

The Anthropocene's Unjust Heirs: Intergenerational Ethics in a Post-Natural World

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Abstract— The foundational premise of mainstream intergenerational ethics, as articulated by thinkers like Hans Jonas and John Rawls, is that future generations will inherit a “natural” world – a biogeophysically stable Earth system broadly analogous to the Holocene conditions that nurtured the development of human civilization. The proposed epoch of the Anthropocene fundamentally shatters this premise. This paper argues that future generations will not inherit a pristine or self-regulating nature, but a planet pervasively and perpetually shaped by direct human technological management, from climate geoengineering and genetic rescue of species to large-scale pollution remediation and automated conservation systems. This seismic shift renders traditional models of intergenerational ethics, centered on conservation, non-maleficence, and resource distribution, critically inadequate. Our primary duty to the future is no longer merely one of preserving a natural legacy but has transformed into a daunting responsibility of stewardship over complex, irreversible socio-ecological-technological systems. This paper investigates the profound ethical implications of this new responsibility, which we term the “Anthropocene Inheritance.” It entails novel and poorly understood obligations, including the duty to transmit the capacity and knowledge to manage these technological systems, the justice implications of imposing “obligatory technological dependencies,” and the rights of future people to consent to or refuse their inherited technological condition. Through an analysis of emerging technologies like Solar Radiation Management and CRISPR-driven genetic conservation, this paper develops a new ethical framework: “Techno-Stewardship Justice.” This framework obligates present generations to ensure that the actively managed planet we bequeath is not only habitable but also just, navigable, and does not foreclose the ability of future generations to define their own relationship with the world, thereby preserving their autonomy in a post-natural age.

Keywords: Anthropocene; Intergenerational Ethics; Geoengineering; Technological Stewardship; Future Generations.

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INTRODUCTION: THE END OF NATURAL INHERITANCE

For millennia, the relationship between human generations has been framed by the concept of a natural inheritance. Each new cohort enters a world not of its own making, a biophysical reality shaped by cosmic, geological, and evolutionary forces that operate on scales far exceeding human history. This stable Earth system, the Holocene, provided the environmental preconditions for the development of agriculture, complex societies, and the very idea of a future to be planned for. Traditional intergenerational ethics, consequently, has been largely an ethics of *handing down*. It concerns itself with what we owe to those who come after us, predicated on the assumption that the fundamental stage—the Earth itself—will remain broadly recognizable and governed by familiar, autonomous natural processes.

The philosophical architecture of this tradition is robust. Hans Jonas's "imperative of responsibility" commands us to ensure that the conditions for an "authentically human life" persist for future generations, focusing on the avoidance of existential threats. John Rawls's theory of justice, extended intergenerationally, asks what principles of justice we would choose behind a "veil of ignorance" not knowing which generation we would belong to, leading to a "just savings principle" that obligates each generation to preserve a fair share of capital and resources for its successors. The Brundtland Commission's definition of sustainable development as meeting "the needs of the present without compromising the ability of future generations to meet their own needs" similarly operates within a paradigm of managed resource use within a stable natural system. The underlying, often unstated, assumption is that the planet itself is a constant.

The concept of the Anthropocene, however, announces the violent closure of this Holocene paradigm. It posits that human activity has become the dominant force shaping Earth's geology and ecosystems, pushing the planetary system beyond the stable boundaries of the last 10,000 years. We are now living in a world of our own making, characterized by climate disruption, ocean acidification, mass species extinction, and the global dispersion of novel entities like plastics and radioactive isotopes. This new reality forces a radical and unsettling reconceptualization of intergenerational ethics. The central question is no longer simply what we should *conserve* for the future, but what kind of *active, managed world* we are *creating* for it. Future generations will not inherit a natural world to steward; they will inherit a portfolio of planetary-scale interventions, technological fixes, and managed ruins—a "post-natural" world.

This paper seeks to map the treacherous ethical terrain of this new intergenerational compact. It poses the central research question: **In what ways does the condition of the Anthropocene—specifically, the inevitability of bequeathing a technologically-managed and profoundly altered planet—demand a fundamental**

rethinking of the principles, scope, and content of our ethical obligations to future generations?

