**EX MACHINA IN THE GARDEN**

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The work of film in every new technological age is both speculative and reflexive. As the medium incorporates and adapts to technological innovations, films about technology swiftly register the changing technological imaginary that those innovations create. At their best, such films make the interactions between these processes palpable. By making art with new machines about new machines, they highlight film’s place on a kind of Möbius strip in which new technologies create the conditions of possibility both for their own representations and for new techno-visions of a techno-future. There is, then, something reflexive about filming technology.

This mix of technological speculation and reflexivity forms the core of *Ex Machina* (2015), Alex Garland’s recent film vision of AI robots and the humans who make them. Set in a near-future laboratory staged at Pinewood Studios (UK) and a boutique Norwegian hotel, the film uses digital cinema’s capacity for computation to render a computational being, Ava (Alicia Vikander), a robotic creation with a penchant for creating. Ava dreams of freedom, but in the meantime she settles for drawing. While her images might seem like minor plot points, they highlight both the film’s own work of technological artistry and its most powerful themes.

During the third session of the Turing test that loosely structures the film, Ava shows one of these drawings to Caleb (Domhnall Gleeson), the coder who has been brought to the lab to assess her. The drawing depicts a small, concrete-enclosed grove of trees and plants that lies beyond a glass wall on the far side of her room, a room, she tells Caleb, she has never left. In the previous session, Caleb had responded to an earlier drawing, which features a series of interwoven triangles that look like the algorithmic output that a machine would produce, by asking Ava to draw something else, something more specific—something, presumably, a little less machinelike. Her response is a telling one. In replacing her previous algorithmic design with a pointillist rendering of nature’s lines and curves, Ava draws a calculated association between herself and the natural world. In doing so, she activates a series of oppositions that will converge, collide, and collapse across the film’s narrative, spaces, and themes. Increasingly fragile in their differentiation, the oppositions chart human vs. machine, animate vs. inanimate, organic vs. inorganic, nature vs. technology, art vs. technics, and, most reflexively, reality vs. artificiality.

Ava’s drawings give pause precisely because *Ex Machina* explores these oppositions by pondering the nature of representation. The drawings take on meaning within a rich composition of artistic forms, from Renaissance painting to modern architecture and sculpture. These cinematic references to the history of art form a prehistory of artificial intelligence. In suggesting that the creation of (machine) life is an act less of gods than of artists, the film asks: is Ava any different from these other art objects?

By collapsing the distinction between art and technics, *Ex Machina* makes technology into an extension of art and vice versa. But to what end? The film’s on-screen representations offer a starting point for exploring its critical view of contemporary technologies. In the most straightforward sense, the film is an expression of the kinds of concerns that have long shaped the discourses of mechanization and artificial intelligence—concerns about the nature of humanity, about playing god, and about the risks of a world controlled by technology—as well as the new features of the technological, political, and cultural landscape that are shaping what thinking machines mean today.

I propose two ways of reading the film’s vision of artificial intelligence and, by extension, of technology at large: first, as an overly simplistic view of technology as an enticing threat to humanity and nature, as a kind of *femme fatale*, embodied by an Ava Gardner–like figure of dangerous beauty who leads doomed humanoids to their unwitting demises. Understood in this way, the film well deserves the criticism it has received for what Angela Watercutter, writing in *Wired*, describes as its “serious fembot problem.” In Watercutter’s reading, Ava represents little more than a conduit for Nathan’s creativity, an object of Caleb’s desire, and a
potential menace—powered by her simulated sexuality, her sole asset—to humanity itself. In an alternative reading, however, the film offers a rather different view of technology that promotes a productive rejection of male-dominated “tech culture,” one in which Nathan and Caleb become critical parodies of “geek” masculinity while Ava represents a new AI iteration of Donna Haraway’s cyborg politics. Read in this way, the film has something important, if too scantily explained, to communicate about the potential for new forms of collective life in a “posthuman” or “biocybernetic” world defined by the productive destabilization of human/machine and nature/technology distinctions.

In raising these kinds of concerns, Ex Machina also highlights cinema’s own shifting status in the new media world by provocatively staging an allegory of its own production: a story about representation and the creation of artificial worlds (at least on screen) by new technological means. This reflexivity is part and parcel of cinema’s important role in shaping popular discourse about technological change. Film has long served this role as a “technocritical art” (my term), the critical faculty of which is closely tied to film’s own technological basis. That role, however, is necessarily changing as film enters not just the digital age, as so many have argued, but also the posthuman world of what W.J.T. Mitchell has termed the age of biocybernetics.

