Deus Ex Algorithmo: Narrative Form, Computation, and the Fate of the World in David Mitchell's *Ghostwritten* and Richard Powers's *The Overstory*

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Abstract

In two endings that foreshadow planetary catastrophe, David Mitchell's *Ghostwritten* (1999) and Richard Powers's *The Overstory* (2018) revisit the classical narrative device of the "deus ex machina"—an unexpected last-minute intervention that alters the course of the plot. Strictly speaking, however, in these contemporary novels the intervention is algorithmic, not divine: an artificial intelligence takes control of the planet and steers it away from anthropogenic disaster while leaving humanity to its own devices, in a struggle against extinction. This article explores the significance of this strategy against the backdrop of broader debates on narrative form, computational culture, and ecological disaster. I argue that the algorithmic solution implemented

by both novels joins formal and thematic concerns as it models the deep uncertainty of humanity's future vis-à-vis the nonhuman processes that underlie today's ecological crisis.

Introduction

"Computers have helped revolutionize the commercial world and transformed the lives of the general public through the development of the Internet and mobile technologies like the iPhone. But, practically speaking, they have done little for the good of our planet," states a National Science Foundation research report on the science news website *ScienceDaily*. In the worlds of contemporary fiction, though, computers are doing much more for the good of the planet. David Mitchell's debut novel, *Ghostwritten* (1999), and Richard Powers's latest opus, *The Overstory* (2018), converge in imagining a computational solution to the Earth's anthropogenic woes: an artificial intelligence deploys its algorithmic strategies of global surveillance to defuse the many crises—from nuclear proliferation to global warming—that are afflicting our planet. But there's the rub: "saving the planet" involves letting go of humankind as we know it, embracing radical societal change and even the possibility of species extinction.

That is, of course, the iteration of a science fiction motif at least as old as Mary Shelley's *Frankenstein*: technology gets out of human hand and destabilizes the authority of its creator, eventually undoing him; but the stage here is planetary—both Mitchell's and Powers's novels present a plurality of characters and geographically separate story lines—the technological challenge operates on a species and not on the individual level. Further, the algorithmic solution overlaps with a specific *narrative* solution: the multiple strands of the plot are brought together by a computational intervention that ushers in an unexpectedly hopeful ending—hopeful, at least, from a biocentric perspective, because it promises the continuation of life on Earth despite the

devastation caused by human activities. That plot strategy—I call it "deus ex algorithmo"—harks back to the notorious narrative shortcut of Greek drama, in which Gods were lifted onto the stage by a crane (the "machina") to solve a situation that would have been intractable in human terms. By and large, the deus ex machina has become synonymous with a contrived, disappointing ending. In 1954, Gilbert Norwood wrote that anyone "who forces his plot to conclude 'satisfactorily' after all with a violent jerk, unjustified by the preceding action, deserves ruthless condemnation—if he writes tragedy or comedy" (19). Contemporary novelists like Mitchell and Powers deserve perhaps more charitable treatment. After all, the problems they contend with through the imaginative means of narrative are unprecedented in scale: according to philosopher Dale Jamieson (61), "climate change can be seen as presenting us with the largest collective action problem that humanity has ever faced, one that has both intra- and inter-generational dimensions." As fiction engages with a crisis of that magnitude, it is unsurprising that it needs more-than-human help to wrap up a plot. As Ian Bogost argues in an article aptly titled "The Cathedral of Computation," algorithms are a matter of quasi-religious worship in today's technological society. The cult of algorithms can perhaps be woven into a plot, but is that narrative solution to the crises of the present more satisfactory than the dei ex machina of Greek drama?

At first glance, the solution seems deeply defeatist, at least if we take at face value the implication that humans are fundamentally unable to address a problem of their own creation and will need to vanish if the Earth is to thrive. Those who were hoping that contemporary "climate fiction" may serve as a catalyst for pro-environmental action will no doubt be disappointed.[2] But on a deeper level, the algorithmic denouements implemented by Mitchell and Powers serve an important cultural function: they address the radical uncertainty that surrounds the future by

implicating the human mind in a more-than-human, material world. In the terminology introduced by Hubert Zapf (93), that narrative operation creates "reintegrative inter-discourse" that establishes deep connections between three separate areas of cultural discussion: the anxieties surrounding the ecological crisis, the interest in computational intelligence, and the problematic status of human subjectivity in a world that Western science depicts as physical through and through. The "code" in which algorithms are written, it turns out, is structurally analogous to the biological substrate of life on Earth, from which the human mind emerges. By reintegrating the subject within these material processes, the deus ex algorithmo engages—and, in part, defuses—broad-ranging questions regarding the status of the human vis-à-vis planetary processes. As humanity bows out of existence in the ending of these novels, life and mind— placed on a continuum with computational algorithms—continue expanding and flourishing.

Read in this light, the deus ex algorithmo takes on new significance: it is not an intervention problematically uncoupled from the human vicissitudes of the plot but a delayed (and technologically mediated) acknowledgment of biophysical forces that have shaped the fate of humankind throughout its history. These processes, thematically and structurally foregrounded by the novels, are quantum uncertainty (in *Ghostwritten*) and the self-organizing logic of complex systems (in *The Overstory*). The conceptual common ground of quantum physics and complexity science is unpredictable behavior on the human scale: thus, unpredictability grounds both the surprising intervention of the ending (which is in itself comparatively unpredictable) and the indeterminacy of humanity's future vis-à-vis today's ecological crisis. This article sets out to explore the stakes of this narrative strategy against the backdrop of broader debates on algorithmic intelligence and the imaginative possibilities of narrative in times of climate change.

