

million generations'.<sup>199</sup> So, we are always liable to fail our promise and be tempted into errancy.

Ever since Odoevsky's musings on detonatalism, the realisation that our evolutionary past continues to jeopardise our future, that artificial pleasures threaten to become all-consuming, and that humans are vanishing into their machines, have anticipated and contributed to the modern notion of X-risk as a *failure of potential*. Rejecting the 'easy path' to becoming criminal crustacea, and avoiding omnicing ourselves through our pursuit of agreeable gratification, ours must be the harder path. A path which, for Haldane, was one of constant exploration and the resilience that comes with it, a ceaseless flight from the deadly stagnancy that can result from getting everything your past self ever wanted.

And as we will find out in the next chapter, to escape extinction, we may need to reengineer everything—from sex to the stars.

199. Haldane, *Possible Worlds*, 279.

## 6 Physical Salvation: Vocation

*Besides, we are still too close to the birth of the universe to be certain about its death.*

J.D. Bernal, 1929<sup>1</sup>

*Compromise means trading the peaceful existence of yourself and your own generation against thousands of future generations which never will behold the light of the day.*

E. Öpik, 1973<sup>2</sup>

*Nature outside of man will not act to preserve human values; it is our responsibility alone.*

W.H. Murdy, 1975<sup>3</sup>

*Stars have made life. Life should therefore make stars.*

R. Zubrin, 1999<sup>4</sup>

*Ethicists tend not to be much interested in cosmology and vice versa. But the ultimate fate of our Hubble volume may turn on our values.*

D. Pearce, 2013<sup>5</sup>

*For we know that the whole creation has been groaning and travailing in earnest expectation.*

Romans 8:22

1. Bernal, *The World, the Flesh and the Devil*, 28.
2. E. Öpik, 'Our Cosmic Destiny', *Irish Astronomical Journal* 11 (1973), 123.
3. W.H. Murdy, 'Anthropocentrism: A Modern Version', *Science* 187:4182 (1975), 1168–72.
4. R. Zubrin, *Entering Space: Creating a Spacefaring Civilization* (New York: Putnam, 1999), 246.
5. D. Pearce, 'Social Media Unsorted Postings' (2013), <<https://www.hedweb.com/social-media/pre2014.html>>.

### Existential Hope

Anton-Wilhelm Amo was a member of the Nzema people, born on the Gold Coast of what is now Ghana. Snatched as a toddler by the Dutch West India Company and trafficked to Europe, little Amo was given as a 'gift' to a wealthy German named Anthony Ulrich, the Duke of Brunswick-Wolfenbüttel. Despite this early injustice, Amo overcame the hurdles facing him and managed to determinedly pursue his desire to study philosophy. He went on to become the first African to attend a European university, where he excelled, producing a dissertation on the rights of Africans in Europe, and later lectured at the universities of Halle and Jena on topics ranging from logic to cryptography.<sup>6</sup>

In 1738, Amo penned a philosophical treatise expounding upon the purpose of human existence, where he wrote that the end of all human learning is 'on the one hand self-preservation [and] on the other perfection'. This applies 'collectively and singly', he emphasised: not just to the individual's plight, but to that of the entire species. The aim of intelligence, beyond its instrumentality for survival, allowing the 'mutual preservation of all men', is *also* to enable 'the perfection of man [to] take on all possible increase'.<sup>7</sup>

In the profound words of this Ghanaian philosopher speaking from the opening years of the Enlightenment, there is already a clear distinction being made between our flourishing as a species and mere survival. Survival is sufficient in order to flourish, but flourishing cannot be measured by survival alone, or by an increase in numbers. Amo recognises that the human organism doesn't just live or die, it doesn't just either have offspring or not, more progeny or less; there are other measures by which it can be said to succeed or fail. And the same thing goes for the species as a whole. Amo here anticipates an important distinction in current X-risk research, the concern of which is not merely whether there are still humans on this planet or elsewhere, but *what* they are doing and whether they can achieve their full potential—for,

6. N. Lochner, 'Anton Wilhelm Amo: A Ghana Scholar in Eighteenth-Century Germany', *Historical Society of Ghana* 3:3 (1958), 169–79.

7. A.W. Amo, *Antonius Gviliemus Amo Afer of Axim in Ghana: Translation of His Works*, tr. L.A. Jones (Halle: Martin Luther University Press, 1968), 104–17.

as Amo demonstrated admirably in his life and career, being human is about what we do and what we can achieve, not just about perpetuating a set of biological characteristics.

Across the ensuing decades and centuries after Amo's treatise, this recognition would build into one of the most important ideas of recent history: the idea of a **human vocation**.

Such a phrase may sound quaint and lofty now, perhaps even backward. You certainly won't find it in many contemporary scientific or philosophical publications. But perhaps it is an idea whose time has come again: risks multiply on the horizon, and the coming century may be one in which our species has to call upon all of its resources in a struggle to survive—but why fight unless we know *why* we are fighting? Moreover, since success and survival are different things, it is possible we could survive *in the wrong way*: we might become a criminal species, an actively malignant one. But it is exactly because we recognise this that we have the potential to be better, and this is what makes understanding and averting X-risk into a purposeful project that aims at a radically better future, rather than a purposeless struggle against attrition. Other animals struggle and strive, no doubt, but only humans can be said to have reached a point of lucidity where they have understood that they themselves can give a *why* to their struggling and striving—by recognising their potential to exert a genuine influence on the amount of value in the universe, and answering to the duties that flow from this. Even though its importance is often overlooked now, the unfolding understanding of our vocation was an essential driving force in the historical conversation that led to the questions of modern X-risk research.

Historically, we came to care about the possible extinction of the human precisely as we began to acknowledge the radical promise that makes humanity meaningful—the existential hope that comes from the conviction that *we are here for a reason*, that we have a *vocation*. But this is a reason and a vocation that we give to ourselves, by taking responsibility for our existence. It can come from nowhere else.