The Technocritical Work of Film in the Age of Biocybernetic Reproduction

In “The Work of Art in the Age of Biocybernetic Reproduction,” Mitchell ponders the changing landscape of biological and computational research that had come, by the end of the 1990s, to define a new stage in “biocybernetics.” His 2003 essay captured early millennial interest in the imbrication of biological life and machine systems, an imbrication that, in part, concerned the “grandiose plans to engineer a brave new world of perfect cyborgs” promised by such then-new work in genetics as Dolly the sheep, the first mammal cloned in 1996 (who died in 2003), and the Human Genome Project, which released its first sequences in 2001 and was proclaimed complete in 2003 with 99% of the genome sequenced. But it was also, Mitchell argues, about the American public’s seemingly ready embrace of a machine-like conception of human life governed by the tracking and recording of “vital signs and even more vital statistics”—the early days of incipient big (body) data best represented today by the Fitbit, Apple Watch, and app after app designed to measure, regulate, and refine human behavior.

In this context, Mitchell defines the novelty of new millennial biocybernetics as a shift in scientific interest from the physics of moving machines to biological forms, and in the replacement of energy and physical mass by digital data as the dominant form of materiality. Who is in a position to assist in the understanding of this new age? Mitchell asks, suggesting alternately art or cultural historians; artists, philosophers, or anthropologists; geneticists, hackers, bioethicists, and government panels. Mitchell turns to culture—largely conceptual and “new media” artists—to demonstrate how “art in the age of biocybernetic reproduction [might be able] to reveal the codes and expose the illusion of the ultimate mastery of life.”

In the end, Mitchell admits that “biocybernetics has probably found its best medium in the cinema.” Indeed, Ex Machina is only the most recent example of a long history of popular film responses to technological change and the increasing presence of machines in modern life. That film came to serve this role should come as no great surprise. Film’s close relationship to technology has, from the start, given the medium a specific “technocritical” capacity, not unlike that which Leo Marx in his classic The Machine in the Garden ascribes to nineteenth-century literary criticisms of American industrialization.

Born of the changes of the Second Industrial Revolution that made technology part of everyday life as never before, cinema took shape in the image of early twentieth-century
gadgets and technological systems, from the telegraph and phonograph to electric lights and assembly lines. Industrial development made machine-like human behavior—embodied by Fordist-Taylorist efforts to make workers more efficient—an early twentieth century virtue, at least for factory bosses. The dehumanizing effects rendered on their newly “mechanized” employees would become fodder for classic films including Fritz Lang’s Metropolis (1927), René Clair’s A nous la liberté (1931), and Charlie Chaplin’s Modern Times (1935). Already those films gave voice to the disconcerting idea that the mechanization of life might have, as its corollary inverse, the unruly vitalization of machines. In Clair’s film it’s the ontological threat of a (sound film) world in which the machine voice replaces the human one. For Chaplin, it’s the overeager feeding machine that makes the biological need for energy consumption a machine function. And for Lang, it’s the robotic Maria—perhaps Ava’s most telling, if misleading, ancestor—who threatens to undo social order by simulating and overstimulating desire and sexuality.

During this period Walter Benjamin penned his oft-cited study of the effects rendered on art, perception, and humanity by the work of machines. Among Benjamin’s insights was the assertion that film’s reproductive apparatus is fundamentally akin to (indeed, in kinship with) the machines that defined industrial modernity more generally. In the film studio, Benjamin argued, performers reproduced the experience of the working masses, each of which struggled to preserve “their humanity in the face of an apparatus.” One of cinema’s attractions for such workers was the actor’s apparent ability to turn the tables on that apparatus: to reverse its dehumanizing effects by creating a new form of screen vitality. Beyond identifying this potential reversal—about which he was, of course, skeptical (to be filmed was still a form of mediated “self-alienation”)—Benjamin, like a number of his contemporaries, including Siegfried Kracauer and the historian Lewis Mumford, also recognized that film technology offered a unique means of understanding the effects of technological change more generally. Put most succinctly by Mumford, cinema was one of the machine age’s “specific arts.” As such, it had the unique power to generate, in his words, “new possibilities of understanding the world we have helped to create.”

Film’s critical view of technology would take new forms in the post–World War II world of cybernetic research. During this foundational moment in what John Johnston has termed “the allure of machinic life,” scientists and engineers sought not simply to simulate natural forms but rather to generate the complexity of natural behavior in new artificial systems. Their work would drive early developments in computation and set the stage for today’s so-called “information age” or “digital age” and the digital technologies used to make films like Ex Machina. As historians have shown, film technologies had an instrumental role in this process. In the work of researchers like Norbert Wiener, film’s capacity as a recording and storage tool helped shaped the direction of computer design. Much as W.K.L. Dickson and Thomas Edison had turned to the broader context of technologies like the telegraph to guide their early film experiments, so Wiener borrowed models from existing technologies, now including film, to guide his work in cybernetics. Indeed, film—as a material, a system of writing with light, and a conceptual framework for understanding the transcription of data—was at the heart of the development of computers and cybernetic systems.

