forms the main part ↴ of the following chapter. The narrative begins with two pivotal moments in the twentieth-century history of machine art. The 1968 exhibition “The Machine as Seen at the End of the Mechanical Age” by Pontus Hultén constitutes a metaphorical turning point whose curatorial concept was still built around a mechanical understanding of the machine, but also signifies the transformation of the conception of technology toward a more systemic and ecological paradigm. We then take a step backward in time and turn to another crucial moment in the development of the artistic conception of the machine. The advent of futurism brought a radical revaluation of the machine which, at the beginning of the twentieth century, comes into view not only as a motif of representation but as a method and principle of artistic creation. Marinetti’s publication of the first futurist manifesto in 1909 marks that moment. In its original newspaper publication, the manifesto was conspicuously prefaced by the story of a car accident that preceded Marinetti’s hymn to the new technical culture. In technology, as Paul Virilio has remarked, function and malfunction always go together,¹³⁵ and the machine is coupled not only to the figure of the human but also to their joint accident. The accident is something that human and machine have *together*.

For the longest time, the “aesthetic of the machine” has been a rumor rather than a well-defined concept. But its connotations are as divergent as are the different notions of the machine that we reviewed earlier. We will therefore investigate five aspects of such a “machine aesthetics” that characterized the work of artists building machines until the 1960s: the associative reference to the social meanings of technology, often to make a provocative claim against the assumptions of artistic ingenuity; the symbolic reference to mechanics as a way to describe aspects of human culture and psychology; the formalist appraisal of the beauty of functional forms; the play with *kinetic* functions as a way to broaden the expressive potentials of sculpture; and the *automatic* operation of machines that underpins their functional independence and their existential strangeness. Many of the examples we draw on were presented in Hultén’s exhibition, which provided an encyclopedic overview without offering the analytical raster that I am proposing here.

The movement I have indicated of sliding back and forth between different instances in the history of the twentieth century is also characteristic of the narrative that I develop in the following four chapters. I want to point to the historical changes as well as to the genealogies of certain concepts and motifs. Importantly, I want to show how important aesthetic aspects of more recent, computer-based artworks are part of an art historical lineage that connects them, directly or indirectly, to developments in the 1950s and 1960s, and further back into the 1910s and 1920s. This larger argument is developed by focusing on specific domains of the artistic engagement with technology: in chapter 3, the focus is on algorithms and machine autonomy; in chapter 4, on vision and the image; chapter 5 deals with changing conceptions of the human body; and the final chapter discusses the emergence of the ecological paradigm of technology in art.

p. 43

Chapter 3 takes its cue from the work of Canadian artist David Rokeby, who has explored the aesthetics of the human encounter and interaction with technical systems since the ↴ 1980s. The historical narrative of this chapter picks up, roughly, where Hultén’s exhibition had left it, i.e., in the 1960s and with the dialogue between art and cybernetics that Hultén was aware of, but that was more or less beyond the scope of his presentation of the history of the machine in art. Two aspects of the aesthetics of machines can be added here to the list of five developed in the previous chapter: one is the aspect of *interactivity*, which adds the dimension of a charged, at times tense, at other times playful dialogue and exchange to the human-machine relationship; and the other is the aspect of *autonomy*, which becomes a determining factor in the human experience of increasingly independent and self-referential technical systems.

The relationship between aesthetics and technics has been particularly pronounced in discussions about vision and images. The dependency of human vision—not least that of visual artists—on technical media has introduced the topic of the medium into discourses about art, and has raised the question of the technicity of visual perception, whether it is human or machine-based. Chapter 4 begins with a detailed analysis of the concept of “operational images,” which pinpoints the tension between images that are produced to be seen by human eyes and technical vision systems that are independent of human vision and human intervention. There has been an ongoing debate at least since the advent of photography in the nineteenth century about machines that make images and about the status of technical images in art. Technical imaging challenges the status of the human subject—whether as artist or as recipient—in a dual way, since it not only undermines the human privilege of making and interpreting images, but also affords an acknowledgment of the degree to which the particular physiological conditions of human vision are themselves part of the technical dimension of aesthetic experiences.

The meaning of machines is most crucially contested in relation to the human body. Throughout modernity, the human organism has been understood both as a model for the conception of mechanical systems and as the site of a subjectivity which is fatally undermined by such technological systems. This charged terrain has been the subject of the entire artistic career of the Australian artist Stelarc, whose work serves as a point of entry in chapter 5 into a historical presentation of conceptions of the body, from the mechanical through the cybernetic. These excursions into different aspects of the body-machine relationship are grounded in the assumption, confirmed by evidence gleaned from the analysis of the examples, that the notion of the machine remains coupled to the physical body and to the paradigms of mechanics. The emergence of cybernetic conceptions of technology, when they actually overwrite such mechanical conceptions, therefore not only suggest an “end of the mechanical age,” but also put the constitutive relationship of human and machine into question. The various attempts by artists throughout the twentieth century at defining and innovating this relationship, transforming and pushing at the boundaries of what constitutes the human body, can be understood in this broader epistemological context.

The final chapter develops the hypothesis about a fundamental shift in the meaning of technology with the emergence of systems thinking and ecology in the second half of the twentieth century—a shift that also has a significant impact on the conception of the machine. The chapter looks at contemporary and historical examples of ecological art which not only show how closely related are the conceptions of ecology and technology, but also emphasize how the systemic, environmental understanding of technology decouples the diagram of subjectivation and necessitates a revaluation of human subjectivity. Two artists whose works are—in very different ways—exemplary for exploring the consequences of this crisis of the human-machine relation, and of subjectivity, are the Japanese artist Seiko Mikami and the Austrian Herwig Weiser. Their works straddle different domains covered in the various chapters of this book. Seiko Mikami questions the position of the human body and its faculties in relation to technical systems which in her installations, spanning over two decades, change from neutral media interfaces into autonomous, solitary machine subjects. Herwig Weiser, in contrast, questions the very logic of technics, inventing alternative technologics for the materials and concepts of contemporary technoculture.