Our central thesis is that the Anthropocene necessitates a paradigm shift from an ethics of *conservation and non-maleficence* to an ethics of *active techno-stewardship and just inheritance*. The defining intergenerational challenge is no longer merely to avoid harming future people by depleting resources or destabilizing the climate, but to manage responsibly the powerful, long-lived, and often irreversible technological systems we are deploying to address the very crises we have created. We are moving from being caretakers of a natural estate to being architects of a planetary system, with all the immense and unprecedented responsibilities that entails.

The structure of this paper is as follows. First, we will critically examine the foundations and subsequent failures of Holocene-centric intergenerational ethics, highlighting their inability to contend with a world of active planetary management. Second, we will delineate the contours of the “Anthropocene Inheritance,” describing the specific suite of technological interventions and managed environments that future generations will be compelled to engage with. Third, we will dissect the novel ethical dilemmas this inheritance generates, focusing on the problem of obligatory technological dependencies, the duty of knowledge and capacity transfer, and the threat to future autonomy. Fourth, we will introduce and elaborate upon the proposed ethical framework of “Techno-Stewardship Justice,” outlining its core principles. Finally, we will apply this framework to two critical case studies—climate geoengineering and biotechnology-driven conservation—before concluding with a discussion of the profound institutional and governance implications for the long-term future.

THE FOUNDATIONS AND FAILURES OF HOLOCENE-CENTRIC INTERGENERATIONAL ETHICS

To understand the radical break introduced by the Anthropocene, one must first appreciate the deep-seated assumptions that have underpinned ethical thought about the future. The work of key philosophers in this domain, while monumental in its ambition, is built upon a set of premises that the new geological epoch renders obsolete.

Hans Jonas’s philosophy of responsibility, developed in response to the technological power unveiled in the 20th century, represents a profound attempt to establish an ethical imperative for the future. His “heuristics of fear” suggests that we should give greater weight to prophecies of doom than to prophecies of bliss, leading to his central maxim: “Act so that the effects of your action are compatible with the permanence of genuine human life.” For Jonas, this meant exercising a precautionary principle towards technologies with potentially catastrophic and irreversible consequences. However, Jonas’s framework operates with a static, almost Aristotelian,

conception of “genuine human life” and its natural conditions. It is an ethics designed to *preserve* a given order of being against technological hubris. In the Anthropocene, this is no longer a sufficient guide. We are past the point of mere preservation; we are now in the realm of active, and often desperate, technological intervention to maintain basic planetary habitability. The question is no longer whether to intervene, but *how* to intervene justly and wisely. Jonas’s ethics provides a powerful warning but offers little guidance for the messy, triage-like decisions of planetary management that now confront us.

John Rawls’s theory of justice, while primarily focused on intra-generational equity, has been extensively applied to intergenerational problems. His “just savings principle” suggests that each generation should set aside a fair share of real capital and resources for its successors, building up to a point where a just society can be sustained indefinitely. This model is fundamentally economic and resource-based. It imagines the future as a series of generations drawing down or adding to a common pool of capital within a stable environmental context. The Anthropocene shatters this image. The “savings” we are bequeathing are not only financial or manufactured capital but also, and more significantly, a legacy of radioactive waste, climatic instability, eroded ecosystems, and a biosphere populated by genetically engineered organisms and invasive species. Furthermore, the concept of “savings” implies a passive transfer. In the Anthropocene, the inheritance is active and demanding; it requires future generations to *operate* and *manage* the technological systems we have set in motion. Rawls’s model, focused on distributive justice for a static set of goods, cannot account for the justice of imposing dynamic, high-maintenance, and risky technological responsibilities on the future.

The discourse of sustainable development, as enshrined in international policy, suffers from a similar limitation. Its core principle—to meet present needs without compromising future needs—relies on the Holocene assumption of a resilient, self-regulating natural system that can replenish itself if human pressures are adequately managed. It envisions a future where humanity lives in harmony with a restored nature. The Anthropocene suggests a different trajectory: a future of “designer ecosystems,” climate-controlled by stratospheric aerosols, and coasts protected by automated engineering works. Sustainability, in this context, becomes less about restoring a natural balance and more about perpetually managing an artificial one. The ethical question shifts from “Are we consuming too much?” to “What kind of controlled and engineered world are we creating, and is it a just one to impose on our descendants?”