Science-fiction films such as Forbidden Planet (Fred M. Wilcox, 1956) and The Day the Earth Stood Still (Robert Wise, 1951) gave popular visual form to the hopes and fears about the thinking machines that such research promised. These early technocritical takes on machine life would set the standard for the classic AI characters to come in 2001: A Space Odyssey (Stanley Kubrick, 1968) and Alien (Ridley Scott, 1979), films that portrayed thinking machines as efficient and capable but at risk of malfunctioning and ultimately inhuman in their lack of emotional understanding. Such themes would be taken up in greater depth in films like The Stepford Wives (Bryan Forbes, 1975), Blade Runner (Ridley Scott, 1982), and the Terminator series, each of which highlighted anxieties about the nature of humanity in a world of near-perfect machine simulation. By the 1990s, that simulation had expanded to include not simply artificially intelligent machines but entire simulated worlds.

Through all of these periods, film’s power for criticism stemmed not simply from its popular reach but also its relationship to technology. If, as Mumford argued, film has a special role to play in helping understand the technological world, it is because its own technological system changes with that world. New film technologies inspire opportunities to explore their potentials and limits, and science and technology make ideal subjects. Film’s technocritical capacity derives from that convergence of material and content, a convergence highlighted in moments of technological change like the recent “digital” one.

But is the “digital age” still the most useful way of describing this moment? The recent spate of AI allegories suggests an alternative approach. While Ex Machina might be productively read as an allegory for analog film’s replacement by digital hard drives, it also points to different possibilities for cinema’s millennial technologies—for
a new technocritical capacity to address broader technological issues—in the age of biocybernetics.

**Ex Machina and the New AI**

*Ex Machina* precisely registers the biocybernetic age that Mitchell described in 2003 as “the convergence of genetic and computational technologies with new forms of speculative capital [that has] turned cyberspace and biospace, the inner structure of organisms, into frontiers for technical innovation, appropriation, and exploitation.” The film situates this convergence in the work of an eccentric inventor-entrepreneur named Nathan (Oscar Isaac). A grown-up child prodigy who, at age fourteen, composed the code for his market-dominant company, a search engine called Blue Book, Nathan has retreated from society to a mountainside laboratory where he is developing artificially intelligent machines. Nathan’s turn to AI reads as a loosely veiled reference to Google co-founder Larry Page’s massive investment in machine learning and language processing.

The film’s narrative is set in motion when Nathan’s latest prototype, Ava, is ready for her close-up examination, prompting Nathan to bring an initially naïve Blue Book employee, Caleb, into his laboratory to put Ava through the Turing test. In a series of test “sessions,” Caleb and Ava reflect upon the codes of social behavior, the nature of artificial intelligence, and the function of the test itself while Nathan closely monitors their behavior through surveillance cameras that stream to his workstation a few rooms away. Tension mounts as Caleb’s affection for Ava grows and the two apparent allies hatch a plan to escape before the test ends, when Nathan will shut down Ava to move on to the next prototype. In the film’s untidy conclusion, the machine herself overthrows both master and inquisitor, escaping into the “real” world and a technological future that the audience is left to imagine.

The film’s early critics have rightly emphasized its gender politics, which seem all too congruent with the dynamics of today’s American tech world. The fembot problem described by Angela Watercutter in *Wired*, for instance, reads the film as a straightforward reproduction of the gender dynamics of Silicon Valley: a male-dominated world in which women and/or robots represent little more than objects of desire and conduits (or muses) for masculine creativity. For Watercutter, Ava’s power is based on her sexuality and ability to “flirt manipulatively,” marking her as a “seductress posing as a damsel in distress” and only the most recent iteration in a lineage of dangerously beautiful robots that includes *Metropolis’s* Maria and *Blade Runner’s* Pris.

An equally compelling but no less critical reading might see Ava as the modern manifestation of women’s mischaracterized roles in the early “tech” world of the 1940s. As historian Jennifer Light has described, the development of ENIAC, the first electronic computer in the United States, during World War II relied upon a group of women mathematicians who were trained to calculate ballistics data and acted as literal “computers.” Using these skills, the women became programmers for the machine that would come to take over their computing role. After the war, their contribution would be written out of the ENIAC’s history as many of these women were dropped from government computing programs despite their expertise in early computer design. Although their work was publicly recognized at the time, women were characterized not as innovators or inventors—titles reserved for men—but rather as sub-professional clerical workers. These women “computers,” Light explains, were seen as little more than the conduits through which men created the modern computer-powered world. *Ex Machina* reproduces this dynamic in its depiction of Ava as the conduit for Nathan’s creative work, making its sole women characters, once again, into computers.

