D·U·N·E
AND PHILOSOPHY

Humans, Machines, and an Ethics for Technology in Dune
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> *"Jihad, Butlerian: (see also Great Revolt)—the crusade against computers, thinking machines, and conscious robots begun in 201 B.G. and concluded in 108 B.G. Its chief commandment remains in the O.C. Bible as 'Thou shalt not make a machine in the likeness of a human mind.'"* --Terminology of the Imperium, appendix to *Dune*.

The worlds of Dune forbid the creation of "thinking machines," due to an ancient war, called the Butlerian Jihad, which was fought to keep humans from using such machines. Frank Herbert's views on technology are some of the most famous and memorable parts of the book series. Beginning in the first pages of *Dune*, the dangerous ways in which humans can use technology to harm each other loom wider in the later books of Herbert's series.[1] The Butlerian Jihad, or the Great Revolt, resulted in new moral and religious values that determined which technologies were acceptable and which were not. Details of the technological values and motivations of the Dune universe are relevant to the ethics of technology in our own world. As we'll see and discuss, a particularly important topic in the philosophy of technology is the role of humans in directing changes in technology.[2] Do humans shape the future of technologies? Or do technologies evolve on their own and determine the course of human lives?

Social Construction versus Technological Determinism

The relationship between humanity and forbidden technology in Dune touches on two basic possibilities for the relationship of humans and technology: social construction of technology and technological determinism. The social construction of technology means that the use and development of a technology is deeply shaped by humans, with the presumption that political and cultural influences on a technology can matter as much as its underlying physics.

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[1] For those who want to avoid spoilers for the later Dune books, I'll discuss this context in a footnote only. In a nutshell, the Dune series goes thousands of years after Paul Atreides, who himself comes almost ten thousand years after the Butlerian Jihad. Paul's son, the God-Emperor Leto II, institutes a regime that deliberately squelches technological advancement for over three millennia. And two thousand years later, some type of thinking machines start hunting humanity for reasons Herbert never fully gets to explain. Reading the first book alone doesn't give the full perspective on how the view of technology in Dune shifts across the series, although the first book is perhaps the most nuanced in its thinking on technology.

[2] If you want to learn more about the philosophy of technology and engineering, check out the Forum on Philosophy, Engineering and Technology, which welcomes both engineers and philosophers. There's also the Society for Philosophy and Technology, which formed in 1976. A great resource is Diane P. Michelfelder and Neelke Doorn eds., *The Routledge Handbook of the Philosophy of Engineering* (New York: Routledge, 2020).

Technological determinism, on the other hand, means that technology shapes our lives in ways that we can't control, inevitably influencing the political and cultural life of humans.

The ideas behind Dune's Butlerian Jihad represent a nuanced worldview between social construction and technological determinism. Butlerians feared how technology might shape human lives, evoking worries about a lack of control. But the leaders of the Butlerian Jihad also embody the possibility of changing technology by fighting to change which technologies are permissible. The bans on certain technologies in the Dune universe epitomize social influence on how technology develops, but the bans themselves are driven by fear of technology's reach, which is a deterministic view. However, neither viewpoint fully captures the richness of how humans relate to technologies.

First, a definition: technologies are artifacts (or objects) in our environment that we can use to cause change in ourselves or our environment. Typically, these artifacts are created by humans, and many are designed and developed by engineers.[3] The philosopher-engineer Walter Vincenti defines engineering as "the practice of organizing the design and construction [and operation] of any artifice which transforms the world around us to meet some recognized need."[4] Technologies in our world range from spaceships, such as NASA's Space Shuttle or Orion spacecraft, to planes, to computers, but mundane objects like pencils and garbage trucks also count as technologies. Use alone may make an object a technology, as we can turn a branch into a walking stick or a pile of rocks into a fence. Many see food as technology–in that sense, the spice melange of Dune, similar to caffeine found in coffee beans in the real world, is a type of technology, as are the many poisons in the Dune universe. Technology has to be used by humans for some purpose, but that purpose can change over time.