The common failure of these Holocene-centric frameworks is their inability to grapple with three core attributes of the Anthropocene condition: **irreversibility, active management, and the end of nature as an external referent**. We are creating changes—

in climate, in biodiversity, in geochemistry—that will persist for millennia, far beyond the lifespan of any human institution. These changes will not simply “recover”; they will require continuous monitoring and intervention. And the “nature” that future generations will experience will be a hybrid, a product of both natural and human forces, devoid of the wilderness that has long served as a benchmark for health and a source of meaning. Our ethical frameworks must be rebuilt from the ground up to address this new reality.

THE CONTOURS OF THE ANTHROPOCENE INHERITANCE: A PORTFOLIO OF INTERVENTIONS AND RUINS

The legacy we are preparing for future generations is not a single, monolithic burden but a complex and diverse portfolio of socio-ecological-technological systems. Understanding the specific components of this inheritance is crucial for diagnosing the ethical challenges they pose. This portfolio can be broadly categorized into three, often overlapping, domains.

The first domain is that of **Climate Intervention and Geoengineering Technologies**. As mitigation efforts continue to lag, the prospect of large-scale climate engineering becomes increasingly likely. The most widely discussed approach is Solar Radiation Management (SRM), which aims to cool the planet by reflecting a small percentage of sunlight back into space, for instance by injecting sulfate aerosols into the stratosphere. Bequeathing an SRM regime to future generations represents an ethical quandary of staggering proportions. It would be a global technological system that must be maintained continuously to prevent a catastrophic “termination shock”—a rapid and devastating rebound of global temperatures if the program were ever stopped. Future generations would thus inherit an obligatory dependency: they would be forced to manage the SRM system indefinitely, regardless of their cultural values, political preferences, or the financial cost, simply to avoid an immediate planetary emergency. They would have no choice but to become the permanent operators of the global thermostat, a responsibility fraught with immense technical challenges and geopolitical perils.

The second domain encompasses **Biotechnological Stewardship and Bio-engineering**. In response to the biodiversity crisis, we are developing and deploying a suite of powerful biotechnologies. This includes “genetic rescue” using tools like CRISPR to enhance the resilience of endangered species to disease or climate change, and the more controversial “de-extinction” projects that aim to resurrect lost species. Furthermore, “gene drives” are being researched as a way to genetically engineer entire wild populations, for instance, to eliminate invasive species or suppress mosquito-borne diseases. Bequeathing these technologies means handing over a living, evolving

toolkit. Future generations will inherit a biosphere where the genetic boundaries between “natural” and “artificial” are permanently blurred. They will be tasked with managing these engineered species and their unpredictable ecological consequences in perpetuity. This includes making decisions about which forms of life to prioritize, which to alter, and which to let go—decisions that carry profound ethical weight and which we are making today by default through our actions and inactions.

The third domain is the **Legacy of Managed Ruins and Continuous Remediation**. Beyond active technological systems, future generations will inherit landscapes and ecosystems that are permanently degraded and require constant, energy-intensive management to remain functional or safe. This includes nuclear waste repositories that must be monitored and secured for hundreds of thousands of years, a timescale that dwarfs human civilization. It includes coastal megacities protected by vast and ever-expanding systems of sea walls, pumps, and barriers—a permanent war against the rising ocean. It includes “novel ecosystems” composed of new combinations of species, which may provide some ecosystem services but lack the historical biodiversity of the systems they replaced. These are not problems that can be solved; they are conditions that must be managed. The inheritance here is one of perpetual, costly caretaking of our failures and our stop-gap solutions—a Sisyphean task that will consume a significant portion of future societies' resources and attention.

Together, these three domains constitute the Anthropocene Inheritance: a world that is not self-sustaining but must be actively and knowledgeably held in a state of precarious habitability. It is a world where the distinction between preserving nature and managing a planetary artifact has collapsed.