Indeed, we realised that our continued existence has a reason just as we realised that it is possible that the very existence of reason may depend solely upon us: that we cannot rely upon God or Nature to

uphold all that we find valuable.<sup>8</sup> This idea of a human vocation is not a matter of tradition or dogma, we may not have lived up to it in the past, and we do not yet have a complete or final understanding of it, but it is linked to the undecided *future* of the human race, to a ‘why’ that we ourselves must continue to construct. It is our vocation because *we grant it to ourselves*—by recognising, more and more, what is truly at stake in our decisions.

This final chapter in the history of X-risk traces the emergence of this species-wide vocation, and hints at how it might be refurbished for the challenges of the turbulent epoch ahead. By looking at how others historically responded to the question ‘What is to be done?’ in the wake of the monumental discovery of human extinction, we can discern the outlines of what our response may need to look like during the next episode of cosmic history, should Earth-born intelligence make it out of its precarious phase of adolescence. And in the increasingly awe-inspiring ways in which thinkers have imagined humanity constructively responding to the discovery of X-risk *by truly coming of age as a civilisation*, we will glimpse the emergence of a new, secular **doctrine of salvation** (a ‘soteriology’) based purely on the modern naturalised, desacralised, and imperilled world view.

### Birth of a Vocation

It is 1820, and Hegel scribbles away furiously in his apartment on Leipziger Straße, which looks down onto the aristocratic boulevards of Berlin’s beating heart. Deep in thought, he dips his quill, pauses, and pens a seemingly unassuming line to record a dawning realisation: in the ethical system of his predecessor, Kant, one cannot readily make out any argument for why the human species should *not* go extinct if everyone wished it so. In Hegel’s own words, Kant’s ethics fails to explicitly

8. As we explored in Chapter 2, ‘we’ need not mean terrestrial humanity, but just ethically-recognisable beings in general—the prevalence or non-prevalence of which remains to be determined by scientific study and exploration. Also, even if we cannot be *absolutely certain* it all depends upon us, a nonzero probability of that being the case means that we should still act with great caution, *as if it were*—given the severe consequences of our extinction if we are indeed alone.

give a reason why ‘the death of the whole human race’ would be inherently wrong.<sup>9</sup> Of course, Kant would certainly have agreed that this would be an enormous evil—and, as we have seen, he became increasingly concerned with extinction as he aged—but his system *gives no explicit reason as to why*. Hegel’s observation of this is only part of a larger argument, a small cog in his vast lumbering machine. Nonetheless, the German philosopher has just glimpsed a monumental truth. Almost by accident, he has stumbled upon the realisation that any coherent ethical outlook must be able to *rationally justify* its most fundamental assumption: that the human species, as a collective entity, ought to continue existing.

After all, if those who think that humanity should *not* go on existing (anti-natalists, for example) are called upon to justify their belief by supplying reasons for this misanthropic conviction, shouldn’t we also demand reasons from those who hold that *we should* fight for humanity’s survival? Enlightenment reason was founded upon asking for reasons for all social institutions and practices.<sup>10</sup> So, taken to its conclusion, it dictates that we ought to do the same for the survival of the whole. We can no longer go on *simply assuming* this principle; it is no longer good enough to continue merely surviving and striving unreflectively, caring about our continued existence just because our biology programs us to do so. This isn’t even a *reason*, in the ethical sense of the term, for biology involves only causes, not reasons. Kant sensed it, Darwin’s findings proved it: biology does not follow *purposes* in any moral sense of the term, far from it: instincts have no concern for right or wrong. So we have to make our own reasons. To ethically justify our existence—to give a genuine legitimating moral reason for

9. “The [...] Kantian formulation [...] in itself contains no principle beyond formal identity and the “absence of contradiction” [...]. The absence of property contains in itself just as little contradiction as the non-existence of this or that people, family, etc., or the death of the whole human race. But if it is already established on other grounds and presupposed that property and human life are to exist and be respected, then indeed it is a contradiction to commit theft or murder; a contradiction must be a contradiction of something, i.e. of some content presupposed from the start as a fixed principle’. G.W.F. Hegel, *Outlines of the Philosophy of Right*, tr. T.M. Knox (Oxford: Oxford University Press, 1952), 131.

10. Kant, *Critique of Pure Reason*, 99–100 [Axi–Axii].



its continuance—is to elevate it beyond the realm of blind survival. It is to realise that human flourishing is liable to assessment by criteria other than the survive-or-die tribunal of the evolutionary meat-grinder. *It is to make our existence into a vocation.*

At its simplest, this idea of a vocation is that the human constitutes not just a biological germline but also a project of ethical self-betterment. It is a radical recognition of our potential to do good. Because our species recognises and responds to ethical argumentation, it can exert a genuine influence on the amount of value there is, and this is why our survival *matters morally*. We do not merely survive or die, we flourish or fail, and whatever we do, we will have earned it.

The idea first surfaced in Germany, early on during the Enlightenment—which was nothing if not an efflorescence of self-conscious reflections on humanity as a historic collective project. Aside from earlier intimations in the visions of thinkers such as Amos, the first usage of the word ‘vocation’ came from an unassuming pamphlet published anonymously in 1748 by Johann Joachim Spalding entitled *Meditations on the Vocation of Man*.<sup>11</sup> The notion took hold and, over the next century or so, no less than seventy-one books were published in German with similar titles.<sup>12</sup> Almost immediately, the giants of German Enlightenment philosophy—Kant, Fichte, Schelling, Hegel, Marx—all took up the theme and deployed it at the heart of their sprawling and massively influential systems. Where such heady themes proved for a long time unpalatable to the ingrained philosophical modesty of the Anglophone West, they found fertile soil in the speculative spirit of the Slavic East, where, within the Russian intellectual movement of Cosmism, they first became attached to existential questions of human flourishing and extinction. The idea of the human vocation elaborated during these historical episodes has fuelled the visions of transhumanists, utopians, and optimists ever since.

In 1784, Kant defined enlightenment as humanity’s emergence from immaturity. This was conceived of as the assumption of ever greater

11. J.J. Spalding, *Betrachtung über die Bestimmung des Menschen* (Greifswald, 1748).

12. F. Jannidis, ‘Die “Bestimmung des Menschen”—Kultursemiotische Beschreibung einer sprachlichen Formel’, *Aufklärung* 14 (2002), 75.