To these debates I turn in the next two sections, before examining the novels and how computation deepens their formal and conceptual engagement with the end of the world.

Algorithmic Magic

In *What Algorithms Want*, Ed Finn offers a sustained philosophical meditation on the cultural significance of computation. In recent times, algorithms have been the subject of both extensive praise for the possibilities of knowledge production they disclose—for instance, through "big data" analysis—and systematic critique for their implication in neoliberal ideology as well as state and corporate surveillance.[3] Finn argues that that dilemma is symptomatic of contemporary culture's fascination with computation as an inherently "protean" technology, which promises limitless knowledge but also, in the same breath, disrupts notions of privacy and individual autonomy: "The algorithm offers us salvation, but only after we accept its terms of service" (9). To understand the nature of our algorithmic age, Finn places algorithms in a long history of technological extensions of the human mind. Algorithms are a form of language; just like verbal language, they have a performative power that Finn sees as part of a "tradition of magical thinking" (2): algorithms do things for us—they recommend what books one should read or restaurants one should visit—in ways that are surprisingly effective, and yet we don't fully understand. Because of how they "just work," algorithms are the closest our digital age comes to what anthropologist Alfred Gell would call a "technology of enchantment." The magic of algorithms forms the basis for the link with religion discussed and critiqued by Bogost: "Once you adopt skepticism toward the algorithmic- and the data-divine, you can no longer construe any computational system as merely algorithmic" (n.p.). Finn, as we'll see, pursues this critique. It is worth noting that the God-like construal of the algorithm fits elegantly with the narrative

solutions adopted by Mitchell and Powers in their novels: the algorithmic denouement offers "salvation," but with the ethically significant caveat that it is the planet, not humanity, to be saved. Further, the algorithm performs something akin to narrative magic: unexpectedly, it sews together the threads of the plot and brings closure to a planetary crisis that most readers will recognize as closely related to the real emergencies the world is currently facing.

For Gell, magic is "a by-product of uncertainty" (57) about how a certain object was created. This idea also dovetails with Finn's account. The algorithm, Finn explains, is a technology situated at the intersection of computation, material culture, and human cognitive processes. This space is "a magical or alchemical realm where [algorithms] operate in productive indeterminacy. Algorithms span the gap between code and implementation, between software and experience" (34). The key phrase here is "productive indeterminacy": algorithms are useful because they can yield results that cannot be predicted a priori by the programmer *or* by the end user (for example, the Amazon website suggesting that I buy a copy of Finn's *What Algorithms Want*). The productivity of algorithms, Finn continues, derives from a double process that generates uncertainty: on the one hand, they involve multiple levels of abstraction, compressing a large number of data points acquired through disparate routes; on the other hand, they deploy that abstraction in socio-cultural contexts (Finn calls this "implementation") where they fulfill a deep-seated human desire for knowledge. Finn uses a striking analogy to convey this dynamic: "a kind of magic [emerges] from the complex interactions of abstraction and implementation like flocks of birds from a computational game of life" (52). This magic is foregrounded in Mitchell's and Powers's novels, where the algorithmic ending involves a leap to a higher level of abstraction—the planetary scale on which the AI operates—and resonates with a desire to know humankind's future as catastrophe (environmental or otherwise) approaches. As we'll see, ideas

of "productive indeterminacy" are also thematically central to both novels and underpin the algorithmic solution of the ending.

Further, as Finn suggests, the space in which algorithms exist embraces the human subject, and not just in the sense that computers allow us to distribute or offload cognitive functions such as memory or inference-making.[4] Rather, and more fundamentally, the epistemic desire fueled by algorithmic technologies folds back on itself, raising questions about the nature of subjectivity and its place in a material universe: the idea of "effective computability" (the view, that is, that all knowledge can be obtained through computational means) implies that the human mind itself works computationally—that is, algorithmically. The mind as computer is, of course, a contested metaphor at the heart of first-generation cognitive science, which enjoyed a particularly close relationship with Artificial Intelligence.[5] The metaphor is contested because it has historically emphasized the independence of mind from its physical "hardware" (be it biological bodies or computer technology), thus raising Cartesian specters of dualistic separation between subjectivity and the material world. Instead, influential work in second-generation cognitive science, such as Varela, Thompson, and Rosch's *The Embodied Mind*, has drawn attention to the constitutive link between life and mind—how processes that we regard as "cognitive" are grounded in, and an extension of, the material pressures that shape life in the framework of natural selection.

A more balanced view of the relationship between mind and computation doesn't collapse the former into the latter (the mind as a computer in the reductive sense) but rather points to their shared materiality as a condition of possibility for cognition. This is the path taken by Katherine Hayles in *Unthought*, in which she proposes "a definition for cognition that applies to technical systems as well as biological life-forms" (*Unthought* 3). In Hayles's account,

cognition is understood "as inseparable from choice, meaning, and interpretation, [which bestow on a cognitive system] special functionalities not present in material processes as such. These include flexibility, adaptability, and evolvability" (*Unthought* 29). Both advanced computational technologies (including the algorithms discussed by Finn) and living organisms display these features, and in both cognition is materially realized (albeit following profoundly different routes of physics and biochemistry). Finn and Hayles thus show convincingly that algorithmic technology, with its cognitive efficacy, confronts us with pointed questions about the nature of mind and its position within the physical world.