Such readings, on the other hand, don’t fully capture the gender dynamics implicit in the film’s approach to artificial intelligence. After all, not only does Ava outsmart her brutal, abusive creator and outwit her naïve examiner, she also, precisely as an artificially intelligent machine, surpasses Nathan’s control and becomes her own self-creating entity. Indeed, that ability to exceed the creator’s control—as both desirable and dangerous outcome—structures the film’s consideration of AI development and begins to suggest a more positive, if undereexplored, techno-feminist vision for a posthuman world.

*Ex Machina* develops that vision by restaging the standard questions about AI development: Is their creation a God-like work of hubris, a Promethean act that can only end in the kind of retribution that Ava and an earlier prototype, Kyoko (Sonoya Mizuno), enact upon Nathan? What are the creator’s moral and ethical responsibilities to his or her machine creations? In posing these questions, it joins a recent spate of AI-preoccupied films—*The Machine* (Caradog James, 2013), *Her* (Spike Jonze, 2013), *Transcendence* (Wally Pfister, 2014), *Autómata* (Gabe Ibáñez, 2014), *Debug* (David Hewlett, 2014), *Chappie* (Neill Blomkamp, 2015), and *Vice* (Brian Miller, 2015)—that reflect a renewed and well-publicized emphasis on AI research at big tech companies and universities, as well as a growing outcry from a minority of scientists and public intellectuals about its dangers.
Perhaps it’s all Google’s fault. In May 2013, the company announced the creation of a new initiative, QuAIL (the Quantum Artificial Intelligence Laboratory), developed in collaboration with NASA and the University’s Space Research Association, with stated goals that included the development of “quantum AI algorithms.” Coming only six months after the hiring of famed AI-prognosticator Ray Kurzweil to direct its research in machine learning, this announcement was in turn followed by Google’s high-profile, capital-intensive acquisitions of competing AI research teams.20

A group organized under the banner of the Future of Life Institute (FLI) has been among the most vocal opponents of new AI initiatives. Headed by Skype co-founder Jaan Tallinn and a mix of scientists (including Stephen Hawking), entrepreneurs (such as SpaceX and Tesla Motors founder Elon Musk), Hollywood actors (Alan Alda and Morgan Freeman), and PhD students, the FLI has called for careful, deliberate attention to how humanity might best “reap [AI’s] benefits while avoiding potential pitfalls.”21 In a New York Times op-ed published with canny PR timing during the weekend of Ex Machina’s wide American release, director Alex Garland quoted Hawking, Musk, and Steve Wozniak, warning of a computer-led future that would be “scary and very bad for people.”22

For all of these warnings’ apparent urgency, their general content is hardly new. After all, even as early as 1948, in the introduction to Cybernetics; or, Control and Communication in the Animal and the Machine, AI developer Norbert Wiener was already cautioning that artificial machines presented “unbounded possibilities for good and for evil.”23 Beyond military applications, Wiener saw the potential for “evil” in the form of widespread social acceptance of slave labor by machines as substitutes for human work. He equated this potential to “devalue the human brain” with the “devaluation of the human arm” in the “dark satanic mills” of the Industrial Revolution. While skilled workers—scientists and administrators—might survive this machine revolution just as skilled artisans had in the nineteenth century, Wiener, sounding more prescient than ever, warned that “the average human being . . . has nothing to sell that is worth anyone’s money to buy.”24

These prophecies are being realized today at the fulfillment centers of Amazon, Office Depot, and Saks 5th Avenue, where autonomous robots designed by Kiva Systems process orders. In the world of journalism, machine bots are generating news stories for organizations like the Associated Press.25 And while the appearance of online thesis statement bots or essays produced by programs like the Postmodernism Generator might provoke laughter, it is not unreasonable to ask how much longer it will be before the aggregated data of a century’s worth of film criticism might even be used to generate articles like this one.26 Big data, anyone?

The Art of Artificial Intelligence

Ex Machina links this changing world of new technologies with its ramifications for art. Most AI-themed films understand that artificial intelligence is an act of character and world creation. In The Matrix series (Lana and Lilly Wachowsk, 1999–2003), for instance, this creation is represented by the Architect, designer of the computer-coded world that blinds plugged-in humans to their machine-dominated reality. The liberated human rebels marvel at the code’s beauty, even as they struggle to destroy its foundations. Characters like the Matrix Agents or the T-1000 liquid metal robot in Terminator II: Judgment Day (James Cameron, 1991) similarly signal, in their capacity to simulate living beings, the entanglement of representation and artificial life.