In this book, I put forward a historical argument about machine art and machine aesthetics in the twentieth century, mainly in the field of visual and media art. Similar arguments could be developed with regard to, for instance, music and sound art,¹³⁶ for the aesthetics of the machine in theater and performance¹³⁷ or in film or architecture. I have decided against such an encyclopedic approach, and in favor of an attempt to put forward a more narrowly defined historical argument about the emergence and dissipation of concepts of the machine, as witnessed in the visual arts of the twentieth century. Works of robotic art are discussed especially with regard to the aesthetics of machine autonomy, while the artistic robots that mimic human and animal movements and behaviors are all but passed over; their theatricality draws on different aesthetic registers than those crucial for an aesthetics of machines developed here which, by their very nature,

suspend such mimetic ambitions. This is therefore also not a book about media art, but one that attempts to develop a focused discourse about machines in art. It takes an art historical perspective that does not so much aim for a diagnosis of the present situation as it looks at a genealogy of thought and at historical conceptions that form correlates of our contemporary understanding of technology and its aesthetics.

The artworks discussed do not seek to illustrate an epistemological hypothesis. Rather, they make it possible to feel and think something that only becomes possible in the singular encounter with the work. Reading this book and looking at the images cannot replace your own experience that, with regard to most of the examples under discussion, requires you to be affected by the works directly. The hypothesis put forward here—that the crisis of the machine is also a crisis of subjectivity—is both an abstract concept and a concrete experience that the artworks can elicit. The more general question to ask may thus also become very concrete: In the face of an emergent ecological understanding of the world, the “constraint of thought” of the machine becomes dispersed into networks of interdependency where the phantasm of technical subjectivation and agency can no longer be fixated in one spot—the spot where the machine used to be, and from which it co-constituted the modern human ↴ subject. What, then, are the forms of subjectivity that emerge from the inscriptions of such an ecological field? It may well be that the notions of the body, the image, and algorithms, which structure our investigation, are part of the same technological episteme and might thus be withering away, together with the machine.

p. 45

This book is an investigation into a rumor—namely, the rumor that there is something that can be called “machine art,” something that is probably neither a particular genre nor a well-defined field of artistic practice. I attempt an explication of the rumor, rather than offering proof of its truthfulness. If there is or was a machine art, it may have been something like this. ↴

p. 46

Notes

1. On the 1920 appropriation of the “Tatlin myth” by the Berlin Dadaists, see Hanne Bergius, *Montage und Metamechanik. Dada Berlin—Artistik von Polaritäten* (Berlin: Gebrüder Mann, 2000), 50–52. The assumption that the Berlin Dadaists knew little of Tatlin’s work in 1920 is confirmed by Timothy O. Benson, *Raoul Hausmann and Berlin Dada* (Ann Arbor, MI: UMI Research Press, 1987), 186.
2. Konstantin Umanskij, “Der Tatlinismus oder die Maschinenkunst,” *Der Ararat*, no. 4 (Munich, January 1920): 12; accessed December 5, 2015, <http://sdrc.lib.uiowa.edu/dada/ararat/4/>.
3. Christina Lodder, “Soviet Constructivism,” in Steve Edwards and Paul Wood, eds., *Art of the Avant-Gardes* (New Haven: Yale University Press, 2004), 359–393.
4. See Andreas Broeckmann, “Escaping Gravity: Letatlin and Other Utopian Flying Machines in Twentieth-Century Art—Five Marginalia,” in Roland Wetzel and Anna Szech, eds., *Tatlin: New Art for a New World International Symposium, Tinguely Museum, Basel* (Ostfildern: Hatje Cantz, 2013), 291, for a suggestion on how to distinguish between Vladimir Tatlin (the artist), TATLIN (the self-styled myth), and “TATLIN” (the public myth beyond Tatlin’s control, of which the Dadaists’ appropriation is an example).
5. For a contemporary report about art production in the mid-1920s Soviet Union that extensively uses the notion of machine art and can serve as a document of how its myth was carved into discourse, see René Fülöp-Miller, *Fantasie und Alltag in Sowjet-Rußland* (Berlin: Elefanten Press, 1978), 94–100.
6. Larissa Zhadova, ed., *Tatlin* (New York: Rizzoli, 1988), 244. See also Tatlin’s biographer Anatolii Strigalev’s rejection of the designation of Tatlin as a technofetishist and an iconoclast: Anatolii Strigalev, “Vladimir Tatlin. Eine Retrospektive,” in Strigalev and Jürgen Harten, eds., *Vladimir Tatlin Retrospektive*, exh. cat. (Cologne: DuMont, 1993), 36. The formula of “Tatlin’s machine art” has persisted ever since, though not always employed as precisely as, for instance, by Felix Philipp Ingold, who points to the “Tatlinist” conservation of the art aspect: “Panamarenko does not want his flying machines to be understood as art (not as ‘machine art’ in the sense of Tatlin, or of the contemporary cyberneticians), but as a ‘logically’ conceived work in progress that is left to the autonomous laws of fantasy and permanently becoming and never complete.” Felix Philipp Ingold, “Künstler und/oder Ingenieur. Zu Panamarenkos Flugstudien und Flugobjekten,” in *Panamarenko*, exh. cat. (Basel: Kunsthalle Basel, 1977), ch. 3, n.p. (my translation).
7. Prampolini’s text was based on an earlier version by Ivo Pannaggi and Vinicio Paladini, “Manifesto dell’arte meccanica