Science, Narrative, and Calamity Form

Troubling the separation between subjectivity and material technology means casting into doubt notions of human exceptionalism, which traditionally rest on assumptions about the autonomy of the human subject. That is one of the key takeaways of discussions in posthuman and nonhuman-oriented thinking (Wolfe; Grusin); the algorithmic ending allows Mitchell and Powers to weave that insight into their narratives, not just thematically but at a deep, formal level. Further, both *Ghostwritten* and *The Overstory* integrate scientific ideas that tie in with the algorithmic framework outlined so far and amplify thematically the formal resonance of the ending: they are, respectively, the uncertainty principle formulated by Werner Heisenberg in the context of quantum physics and the self-organizing nature of complex systems. Building on quantum physics, *Ghostwritten* suggests that indeterminacy is not an epistemic limitation of the human mind—our inability to know with certainty—but a fundamental feature of the physical universe, shaping human history, including the novel's fictional plot, and entangling both in a more-than-human, cosmic history. For its part, *The Overstory* sees the evolution of life on Earth as a

complex system coupled with the Earth's geophysical realities—an idea reminiscent of James Lovelock's influential "Gaia hypothesis"; aided by machine-learning algorithms, life organizes itself to survive anthropogenic catastrophe and thrive after humanity's extinction or radical transformation.

Both quantum physics and complexity science have had an important role to play in posthumanist theory, from Hayles's own discussion of autopoiesis and self-organizing structures (in *How We Became Posthuman*) to Karen Barad's quantum-physics inspired *Meeting the Universe Halfway*. No doubt, Mitchell's and Powers's engagement with scientific themes is filtered through and informed by these debates. But the point here is less reconstructing the genealogy and conceptual affinities of these ideas than acknowledging their unique contribution to the algorithmic ending of the two novels: when injected into narrative form, quantum uncertainty and self-organizing complexity turn a seemingly arbitrary "twist" (the traditional deus ex machina) into a far more compelling reconsideration of humanity's role in both novelistic story and planetary history.

Let us not forget that the computational magic of that ending emerges as narrative faces up to the possibility of a global catastrophe driven by human activity. While Powers is explicit in referring to the anthropogenic increase in greenhouse gases, Mitchell—writing at the end of the 1990s—does not address climate change as such, but his novel still presents humanity as causally and ethically implicated in the end of the world. This irruption of a planetary, species-threatening cataclysm in the conceptual space of narrative is a source of considerable tension. As scholars and writers have pointed out—most notably, Amitav Ghosh in *The Great Derangement*—narrative as a practice, and the novel as a genre, do not accommodate climate change easily. Narrative is geared toward social experience in relatively small-scale communities

(Scalise Sugiyama); the novel is a narrative form whose history is intrinsically bound up with industrialization and the emergence of an urban middle class made possible by industrialization (Watt).[6] Climate change is both the result of these historical transformations and a multifaceted phenomenon whose spatial and temporal scale tends to elude everyday social experience: we are aware of the weather, not of average global temperatures or of the concentration of carbon dioxide in the atmosphere; we may have to endure extreme weather events, but it is impossible to perceive (as opposed to understand conceptually) how such events reflect broader transformations in the Earth system. These spatially and temporally distributed processes fall through the cracks of the novel, with its penchant for focused plots that stage social conflicts in human-scale space and time.

Moreover, catastrophe destabilizes human knowledge and confronts us with what Anahid Nersessian discusses under the heading of "nescience"—our constitutive lack of knowledge about the future. The consequences of climate change are difficult to predict with precision because of the many factors—physical, climatological, but also socio-economic—interacting in nonlinear ways: accordingly, scientific scenarios range from local disruptions to the global catastrophes envisioned by Mitchell and Powers (see Lewandowsky et al.). Ghosh argues that climate change escapes the normal probability calculus of human societies: its consequences are spectacularly improbable and yet dramatically plausible. By distinct contrast, "the modern novel . . . has never been forced to confront the centrality of the improbable: the concealment of its scaffolding of events continues to be essential to its functioning. It is this that makes a certain kind of narrative a recognizably modern novel" (Ghosh 23). Ghosh's claim mirrors the kind of reasoning that has long discounted the deus ex machina as "improbable" and therefore narratively flawed. Integrating climate change into a novelistic plot—not as a mere concept, but

as a force shaping the progression of narrative—involves embracing the improbable nature and unthinkable scale of its consequences. Nersessian introduces the notion of "calamity form" to refer to "an operation performed on language, syntax, and image such that they may stage a very particular kind of intellectual crisis. This crisis concerns, above all, the unknowability of the future and the uncertain impacts of our actions on it" (324).[7] The algorithmic ending implemented by Mitchell and Powers is an instance of calamity form in narrative terms: instead of shying away from the improbability of catastrophe, it builds that improbability into the "productive indeterminacy"—to quote again Finn—of the algorithm as a technological device and explores its cultural consequences in relation to both the climate crisis and the fraught boundary between human mind and matter.