Ex Machina’s novelty is to make this relationship one of its central themes by referencing a history of representational forms, the elements of which appear from the moment Caleb arrives at Nathan’s laboratory home. Built on the banks of a river and incorporated into the landscape so that many of its interior walls are composed of the mountain rock itself, the house evokes Frank Lloyd Wright’s Kaufmann Residence, Fallingwater, built in 1935. What better setting than a building that conjures the utopian desire to balance technological and natural existence for a film about machines designed to blend in with—or replace—organic life?

Inside the house, the artistic references quickly pile up. African and Asian masks line the halls and the wall of Nathan’s office. A bejeweled skull and abstract glassware decorate the table in the entryway lounge. A Pollock drip painting hangs in Nathan’s man cave. Gustave Klimt’s portrait of Margaret Stonborough-Wittgenstein (1905), sister of the philosopher, hangs in Nathan’s bedroom. Titian’s An Allegory of Prudence (1550–65) hangs conspicuously on the wall behind Nathan’s workstation. Ava’s design was reportedly inspired by the work of Constantin Brâncuși.27 And Nathan himself, the presumed curator of this collection, is a kind of wannabe Aby Warburg, the German art historian whose Mnemosyne Atlas—a wall of images organized by theme—is evoked here by the wall of yellow Post-it notes with which Nathan studies his own art history of AI representations.

In sum, the film seems determined to make a point about representation. But what is it? In interviews, Garland has offered a straightforward explanation: science involves no less
artistic creation or symbolic representation than art. Ava, in other words, is an art form. Garland has also suggested an additional interpretation in response to questions about the scene near the film’s midpoint when Nathan submits Caleb to an art historical browbeating about Jackson Pollock. Pollock’s genius, Nathan argues in this scene, is his willingness to move beyond modernism’s insistently precise calculations and thereby reach a new step in representation that lies just beyond knowability. According to Nathan, this next stage of art, with its post-algorithmic nature, corresponds to the next stage of computing: though requiring an artist’s hand, it can only reach total abstraction when it defies knowability.

In a longer version of the scene that was cut from the final film, the audience would have learned that Nathan had bought and re-created an original Pollock to see if anyone could tell the difference. Just as it wouldn’t matter which Pollock was the original and which the fake if the difference were undetectable, so it wouldn’t matter if Ava was human or machine. Nathan’s great hope, then, is twofold: that Ava should become the abstract expression of his AI artistry, as the drip painting was to Pollock, but also that her simulation of human life should be as good as the best Pollock forgery that a machine—perhaps Ava the would-be artist—could create. Both hopes are founded on the idea that AI creation is art, an idea that soon turns reflexively to the film’s own AI simulation. In a key scene set in the house’s underground laboratory/workshop, Nathan allows Caleb a brief glimpse behind the curtain at the parameters that frame this act of creative simulation: the designs and prototypes for Ava’s machine body, her brain’s wetware construction, and her unseen software, which is based, Nathan explains, on how people use search engines, an interface that tells not what people want but how they think.

Caleb’s trip into the workshop doubles as a tour of the film crew’s similar creation of an artificial AI: its mise en scène becomes a mise en abyme—a reflexive view of the work of creating cinematic characters and worlds. The parameters for Ava’s diegetic machine body are, after all, the basis for her profilmic one. The design images that hang on the walls and the props of machine-like prostheses are objects for creating both filmic AIs and the profilmic ones that play them. This reflexive invocation of the film’s own making unfolds as part of a broader allegory about the art of artifice in digital...
The Intelligent Art of Cinematic Artifice; or, The Blue Flower in the Land of Blue Screen

If *Ex Machina* is a film about representation, its privileged form is film itself. Caleb’s tour of the AI laboratory is only the most apparent of the film’s reflexive explorations of artificial world creation. Although nothing new—films have long reflected upon their own creation and their illusionary techniques—*Ex Machina’s* singular reflexivity needs to be understood in the context of cinema’s changing technological base and its changing forms of artifice, for what is at stake is the issue of how technological changes to film as a medium are shaping both cinema’s form and its historic role in the cultural criticism of technology.

Ava’s garden drawing, the signifier that opened this essay, is also a key element of the film’s reflexive technological allegory about its own production. Indeed, her garden may be seen as a metaphor for what Walter Benjamin described as the “blue flower in the land of technology.” For Benjamin, the *blaue Blume*—the unattainable object of desire in German Romanticism—signifies “the height of artifice” in studio cinema’s production of reality. In a studio-built world defined by technological artifice, he argued, reality is unattainable; it can only be experienced in illusionary form—by seeing through the eye of the machine (the film camera). This is precisely the work of Ava’s drawing, for its enclosed garden—the sole expression of organic vitality—marks out the artificial nature of all that surrounds it.