- futurista," *La nuova Lacerba*, no. 1 (June 20, 1922): 7. Prampolini's version was published in English as "The Aesthetic of the Machine and Mechanical Introspection in Art," in *Broom: An International Magazine of the Arts* 3, no. 3 (October 1922): 235–237; all quotations are from this translation. See also Maria Elena Versari, "Futurist Machine Art, Constructivism and the Modernity of Mechanization," in Günter Berghaus, ed., *Futurism and the Technological Imagination* (Amsterdam: Rodopi, 2009), 149–170, and the discussion in chapter 2 below.
8. Prampolini, "The Aesthetic of the Machine," 237.
 9. Philip Johnson, introduction to Johnson, ed., *Machine Art*, exh. cat. (New York: Museum of Modern Art, 1934; rpt., New York: Harry N. Abrams, 1994), n.p. For a detailed account of the 1934 "Machine Art" exhibition, see Jennifer Jane Marshall, *Machine Art, 1934* (Chicago: University of Chicago Press, 2012).
 10. Alfred H. Barr Jr., foreword to Johnson, *Machine Art*, n.p.
 11. Ibid., n.p.
 12. Ibid., n.p.
 13. Ibid., n.p.
 14. The "Machine Age" exhibition was curated by art critic Jane Heap, editor of the *Little Review*; see Susan Noyes Platt, "Mysticism in the Machine Age: Jane Heap and *The Little Review*," 20/1: Twentieth-Century Art and Culture 1, no. 1 (1989): 40; Anne Blood, "The Russian Section of the 'Machine-Age Exposition' (1927)," *Burlington Magazine* 154 (October 2012): 13–15; and the comparison between the "Machine Age" and the "Machine Art" exhibitions in Kristina Wilson, *The Modern Eye: Stieglitz, MoMA, and the Art of the Exhibition, 1925–1934* (New Haven: Yale University Press, 2009), 149–199.
 15. Ibid., n.p. In a variation on this formalist conception, the US poet and writer Ezra Pound published a text entitled "Machine Art" in 1930. The essay deals with the music that George Antheil had created for the experimental film *Ballet mécanique*, a project that Antheil had worked on with painter Fernand Léger and that had premiered in 1924. Besides piano and percussion, Antheil's soundtrack used multiple instruments and sounds derived from industrial contexts, with the thumping of engines, the blowing of whistles, and the screeching of metal on metal accompanying the restless movement of machine parts. In his essay, Pound celebrated the machine as "form in motion," and argued that the art it brought forth was no longer mere static "space art" like sculpture and architecture; instead, "we find ourselves on the brink of considering time and recurrence"—key aspects of what will become labeled as "kinetic art" twenty years later. Ezra Pound, "Machine Art" (1927–1930), in Pound, *Machine Art and Other Writings*, ed. M. L. Ardizzone (Durham: Duke University Press, 1996), 71. Thus, Pound's notion of "machine art" implied a conception of the machine in operation as a dynamic aesthetic object, with the movement-producing motor at its heart (see Ardizzone, introduction to Pound, *Machine Art*, 22). See also Tony Tost, "Machine Poetics: Pound, Stein and the Modernist Imagination," PhD diss., Department of English, Duke University, 2011.
 16. Barr in Johnson, *Machine Art*, n.p. This skeptical note was struck, not coincidentally, in the same year that Lewis Mumford published his study on *Technics and Civilization* (1934; rpt., Chicago: University of Chicago Press, 2010), which expresses a similar worry about the necessity of taming what Mumford later called the "mega-machine." Mumford's book *Art and Technics* (New York: Columbia University Press, 1952) contains a chapter, "From Handicraft to Machine Art," 59–84, that is a like-minded response to Barr's foreword in the 1934 *Machine Art* catalog; Mumford writes: "The essence of machine art is the expression of function" (71). As artists "who have taught us most about the value of the machine in our day," Mumford singles out Alfred Stieglitz, Constantin Brancusi, and Naum Gabo (82)—the latter two of whom had also been mentioned by Barr as references for contemporary artists inspired by the art of the machine.
 17. Munari's manifesto was first published in 1952; an English translation can be found on p. 101 of Miroslava Hájek, "Munari's Machines," in Bruno Corà et al., eds., *Tinguely e Munari. Opere in azione* (Milan: Mazzotta, 2004), 101–103.
 18. Ibid., 101. For a related, situationist reflection on the effects of automation, see Asger Jorn, "The Situationists and Automation" (1958), in Ruth Baumeister, ed., *Fraternité Avant Tout: Asger Jorn's Writings on Art and Architecture, 1938–1958* (Rotterdam: 010 Publishers, 2011), 299–303.
 19. Manfred Schneckenburger, "Jenseits der Maschinenkunst—Beyond Machine Art," in Otto Piene und das CAVS, exh. cat., Badischer Kunstverein Karlsruhe (Berlin: Deutscher Künstlerbund, 1988), 20–24; cf. chapter 6 below.
 20. Ibid., 20.
 21. Ibid., 20–21.
 22. Similarly, in a review of curator Erika Billeter's exhibition about art in the 1920s (Erika Billeter, ed., *Die Zwanziger Jahre. Kontraste eines Jahrzehnts*, exh. cat. [Zurich: Kunstmuseum, 1973]), the German art critic Eduard Beaucamp refers to the machine cult of the 1920s and its "dream of a mechanized Elysium," but he does so in a language that betrays his interest in denouncing the rather more contemporary Soviet Union, or Allende's cybernetically inclined Chile (for example, he speaks of a "self-generating" and "self-regulating society"). See Eduard Beaucamp, "Streit der zwei Kulturen," in Beaucamp, *Das Dilemma der Avantgarde. Aufsätze zur bildenden Kunst* (Frankfurt am Main: Suhrkamp, 1976), 86–93; Originally published in the *Frankfurter Allgemeine Zeitung*, August 2, 1973.
 23. Gotthard Günther's essay "Die 'zweite' Maschine" appeared in 1963 as an annex to the second edition of a book first