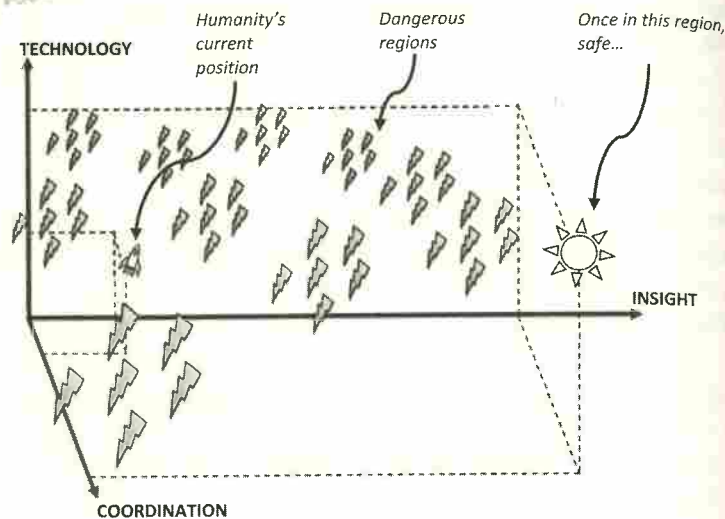
responsibility for ourselves as moral agents in a physical universe: exerting greater control over our means of existence (thus liberating ourselves from need and disaster) and assuming greater accountability in relation to our beliefs and institutions (thus overcoming ignorance and injustice). However, the first person to really notice that this passage from immaturity to maturity is not just an abstract question of liberation, but has genuinely *existential implications* for our species, was the founder of the Russian Cosmist movement, Nikolai Fedorov. Taking up the metaphor of the transition to maturity, around the turn of the 1900s he argued that

[t]he question of minority and majority is a question of either crisis, as a necessary consequence of minority, or amnesty as a result of coming of age; amnesty instead of doomsday, universal war, annihilation and planetary catastrophe.<sup>13</sup>

By ‘amnesty’, as we shall see below, Fedorov meant something like *salvation*—the concerted removal of all injustice from the physical world. And the mere possibility of extinction, the fact that we find ourselves in a universe full of threats to our very existence, is surely the injustice of all injustices. Although Fedorov was deeply religious, he nonetheless believed that it was up to the human race to save itself from this predicament: he clearly saw that if *we ourselves* don’t assume full responsibility for our means of existence and actively minimise such iniquities, then sooner or later, in cosmic timescales, our species will inevitably succumb to extinction. This then is the stark alternative Fedorov poses: remain immature and go extinct, or assume maturity and achieve long-term flourishing.

Once the emergence of nuclear weapons had manifested the very real threat of the ‘universal war’ Fedorov had warned of, astronomers such as Carl Sagan began to talk about this path to civilisational maturity as one that *any* intelligent species must tread. In the 1970s, Sagan spoke of ours as an age of ‘technological adolescence’: an epoch where

13. Fedorov, *Sochineniya*, vol. 1, 402.



'The challenge of finding a safe path'. Diagram from Nick Bostrom's paper 'Existential Risk Prevention as Global Priority', *Global Policy* 4:1 (2013).

humans have acquired the power of 'self-destruction' but not yet the institutional wisdom, resilience, or foresight required to guard against this outcome. He dreamt of 'passing through this stage of technological adolescence into a long-lived, rich and fulfilling maturity [for] our species'.<sup>14</sup> Moreover, he explicitly claimed that this is what gives SETI its profound significance:

The existence of a single message from space will show that it is possible to live through technological adolescence: the civilization transmitting the message, after all, has survived.<sup>15</sup>

Even more recently, since the millennium, Bostrom and others have spoken of 'technological maturity' as a primary goal for our species, defining it as 'the attainment of capabilities affording a level of economic

14. C. Sagan, 'In Praise of Science and Technology', *The New Republic* 176:4 (1977), 21.

15. C. Sagan, 'The Quest for Extraterrestrial Intelligence', *Cosmic Search* 1:2 (1979), 7.

productivity and control over nature close to the maximum that could feasibly be achieved'.<sup>16</sup> Maturity would come when a species attains a level of mastery over itself and its environment that grants as much insulation against X-risk as is physically possible.

### Keeping History Going

Of course, this does not mean that we yet know what this maturity would consist in, institutionally or technologically, nor what is required to get there. Hegel, once again, was one of the first to realise this. Having lived through the heady turmoil of the Napoleonic Wars, he saw that the problem with many ethical claims was that they were not sufficiently *historical*. In his view, abstract commands ('fight injustice' or 'act selflessly') are all well and good, but we cannot know *in advance* everything that they demand of us nor how to best achieve them. We only figure this out by painstakingly and messily correcting ourselves. This takes time; and this 'taking time' is what we call *history*.

It is no wonder Hegel became suspicious of the emptiness and formality of ethical claims, and more attentive to history: as we have seen above, it was precisely within his lifetime that the prerequisites for acting morally had begun to shift radically, and the discovery of X-risk was a part of this shift. Once the presence of morally responsible agents within the universe could no longer be assumed as guaranteed and eternal, securing and fortifying the very existence of moral agents could slowly be revealed as the primary responsibility,<sup>17</sup> the **imperative behind all imperatives**. It may seem to deal with remote possibilities and distant futures, but compared with it, all other moral claims are drastically limited in scope; everything else comes second. After becoming alert to this truth, ensuing generations embarked upon the long process of working out precisely what follows from the recognition that human extinction 'would be the greatest of conceivable crimes'.<sup>18</sup>

16. Bostrom, 'Existential Risk Prevention as Global Priority', 19.

17. H. Jonas, *The Imperative of Responsibility: In Search of an Ethics for the Technological Age*, tr. H. Jonas and D. Herr (Chicago: University of Chicago Press, 1981), 10.

18. H. Sidgwick, *The Methods of Ethics* (London, 1874), 450. Thanks to Matthew van der Merwe for alerting me to this passage.