This sophisticated operation is assisted by scientific ideas of quantum uncertainty and self-organizing complexity; however, its goal is fundamentally unscientific in that it doesn't aim to produce certainty but to project uncertainty: the deus ex algorithmo gives expression to the precarity of humanity's current predicament. Thus, the scenario of human extinction foreshadowed by both novels oscillates between consolation and distress, between faith in the possibility of a posthuman future and grief over the extent of the human loss. This profound affective ambivalence is in itself highly productive—it trains willing readers in the management of uncertainty. I will come back to this point in the conclusion; for now, it is time to turn to the two novels and the specific ways in which their endings perform algorithmic magic.

"Syntax of Uncertainty": David Mitchell's *Ghostwritten*

"What is DNA's engine of change? Subatomic particles colliding with its molecules. These particles are raining onto the Earth now, resulting in mutations that have evolved the oldest

single-celled life-forms through jellyfish to gorillas and us, Chairman Mao, Jesus, Nelson

Mandela, His Serendipity, Hitler, you and me" (360). This is one of the narrators of Mitchell's

Ghostwritten, the physicist Mo Muntervary, addressing the reader in the "Clear Island" chapter

of the novel. "Quantum physics speaks in chance, with the syntax of uncertainty," she adds a few

pages later (364). The plot of Mitchell's novel is also at ease with the syntax of chance, which

serves as the narrative's own "engine of change." The novel has eight different narrators—one

per chapter, with the exception of the first and the last, which feature the same narrator, and the

chapter after "Clear Island," titled "Night Train," which consists entirely of dialogue. According

to the novel's central analogy, these characters are colliding particles, crossing paths at various

locations around the globe and shaping, through their serendipitous encounters, the overall plot

pattern. Some of these characters are more central to the pattern—Mo is a key figure, as we'll

see—others remain peripheral and make a thematic, rather than strictly diegetic, contribution

(this is the case of the narrator of the novel's first and last chapters).[8] This is a familiar narrative

strategy in contemporary fiction and film, discussed by David Bordwell under the rubric of

"network narrative": a narrative set-up in which "there are . . . several protagonists, but their

projects are largely decoupled from one another, or only contingently linked" (192).[9] In the

chapter before "Clear Island," for instance, the narrator—Marco, a London-based writer—sees a

woman hurrying across the street and dives to save her from collision with a taxi. In "Clear

Island," we find out that the woman involved in the near-miss is Mo. Chance encounters like this

are the building blocks of network narrative, with its distributed and decentralized approach to

storytelling; *Ghostwritten* embraces this poetics of contingency and props it up, via Mo's

ruminations, with two distinct but conceptually related scientific ideas: the uncertainty principle

of quantum physics and random genetic mutations as a driving factor in natural selection.

Readers learn that Mo is working on "Quancog," a quantum computer that promises to revolutionize the world of Artificial Intelligence. When Mo hears that her research is being exploited for military uses by the US government, Mo decides to quit her job in Switzerland and visit Hong Kong and later Mongolia, the setting of two previous chapters, in which readers have already had glimpses of her. After Marco saves her life in London, Mo returns to her native Ireland, where we find her in "Clear Island." There she discusses her ethical concerns over Quancog with her son, Liam, and announces an idea she had hit upon during her travels in Asia: "What if Quancog were powerful—ethical—enough to ensure that technology could no longer be abused? What if Quancog could act as a kind of . . . zookeeper?" (364–65). Quancog is not just an "intelligent" weapon, but one that is capable of ethical reasoning. In many ways, Quancog is a dream of "effective computability" (to use Finn's words again) come true, but with the important addendum that ethical questions are also considered computable. Further, the zookeeper analogy echoes an idea that had emerged earlier in the novel, in the "Mongolia" chapter—that of a nonhuman being watching over the world.

A frequently repeated motif in the novel is a story, claimed to be part of Mongolian folklore, about three animals—a crane, a locust, and a bat—thinking about the fate of the world (151). Three brief sketches show the animals absorbed in thought: they worry about an imminent disaster and believe they can avoid it through ritualized physical actions, such as gracefully crossing a river (the crane) or sitting all day on a rock (the locust) or alternatively fluttering and resting (the bat). The story, overheard by Mo in a train compartment in "Mongolia," appears to have influenced her view of Quancog as a "zookeeper." Whether conceptualized as an animal or an AI, this nonhuman figure overturns the Biblical notion of humans' stewardship of the planet. In a famous article published in *Science* in 1967, historian Lynn White argued that Christian

readings of the Biblical concept of stewardship are at the root of the ecological crisis: "Christianity—writes White—made it possible to exploit nature in a mood of indifference to the feelings of natural objects" (1205). In *Ghostwritten*, Mitchell draws on Eastern philosophy—particularly Buddhism—to subvert this Judeo-Christian understanding of the nonhuman world as available to human exploitation.[10] The zookeeper metaphor enacts this critique via a perspectival inversion: it is not humans who look after the world (including its nonhuman animals), but humans who need nonhuman supervision, as if they were animals in a zoo.