- published in 1957, *Das Bewußtsein der Maschinen. Eine Metaphysik der Kybernetik* (The consciousness of the machines: A metaphysics of cybernetics) (Krefeld and Baden-Baden: Agis, 1963). The essay had first been written in 1952 and was published at that time as a commentary on the German translation of Isaac Asimov's science fiction novel *I, Robot*; see Günther, *Das Bewußtsein der Maschinen*, 17. For a critical discussion of Günther's text, see also Erich Hörl, "Die offene Maschine—Heidegger, Günther und Simondon über die technologische Bedingung," *Modern Language Notes (MLN)* 123, no. 3 (2008): 194–217.
24. Günther, "Die 'zweite' Maschine," 180.
 25. Ibid., 181.
 26. Ibid., 182.
 27. Ibid., 183.
 28. Ibid., 184. In organization studies, this principle would later be extended into the concept of "cyb-organization," in which the focus is not on the technical system that steers, but on the patterns of information that move between and constitute such systems. See R. Cooper and J. Law, "Organization: Distal and Proximal Views," in S. Bacharach et al., eds., *Studies of Organization in the European Tradition* (Greenwich, CT: JAI Press, 1995), 237–274.
 29. Günther, "Die 'zweite' Maschine," 186.
 30. Ibid., 187.
 31. Von Förster also reiterates the topos of automated technologies gaining power over human society, which had already worried Barr and Munari, and warns: "If we don't act ourselves, we shall be acted upon." Heinz von Förster, "Perception of the Future and the Future of Perception," *Instructional Science* 1, no. 1 (1972): 31–43.
 32. For an analysis of the "anthropology of technology" that does not distinguish between such different types of machines but views all machines (especially in industrial production) under the paradigm of automatism and of the emergence of a new type of processes, namely "machine processes," that are generated as an addition to natural processes and processes of human agency, see Heinrich Popitz, *Der Aufbruch zur artifiziellen Gesellschaft. Zur Anthropologie der Technik* (Tübingen: Mohr, 1995), esp. 29–31.
 33. Mumford, *Technics and Civilization*, 12.
 34. See Lewis Mumford, *The Myth of the Machine*, 2 vols. (New York: Harcourt Brace Jovanovich, 1967–1970). Cf. also Günther Anders, "Antiquiertheit der Maschinen," part I (written in 1960) and part II (1969), in *Die Antiquiertheit des Menschen* (Munich: C. H. Beck, 1980), 110–127, which discuss (1) the "Promethean Shame" that humans feel because they have been born, not produced, and (2) the super-session of the individual machine of the nineteenth century and its coupling and integration with others into the "meta-apparatus," the "universal apparatus," or the "total" or "big machine" of the later twentieth century. Anders does not distinguish between "apparatus" and "machine," but uses both terms more or less synonymously.
 35. Alan Turing, "Computing Machinery and Intelligence," *Mind*, no. 59 (1950): 435–436. It is a matter of academic debate whether the conceptual model of the "machine" Turing had in mind was a calculating machine of the type conceived by Leibniz and Babbage; Turing's biographer Andrew Hodges, in *Alan Turing: The Enigma* (Princeton, NJ: Princeton University Press, 2012), 96–98, suggests that the model "machine" in 1935–1937 may well have been a typewriter like the one owned by Turing's mother; see also Andrew Hodges, "What Did Alan Turing Mean by 'Machine'?", in Philip Husbands, Owen Holland, and Michael Wheeler, eds., *The Mechanical Mind in History* (Cambridge, MA: MIT Press, 2008), 75–90. For a historical overview of "intelligent machines" in art, see in the same volume Paul Brown, "The Mechanization of Art," 259–282; for a discussion of the transition from the classical to the cybernetic machine concept, and the role of mathematics, see Dieter Mersch, "Kunstmaschinen. Zur Mechanisierung von Kreativität," *Paragrapna* 14, no. 2 (2005): 183–202, esp. 187–189.
 36. The following discussion is based in part on the summary of Deleuze and Guattari's machine concept by Gerald Raunig, *Tausend Maschinen. Eine kleine Philosophie der Maschine als sozialer Bewegung* (Vienna: Turia + Kant, 2008), 18–30. While Raunig's analysis of the notions of the machine in Marx and Guattari is precise, and the reintroduction of the ancient concept of *machina* in a chapter on "Theatre Machines" (31–49) affords a useful broadening of the discussion, his attempts to apply the concept of the machine to social movements and to debates about the twenty-first-century precariat are less convincing. For an extensive analysis of the notion of the machine in the works of Guattari, Deleuze, and Lacan, see Henning Schmidgen, *Das Unbewußte der Maschinen. Konzeptionen des Psychischen bei Guattari, Deleuze und Lacan* (Munich: Fink, 1997), esp. 42, 68–69, 75, 80–82. For a summary of the machine-related terminology by philosopher and *Mille Plateaux* translator Brian Massumi, see his *A User's Guide to Capitalism and Schizophrenia* (Cambridge, MA: MIT Press, 1992), 192 fn. 45.
 37. Schmidgen, *Das Unbewußte der Maschinen*, 29.
 38. Raunig, *Tausend Maschinen*, 30. On the need for a critical historical approach to the concept of the machine, see also Félix Guattari, "Über Maschinen" (1990), in Henning Schmidgen, ed., *Ästhetik und Maschinismus. Texte von und zu Félix Guattari* (Berlin: Merve, 1995), 119f., and Félix Guattari, *Molecular Revolution: Psychiatry and Politics* (New York: Penguin, 1984), 112.

In an appendix to their book *Anti-Oedipus* (1972; London: Continuum, 2004), Deleuze and Guattari asked, “which societal machine enables and necessitates the appearance of specific technical, affective, cognitive, semiotic machines and their concatenation” (Raunig, *Tausend Maschinen*, 27). Gilles Deleuze later reiterated the idea of machines as social phenomena in his “Postscript on the Societies of Control,” *October*, no. 59 (Winter 1992): 6, where he offers an alternative numbering for, in this case, three different machine concepts: “Types of machines are easily matched with each type of society—not that machines are determining, but because they express those social forms capable of generating them and using them. The old societies of sovereignty made use of simple machines—levers, pulleys, clocks; but the recent disciplinary societies equipped themselves with machines involving energy, with the passive danger of entropy and the active danger of sabotage; the societies of control operate with machines of a third type, computers, whose passive danger is jamming and whose active one is piracy or the introduction of viruses.”