Indeed, we are still in the process of figuring out precisely what this responsibility demands of us, and, precisely because it is a *historical* process, there are bound to be more shocks on the road ahead. As the previous chapter explored, getting 'what we want' in a simplistic and immediate sense, by gratifying our most ancient desires, may imperil our future—even to the point of extinction. Acting rationally is not just preference satisfaction, it consists in a continual realignment of our preferences, and thus a continual altering of the shape of our future. We may well be wrong about many of our ideas about value, but precisely because of this there is great value in *ensuring that we stick around long enough to correct ourselves*. The imperative behind all imperatives still holds. Bostrom makes the point lucidly:

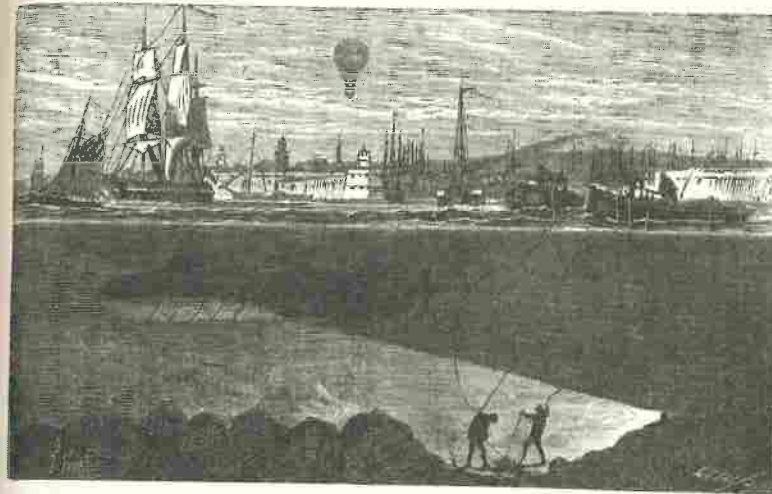
We may not now know—at least not in concrete detail—what outcomes would count as a big win for humanity; we might not even yet be able to imagine the best ends of our journey. If we are indeed profoundly uncertain about our ultimate aims, then we should recognize that there is great option value in preserving—and ideally improving—our ability to recognize value and to steer the future accordingly.<sup>19</sup>

#### Artificial Oases of Value in a Cosmic Desert of Extinction

We are still finding out what maturity looks like. But reviewing the history of conceptions about its general direction reveals a number of consistent themes. One is that, over time, thinkers have become more convinced that the only way to build a moral world—properly insulated from the risk of its extinction—is to make it an *artificial* one.

Historically speaking, the concept of civilisational maturity, together with the idea of a human vocation, emerged precisely in tandem with our awareness of X-risk. Together they imply that, if we are to fully follow through on our determination to mitigate the risk of extinction, we must ultimately forge a world for ourselves of our own design. Leibniz's sanguine theodicy will no longer do. For, upon realising that

19. Bostrom, 'Existential Risk Prevention as Global Priority', 24–26.



The human drive to create oases of value secured against the forces of extinction. Illustration from Léon Sonrel, *The Bottom of the Sea* (1872).

nature lacks all design, is unresponsive to our values, and threatens our project at every turn, we also come to acknowledge that it is up to us to *build* the best of all possible worlds, and that it will necessarily be an artificial world.

Ever since the notion of a human vocation emerged, it has always been about giving a reason to our existence in order to elevate it above mere survival. Giving a reason to our existence is removing everything reasonless about it, and there is nothing more senseless and reasonless than the mere threat of extinction, no matter how slight. That is to say, *there is no acceptable amount of existential risk*. And, as we have increasingly come to understand, numerous X-risks come from large-scale astrophysical phenomena that unfold far beyond the planetary locale—such as near-Earth supernovas, gamma-ray bursts, or encounters with dense molecular clouds.<sup>20</sup> These risks, though remote and seemingly intractable, aren't acceptable either. Thus, another consistent theme in thinking

20. M.M. Ćirković and B. Vukotic, 'Long-term Prospects: Mitigation of Supernova and Gamma-ray Burst Threat to Intelligent Beings', *Acta Astronautica* 129 (2016), 438–46.



about the human vocation is that escaping extinction—entirely rather than partially—demands making our project *extraplanetary*, and redesigning nature's large-scale structures as we go, so that we can yield the greatest possible amount of value whilst fortifying it against the extinction that surrounds it on all sides. In an otherwise inhospitable universe, minimising the threat of X-risk—and fulfilling the imperative behind all imperatives—is identical with maximising the anchorage of value in the wider cosmos by building the empire of the artificial here on Earth and expanding it outward to the stars.

### That Great and True Amphibium, or, Jailbreak from the Darwinian Order

Historically speaking, the shock of extinction really hit when we realised that none of our ethical preferences were inherent in the natural world. Though troubling, this also presented an opportunity: it unveiled the radical promise of our vocation by facilitating recognition that what is natural—all those things that we blindly inherit from evolution's aimless aeons—cannot constitute a model for, or a limit upon, human potential to do good.

Rewind to the fifteenth century, when Italian renaissance nobleman Giovanni Pico della Mirandola wrote that the human is the only creature lacking a set place in the natural hierarchy—an animal with an 'indeterminate image', a kind of 'chameleon':

The nature of all other creatures is defined and restricted within laws which We have laid down; you, by contrast, impeded by no such restrictions, may, by your own free will [...] trace the lineaments of your own nature. [...] It will be in your power to descend to the lower, brutish forms of life; you will be able, through your own decision, to rise again to the superior orders whose life is divine.<sup>21</sup>

As Sir Thomas Browne pronounced later, in 1643, '[t]hus is Man the great

21. G.P. della Mirandola, *Oration on the Dignity of Man*, tr. A.R. Caponigri (Washington DC: Gateway, 1984), 6–9.

and true *Amphibium*'.<sup>22</sup> The human is an amphibious being that falls somewhere between angel and animal, with both the potential to improve itself and the potential to lapse back into thoughtless instinctual behaviour. But what is it that constitutes this ability for self-authorship which distances us from hardwired instincts? Writing in 1711, Anthony Ashley Cooper, Third Earl of Shaftesbury, arguing against the political cynicism of thinkers like Thomas Hobbes and Bernard Mandeville who regarded human nature as essentially selfish, pointed out that when we appreciate the beauty of a painting or a mathematical equation, we are deriving pleasure devoid of the gratification or consummation of any bodily appetite.<sup>23</sup> This state of 'liking' divorced from any 'wanting'<sup>24</sup> is interested but not self-interested—it is a **disinterested interest**. Beauty was considered the paradigm case of this (we will return to this later) but Shaftesbury readily made the connection between aesthetic perfection and altruistic conduct. In both cases, we humans are unique in expending effort pursuing things that do not immediately satisfy any bodily drive or have any imminent survival value. Placing natural compulsion at a distance, this opens up the space for abstract and artificial pursuits both aesthetic and altruistic. It is what gives us our potential to do genuine good, to improve lastingly upon brute nature.