Knives, Shields, Lasguns, and Feedback Loops

Now, consider technology in the Dune books. Life on Arrakis and the Imperium is filled with technologies that range from the very realistic to the fantastical. Technologies that we can currently imagine as real include wind traps that collect moisture from the air, thumpers to create drumming noises on the ground, stilltents for capturing moisture, and the exotic paracompass, a guidance to mitigate the effects of Arrakis' uncertain magnetic field. Herbert shows some technologies that are ambiguous but fascinating: ornithopters are used for air travel via "wing-beats…in the manner of birds," but it's unclear if they could be realized in the real world today.[5] The stillsuits of the Fremen provide the seemingly simple ability to retain moisture and process body waste, but they are far more efficient than similar real-world technologies today. Herbert also writes of atomic weapons. Paul uses atomics in a focused way, not to attack people directly,

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[3]Herbert's world does call out engineers at several places in the book, in ways that recognize that science, technology and engineering are related. Herbert also has a habit of using "engineering" as a very broad term to systematically enable change in something, with one of his recurring themes being about religious engineering, such as the mythology making that paved the way for Paul and Jessica among the Fremen.

[4] Walter Vincenti, *What Engineers Know and How They Know It: Analytical Studies From Aeronautical History* (Baltimore, MD: Johns Hopkins University Press, 1990), 6. This is a variation of the British engineer Thomas Tredgold's definition from 1828 definition.

[5] *Dune*, Ace, 850.

but to blast open the Arrakeen shield wall to allow worms and his Fremen army to attack the Emperor's Sardaukar soldiers. Whether or not the atomics of *Dune* are more powerful than our own nuclear weapons, they embody the Cold War concept of "mutually assured destruction." All the Great Houses and political leaders have foresworn use of atomics, with a pact to fight against any leader who uses them.

In light of these advanced technologies twenty-four millennia from now, it's strange that there are knives and sword-fighting in Dune. Yet it makes sense. Herbert's radical way of thinking about how technologies develop and grow in non-linear ways rests on the idea that there are *feedback loops* between technical innovations, humans, and other technologies.[6] We often talk about technologies developing in linear ways, with new technologies making old ones obsolete. The reality is much more complicated, though. For example, knives become necessary in the Dune future because of other, far more advanced technologies: defensive shields can be placed on individuals and buildings that repel fast-moving projectiles like bullets and artillery shells. The development of shields represents a feedback loop that made projectile weaponry obsolete.[7] Individual fighters equipped with shields must revert back to combat using slower-moving daggers and swords, hoping to win battles by penetrating an opponent's shield.

Herbert also creates lasguns, another fantastical technology, through a feedback loop that counters shields. These are basically lasers that cut through walls and body armor. Lagsuns are incredibly powerful in the Dune world, but not as effective as their wielders might hope. If a lasgun strikes a defense shield, a fusion reaction is triggered, destroying both attacker and defender. Users of both shields and lagsuns must take care to avoid shared destruction. Dune characters know this feedback loop exists, and so they change how they use the technologies as a result. Some characters exclusively use knives when they believe shields may be nearby, to avoid destructive feedback. Meanwhile, other characters find ways to cause trouble in desperate circumstances by setting a lasgun and shield against each other.

Just like real-world technical innovations, Dune technologies are used by individual people, who change the uses of their technology over time, based on new circumstances. The technologies don't develop in a linear, deterministic way, because feedback loops develop between technologies and the goals and desires of people.[8] Later, we'll see how spaceships in the Dune universe and other complex technologies always have a human "in the loop." This means

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[6] The philosopher of technology, Joe Pitt, articulated the notion of feedback loops in how technology shapes and adjusts our lives. See Joseph Pitt, "Afterword," in Andrew Wells Garner and Ashley Shew eds., *Feedback Loops: Pragmatism about Science and Technology.* (New York: Lexington Books, 2020).

[7] Or almost obsolete! Knowing that House Atreides soldiers would hide in caves, prepared to fight hand to hand with shields, House Harkonnen used ballistic artillery weapons to collapse the entrance to the caves, trapping the shielded Atreides inside. The Baron Harkonnen prided himself on his use of 'ancient' weapons.