39. See Raunig, *Tausend Maschinen*, 25.
40. Ibid., 28–29.
41. Brian Massumi has pointed out that “due to persistent subjectivist misunderstandings,” Deleuze and Guattari abandoned the term “desiring machine” in favor of the more neutral “assemblage”; see Massumi, *A User’s Guide*, 82.
42. Martin Burckhardt, *Vom Geist der Maschine* (Frankfurt am Main: Campus, 1999), 17. Similarly, philosopher Jean-François Lyotard has described the machine as a cunning “trap set for the forces of nature”; see Lyotard, *Duchamp’s TRANS/formers* (Venice, CA: Lapis Press, 1990), 41–43. And ethnographer Lucy A. Suchman has pointed to the fact that human-computer interaction is organized around different, asymmetrical constraints which require the human user to understand the nature of the machine and the operations required to use it, while the machine is constrained by its design plan; see Lucy Suchman, *Plans and Situated Actions: The Problem of Human-Machine Communication* (Cambridge: Cambridge University Press, 1987), 118.
43. Hans Blumenberg, *Paradigmen zu einer Metaphorologie* (Frankfurt am Main: Suhrkamp, 1998), 91–92.
44. Ibid., 108.
45. Jonathan Sawday, in *Engines of the Imagination: Renaissance Culture and the Rise of the Machine* (London: Routledge, 2007), has shown how tropes related to the concept of the machine and its inherent dangerousness (art, technology, human, nature, etc.) have not only been prominent since the nineteenth century, but were already present in the Renaissance discourses on technology of the sixteenth and seventeenth centuries (including the mega-machine, intelligent or reasoning machines, and sex machines).
46. See Georges Canguilhem, “Machine and Organism” (1952), trans. Mark Cohen and Randall Cherry, in Jonathan Crary and Sanford Kwinter, eds., *Incorporations* (New York: Zone Books, 1992), 52–53.
47. Ibid., 49. On the history of automata, see Adelheid Voskuhl, *Androids in the Enlightenment: Mechanics, Artisans, and Cultures of the Self* (Chicago: University of Chicago Press, 2013); and Minsoo Kang, *Sublime Dreams of Living Machines: The Automaton in the European Imagination* (Cambridge, MA: Harvard University Press, 2011). On robotic art, see Thierry Dufrêne, *Outresculpture* (Paris: Éditions Hazan, forthcoming).
48. See Canguilhem, “Machine and Organism,” 52.
49. Ibid., 63.
50. Ibid., 54.
51. Ibid., 56.
52. Ibid., 58.
53. See Karl Marx, “Fragment on Machines” (1857–1858), in *Grundrisse: Foundations of the Critique of Political Economy*, trans. Martin Nicolaus (London: Penguin Books, 1973), 690–712. The fragmentary text was prefaced by a quotation from Marx’s contemporary, Charles Babbage. See Raunig, *Tausend Maschinen*, 18–30, for a succinct summary of Marx’s conception of the machine.
54. Marx, “Fragment on Machines,” 692.
55. Ibid., 692–693. This conception of total integration will inform much of the Marxist literature of the twentieth century; see for instance, Georg Lukács’s *History and Class Consciousness* (1923): “on the assembly line, the bodily integrity of the worker is broken up as much as the organic unity of the product, and the worker becomes ‘a mechanical part incorporated into a mechanical system.’” Cited in Hal Foster, *Prosthetic Gods* (Cambridge, MA: MIT Press, 2004), 184.
56. Gastev, cited in Fülop-Miller, *Fantasie und Alltag in Sowjet-Rußland*, 48.
57. Sigfried Giedion, *Mechanization Takes Command* (1948; Oxford: Oxford University Press, 1980), 126.
58. N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: University of Chicago Press, 1999), 105; see 66–67 for Hayles’s analysis of how, in cybernetics, language forms the crucial linkage between humans and machines.
59. Günther, “Die ‘zweite’ Maschine,” 189.
60. Turing, “Computing Machinery and Intelligence,” 442; see David Rokeby, “Transforming Mirrors: Subjectivity and Control in Interactive Media,” in Simon Penny, ed., *Critical Issues in Interactive Media* (Albany, NY: SUNY Press, 1995), 133–158.

61. Claus Pias, "Das digitale Bild gibt es nicht—Über das (Nicht)Wissen der Bilder und die informatische Illusion," *Zeitenblicke* 2, no. 1 (2003), <http://www.zeitenblicke.de/2003/01/pias/>, section 20.
62. Ibid., section 17.
63. Ibid., section 19.
64. Erich Hörl and Michael Hagner, "Überlegungen zur kybernetischen Transformation des Humanen," in Hörl and Hagner, eds., *Die Transformation des Humanen—Beiträge zur Kulturgeschichte der Kybernetik* (Frankfurt am Main: Suhrkamp, 2008), 9.
65. Günther, "Die 'zweite' Maschine," 181–182 (emphasis added).
66. This is one of the main themes of Pickering's major study *Cybernetic Brain: Sketches of Another Future* (Chicago: University of Chicago Press, 2010).
67. Louis Althusser, "Ideology and Ideological State Apparatuses: Notes towards an Investigation" (1969), in Althusser, *Lenin and Philosophy* (London: New Left Books, 1971), 127–186.
68. Giorgio Agamben, "What Is an Apparatus?" (2006), in Agamben, *What Is an Apparatus? and Other Essays*, trans. David Kishik and Stefan Pedatella (Stanford, CA: Stanford University Press, 2009), 1–24.
69. Ibid., 14.
70. Ibid.
71. Ibid., 17. Agamben's dual, nested use, in this section, of the term "apparatus" for both technical instruments and gadgets, and for the systems that bring these gadgets forth to "crowd the spaces of social interaction," appears somewhat contradictory. Agamben does not employ a differentiated concept of technology, and discusses rather anecdotally the mobile phone as a contemporary "apparatus" (16–17, 21). He also employs the concept of the "machine" rather casually and without offering a definition; the term is used several times in the context of "the governmental machine" (20, 22, 23) and seems to be conceived as the force that controls the apparatuses and puts them to work, thus reminding us of Mumford's "mega-machine."
72. For a discussion of the relation between humans and animals, and an analogy between animals and machines, see Giorgio Agamben, *The Open: Man and Animal* (Stanford, CA: Stanford University Press, 2004), where the "anthropological machine" is posited as the conceptual mechanism through which the human is created with and against the animal.
73. This is also the reason why art-making machines—which repeat the gesture of desubjectified art making—and automata and robots—which perpetuate anthropomorphic and zoomorphic encounters—are less relevant for the inquiry pursued in this book.
As a strategic means against the phantasmatic claim to a digital universalism, i.e., the idea that everything can be digitalized and calculated, Dieter Mersch in "Kunstmaschinen. Zur Mechanisierung von Kreativität" posits the *paradox*, "especially because it traverses and explodes the binarism of digital systems, and thus points to the other, the nondichotomous and nondigitalizable" (198). Mersch writes that there cannot be creativity under the conditions of cybernetic machines, and argues for blowing the cover of the machine through art: "The site of such an invention is art. The Other—which gains its contour only in the passage, in the transition, and which reveals the trace of creativity like a silhouette—is set free in a break with all mechanicity not by art machines, but by the ironical and paradoxical 'machines' of the arts" (199). In this text, Mersch does not mention examples of concrete artworks. On the notion of the paradox, see also Günther, "Die 'zweite' Maschine," 189, n. 5: "Paradoxes cannot be constructed as technical objects [*Paradoxien aber sind nicht als technische Objekte konstruierbar*]." But can they be constructed as artworks?
74. Andy Warhol, quoted in Gene R. Swenson, "What Is Pop Art? Answers from Eight Painters, Part 1," *Art News*, no. 62 (November 1963), 26.
75. Heiner Müller, "Hamletmaschine," in Frank Hörnigk, ed., *Heiner Müller Material. Texte und Kommentare* (Leipzig: Reclam, 1989), 48–49 and 45.
76. Ibid., 47.
77. Roland Puccetti, "On Thinking Machines and Feeling Machines," *British Journal of the Philosophy of Science* 18, no. 1 (1967): 42.
78. Turing, "Computing Machinery and Intelligence," 446, emphasis in the original. See also the case of "Joey, the mechanical boy" analyzed by Bruno Bettelheim in "Joey, the Mechanical Boy," *Scientific American* (March 1959): 3–9. Cf. Stephen Thompson, "Joey the Mechanical Boy," in *The Transtechnology Reader* (Plymouth, UK: Plymouth University, 2010): 85–97.
79. Gastev, cited in Fülop-Miller, *Fantasia und Alltag in Sowjet-Rußland*, 50.
80. Fritz Böhle and Brigitte Milkau (1988), cited in Dietrich Hoß, "Maschinenträume und Traummaschinen—Aktuelle Bezüge einer kritischen Theorie des Technikumgangs," in Rainer Erd, ed., *Kritische Theorie und Kultur* (Frankfurt am Main: Suhrkamp, 1989), 330.
81. Hoß, "Maschinenträume und Traummaschinen," 330.
82. C. S. Lewis, *The Four Loves* (New York: Harcourt, 1960). Less harmoniously inclined, Friedrich Nietzsche claimed that love and death are inextricably linked, and that the will to love is always wedded to the will to ruin and destruction. We will