Shaftesbury conceived of such improvement exclusively in the imaterial, private, and spiritual register of individual edification. But his notions of human artifice and artisanship would go on to directly influence the broader idea of our species as in some way constituting a dispassionate vocation rather than merely a self-interested struggle for survival.<sup>25</sup> In particular, his ideas left their mark on Kant, who was the first to truly apply the idea of vocation not just to the tutelage of

22. T. Browne, *Religio Medici* (London, 1645), 73.

23. A.A. Cooper, *Characteristics of Men, Manners, Opinions, Times, Etc.* (London, 2 vols., 1711), vol. 1, 296; see D. von Mücke, *The Practices of the Enlightenment: Aesthetics, Authorship, and the Public* (New York: Columbia University Press, 2015), 1–38.

24. On the modern neuroscientific basis of this distinction, see K.C. Berridge, T.E. Robinson, and J.W. Aldridge, 'Dissecting Components of Reward: "Liking", "Wanting", and Learning', *Current Opinion in Pharmacology* 9:1 (2009), 65–73.

25. P.A. Häcker, *Geistliche Gestalten, Gestaltete Geistliche* (Würzburg: Königshausen & Neumann, 2009), 97.

escape for premeditated risk

the individual but to that of the entire species, connecting it to our capacity to overhaul our shared material conditions rather than merely our private spiritual disposition. Writing in 1784, Kant asserted that *Homo sapiens* is not 'guided by instinct or cared for and instructed by innate knowledge', but instead must 'produce everything out of himself' that is physically needed for survival.<sup>26</sup> This means that the human is uniquely responsible for its own material flourishing or failure: realising that it inherits no home from nature, the human is driven to *forge one for itself*.<sup>27</sup>

Near the turn of the 1900s, over in Russia, Nikolai Fedorov (who was well-read in German philosophy) wrote that the human organism is a 'pauper' when it comes to well-defined instincts and specialised behaviours, and thus has been forced to supplement this unspecialised poverty by developing 'artificial supports' such as 'clothes' and 'dwellings'.<sup>28</sup> In Germany, in the first half of the twentieth century, the notion would be beautifully elaborated by Paul Alsberg, Arnold Gehlen, and others from the tradition that came to be known as Philosophical Anthropology, a movement to which Fedorov himself also properly belongs. They cast human evolution as a dramatic jailbreak from the claustrophobia of predetermined instinct into an open world of artifice and artistry.<sup>29</sup>

But by this time, it was already clear just how hazardous the escape attempt was, and what new dangers it brought with it. In 1940, Gehlen declared that 'man, dependent upon his own initiative, may fail to meet

26. I. Kant, *Anthropology, History, and Education* (Cambridge: Cambridge University Press, 2007), 110; see also J.G. Herder, *Werke* (Frankfurt, 10 vols., 1985–2000), vol. 1, 717.

27. The Romantic idea that the human is uniquely deficient in instincts, and that this initiates our drive to artifice and altruism, finds support in the more modern theory of biological neoteny. Neoteny is a retention of infantile features later into adulthood. Humans are uniquely neotenic: the ability for a human adult to acquire new skills is essentially the retention of what is a childhood trait for other animals. *Ironically, we are able to assume maturity as a species because we, as individuals, never really grow up.* This idea was important for early transhumanists like Haldane and Stapledon. See A. Montagu, *Growing Young* (New York: McGraw-Hill, 1983).

28. Fedorov, *Sochineniya*, vol. 2, 253.

29. P. Alsberg, *Der Ausbruch aus dem Gefängnis* (Berlin: Focus-Verlag, 1975).

[the challenge of survival and thus] is an endangered being facing a real chance of perishing'.<sup>30</sup> Being human is anything but a risk-free vocation. Above all, the strange evolutionary path of the human has somehow made it the only creature to be *conscious* that, beyond the individual's precarious condition, its kind as a whole faces existential risk. And if extinction is the rule of nature, it is our vocation to engage in artifice, compounding our 'amphibious' status in order to escape the biological inevitability of extinction. Indeed, it is a fact that 99.9% of all terrestrial species have ended up extinct.<sup>31</sup> The Darwinian order is a dynasty of death; the only way beyond it is artifice.

### The Naturalisation of Artifice

artificia needed to escape  
from nature and

It was only during the Enlightenment that the ideal of our vocation truly became attached to a desire to artificially change material conditions. But this was anticipated by earlier pioneers such as Francis Bacon, who in 1626 wrote that

[t]he end of our foundation is the knowledge of causes, and secret motions of things, and the enlarging of the bounds of human Empire, to the effecting of all things possible.<sup>32</sup>

Rather than being built for any one natural habitat, the human makes artificial habitations for itself, and is able to expand across all climates and, in Bacon's words, 'enlarg[e] the bounds'. Over the next two centuries, the idea took hold. Enlightenment discourse is peppered with proclamations of the human as a creature that is weak by itself but, with the assistance of tools, can treat the limits of time and space as arbitrary boundaries to be overleaped by manipulating sea, wind, and fire.<sup>33</sup>

30. A. Gehlen, *Man: His Nature and Place in the World*, tr. C. McMillan and K. Pillemer (New York: Columbia University Press, 1988), 24.

31. See Raup, *Bad Genes or Bad Luck*, 3–4.

32. F. Bacon, *New Atlantis* (London: Macmillan, 1911), 32.

33. Carlyle, *Sartor Resartus*, 32.



Burgeoning ideas of a cumulatively artificialised planet—including visions of the earth's interior honeycombed with tunnels and 'subaqueous ways'<sup>34</sup>—were the inevitable outcome of the Enlightenment's critique not only of inherited institutions of belief, but also of the inherited habitat. But they were also an inevitable reaction to growing awareness of existential precarity—the acknowledgement that the Earth system is purposeless and lacks design, to the point where natural processes threaten humans with extinction. To understand that nature will not uphold our values, to the point of extinguishing them, is to realise that we must assert them ourselves at a scale requisite to counter this omnipresent risk.