That is the premise of "Night Train," the novel's penultimate chapter, which directly follows "Clear Island" and contains the algorithmic denouement. "Night Train" revolves around a phone-in radio show hosted by a character named Bat Segundo; it is the only chapter without a first-person narrator, being entirely based on dialogue between Bat and his interlocutors on the phone. One of these interlocutors—and the most prominent one—is a mysterious character who introduces himself as the "Zookeeper"; the reader quickly identifies it as the fruit of Mo Muntervary's Quancog project: a God-like, algorithmic intelligence capable of ethical reasoning and global surveillance through a network of satellites. As the chapter progresses, Bat Segundo keeps probing (and comically misunderstanding) the Zookeeper's identity, with their exchanges offering an ironic commentary on numerous unfolding disasters and global threats: an upsurge in terrorism, an oil spill in the Gulf of Mexico—a familiar list of grievances. The dialogue builds up to an "End of the World Special" of the radio show, in which the planet is on the brink of a nuclear apocalypse. Throughout these exchanges, the humorous tone offers a clear-cut example of what Mark McGurl has called the "posthuman comedy": for McGurl, the comic is a particularly productive site for humanity's (and contemporary culture's) confrontation with planetary changes. Indeed, during this lighthearted "End of the World Special," the Zookeeper

swoops in and averts the crisis by causing malfunctions in military computer systems worldwide. This algorithmic solution derives from multiple areas of "productive indeterminacy": the Zookeeper's identity, from Segundo's perspective, but also the thematized uncertainty principle that underpins the computer's "quantum cognition." Mired in human conflict, the Earth is miraculously saved by a computer that, when pressed by Segundo, claims to be "in charge of the monkey house" (400)—that is, with another ironic inversion between humans and animals, in charge of protecting *Homo sapiens*.

Not only does the deus ex algorithmo resolve the planetary, and anthropogenic, crisis staged by "Night Train" through the humorous device of the radio show, but it also brings together the strands of the novel's plot: directly—most notably, through Mo's research—or indirectly, through thematic resonances, all the novel's chapters converge in the figure of the Zookeeper. The novel doesn't end on that positive note for humankind, however. After avoiding nuclear disaster, the Zookeeper slowly begins to realize that the ethical laws it has been given by Mo—preserving human life *and* the planet's integrity—are impossible to reconcile: "The visitors I safeguard are wrecking my zoo," he declares (419). Thus, as another catastrophe approaches (a comet is in collision course with the Earth and threatens to wipe out humanity), the Zookeeper determines, with Segundo's unsuspecting help, that it should *not* be prevented. This second algorithmic decision undoes the first, with the important difference that the human species is not erased by its own irresponsible actions but by an external, cosmic force—thus denying humanity any form of control over its own destiny. This is an ironic (and highly prescient, in 1999) rebuttal of a reading of the Anthropocene narrative that casts humanity as a quasi-geologic agent in charge of the Earth.[11] Instead, the algorithmic intervention is a calamity form positioning the human species in a cosmic context—a vantage point from which the rise and fall of *Homo*

sapiens appear as a mere fluke, a product of a quantum physics-inspired "syntax of uncertainty," like everything else in the universe.

The novel's last chapter, "Underground," offers the further suggestion that the human mind—subjectivity—is fundamentally implicated in that uncertainty. Ostensibly, the chapter continues the novel's first chapter: Quasar, the narrator, is a member of a doomsday cult and has just planted a sarin gas bomb on a subway train in Tokyo. As he struggles to leave the train car, Quasar experiences a series of highly vivid and embodied visions—one for each of the novel's preceding chapters. The novel thus leaves us with the question: "I haul myself to my feet, spent and quivering. What is real and what is not?" (426). Put otherwise: is the novel's network narrative, with its nodes seemingly spread out around the globe, a product of a psychopath's delirium? That final hesitation, tied not just to human subjectivity but to humanity's most destructive and antisocial impulses, holds a psychological mirror up to chance and uncertainty as fundamental laws of the universe. That revelation was already implicit in the Zookeeper's algorithmic magic, but while the "Zookeeper" chapter was steeped in humor, the finale gives the novel a far darker, more anxious twist. Two affective perspectives on uncertainty—lighthearted commentary and a psychopath's deranged mind—are juxtaposed in a way that admits no straightforward closure, but only raises the stakes for the reader to appreciate the ambivalence of Mitchell's vision of human-nonhuman relations. By embracing ambivalence without resolving it, readers gain precious insight into the present moment and the precarity of humanity's collective future.

"The Code Spreads Outward": Richard Powers's *The Overstory*

Like Mitchell's novel, Powers's *The Overstory* displays a network-like narrative organized

around nine characters and partially overlapping story lines. The guiding analogy behind that

network is not a parallel between subatomic particles and the novel's characters, but between

their lives—considered collectively—and the physical structure of a tree. This parallel is already

evoked by the novel's table of contents, where the chapter headings read "Roots," "Trunk,"

"Crown," and "Seeds." This is a novel obsessed with plants; that obsession is what brings the

nine characters together in the first place.[12] In "Roots," the nine characters are introduced one by

one, with the narrative focusing on the defining moment in their lives—a dramatic encounter

with a tree that instills into them the insight that their existence, in individual as well as in

collective terms, is fundamentally dependent on plants. In "Trunk" and "Crown," a series of

short sections trace the impact of that plant epiphany on the characters' lives, alternating rapidly

from one character to another and later showing how five of them converge on the West coast

from multiple locations in the United States: in line with the poetics of contingency of network

narratives, these five characters join the same environmentalist organization, protesting against

widespread logging. Together, the five environmentalists go from peaceful activism to

ecoterrorism, which ends in tragedy when (in the last pages of "Trunk") one of them loses her

life during the attempted burning of an equipment shed used by loggers. "Crown" reconstructs

the aftermath of this accident, as the five protagonists, deeply shaken by their friend's death,

struggle to transition back to their everyday lives and elude an FBI investigation into their

criminal activities.