It is in this sense that the mise en abyme of the AI laboratory can be extended to the film’s diegetic setting more generally: Ava’s garden is the blue flower in the land of blue screen. Shot on stages B and D of Pinewood Studios in Iver Heath, England, this scene’s staged nature stands in sharp contrast to the film’s other locations across the North Sea in Norway. In both the diegetic and profilmic worlds, a contrast is necessary to generate the artifice. Thus the laboratory is a fortress, a windowless, claustrophobic, subterranean maze, its walls lined with enough fiber optic cable (according to Nathan) to reach the moon: to create artificial intelligence, Nathan must seal himself off from nature.

Pinewood Studios fills the same role: that is, to provide the studio conditions needed to produce Ava’s artificial AI. Sealed within its two warehouse-like stages of 18,000 and 9,000 square feet, respectively, the spaces and data for the film’s realistic artificial world could be precisely controlled. Cinematographer Rob Hardy lit the sets with 15,000 mini-tungsten pea light bulbs, a strategy that provided the ability, in his words, “to control the space.” To achieve the greatest spatial fidelity available in digital cinematography and to create “very human, soft imagery,” Hardy shot the film at 24 frames per second on Sony F65 and F55 4K digital cameras. The digital abundance required to produce an AI in the film’s diegetic world mirrors the film production’s own reliance upon almost imponderable amounts of digital data and the requisite processing power to use it. In today’s digital production world, each fifteen minutes of raw 4K footage shot on a F65 requires one quarter of a terabyte of hard drive space (that is, half the maximum of the camera’s largest compatible 512GB memory cards, still quaintly referred to in the trade as “mags” or “magazines”). Even the smaller F55, used for the film’s handheld shots, required half a terabyte for every hour recorded.

At Pinewood Studios, advanced postproduction facilities processed daily output, while an on-set 12-core Mac computer setup handled just enough data to allow the crew to evaluate footage for quality control in real time. On location, however, a smaller portable Mac Retina system only processed enough data for real time viewing at half quality. To be sure, such limits can be explained, in part, by budgetary constraints (the film cost “only” $13 million), but it is nonetheless the case that cinematic world-making has technological limits. It is precisely the distinction between the control and certainty of AI creation offered by the laboratory interior and the risks implicit in Nathan’s inability to predict the AI’s behavior in the world outside that drive the film’s narrative and define the parameters of Ava’s performance.

This distinction comes to the fore during the fourth session of the Turing test, when Caleb tells Ava the allegorical story of “Mary in the black-and-white room.” A version of
what its creator, philosopher Frank Jackson, termed the “knowledge argument,” the story highlights the limits of knowledge derived from physics, biology, and chemistry. It concerns a researcher, Mary, who has mastered the science of color while living in a black-and-white room, accessing information through a black-and-white television monitor. Despite Mary’s expertise, Jackson argues, when she walks into the world of color she will still learn something new. Jackson’s point is that knowledge of the physical world cannot encapsulate all knowledge; rather, additional “qualia,” the subjective aspects of sensory perception, are essential to knowledge and experience. This, Caleb explains to Ava, is the key question for artificial intelligence: can the AI, however much it may be coded with expertise about the world, truly understand that world when allowed to inhabit it?

Caleb’s story is intercut with images of Ava in her interior prison and outside the laboratory on location in Norway. The latter shot is one of only two instances, both posited as imaginary, in which Ava/Vikander is seen outside the laboratory/studio before the film’s conclusion. These rare shots highlight both the film’s and its story’s limit conditions. To exit the laboratory/studio creates two related challenges: In the film story, will Ava’s coding be good enough to condition “real” world experience? And for the film production, can the AI costume remain convincing outside of controlled studio conditions? It is no surprise that so few shots attempted to meet that challenge. Although the film was not shot in front of a blue or green screen, filming required absolute control of the profilmic space—and thus studio filming—to allow animators to create composite shots from the footage of Vikander and CGI models of Ava.

In the brief conclusion, Ava can only escape into the world beyond the laboratory by completing her disguise and covering the last traces of her machine body with a new prosthetic arm and artificial skin. In a more reflexive sense, Ava escapes by shedding her machine identity and becoming Vikander, as the character disappears into her human performer. No longer betrayed or burdened by the visible traces of her AI form, Ava/Vikander can escape the laboratory/studio world. The success and failure of digital cinema, the film suggests, is its (in)capacity to generate artificial worlds. Just as there are limits to the expressive capacity of AI creation, so there are limits to digital cinematic expression. The film’s final shots point to a future in which the traces of artifice...
in those expressions may be, like the finally free Ava-cum-Vikander, rendered undetectable.