NOVEL ETHICAL DILEMMAS IN A POST-NATURAL WORLD

This new form of inheritance generates a set of ethical dilemmas that are largely unprecedented in the history of ethical thought. These dilemmas move beyond questions of distribution to questions of power, autonomy, and the very structure of human responsibility.

The most pressing dilemma is that of **Obligatory Technological Dependencies**. By deploying certain technologies, particularly those with “lock-in” effects like large-scale SRM, we effectively force future generations into a relationship of total dependence. They are given no choice but to continue the technological regime, investing their own resources and foreclosing other possible futures, simply to prevent a catastrophe they did not create. This creates a form of intergenerational coercion. It is the ethical equivalent of strapping a bomb to a hostage and handing the trigger to a future person, demanding they never let go. The injustice lies not only in the risk and cost imposed but in the radical restriction of future freedom. It robs them of the autonomy to choose their

own path, locking them into a technological trajectory defined by the shortsightedness of the past.

This leads directly to the second dilemma: **The Duty of Knowledge and Capacity Transfer**. If we are bequeathing a world that requires sophisticated, continuous management, then a mere transfer of material assets is grossly insufficient. We have a profound duty to ensure that future generations possess the knowledge, skills, and institutional capacity to manage the systems we are imposing upon them. This goes far beyond leaving behind scientific data. It requires the transmission of a complete “operating manual” for the planet, including the tacit knowledge of how to maintain geoengineering platforms, the ethical frameworks for making biotechnological choices, and the social and political institutions robust enough to manage these powers wisely over centuries. The failure to provide this would be a catastrophic intergenerational injustice, akin to handing over the keys to a complex machine without any instructions, with the certain knowledge that a malfunction would be fatal. This raises immense practical challenges: How can knowledge be preserved across civilizational timescales? How do we design institutions that are resilient to collapse and tyranny?

The third, and perhaps most profound, dilemma concerns **Future Autonomy and the Right to Refusal**. At the heart of liberal political theory is the idea that legitimate governance requires the consent of the governed. But the governed in this case are unborn. By designing their world in advance, we are making fundamental choices for them about the very character of their existence. Do they have a right to refuse their inheritance? Do they have a right to a world that is not a high-maintenance technological artifact? The Anthropocene Inheritance threatens what we might call the “openness of the future”—the capacity for each generation to define its own projects, values, and relationship with the world. A future generation might value wilderness and autonomy above technological security, but we are foreclosing that option. We are designing a world that demands a specific kind of future society—one that is technologically adept, centrally managed, and perpetually vigilant. This pre-emptive shaping of future political and cultural possibilities is a subtle but deep form of tyranny across time.

A FRAMEWORK FOR TECHNO-STEWARDSHIP JUSTICE

To address these novel dilemmas, we need a new ethical framework that moves beyond the conservation paradigm. We propose a framework of “Techno-Stewardship Justice,” which posits that our primary intergenerational obligation in the Anthropocene is to ensure that the actively managed planet we bequeath is not only habitable but also just, navigable, and autonomy-respecting. This framework is built on four core principles.

The first principle is the **Principle of Reversibility and Plural Future Options**. Whenever possible, we should prioritize technological interventions and policies that are reversible or that keep future options open. This is a direct response to the problem of lock-in and obligatory dependencies. For example, investing in carbon dioxide removal technologies, while costly, is preferable to SRM from a justice perspective because it does not create a permanent, catastrophic termination risk. It is a remediation effort, not an ongoing management dependency. Technologies that are easily discontinued or that allow for a range of future societal choices should be favored over those that force a single, narrow path.

The second principle is the **Principle of Demonstrated Capacity and Knowledge Stewardship**. We should not deploy any long-term, planetary-scale technological system unless we can simultaneously demonstrate and institutionalize a robust plan for transferring the capacity to manage it to future generations. This involves not just scientific data archiving but also the creation of “stewardship institutions” designed for longevity, the cultivation of relevant knowledge and skills, and the embedding of ethical guidelines into the very design of the technology. It means treating the knowledge and social capacity for management as a non-negotiable part of the technological package, without which its deployment is ethically unjustifiable.