   The four remaining characters are not diegetically implicated in the environmentalists'

story line; conceptually, however, their contribution is essential to understanding Powers's

narrative operation, particularly as it builds up to the algorithmic denouement of "Seeds."
Patricia Westerford, a biologist, develops a groundbreaking theory of plant intelligence: her
book, *The Secret Forest*, argues that "mats of mycorrhizal cabling link trees into gigantic, smart
communities spread across hundreds of acres" (218). This book, which is read by virtually all of
the novel's characters, outlines a philosophy of plant interconnection that complicates the central
analogy between trees and the characters' lives: the narrativized form of the characters' social
network does not only mirror the structure of a single tree, but also the mycorrhizal organization
that brings plants together in "smart communities." *The Overstory* thus probes an uneasy analogy
between human and nonhuman collectivities, drawing attention to the striking formal similarities
in human and nonhuman networks but also showing—pointedly—how human collectives fail to
replicate the cohesiveness and efficacy of plant assemblages. If, to quote again Jamieson's words
(61), climate change is "the largest collective action problem that humanity has ever faced,"
Powers holds a mirror up to the shortcomings that keep human collectives (the environmentalist
movement, the scientific community, and of course various levels of government) from
approaching this problem with the genuinely altruistic mindset that defines the social behavior of
seemingly "passive" plants.

Indeed, the key figure in Powers's ending is not a human group but Neelay Mehta, a lone
computer programmer who gains startling insight into plant intelligence early in the novel.
Neelay, the son of Indian immigrants living in California, loses use of his legs after falling off an
oak tree; as he lies in shock next to the tree, unable to move, Neelay hallucinates that "a
thousand—a thousand thousand—green-tipped, splitting fingerlings fold over him, praying and
threatening" (102–03). These are the tendrils of a vegetal intelligence that infiltrates Neelay's
mind and guides his career as a computer programmer. As the narrator remarks a few pages later,

"the alien invaders insert a thought directly into [Neelay's] limbic system. There will be a game, a billion times richer than anything yet made, to be played by countless people around the world at the same time" (110). That video game—titled *Mastery*—gains mass following and turns Neelay into one of Santa Clara County's wealthiest men: it is a *Civilization*-type game focusing on resource extraction and technological progress; ironically, "Enlightenment" is the name of an "overpowered victory strategy" (225) in the game. But Neelay slowly comes to realize that, whether the environment is real or computer-simulated, human mastery and the Enlightenment's faith in progress are actually self-defeating strategies. After resigning from the software house he has founded, and after reading Westerford's *The Secret Forest*, the full significance of plant intelligence dawns upon him: "he sees the tree's central aim, the math behind the phloem and xylem, the intermeshed and seething geometries, and that thin layer of living cambium swelling outward. Code—wildly branching code pruned back by failure—builds up this great spiraling column from out of instructions that Vishnu managed to cram into something smaller than a boy's fingernail" (435). The tree's "math" is the self-organizing complexity of life itself, how it keeps expanding despite being "pruned back by failure" and by the anthropogenic devastation wrought upon the Earth's ecosystems. DNA code—the language of life—is fundamentally similar to the lines of Neelay's computer code, and the two can be yoked together. The seed planted by the tree intelligence after Neelay's dramatic fall germinates into a concrete plan: he must create a computer algorithm that is able to match the complexity of life and address the ecological crisis.

These algorithms—referred to as "learners" in the novel—are capable of self-organization and self-knowledge; no longer under Neelay's control, they "head off to scout the globe, and the code spreads outward. New theories, new offspring, and more evolving species,

all of them sharing a single goal: to find out how big life is, how connected, and what it would take for people to unsuicide" (482). The scale of this algorithmic vision transcends the human species, even if the fate of humanity and its probable greenhouse gas suicide are deeply entangled in it. There is something mysterious and God-like about this biological force, which resonates deeply with the magic and "productive indeterminacy" of computational cognition. Like Mitchell's Zookeeper, the computational "learners" join forces with nonhuman intelligence; but while Mitchell foregrounds animals, Powers focuses his imagination on plants. Both novels reveal, through their algorithmic ending, a form of nonhuman vitality that is secretly in charge of the planet, despite humanity's delusion of mastery. Thus, the final pages of *The Overstory* announce "disastrous setbacks and slaughters," but also add that "life is going someplace. It wants to know itself; it wants the power of choice"; Neelay has only "nudged it along" (496).

Despite the apparent failure of their activism, the five environmentalists also contribute to this "nudge." Neelay's vision of "intermeshed and seething geometries" is prompted by a digital artwork realized by one of the environmentalists, Nick Hoel, who becomes a wandering artist after the group disbands: it is a time-lapse video of a chestnut on Nick's family farm, followed by visual poetry in the shape of the tree, which incorporates lines from Henry David Thoreau's *Walden* (see **Error! Reference source not found.**). The divine "beauty now invisible" brings us back to the "cathedral of computation" discussed by Bogost and Finn in their critique of contemporary culture's quasi-religious imagination of the algorithm. In the context of Powers's novel, however, that numinous quality of the algorithm is revitalized by being mapped (via the reference to Transcendentalism) onto the formal complexity of both nature and art. Nick's creation is discontinuous, abstract, and multifaceted—all features that his digital art shares in common with the patterned strands of biological life and with the lines of computer code written

by Neelay. In this way, the story lines of this network narrative converge in the deus ex

algorithmo of the ending: Neelay's diegetic role in creating the "learners" is augmented by

conceptual input from the environmentalists (through Nick) and Patricia Westerford.