In the 1770s, Buffon was celebrating humanity's capacity to fortify the implantation of value-laden structures within an otherwise indifferent planetary system. 'Compare [...] brute Nature with Nature cultivated', he wrote:

The entire face of the Earth today carries the imprint of the power of man, which, though subordinate to that of Nature, often created more than did she [...] so it is with the help of our hands that she arrives by degrees to the point of perfection and magnificence that we see today.<sup>35</sup>

Having predicted the becoming uninhabitable of the planet through refrigeration, Buffon was already thinking of the planetary project of 'perfection': a necessary subgoal of which was to fight this frozen fate. The gradual recognition that value could not only be materially diminished but potentially destroyed in its totality leads directly to the hatching of great schemes to stave off such an imperfect outcome.

One of the most ambitious visions of this kind was set out in Fichte's 1799 *Vocation of Man*. We have already encountered Fichte's image of a fully domesticated world where the injustice of catastrophe has been eradicated by perfect prediction. He saw this removal of arbitrariness and antagonism as belonging to 'the last convulsive strokes in

34. A. Pushkin, *Eugene Onéguine*, tr. H. Spalding (London, 1881), 205.

35. Buffon, *The Epochs of Nature*, 124–25.

the formation of our planet, which is now reaching completion', a completion that is only possible with the interpolation of rational planning:

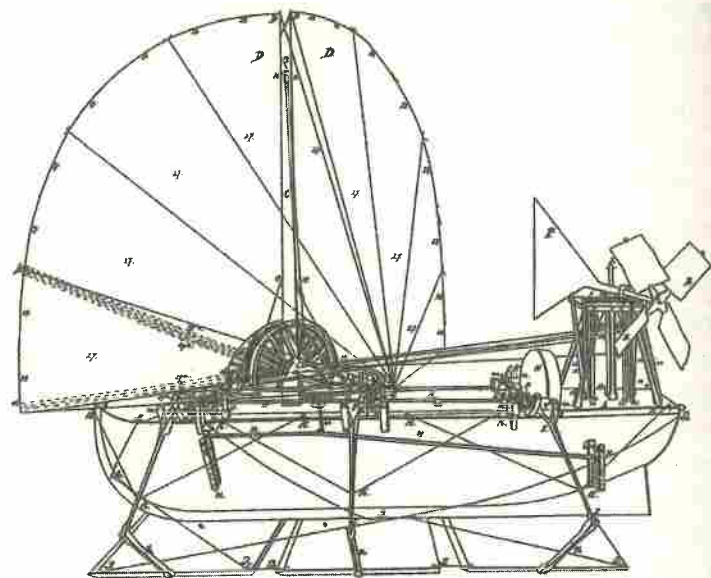
In this way, nature is to become ever more transparent to us until we can see into its most secret core, and human power, enlightened and armed by its discoveries, shall control it without effort.<sup>36</sup>

In this post-scarcity and post-risk world, Fichte foresaw that science, 'first awakened by the pressure of need', and later driven by utility and profit, would finally leave all such instrumental interests behind. Exigent and expedient projects of protection and preemption will steadily fall away, he implied. Science would thus eventually become totally disinterested, an essentially aesthetic manipulation of the environment in the pursuit of conceiving a 'new nature'. Here, ridding the globe of the ugliness of risk is precisely tantamount to its full beautification. Recall how the sixteenth-century theologian Thomas Burnet, with his distaste for our geologically jumbled and haphazard planet, had assumed that our ugly and badly designed home must have been some kind of divine punishment. Thinkers such as Buffon and Fichte were finally standing this upside-down idea back on its feet: *Eden is not something we spiritually lost, but something we must materially build*. Once it is understood that imperfect habitability and threats of extinction are bugs, not features, one can set about fixing them, patching the planet. *buildy Eden*

### Paradise Engineering

Hence the title of one particularly ambitious manifesto from the period: *The Paradise Within Reach of All Men, Without Labour, By Powers of Nature and Machinery*. This came from the pen of John Adolphus Etzler, a German civil engineer who emigrated to the USA in 1831 along with a fellow engineer who would later go on to build the Brooklyn Bridge. Etzler's projects were even more ambitious; he had lofty dreams inspired by his reading of Hegel. Within two years he had made something of a splash in his adopted homeland by publishing a comprehensive instruction

36. Fichte, *Vocation of Man*, 83.



One of Etzler's patent designs for a wave-powered 'Naval Automaton' to make the seas habitable, 1840.

manual for creating a planetary paradise. The pamphlet lays out a macroengineering programme for transforming and refurbishing the globe for maximum habitability with minimum labour, simply by using automated machinery. Etzler's motivation clearly being to stave off the collapse brought on by Malthusian catastrophe, overpopulation, and resource depletion. How? By more efficiently channeling nature's preexisting forces and energy flows, from hydro-power to solar power.

Among many other things, Etzler proposes the building of artificial islands—gigantic wave-powered floating city states—which use the ocean currents to voyage 'in any desired direction with immense power and celerity, in perfect security and in all comforts and luxury, bearing gardens, palaces, with thousands of families'.<sup>37</sup> He also describes methods

37. J.A. Etzler, *The Paradise Within Reach of All Men* (Pittsburgh, 1833), 1.

for harnessing the sunshine itself via vast systems of looking-glasses.<sup>38</sup> Elsewhere, he imagines new ways of crisscrossing the globe—and its 'interior'—with logistics networks capable of 'transporting heavy loads of many thousand tuns [at] 1000 miles in 24 hours'.