return to this motif when discussing the concept of the bachelor machine.

83. Max Scheler, “Liebe und Hass” (1922), in *Wesen und Formen der Sympathie, Werke*, vol. 7, ed. Manfred S. Frings (Bern and Munich: Francke, 1973), 157–158. Scheler’s study was first published in 1913; we can only speculate why his anti-anthropopathic affirmation coincided with the futurists’ eroticized celebration of machines during those years. In an influential study of sexuality, *Psychopathia Sexualis* (first published 1886, multiple updated editions until 1924), Richard von Krafft-Ebing considered not only love and sexual relationships (and their “perversions”) between people, but also fetishization of body parts, objects, and materials—though not machines. Critic Peter Kroher reminds us that according to Jacques Lacan, Freud’s decisive discovery of libidinal energy, a precondition of psychoanalysis, was predicated on the appearance of machines; see Peter Kroher, “Libidinöse Energetik,” in Knowbotic Research, ed., *Nonlocated Online: Digital Territories, Incorporations and the Matrix*, Medien Kunst Passagen no. 3 (Vienna: Passagen Verlag, 1995), IIIa; and Jacques-Alain Miller, ed., *The Seminar of Jacques Lacan: Book II: The Ego in Freud’s Theory and in the Technique of Psychoanalysis, 1954–1955* (New York: W. W. Norton, 1991), 73–74.

As early as the eighteenth century, the philosopher Hermann Samuel Reimarus hinted at the strong (if negative) emotional movement that machines could call forth: he regarded a world in which machines would not produce their phenomena with explicit regard to a human observer as “dreadful” (*scheußlich*). See Horst Bredekamp, *Antikensehnsucht und Maschinenglaube. Die Geschichte der Kunstkammer und die Zukunft der Kunstgeschichte* (Berlin: Wagenbach, 2002), 88; quoting Wilhelm Schmidt-Biggemann, *Maschine und Teufel. Jean Pauls Jugendsatiren nach ihrer Modellgeschichte* (Munich: Alber 1975), 90.

84. Pontus K. G. Hultén, *The Machine as Seen at the End of the Mechanical Age*, exh. cat. (New York: Museum of Modern Art, 1968), 172.
85. Jean Tinguely, quoted in *ibid.*, 167.
86. Claus Pias, “Hollerith ‘Feathered Crystal’: Art, Science, and Computing in the Era of Cybernetics,” *Grey Room*, no. 29 (2007): 99; see also Claus Pias, “Der Hacker,” in Eva Horn and Ulrich Bröckling, eds., *Grenzverletzer. Figuren politischer Subversion* (Berlin: Kadmos, 2002), 248–270, where the “I Love You” computer virus is called a “global declaration of love [*globale Liebeserklärung*]” (248).
87. Kito Nedo, “Atonal mit Youtube-Kätzchen,” *Berliner Zeitung*, December 17, 2010.
88. Saul Albert, “Interactivity, Image, Text, and Context within Jodi.org” (1998), *Nettime mailing list archives*, <http://www.nettime.org/Lists-Archives/nettime-l-9804/msg00015.html>; see also Inge Hinter-waldner, “When Windows Attack ... Doors Won’t Help. Zur Hinterfragung von Bildlichkeit und Interaktivität in der Netzkunst,” in Birgit Mersmann and Martin Schulz, eds., *Kulturen des Bildes* (Munich: Fink, 2006), 373.
89. “Another lonely night/Stare at the TV screen/I don’t know what to do/I need a rendezvous/Computer love/Computer love/I call this number/For a data date.” Kraftwerk, “Computer Love,” from *Computer Love/The Model*, EMI 5207, 1981, 7-inch vinyl single.
90. See David Link, “There Must Be an Angel. Zu den Anfängen des Rechnens mit Strahlen” (2006), in Siegfried Zielinski and Eckhard Fürlus, eds., *Variantologie. Zur Tiefenzeit der Beziehungen von Kunst, Wissenschaft und Technik* (Berlin: Kadmos, 2013), 200–227.
91. See David Levy, *Love and Sex with Robots: The Evolution of Human-Robot Relationships* (New York: Harper, 2007), which focuses on robots as sex partners and related ethical questions. In the chapter “The Cyborgs among Us” of his book *Future Shock* (New York: Random House, 1970), Alvin Toffler speculated about the future challenge to determine “whether the smiling, assured humanoid behind the airline reservation counter is a pretty girl or a carefully wired robot.—The likelihood, of course, is that she will be both” (211). In a footnote, Toffler adds: “This raises a number of half-amusing, half-serious problems about the relationships between men and machines, including emotional and even sexual relationships. Professor Block at Cornell speculates that man-machine sexual relationships may not be too far distant. Pointing out that men often develop emotional attachments to the machines they use, he suggests that we shall have to give attention to the ‘ethical’ questions arising from our treatment of ‘these mechanical objects of our affection and passion.’ A serious inquiry into these issues is to be found in an article by Roland Puccetti in the *British Journal of the Philosophy of Science*, 18 (1967) 39–51.” (See Puccetti, “On Thinking Machines and Feeling Machines,” about the possible human feelings toward a “parahuman automaton.”)
92. Karel Čapek, *R.U.R.* (1920), University of Adelaide, e-books, 2014, accessed November 17, 2015, <https://ebooks.adelaide.edu.au/c/capek/karel/rur/complete.html>.⁴¹ An epiphenomenon of machine love is what Günther Anders diagnosed as the “promethean shame” that humans feel about their inferiority to machines, and about having been born, not made—an affect of confrontation and alterity that Anders compares to erotic love (“Über prometheische Scham” [1956], in Anders, *Die Antiquiertheit des Menschen*, 26). In Anders’s narrative, the feeling of shame is cast off when decisions about operations in the Korean War are left to the computer, and people say: “Since we are worse at computations than our apparatus, we are incalculable; thus, let’s not calculate.” *Ibid.*, 61 (my translation).