<<Insert Figure 1 around here; caption: "Nick Hoel's visual poetry, from Powers (435)."">>

The two remaining characters are also involved in this narrative pattern. They are Ray and

Dorothy, a middle-aged couple living in suburban St. Paul—"two people for whom trees mean

almost nothing" (64), states the narrator in "Roots." But, partly through reading Patricia's book,

their minds change. Ray suffers a stroke and remains bedridden; in a final scene, he hears about

the two life sentences faced by one of the environmentalists after arrest. Ray, a lawyer, imagines

arguing in court that the ecoterrorist's actions should be seen as self-defense, on behalf of

humanity, against the capitalist exploitation of the planet. That thought fatally destabilizes Ray's

brain and yields the following near-death vision: "the vessels in his brain give way, the way that

earth does when roots no longer hold it together. The flood of blood brings a revelation. . . .

Their branches rush to enclose the house and punch through its windows. At the stand's center,

the chestnut folds and unfolds, girthing out, spiraling upward, patting the air for new paths, new

places, further possibilities. Great-rooted blossomer" (498). On the brink of death, Ray

experiences the collapse of the Earth as well as the vital blossoming of the planet, his bursting

brain anatomy mirroring—through its complex formal arrangement—the branching structure of a

chestnut tree. The insight into Ray's dying brain evokes the entanglement of human subjectivity

in the drama of life on Earth—and how that subjectivity itself is eventually superseded by life's

ever-growing spirals. This section is thus functionally analogous to the last chapter of Mitchell's

novel, with its foregrounding of Quasar's deviant mind: the current Anthropocenic predicament is injected, with devastating consequences, into a character's psychology.

But while Mitchell's final chapters juxtapose the Zookeeper's humor and the nightmarish anxieties of a psychopath, the affect that prevails in Powers's algorithmic ending is the sublime of complex pattern, where—as seen above—religious language infuses art and the deep history of life on Earth. It is by adopting the sublime imagination of the "great-rooted blossomer" that Powers's novel can embrace catastrophic change and its possibilities. This is an open ending, the extinction of *Homo sapiens* being far less definite than *Ghostwritten*'s Zookeeper chapter presents it: "the Earth—announces the narrator of *The Overstory*—will become another thing, and people will learn it all over again" (500). Who are these "people," though, and to what extent will they resemble our conspecifics? We do not, and cannot, know. But paying attention to the quasi-divine magic of formal complexity, whether through art (including Powers's novelistic art), biology, or computer science, evokes the startling possibility that life will survive an anthropogenic cataclysm. For the reader, there is consolation to be found in that idea, but also increased awareness of the scale on which the current ecological crisis unfolds.

Conclusion: Narrative Games of Life

In an already quoted passage of *What Algorithms Want*, Finn argues that algorithms involve interactions that are "like flocks of birds from a computational game of life" (52). We are now in a better position to understand how apt Finn's simile is to characterize the narrative operation performed by both Mitchell and Powers. Finn's reference is to the famous "game of life" devised by British mathematician John Horton Conway in the 1970s, a cellular automaton that displays self-organizing behavior—in the form of recurring spatial patterns—on the basis of a simple rule

set. None of the game's rules dictates, for instance, the existence of "gliders" (patterns traveling across the board) or stable "still lifes"; these coherent configurations are a product of algorithmic magic.

The flock of bird that soars, unexpectedly, in the endings of *Ghostwritten* and *The Overstory* is a vision of life itself as a creative force that envelops, and at the same time reaches far beyond, the history of *Homo sapiens*. There is nothing fundamentally transcendental about this vision: life, for both writers, is encoded in genes and shaped by evolutionary pressures; its operations may be mysterious and God-like, but its nature is material, even as the complexity that distinguishes living and cognizing matter from "mere" matter is only partially understood by humans.[13] Just like Conway's game necessitated computers for a full-scale implementation, the life imagined by Mitchell and Powers springs up only under the lens of algorithmic intelligence capable of overcoming the intellectual strictures of human cognition—a posthuman perspective that leaves our species, perhaps tragically, on the sidelines. This algorithmic logic is active in contemporary culture at large; Mitchell and Powers blend it into the formal workings of narrative, and the genre of the novel in particular, by revisiting the classical device of the deus ex machina. In this final intervention of a computational savior, Mitchell's Zookeeper and Powers's "learners," we have a striking superimposition of form and theme: structurally speaking, the deus ex algorithmo appears to bring in closure through the coming together of the strands of the network plot; but the algorithm is also an expression of the uncertainty that the novels had foregrounded at the level of theme—namely, the uncertainty surrounding the fate of the human (including the human mind) in a nonhuman world. Hence the reintegrative inter-discourse offered by the novels (to use again Zapf's terminology) as they weave together subjectivity, material realities, and computational intelligence. This inter-discourse helps readers grasp how

the uncertainty of the future should not be swept under the rug but rather welcomed as a source

of radical change in psychological and political terms. Affectively, though, the two texts come to

this idea from significantly different angles: Mitchell's unresolved combination of humor and

existential angst gives way, in Powers's work, to a sublime of formal complexity that also

remains suspended, but without closing the door on the possibility of human survival as part of a

much greater pattern of life.