**Conclusion: Art, Technics, Cinema**

What does *Ex Machina’s* reflexive story about representation reveal about digital cinema in the age of biocybernetics? Ultimately, this is not a film that cares much about the end of celluloid and film’s soon-to-be past. Rather, it is more concerned with the future of the digital, what it can and will be able to do, and about technological change. Much as Benjamin’s identification of cinema’s illusionary power with his “blue flower” metaphor recognized film technology’s critical role in assessing the technological changes of industrial modernity, so too *Ex Machina* points to digital cinema’s role in assessing the technological changes of the new millennium. Film’s capacity to fulfill this role—to perform technocriticism—follows from its own transformation in the age of new technologies.

*Ex Machina’s* reflexive AI story focuses its technocriticism on the nature and conditions of human life in a world dominated by “smart” machines, big data, and surveillance, topics about which the film’s critical reception has remained surprisingly silent. Blinded, it seems, by the AI story and, especially, by Ava’s lines, curves, and innocent eyes—a focus on Vikander’s body that fully exposes the film’s “fembot” problem—critics have ignored the film’s own insistent reference to the guilty eye of the corporate state. As Nathan explains to Caleb, Ava is a lie detector machine able to interpret the microimpressions of the human face with startling speed and accuracy, based on data secretly collected and compiled from cellphone cameras and search results with the tacit agreement of governments and corporations who dare not denounce the crime they all commit. Much to Caleb’s later chagrin, even his own sexual attraction to Ava is the predictable result of an algorithmic formulation of data he would rather not talk about. The long-standing and, perhaps for the film’s reviewers, all too banal image of the digital panopticon speaks directly to post-Snowden anxieties about privacy in a digital world that needs every online request by depositing a cookie in each user’s browser.

What is left for human behavior in a world in which machines have become so integrated into daily life and can reproduce it with such fidelity as to cast doubt on the very nature of humanity? Such questions, which preceded the start of cybernetics, took on new meaning in the early cybernetic age: Lewis Mumford, who had identified the problem in the 1930s, tied it to the nature of artistic representation in the early 1950s. In Mumford’s view, the link between human and machine largely concerned the former’s increasing reliance upon the latter, a reliance that he understood through anthropomorphic metaphors equating the “mechanical order” with “the autonomic nervous system and the reflexes of the human body.” One of the most vexing problems with this “mechanical world,” Mumford argued, was that humans had failed to understand “that the humanization of the machine might have the paradoxical effect of mechanizing humanity.”

To make matters worse, “at this fatal moment,” he continued, “the other arts, once so nourishing to man’s humanity and spirituality, [had] become equally arid, and so incapable of acting as a counterpoise to this one-sided technical development.” In other words, humanity risked losing its last hope for a nonmechanized world—namely, art—as art itself became even more mechanized through mechanical reproduction. Rather than seeking a solution in “nonmechanical” arts like painting, however, Mumford took the compelling step of demanding something more from the “specific arts of the machine,” film and photography. Paradoxically, it was up to the machine arts, he argued, to demonstrate and draw out the liveliness of the natural world before it was too late. He believed that humans might retain their pre-mechanized state by using representational machines to re-humanize themselves.

In the age of AI, his formula could make even more sense. This seems to be Nathan’s futile quest, a misguided struggle to understand what humanity ought to be like in an intelligent machine world, veering wildly between an automaton-like control (via exercise regiments and a “natural” diet of mineral water and brown rice) and a maelstrom of binge-drinking disarray. This struggle explains the almost absurd dance sequence at the film’s center when, in sync with his AI servant, Kyoko, Nathan swings from entropic alcoholism to vital dynamism, responding to the music with the formulated precision of a programmed machine. As Caleb gawks at the scene in confused horror, the bemused viewer is invited to wonder whether Nathan, not Ava, might in fact be the AI.
What Nathan fails to understand is that there is no longer any entirely non-machine state to which humans might still escape. Donna Haraway once predicted that “by the late twentieth century . . . we are all chimeras, theorized and fabricated hybrids of machine and organism; in short, we are cyborgs.”\textsuperscript{43} As many have argued, humanity long ago manifested a machine destiny. N. Katherine Hayles suggested, on the eve of the century’s close, that the “posthuman” is a state in which “there are no essential differences or absolute demarcations between bodily existence and computer simulation, cybernetic mechanism and biological organism, robot teleology and human goals.”\textsuperscript{44} Yet as John Johnston has explained more recently, the world of AI creation has yet to acknowledge this interpenetration of human and machine life. The drive to create artificial intelligence based on the model of human thinking has continued to operate, all too often, under the assumption that human behavior has not already been mechanized. For Johnston, the important point is that thinking is itself technological, that “human intelligence arises in and through the use of not only tools but gestures, signs, languages, and props in the environment that make cognitive activities repeatable.”\textsuperscript{45} The distinction between biocybernetic and natural beings, as Haraway had already insisted two decades earlier, is false.