[8] Dune famously was the first fiction book published by Chilton books, which was a long-standing auto-repair manual publisher. The editor of Chilton had enjoyed reading the serialization of Dune so much that he reached out to Herbert, asking to expand and publish the book (Brian Herbert, *Dreamer of Dune*. MacMillan Press, 2004). It seems likely that the heavily technological aspects of Dune made it an easier fit for Chilton as a publisher, though the editor of Chilton eventually lost his job when sales did not increase as quickly as planned.

the overall control, direction, and purpose of the machine is shaped by a person, not by forces outside our control.[9]

Technology: Cultural Prestige, or Everyday Life?

Philosophers of technology look both at the role of technology in society and at how a society's values shape those technologies. In *Dune*, even everyday technical devices get deep appreciation from key characters. So, after he realizes that people need stillsuits to endure everyday life in the Arrakeen desert, Duke Leto remarks that the "design and manufacture of these stillsuits bespeaks a high degree of sophistication," and he also expresses a strong interest in visiting a sietch factory.[10] Unfortunately, the novels never dig deeply into the inner workings of how specific technologies are created, but there must be a significant amount of work happening elsewhere in the Dune universe to make the technologies possible. In the scene where Paul realizes that his father has died, he reflects on the Fremen technology in front of them, saying "Think of all these special-application Fremen machines. They show unrivaled sophistication. Admit it: the culture that made these things betrays depths no one suspected."[11]

In fact, the main characters in Herbert's Dune universe may have a deeper appreciation of technologies than many of us do. Some real-world thinkers argue that western societies don't give enough attention to what it takes to engineer complex technologies.[12] (It would be great to have political leaders who sincerely appreciate factories for more than the number of jobs they provide!) In addition, we tend to glorify new innovations powered by science, while tending to ignore technologies used in everyday life.

Societies in the Dune universe tend to value a variety of everyday and cutting-edge technologies. But what about the technologies they eliminated? How could a society come to have ethical norms against thinking machines and related technology? What led to the Butlerian Jihad?

The Great Revolt to Set Humans Free

Understanding the reasons why some technology is forbidden in Dune depends on understanding how Herbert views human beings. The Reverend Mother Gaius Helen Mohiam's test of the "gom jabbar" on young Paul Atreides is a severe way to define "humanity," and this test greatly shapes Paul's sense of purpose. Mohiam uses a box that makes Paul believe his hand is in extreme pain and that if he removes his hand from the box, then Mohiam will kill him with the poisoned gom jabbar needle. She calls this a "test for humans": true humans, unlike animals, will have the self-restraint to keep their hand in the box despite the pain. Paul passed the test but he was bewildered at the test's purpose. Mohiam explains that the gom jabbar "kills only animals…. You've heard of animals chewing off a leg to escape a trap? There's an animal kind of trick. A

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[9] It's possible that there are some computer algorithms that exist in the artifacts described above, just as our cars use algorithms and math to enable cruise control and anti-lock brake technologies. But such calculations would be about how an object functions and responds to its immediate environment, and would not be making broader calculations or simulations of the broader world. The technologies are still tightly linked to the human user's intentions.

[10] *Dune,* Ace, 180.

[11] *Dune*, Ace, 312.

[12] Venkatesh Narayanamurti and Toluwalogo Odumosu, *Cycles of Invention and Discovery* (Cambridge: Harvard University Press, 2017).

human would remain in the trap, enduring the pain, feigning death that he might kill the trapper and remove a threat to his kind.... A human can override any nerve in the body… Ever sift sand through a screen? We Bene Gesserit sift people to find the humans… Pain's merely the axis of the test."[13]

Now, Herbert isn't trying to state that real humans should be able to suffer great pain. Mohiam says the goal of her hypothetical human is "to remove a threat to his kind." For her, the true "human" wants their kind—the human species and civilization—to continue, and is willing to undergo great pain and struggle to achieve it. Mohiam and the Bene Gesserit's vision for what it is to be truly human is based on serving a higher purpose for the good of humanity. Enduring pain, as with many kinds of struggle, serves as a test for whether a person really intends to support a higher purpose with action, or if they will only offer words.[14] Explaining how the Bene Gesserit sought to create continuity and order across the millennia, Mohiam says that they seek humans who will act for this higher purpose. But how does any of this apply to technology and the Butlerian Jihad?