Algorithmic strategies may be present in contemporary fiction well beyond *Ghostwritten*

and *The Overstory*, and they may bring in an even larger affective palette. More importantly,

however, that strategy is part of a broader need for imaginative forms that allow us to engage

with the deep uncertainty of humanity's future in times of ecological crisis. Confronting that

ecological crisis is, fundamentally, a *formal problem*—that is, a problem of finding an adequate

calamity form that affords insight into our Anthropocenic predicament and the human and

nonhuman forces that shape it. To that end, we need innovative forms of storytelling that disrupt

the linearity of the narrative of the *Anthropos* in charge of the world.[14] Those forms may involve

experimentation with digital media and the hybridization of novelistic concerns with interactive

storytelling in video games (see Ensslin). Because of the potential for nonlinearity in digital

narrative, this medium is particularly well suited to complicate the form of human-nonhuman

relations beyond a fundamentally hierarchical (and in that sense linear) conception that frames

humans as masters of the natural world. For instance, a science-fiction game developed by Inkle,

Heaven's Vault, uses interactive narrative to stage catastrophic anxieties that have much in

common with those explored by Powers and Mitchell; computational intelligence and questions

about the embodiment of mind also loom large in the game. While this use of the game medium

involves adopting algorithmic solutions in a literal sense, in print narrative nonlinearity may be

realized by other means, and in more conceptual terms. We are already witnessing an expansion

of the novel's cast of characters, to include nonhuman actants that reflect on, and at the same

time critique, human entanglement in natural processes. Johanna Drucker's 2018 *Downdrift*, a

satirical novel narrated by an ancient microorganism, is a case in point. Certainly, speculative

and science fiction, along with other forms of storytelling often relegated to what Ghosh

dismissively calls "generic outhouses" (24) in *The Great Derangement*, have a major role to play

in this reconfiguration of the novel.[15] Thus, authors such as Jeff VanderMeer are revisiting weird

fiction in ways that are both formally challenging and directly geared toward ecological issues

(Robertson).

In short, contemporary fiction is already diversifying and complicating its narrative forms

in an attempt to respond to the ecological crisis. The device of the deus ex algorithmo, discussed

in this article, should be seen as part of this broader endeavor. But these complex engagements

with the Anthropocene call for an equally sophisticated conceptualization. The field of

ecocriticism has tended to operate on the assumption that, in Timothy Clark's words,

"environmental destruction can be remedied by cultural means" (19). Perhaps the value of

literary responses to the ecological crisis lies less in narrative's role as a prompt for pro-

environmental action, and more in a certain kind of affective impact—namely, in its capacity to

model uncertainty and therefore color and deepen the reader's acceptance of the fundamental

ambivalence of our climate future. Crucial to that affective project is the creation of insight into

humanity's participation in a game of life on a planetary scale.

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[2] On climate fiction, see comprehensive surveys by Trexler and Johns-Putra.

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[3] See Golumbia: "it seems problematic to put too much emphasis on computers in projects of social resistance, especially that kind of resistance that tries to raise questions about the nature of neoliberalism and what is (too often, disingenuously) referred to as free-market capitalism" (5).

[4] This idea has been discussed extensively in the mind sciences in the context of "distributed" (Hutchins) or "extended" (Clark and Chalmers) cognition.

[5] For discussion of the computational theory of mind, see Horst; for an influential critique, see Lakoff and Johnson, who introduce the distinction between first-generation (computational) and second-generation (embodied) cognitive science.

[6] For more on the anthropocentric bias of narrative, see Caracciolo, "Posthuman Narration."

[7] Also relevant in this context is Namwali Serpell's *Seven Modes of Uncertainty*, which explores the ethics of uncertainty in experimental fiction in ways that partly overlap with my focus on form and affect. Serpell foregrounds "the interactive, temporal, and experiential qualities to reading," referring to Heisenberg's uncertainty principle and characterizing narrative uncertainty as "an experience that emerges out of specific structures" (9).

[8] Thus, in discussing multilinear narratives, Arnaud Schmitt distinguishes between "knots" (a diegetic convergence of story lines, for instance when characters meet) and "connectors" (merely thematic links and resonances across story lines).

[9] Rita Barnard reads the network narrative of *Ghostwritten* as a prime example of contemporary fiction's engagement with globalization. For more on the network as a productive aesthetic form in the contemporary moment, see Jagoda.

[10] Harris-Birtill offers a book-length discussion of Mitchell's engagement with Buddhist ideas.

[11] For discussion of this (mis)reading of the Anthropocene, see Crist.

[12] Powers's novel ties in with a recent wave of interest in plant cognition and intelligence in biology; for an overview and discussion from a humanities perspective, see Gagliano, Ryan, and Vieira. See also Wohlleben for a popular account of mycorrhizal networks that overlaps significantly with Patricia Westerford's ideas in *The Overstory*.

[13] Cf. also Caracciolo, "The Bagatelle of Particle Waves," which explores contemporary fiction's confrontation with the seemingly insoluble "hard problem of consciousness"—or how subjectivity can exist in a material world.

[14] See also Caracciolo ("Posthuman Narration") and James's discussion of the possibilities of an "econarratology" in *The Storyworld Accord*.

[15] Controversially, Ghosh contrasts these "generic outhouses" with the "mansion in which serious fiction has long been in residence" (24). In a review article, Ursula Heise calls this distinction "one of the most striking argumentative shortfalls in [Ghosh's] otherwise perceptive and eloquent essay" (n.p.).