93. Mumford, *Art and Technics*, 81.
94. Marshall McLuhan, *Understanding Media* (New York: McGraw-Hill, 1964), 56–57.
95. Claus Pias, “Die kybernetische Illusion,” in Claudia Liebrand and Irmela Schneider, eds., *Medien in Medien*, 51–66 (Cologne: DuMont, 2002), 59–60 (emphasis in the original).
96. Ibid., 60.
97. Ibid.
98. Günther, “Die ‘zweite’ Maschine,” 169.
99. Ibid., 173.
100. Hayles, *How We Became Posthuman*, xii. For a historical account of gendered conceptions of technology with a focus on the eighteenth century, see Allison Muri, “The Woman-Machine: Techno-lust and Techno-reproduction,” in Muri, *The Enlightenment Cyborg: A History of Communications and Control in the Human Machine, 1660–1830* (Toronto: University of Toronto Press, 2007), 166–225.
101. Paul Haviland, “We Are Living in the Age of the Machine,” 291, no. 7–8 (New York, 1915): 1, accessed November 17, 2015, <http://www.jstor.org/stable/25311796>.¹⁴ An aspect of the machine to keep in mind is that, whereas its grammatical gender is neutral in English, the word “machine” is feminine in French and German.
102. Michel Carrouges, “Directions for Use,” in Harald Szeemann, ed., *The Bachelor Machines* (New York: Rizzoli International Publications, 1975), 21. Carrouges had first used the term in the essay “La Machine-célibataire: selon Franz Kafka et Marcel Duchamp,” *Mercure de France* (1950), 261–281. In a letter from 1950, Duchamp wrote to Carrouges that he appreciated the attention Carrouges had given his work, but that he disagreed with the proposed interpretations of *The Large Glass*. Duchamp’s letter is quoted in Hans Ulrich Reck, Jean Clair, and Harald Szeemann, eds., *Junggesellenmaschinen* (Vienna: Springer Verlag, 1999), 104–105.
103. Marcel Duchamp, “The Green Box,” in *Marchand du Sel: The Essential Writings of Marcel Duchamp*, ed. Michel Sanouillet and Elmer Peterson (London: Thames and Hudson, 1975), 44. See chapter 2 below for a description of the *Large Glass*. See also Jean-François Lyotard, “Partitions,” in Lyotard, *Duchamp’s TRANS/formers*, 39–61 (first published in the catalog of the “Bachelor Machines” exhibition).
104. Carrouges, “Directions for Use,” 21.
105. See Harald Szeemann, “Die Obsession eines Junggesellen—Und was sie ihn gekostet hat,” *du, Europäische Kunstzeitschrift*, no. 452 (October 1978), rpt. in Reck, Clair, and Szeemann, *Junggesellenmaschinen*, 48–49. See also Harald Szeemann, ed., *Junggesellenmaschinen/Les machines Célibataires*, exh. cat. (Venice: Alfieri, 1975); reprint of the catalog texts and additional materials are in Reck, Clair, and Szeemann, *Junggesellenmaschinen*. On the importance of the 1975 exhibition catalog for the construction of the myth, see Reck’s statements in Oswald Wiener and Hans Ulrich Reck, “Virtual Reality ist doch faktisch die Ève future par excellence.” Oswald Wiener im Gespräch mit Hans Ulrich Reck,” in Reck, Clair, and Szeemann, *Junggesellenmaschinen*, 327, 329. Similarly, Pietro Bellasi suggests that the “bachelor machine” was not “discovered” but “invented” by Carrouges in 1954; Pietro Bellasi, “Cogitation of a Dreamer of Machines,” in Corà et al., *Tinguely e Munari*, 41. For a discussion of Deleuze and Guattari’s notion of the bachelor machine, see chapter 5 below.
106. In Wiener and Reck, “Virtual Reality,” Oswald Wiener raises the question of what the analogous “spinster machine” might be (327). See also Meret Oppenheim’s 1975 letter to Szeemann, in which she protests the inclusion of her painting *Votivbild (Würgeengel)* (1931) in the “Femme Fatale” section of the exhibition (rpt. in Reck, Clair, and Szeemann, *Junggesellenmaschinen*, 43).
107. Wiener in Wiener and Reck, “Virtual Reality,” 330–331; see also Wiener’s remarks on the “Bio-Adapter” (338). The body-machine artist Stelarc, whose work features prominently in chapter 5 below, appositely remarked: “What is significant is no longer male-female intercourse but human-machine interface. THE BODY IS OBSOLETE.” Stelarc, “Prosthetics, Robotics, and Remote Existence: Postevolutionary Strategies,” *Leonardo* 24, no. 5 (1991): 591–595; cited in Bernard Stiegler, “Stelarc and What’s to Come, or the End of Sexual Difference,” in Marc Partouche, ed., *Art/cognition. Practiques artistiques et sciences cognitives* (Aix-en-Provence: Cypress Ecole d’Art, 1994), 61. See also Hayles, *How We Became Post-human*, 108–112, for comments on Norbert Wiener’s use of metaphors of celibacy and erotics with regard to his anxiousness to preserve the boundaries of the subject.
108. Wiener in Wiener and Reck, “Virtual Reality,” 328.
109. Ibid., 331.
110. Reck in Wiener and Reck, “Virtual Reality,” 336.
111. Wiener in Wiener and Reck, “Virtual Reality,” 330. Wiener also criticizes the drawing of parallels between the symbolic machines of art and scientifically based technical and conceptual machines, which he calls a “fabrication of powerless analogies” (339). On the phantasmatic dimensions of the relation of the machine and the unconscious, especially with regard to Charles Babbage, Ada Lovelace, and Alan Turing, cf. Burckhardt, *Vom Geist der Maschine*.
112. Wiener in Wiener and Reck, “Virtual Reality,” 338 (“Man vertraut im Sinne eines vagen Selbstentwurfs dem Gefühl, selber keine Maschine zu sein”). This observation confirms my contention that the machine is a sign for the subject’s disavowal