Moreover, it wasn't just the globe that we could redesign but also the human life-process: Etzler was confident that his project would 'even put death far beyond the common [term]'.<sup>39</sup> Despite this vision of universal life extension, Etzler was confident that his mega-engineering regime would smash all Malthusian limits. His aim was that '100 millions of square miles might nourish 1,000,000,000,000 of human individuals, that is, about 1,000 times as many as there are actually living on Earth'.<sup>40</sup>

Etzler wasn't just a dreamer: he filed patents and eagerly attempted to recruit disciples, muster funding, and gain government support to implement his paradise-engineering projects. And with such ambition, he did succeed in securing some financial backing. Evidently, however, his earthly paradise failed to materialise. Etzler duly retreated from public life.<sup>41</sup>

### Technofossils of a Brain-Planet

These early visions imagine humanity asserting itself on a planetary scale, intensifying its manipulation of the environment, yielding more welfare from its surroundings, and weaving human volition deeper into the structures of nature in order to fight off crises on the horizon. But what might the endpoint of this interweaving of mind and nature look like?

By 1844, a young Karl Marx, writing from Paris, was already drawing the ultimate conclusion from these cumulative tendencies. Sociologists and economists of Marx's generation were instrumental in bringing the idea of the human vocation 'down to earth', making it a question of alleviating material need and improving concrete conditions.

38. Ibid., 37.

39. Ibid., 1–2.

40. Ibid., 98.

41. See R. Antoni, 'A Counterfeit Utopia', *Cabinet* 51 (2013), 60–68.

In his burgeoning thoughts collected in various notebooks, Marx foresaw that the climactic point of environmental manipulation would amount to both the artificialisation of nature and the naturalisation of artifice.<sup>42</sup> In other words, the nonhuman nature that surrounds us will become an *extension of our will* rather than an exteriority that opposes or obstructs it. By rerouting the planet's energy flows as part of its expanding economic activity, he wrote, our species will essentially one day incorporate the whole of terrestrial nature as its own 'inorganic body'.<sup>43</sup>

How might we physically measure the extent and pace of this process? In the mid-nineteenth century the American mineralogist James Dwight Dana followed Marx in announcing that our planet had entered into the 'Era of Mind'.<sup>44</sup> After aeons of amoral evolution, with the arrival of *Homo sapiens*, morality was now an organising force in the world, he suggested. Humanity 'is, hence, the only being capable of conscious obedience or disobedience of any moral law, the only one subject to degradation through excesses of appetite and violation of moral law, [but also] the only one with the will and power to make nature's forces his means of progress'.<sup>45</sup> This new dawn was marked, he suggested, by the fact that human artifice is now ensconced in the strata of the earth, with ancient coins constituting a form of technofossil.

Ten years later, the Italian geologist Antonio Stoppani baptised ours the 'Anthropozoic Era' of Earth history—a phase of geological evolution characterised by the capture of the totality of the Earth system by anthropological factors. A new era is inaugurated, Stoppani argued, when *Homo sapiens* assumes a position as a 'new telluric force which, in its power and universality, is easily comparable to the other major forces of the earth'.<sup>46</sup> For the first time, it seemed that a species could counteract the inevitable slide to extinction—experienced by almost all of its ancestors and relatives—by taking **total control over its environment**.

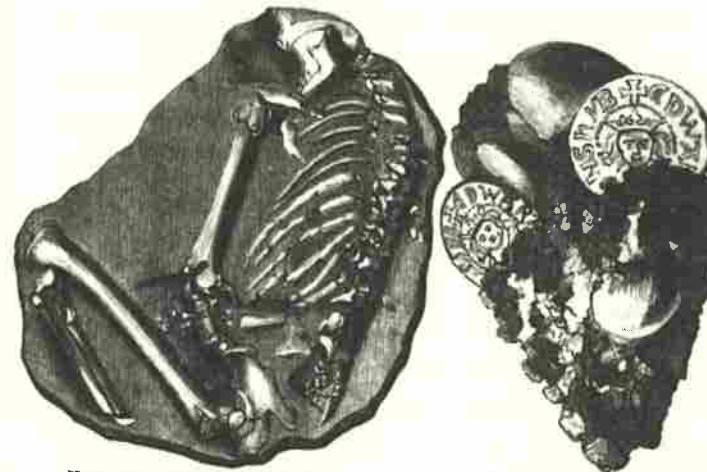
42. K. Marx, *Ökonomisch-philosophische Manuskripte* (Hamburg: Felix Meiner Verlag, 2005), 88.

43. *Ibid.*, 61.

44. J.D. Dana, 'Anticipation of Man in Nature', *New Englander*, May 1859, 296.

45. J.D. Dana, *A Textbook of Geology* (Philadelphia, 1864), 236.

46. A. Stoppani, *Corso di Geologia* (Milan, 3 vols., 1873), vol. 2, 732; see also G.P. Marsh, *The Earth as Modified by Human Action* (London, 1874).



Human skeleton from Guadaloupe.

Conglomerate containing coins.

Dana's illustration of technofossil 'coin conglomerates'.

Around the same time, others started adopting the term 'Psychozoic Era'—which was taken up by, among many others, Marsh's countryman, the geologist Joseph LeConte.<sup>47</sup> Since the beginning of the 1800s geologists had been carving up Earth's history into phases corresponding to the activities of life: demarcating its eras from the Paleozoic to the Mesozoic to the Cenozoic based upon fossil markers.<sup>48</sup> It therefore made sense, LeConte and others thought, to mark our entry into a new epoch defined by the predominance of *intelligent life* ('Psycho-' means mind; '-zoic' denotes life.) No longer is it primarily the vicissitudes of evolution and biology that determine what is left on the geological record; now the forces of psychology will also be recorded for posterity in the strata. LeConte asserted that *Homo sapiens* has become the 'chief agent of change',<sup>49</sup> while Dana confidently claimed that nature's 'once wasted energies' were now being successfully channelled into a 'strong

47. J. Le Conte, 'On Critical Periods in the History of the Earth, and their Relation to Evolution', *American Naturalist* 11 (1877), 540–57.