The Butlerian Jihad's technological ethics are invoked in the very same discussion between Paul and Mohiam, where Herbert links his views on technology to his view of humans. Paul asks,

"Why do you test for humans?"

"To set you free."

"Free?"

"Once, men turned their thinking over to machines in the hope that this would set them free. But that only permitted other men with machines to enslave them."

Paul: "'Thou shalt not make a machine in the likeness of a man's mind.'" Paul quoted.

"Right out of the Butlerian Jihad and the Orange Catholic Bible," she said. "But what the O.C. Bible should've said is: 'Thou shall not make a machine to counterfeit a *human* mind.'… The Great Revolt took away a crutch," she said. "It forced *human* minds to develop. Schools were started to train *human* talents."[15]

There is so much hinted at here in so few words: religion, super-humans, and the history of technology and oppression! Let's tackle this in steps. First, the edict to not make a machine in the likeness of a human mind is based on an ethical and religious principle about technology. The O.C. Bible is the main religious document in Dune; it's a synthesis of many existing religious faiths and future ones that evolve in the next twenty-four thousand years. The ethics of the O.C. Bible are treated so reverently by the cultures in Dune that its views on technology are an important element of Dune's moral codes. This is similar to how we today might treat the

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[13] *Dune*, Ace, 11, 13, 14, 15.

[14] The larger narrative of Dune does focus on how pain can be used by others against the broader needs of humanity: the Harkonnen enemies of the Atreides seek their own benefit and power, and routinely inflict pain on others to manipulate them.

[15] *Dune*, Ace. 17

significance of moral values from the Abrahamic faiths—Judaism, Christianity, and Islam. However, our society has very few deep ethical tenets about the nature of technology.[16]

Second, ending the use of certain technological "crutches" has created a new society dependent on enhanced humans. The book elaborates at length about enhanced humans, who play the role that computers do in our world today. In *Dune*, some people train their minds to become "Mentats," or human computers who strategize and collate large amounts of data together into calculations. (Paul himself was being trained to become a Mentat!*)* In other cases as well, the human brain in the Dune universe takes on some of the roles relegated to technological advancements: so instead of a computer guiding spaceships through faster than light travel (like warp drive or hyperspace), Guild Navigators have honed their minds to be capable of folding space, allowing travel throughout the galaxy.[17]

Third, Mohiam describes the causal role that thinking machines played in humanity's decline before the Jihad. In the distant past, many people allowed machines to do their thinking for them, and Mohiam says some bad actors used this fact to enslave the unthinking. The enemy was not thinking machines themselves, and so in this sense the edicts of the Butlerian Jihad are not necessarily anti-technology! Rather, they are about preventing the use of technology for oppression. It's implied that to be free as a human, we must think for ourselves with a higher power in mind.

The Forbidden "Thinking Machines"

What's the nature of the machines banned by the Butlerian Jihad? The epigraph that begins this chapter says that the Great Revolt banned computers, thinking machines, and conscious robots, all of which were believed to simulate ("counterfeit") a human mind. These types are generic, but we can make things clearer by examining each type of technology in turn. While ubiquitous now, computers were very different in 1965 when Herbert published *Dune*. Since then, computers have evolved far beyond performing targeted calculations using printed stacks of code. A simple calculator, probably what Herbert meant by "computer" in the sixties, could even be considered something that simulates a human mind. It seems that part of what makes a technology a simulation of a human mind in *Dune* is the ability to solve complex equations.

Herbert provides fewer clues about what "thinking machines" might be. Perhaps these are supposed to be a subset of the kind of computers we just discussed. These would be programmed to run simulations, make models that predict the future of the world's climate or the economy.

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[16] There are some instances where society views certain technologies as of questionable ethical values, such as those who view the existence of nuclear weapons as being undesirable. Others pass ethical restrictions on the use of stem cell technologies in research. There are also other examples of ethics applied to technology. The science and society scholar, Jameson Wetmore, has researched on how the Amish, a church fellowship group in the United States, have a set of moral values about what are acceptable technologies to use. But even for the Amish, the ban is not so much about inherent moral values of technology: "the foremost reason the Amish carefully regulate technology is to preserve their culture." See Jameson M. Wetmore, "Amish Technology: Reinforcing Values and Building Community," *IEEE Technology and Society Magazine* 26 (2007), 10-21.