- of the apparatus, which brings forth the modern subject and the specter of the machine as doubles of each other.
113. Dieter Daniels, “Duchamp—Interface—Turing: A Hypothetical Encounter between the Bachelor Machine and the Universal Machine,” in Oliver Grau, ed., *Media Art Histories* (Cambridge, MA: MIT Press, 2007), 124. In this explicitly speculative essay, Daniels compares Duchamp’s bachelor machine with Turing’s Universal Machine, drawing parallels between the machines’ conceptions and their psychological foundations and impact. (He may have been responding to a remark by Hans Ulrich Reck in the 1998 conversation with Oswald Wiener, claiming that the connection between Turing and Duchamp had not been drawn.) For Daniels, “going back to the origins of the universal and bachelor machines [makes it possible to] find the common basis for … postmodern gender- and cybertheories”; both Duchamp’s and Turing’s machines become “recognizable as specifically masculine scenarios that revolve around an insurmountable distance from the female and … install a media-technical communication as a replacement for a physical encounter” (Daniels, “Duchamp—Interface—Turing,” 115). It is disputable whether Daniels’s argument makes sense in equating the “computer hardware” with the material object of *The Large Glass* and the notes of the *Green Box* with a “software program” that would run on that hardware. Moreover, *The Large Glass* cannot be reduced to a “diagram,” as Daniels approaches it, but has to be analyzed as a sculptural object, part of which can be understood and interpreted as a diagram.
 114. Daniels, “Duchamp—Interface—Turing,” 126.
 115. Donna Haraway, “A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century” (1985), in Haraway, *Simians, Cyborgs, and Women* (London: Free Association Books, 1991), 149–181. For discussions of such a cyberfeminist approach, see Rosi Braidotti, “Cyberfeminism with a Difference,” *New Formations*, no. 29 (Autumn 1996): 9–25, and Maria Fernandez, Faith Wilding, and Michelle M. Wright, eds., *Domain Errors! Cyberfeminist Practices* (New York: Autonomedia, 2003), accessed November 30, 2015, <http://home.refugia.net/portfolio/domain-errors>. ↗ Matthew Biro, *Dada Cyborg: Visions of the New Human in Weimar Berlin* (Minneapolis: University of Minnesota Press, 2009), offers a detailed analysis of the aesthetic strategies of Berlin Dada, especially the photomontages of Höch and Hausmann, and explores many gender-political aspects, among others. Biro’s bracketing of his investigation with the cyborg concept is historically not convincing, but his treatment of the construction of identity in relation to technologized bodies—not least those of maimed veterans—is compelling.
 116. Haraway, “A Cyborg Manifesto,” 178, 180.
 117. Ibid., 150.
 118. Ibid., 165; see also 170ff.
 119. Ibid., 163.
 120. Ibid., 173.
 121. Ibid., 154.
 122. Ibid., 170; see also 163–164.
 123. Ingrid Wiener, Karin Schick, Stephan Kunz, and Dieter Roth, *The Tapestries of Dieter Roth and Ingrid Wiener: You Can Also Weave What You Do Not See* (Bielefeld and Leipzig: Kerber, 2007).
 124. See Raymond Bellour, “Moving Pictures,” in Tania Ruiz Gutierrez, ed., *Elsewhere/Annorstädes/Ail-leurs* (Paris: Aliubi Atque, 2010), 23–43.
 125. See Sadie Plant, *Zeros and Ones: Digital Women and the New Technoculture* (London: Fourth Estate, 1998). For the historical relationship between programming and textile production, see Birgit Schneider, *Textiles Prozessieren. Eine Mediengeschichte der Lochkartenweberei* (Zurich and Berlin: diaphanes, 2007).
 126. See Judy Malloy, ed., *Women, Art, and Technology* (Cambridge, MA: MIT Press, 2003).
 127. Haraway, “A Cyborg Manifesto,” 181.
 128. Ibid. In the 1991 book edition of “A Cyborg Manifesto,” Donna Haraway reproduces and briefly mentions the painting of a female *Cyborg* (1989) by Lynn Randolph (173 and plate 1), but she does not speak about it in her text: the image of a young woman facing the viewer, looking straight ahead from her gleaming symmetrical face, a lioness’s head lying wiglike on the top of her head, also looking at us, like a mask; the woman’s torso a flat integrated circuit, she appears seated at a desk which is a miniature mountain landscape out of which, in front of her, grows a computer keyboard; behind her, in front of a starry sky, a framed image, perhaps a computer screen, with graphic representations of cell clusters, spiral galaxies, and wireframe model landscapes—thus, microscopic, macroscopic, and virtual worlds; she holds her fingers on some of the keys, as though she was, endowed with the animal power of the lioness, controlling the universe that we see represented on the suspended screen.
 129. Laboria Cuboniks, *Xenofeminism: A Politics for Alienation*, 2015, accessed November 20, 2015, www.laboriacuboniks.net. ↗ Ironically, the website opens with a short sequence from James Whale’s movie *Bride of Frankenstein* (1935) that shows the coming-to-life of the artificial Bride, invented and created by, of course, a male engineer.
 130. Ibid., section entitled “Interrupt,” no. 0x08. ↗
 131. Nina Power, “Women Machines: The Future of Female Noise,” in Mattin Iles and Anthony Iles, eds., *Noise and Capitalism* (Donostia-S. Sebastiá, Spain: Arteleku Audiolab, 2009), 97–103, quoting 98–99.

132. Ibid., 100.
133. Ibid., 98.
134. Ibid., 103.
135. Paul Virilio, “Museum of Accidents” (1986), *Public*, no. 2 (Toronto, 1989): 81.
136. See Douglas Kahn, *Noise, Water, Meat: A History of Sound in the Arts* (Cambridge, MA: MIT Press, 1999). For the role of technology in the music of the early to mid-twentieth century, see Fred Prieberg, *Musica ex machina. Über das Verhältnis von Musik und Technik* (Berlin: Ullstein, 1960), which covers in particular the futurist movement, the mimetic musical representation of “machines” and machine sounds, *musique concrète*, and an international survey of electronic music in the 1950s. Prieberg’s understanding of the “machine” follows a mechanical, precybernetic paradigm in which the human musician decides and controls. The historical introduction focuses on literary examples of automata and robots.
137. See Chris Salter, *Entangled: Technology and the Transformation of Performance* (Cambridge, MA: MIT Press, 2010).