\textit{Ex Machina} demonstrates that falseness through its own reflexive techno-allegory. By showing that the film itself, like its AI subject, is a product of an already technological world of digital artifice—one increasingly but not yet fully capable of holistic artificial creation—\textit{Ex Machina} makes an implicit claim about the technological character of modern life. Indeed the very first shots of Caleb plugged into his workstation and cellphone, observed through the always-scanning eye of his computer, hint at the deep imbrication of humans and machines.

Caleb’s way of thinking cannot be separated from his machine appendages, and the Turing test, as Nathan implies when he asks Caleb to “skip the textbook approach,” no longer makes sense: Caleb is just a textbook-trained machine running through the algorithms. He may still bleed, but that doesn’t mean he isn’t a replicant. \textit{Ex Machina’s} message, encoded and packaged in Ava’s mechanical artistry, is quite simple: there is no garden, it’s all machine. Or perhaps garden and machine can no longer be differentiated.

Read in this way, the film evinces not so much a “fembot problem” as a return to the concerns of the feminist technopolitics of Haraway’s cyborg and Hayles’s posthuman.\textsuperscript{46} In this more generous reading, the film promotes a productive blurring of the distinctions between garden and machine, human and cyborg, to better reflect the technological conditions of the new millennium. It acknowledges, to borrow Haraway’s words, that “the machine is us, our processes, an aspect of our embodiment.”\textsuperscript{47} Moreover, in its depiction of
Ava’s alliance with Kyoko, her (and the film’s) rejection of any tidy coupling with Caleb, and her optimistic escape from Nathan’s prison house into an unpredictable world of new experiences, *Ex Machina* gestures, even if only provisionally, to what Haraway describes as “emerging pleasures, experiences, and powers with serious potential for changing the rules of the game.” It begins to suggest ways of thinking about what Hayles, recently pushing beyond the metaphorical, terms a “regime of computation” in which networked data flows and information processing are redefining both life and “the construction of reality itself.”

*Ex Machina* is at its best when it turns the themes of artificial life and constructed reality back onto its own creation of a cinematic world. The film’s reflexive probing of cinema’s world-making, life-simulating capacity—and its limits—highlights the medium’s critical role in allowing its publics to imagine and think through the realities that science, technology, and cinema itself might make possible in a biocybernetic world. If film has a unique capacity to teach audiences about the world they have helped to create, techno-oriented criticism should highlight film’s epistemological, technocritical role in assessing the changing technologies that shape the world and cinema with it. As Ava’s drawings suggest, there is good reason to start with the art of the machines.

Notes

3. Ibid.
4. Ibid., 498. As a means to deal with the difficulty of studying the changing now, Mitchell also proposes a method that he terms the “paleontology of the present.”
5. Ibid., 496. Mitchell was inspired by *Ex Machina’s* predecessors, what one might think of as its earlier prototypes: *A.I. Artificial Intelligence* (Steven Spielberg, 2001), *The Matrix* (Lilly and Lana Wachowski, 1999), *Blade Runner* (Ridley Scott, 1982), *Alien* (Ridley Scott, 1979), the Terminator films, and especially *Juno岌 Park* (Steven Spielberg, 1993).
9. Ibid., 343.
13. As David Rodowick has argued, digital-age films such as *Dark City* (Alex Proyas, 1998), *The Matrix*, *eXistenZ* (David Cronenberg, 1999), and *The Thirteenth Floor* (Josef Rusnak, 1999) have allegorized analog film’s “death” using the very technologies that portend its imminent demise. David Rodowick, *The Virtual Life of Film* (Cambridge, MA: Harvard University Press, 2007), 4–5.
15. The 2012 centenary celebration of Turing’s birth spawned his widespread return to popular culture in works including the 2011 BBC drama *The Codebreaker* (Clare Beavan and Nic Stacey), a 2012 American Lyric Theater production titled *The Life and Death(s) of Alan Turing* (Justine F. Chen and David Simpatico), and, most recently, *The Imitation Game* (Morten Tyldum, 2014).
16. Watercutter, “Ex Machina Has a Serious Fembot Problem.”
18. This charge might equally apply to the depiction of Joan Clarke (Keira Knightley) in *The Imitation Game*, which does present Clarke as a brilliant cryptographer but places much greater emphasis on her role facilitating Alan Turing’s genius.
20. See www.nas.nasa.gov/quantum/.
27. The Postmodernism Generator is available at www.elsewhere.org/pomo/.
30. Britt, “Ex Machina Writer/Director Alex Garland Talks Robots.”
36. Desowitz, “How They Did It.”
38. “Ex-Machina, the DIT Story.”
42. Ibid., 5.
44. N. Katherine Hayles, How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics (Chicago: University of Chicago Press, 1999), 3.
47. Haraway, Simians, Cyborgs, and Women, 180.
48. Ibid., 173.