[17] Of course, such abilities are greatly assisted in Dune by use of the spice mélange, which one could view as a technology that shapes human beings, enabling them to do it.

Recall that Mohiam said that humans turned over their mental process to thinking machines.[18] In the real world, it's common for us to make policy decisions about jobs or energy systems based on simulations. Some people obsess over computer simulations of political elections, to the point where the results of these simulations can even influence whether people vote or not. Maybe thinking machines are distinguished by the degree to which a human being can go back over the inputs, and understand the corresponding outputs of a simulation. It could be that thinking machines are different from mere calculators or simple computers in that they are far more opaque to the human mind.[19]

Defining the prohibited "conscious robots" is easier than "thinking machines," since conscious robots are based on the use of artificial intelligence. A technology that is artificially intelligent would be able to think and reason for itself. There are complex debates on what that means and if it is even possible. Science fiction is replete with examples of autonomous artificial intelligence that act and feel just like humans do, while others seem strange and alien in how they think. It's hard to know what Herbert intended, as his novels do not provide a detailed glimpse into the idea of fully autonomous robots. Thus the role of AI in the Butlerian Jihad remains unclear.

Regardless, Mohiam explained that some people relinquished their decision-making to "thinking machines," which are comprised of these three technologies, and said that others used this abdication to enslave the people who used those machines. Maybe the use of computerized analysis prediction with computers, thinking machines, or conscious robots helped some factions in the pre-Jihad society gain power and create wealth, resulting in unethical forms of control and oppression.[20] Mohiam's fear seems to rest on the fact that the exploiters took advantage of their fellows in ways they were not be able to resist.[21] The lesson of the Butlerian Jihad is that

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[18] In the non-canon *Dune Encyclopedia*, Herbert said the "secret" of Butler was revealed: Jehanne Butler was a pregnant Bene Gesserit woman who lost her daughter because a machine from Richese had determined that the fetus was "too deformed to survive." They found that computer algorithms had been encouraging many unjust abortions, and more broadly that the "degree to which machines controlled the population of Richese, and had altered the emotional and intellectual characteristics of its inhabitants over centuries, was literally incredible…" Butler found that religious priests took her anti-"thinking machine" vision much farther than she intended, with the Jihad so consisting of thousands of scattered commanders who were united by a "hatred for the machines they could neither understand nor replace." Willis Everett McNelly, ed., *The Dune Encyclopedia: The Complete, Authorized Guide and Companion to Frank Herbert's Masterpiece of the Imagination* (New York: Berkley Books, 1984), 1, 138, 143.

[19] Paul Humphreys has studied the "epistemic opacity" of simulations, or the way in which a simulation creates knowledge in ways that are unseeable ("opaque") to a human. Humphreys, "The Philosophical Novelty of Computer Simulation Methods," *Synthese* 169 (2009), 615-626.

[20] Conscious robots might wield great power, and we could imagine that humans want to mitigate them from taking power. But recall that Mohiam doesn't treat "conscious robots" as self-serving A.I., like the Terminator, which humanity must fight. She's concerned about A.I. that enables other wrong-seeking humans.

[21] I am not treating as canon the sequel and prequel books by Brian Herbert and Kevin J. Anderson, and have not examined them in detail. They shift the impetus of the Butlerian Jihad to focus on a "conscious robot"/artificial intelligence named Omnius, that was a much more Skynet-like evil A.I., which sought to destroy humanity. They also walk back the moral

technology can create power imbalances that harm significant numbers of people. Mohiam's and the Bene Gesserit's mission to improve the collective human condition limits technology because it could be misused by humans.

This is another point at which we see that fiction can be entertaining, but may not offer real moral alternatives. If it's problematic that technologies can enable oppression of some humans by others, then shouldn't we also worry about the same from Dune's enhanced humans, such as the Mentats? After all, people too often give up their duty to think for themselves by relying on other *humans* to do it for them. Maybe Herbert is implying that people will more readily push back against oppression if it has a human face rather than a machine one.