The third principle is the **Principle of Minimal Pre-emption**. Our technological choices should seek to minimize the extent to which they pre-empt the political, cultural, and aesthetic choices of future generations. We should avoid, where possible, creating realities that demand a specific form of social organization (e.g., global authoritarianism to manage SRM) or that irrevocably destroy options they might value (e.g., driving a culturally significant species to extinction or geoengineering a unique regional climate). The goal is to leave a world that is as open-ended as possible, allowing future people the space to craft their own destinies.

The fourth principle is the **Principle of Inclusive and Adaptive Governance**. Recognizing that our current knowledge is limited and the future is unpredictable, the governance of Anthropocene technologies must be designed to be inclusive of diverse perspectives and adaptive to new information and changing values. This means creating decision-making processes that are transparent, accountable, and incorporate voices from a wide range of disciplines, cultures, and nations. It also means building feedback loops and review mechanisms that allow future generations to reassess and, if necessary, alter the technological systems they inherit, in line with their own values and knowledge.

CASE STUDIES IN TECHNO-STEWARDSHIP JUSTICE

Applying this framework to real-world issues illuminates its practical implications and the difficult choices it mandates.

Case Study 1: Solar Radiation Management (SRM)

From the perspective of Techno-Stewardship Justice, SRM appears highly problematic. It scores poorly on the Principle of Reversibility, creating a severe lock-in effect and a massive termination risk. It would likely require a global, centralized governance structure, violating the Principle of Minimal Pre-emption by foreclosing more decentralized, localized futures. Its implementation would demand an unprecedented and likely unachievable level of Demonstrated Capacity for millennial-scale management. Therefore, the justice-based conclusion is that SRM should be considered a option of absolute last resort, if at all. The primary ethical duty is to pursue all other pathways—aggressive mitigation, adaptation, and carbon dioxide removal—with far greater vigor, as they align more closely with the principles of keeping options open and minimizing pre-emption.

Case Study 2: Biotechnology for Conservation

The use of CRISPR for genetic rescue of endangered species presents a more nuanced case. If used to restore a species' resistance to a pathogen introduced by humans, it could be seen as an act of restorative justice, aligning with the Principle of Reversibility by undoing a human-caused harm. However, if used to fundamentally redesign a species for a new climate, it risks creating a “conservation dependency” and pre-empting future values about what constitutes “natural” or “authentic” life (Minimal Pre-emption). The just path requires a strict application of the Principle of Demonstrated Capacity: we must not release engineered organisms without a clear, long-term plan for monitoring and managing their ecological consequences. And it demands Inclusive Governance, involving not just scientists but also ethicists, Indigenous groups, and the public in deciding which species to alter and how.

CONCLUSION: GOVERNING THE LONG NOW

The Anthropocene marks a definitive end to the era of natural inheritance. We can no longer relate to the future as passive beneficiaries of a stable Earth; we are now

active, and often clumsy, architects of its condition. This paper has argued that this new role demands a new ethics—an ethics of Techno-Stewardship Justice. This framework recognizes that our most significant legacy will not be the resources we leave behind, but the technological systems and managed environments we set in motion, and the freedoms we either preserve or foreclose for our descendants.

The implications are profound. It calls for a radical humility in our technological ambitions, a preference for reversible and flexible interventions over rigid, lock-in solutions. It demands that we begin the immense work of building institutions capable of stewarding knowledge and exercising responsible governance over centennial and millennial timescales—what the Long Now Foundation calls “the slow democracy of the centuries.” And it requires us to constantly interrogate our own actions through the lens of future autonomy, asking not only “Is this safe for the future?” but also “Does this allow the future to be free?”

The task is daunting, but it is the essential ethical work of our time. We stand at a unique pivot in history, the first generation to be fully aware that we are shaping the geological future. The question is whether we will do so with a narrow focus on our own short-term security, or with a profound and expansive sense of justice for the unjust heirs of our post-natural world. The quality of their future, and the meaning of our own, depends on the answer.

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