Herbert suggests that the best part of humanity is the ability to think for oneself. So the greatest risk in the use of technology is that it could replace our freedom of thought, our ability to decide our own path.

Freedom to Choose How We Want to Engineer

The cultures of the Dune universe place great cultural value on technology in its importance for everyday lives; like our technology, it develops in non-linear feedback loops, shaping human preferences and raising or lowering the importance of other technologies. The Bene Gesserit embody the Butlerian preference against thinking machines and want to get humans to think for themselves, with a higher purpose in mind. How might we apply these insights to our own lives, suffused as they are with technology? We certainly shouldn't forbid the use of things like calculators. But we should think deeply about whether or not we use technology in ways that enable reflection and human prosperity. Does that mean reducing how much we rely on computer simulations, or limiting automated services in industries? Are there aspects of new technologies that might be more deterministic in shaping our lives? These are just some of the many topics in the ethics of technology that we should be thinking about in broadly public ways.

Carl Mitcham has laid out a vision for "the true grand challenge of engineering":

> In the words of the great Spanish philosopher José Ortega y Gasset, in the first philosophical meditation on technology, to be an engineer and only an engineer is to be potentially everything and actually nothing. Our increasing engineering prowess calls upon us all, engineers and nonengineers alike, to reflect more deeply about who we are and what we really want to become.[22]

Herbert's view is that we should think for ourselves, and in so doing articulate our own purposes in life. Developing technology that doesn't serve merely as a crutch is part of a vision for humanity. But there are many other ways we can debate what type of technological world we

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prohibition against simple calculator-like computers, attributing that to an overzealous follower of the Jihad, Rayna Butler. These changes seem contrary to Mohiam's views on the Jihad discussed here, and to me diminishes the subtlety and value of Dune as a reflection on technology and ethics. Tying back to the earlier footnote on the non-canon *Dune Encyclopedia*, Herbert and Anderson also assumed that Butler lost a child as an impetus for the Jihad, although their machine's role in the death is much more intentionally evil.

[22] Carl Mitcham, "The True Grand Challenge for Engineering: Self-Knowledge," *Issues in Science and Technology* 31 (2014), pages.

want to engineer.[23] Whatever we decide, we have to realize that unintended negative consequences often spring from technologies and it's hard to guarantee that our engineered systems will not be used for unjust purposes. Making individual humans think for themselves may require a new, democratic approach toward the governance of technology. Engineers should think through their democratic obligations, and make technologies that embody the desires and goals of the public.[24] The fact that Dune takes place more than twenty thousand years from now should also be a humbling reminder to us of how much our current political and cultural norms might change over time.

Dune's ethics of technology is science fiction at its most provocative: a fascinating speculation about what kind of ethical values might shape human practices tens of thousands of years from now.[25]

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[23] I've offered some deliberations about what humanity's goals should be in exploring space, while others talk about what types of values we want to create through making everyday engineered artifacts. Pierre Bertrand, Zachary Pirtle, and David Tomblin, "Participatory Technology Assessment for Mars Mission Planning: Public Values and Rationales," *Space Policy* 42 (2017), 41-53. Shannon Vallor, *Technology and the Virtues: A Philosophical Guide to a Future Worth Wanting* (New York: Oxford University Press, 2016).

[24] Zachary Pirtle and Zoe Szajnfarber, "On Ideals for Engineering in Democratic Societies," in Diane P. Michelfelder, Byron Newberry, and Qin Zhu eds., *Philosophy and Engineering: Exploring Boundaries, Expanding Connections* (New York: Springer, 2017), 99-112.

[25] All opinions here are my own and do not necessarily reflect views of my employers. I appreciate significant comments and edits from Jared Moore, Ryan Britt, and Katelyn Kuhl. On the role of science fiction, see also: Malka Older and Zachary Pirtle, "Imagined Systems: How the Speculative Novel Infomocracy Offers a Simulation of the Relationship Between Democracy, Technology, and Society" in Zachary Pirtle, David Tomblin, and Guru Madhavan, eds., *Engineering and Philosophy: Reimagining Technology and Social Progress* (New York: Springer, 2021).