48. John Phillips was the first to use these terms, in 1841.

49. J. LeConte, *Elements of Geology* (New York, 1879), 557.

Psychozoic Era



and combined movement for social, intellectual, and moral purposes'.<sup>50</sup> The 'psychozoicization' of the planet would be tantamount to the maximisation of its habitability by intelligent design—an entrenchment against threats to life internal to the Earth system. Some eccentrics even looked forward to an ensuing geological 'Age of Angels' once this process was complete.<sup>51</sup>

In a bold culmination of this line of thought, around the turn of the twentieth century Fedorov pronounced that

[t]he spread of humanity over the planet was accompanied by the creation of new (artificial) organs and coverings. The purpose of humanity is to change all that is natural, a free gift of nature, into what is created by work.<sup>52</sup>

These ideas were taken up in Russia by the palaeontologist Aleksey Petrovich Pavlov and the biogeochemist Vladimir Vernadsky, whose work inspired Teilhard de Chardin, in the 1930s, to speak of our planet as having gained a 'new skin' in the form of the artificial products of reason. For Chardin, it was almost as if the Earth was growing a 'soul' or brain for itself, a 'thinking layer' in the shape of the networks of human knowledge and interchange that were spreading across its surface.<sup>53</sup> In his eyes, it was the first time an Earth-born species had awoken sufficiently enough to not only steward the planet's future but also consciously counter evolution's paradigm of mindless extinction.

All of this, in a sense, is just an extension of Kant's observations regarding humanity's drive to make a home for itself: in recognising that we inherit no guaranteed home from nature, that value and consciousness themselves can simply be snuffed out, we are driven to forge a more secure home for them. And what more secure home, beyond our brittle braincases, than the entire surface of the planet?

50. J.D. Dana, *The Geological Story Briefly Told* (New York, 1875), 255.

51. See C.C. Monson, 'The Age of Angels: Spiritualism and Evolutionary Progressionism in a Nineteenth-Century Geologic Time Chart', *Historical Biology* 30:4 (2018), 554–63.

52. Fedorov, *Sochineniya*, vol. 1, 255.

53. Teilhard de Chardin, *Phenomenon of Man*, 182.

### Replacing Railroads With Synthetic Steeds

Of course, since the 1950s we have come to acknowledge that, far from ushering in an Age of Angels, our influence on the planet has destroyed ecosystems. Since the 1990s, we have recognised that this is triggering a new and ongoing mass extinction event.<sup>54</sup> As ever, the growth of technology poses its own challenges and threats.

And yet widening the sphere of artifice *need not necessarily look like* the planet-encompassing spread of satanic mills—of industrial malignancy, of unsustainable headlong extraction—that we unreflectingly assume it to be today. This assumption hastily looks to trends from our recent past for indications of the future. Certainly, across the history of technology, there has been a steady increase in the invasiveness and disruptiveness of the kind that culminated in the smog-belching factories of the industrial era. However, post-industrial society has already seen the emergence of new trends in technology that counteract this invasive and disruptive trajectory. As our techniques become more refined, many become more seamless and less distinct from nature's preexisting methods and material.<sup>55</sup> Take new fields of scientific research such as synthetic biology or genome editing, for example, where we learn to achieve our goals by manipulating organic structures directly rather than relying on mechanical mediators. After all, it would appear more energy efficient to work *with* and *through* nature's preexisting systems than to work *against* them. (Even Etzler dimly saw this: his proposal for planetary paradise rested on what is probably the first call for a complete switch to green energy.) It is merely a testament to the *crudeness* of our current technologies that they have such adverse ecological impacts and unsustainable footprints. A true intelligence, surely, could exert its will without polluting its planet or annihilating biodiversity. Why wreck an ecosystem when you can requisition its complex structures as a substrate for achieving your ends, integrating it as an extension of your own volition? As we become better at manipulating nature ever more seamlessly and efficiently—and thus phase out the negative

54. See Kolbert, *The Sixth Extinction*.

55. See C.J. Preston, *The Synthetic Age: Outdesigning Evolution, Resurrecting Species, and Reengineering Our World* (Cambridge, MA: MIT Press, 2018).

impacts of our activities—it is at least plausible that the distinction between ‘the natural’ and ‘the artificial’, which has been heightening ever since the agricultural revolution, will now begin once again to collapse as the two categories merge more intricately following the fruition of fields like nanotech and geoengineering.<sup>56</sup>

*Rosny* Back in 1889, J.-H. Rosny was already speculating in this direction, ‘dream[ing] of an era in which mechanisms, properly speaking, will disappear from our apparatus, giving way to appropriations of lines of force’. Once this has happened, ‘[t]he Earth, stripped of mechanical devices, having disciplined all conductivities and resistances, will become the passive and unconscious reservoir [of intelligent will]’.<sup>57</sup> Rather than a resource to be pillaged, complex ecosystems will become more like our nerve centres. Earlier in the century, it was of course Fourier who had suggested that we might replace railcars with the more efficient biotechnology of ‘anti-lions’. In fact, anti-lions were not the only thing in Fourier’s future biomechanical toolbox, which also included

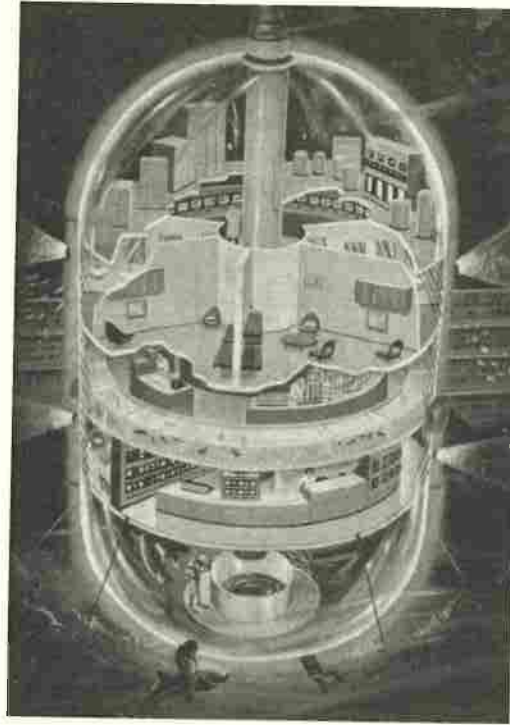
Anti-whales dragging ships through the doldrums;  
 Anti-sharks helping to hunt down fish;  
 Anti-hippos guiding our boats down the river;  
 Anti-crocodiles as river coordinators;  
 Anti-seals as steeds of the sea...<sup>58</sup>

*Wade* Fourier’s prospectus of synthetic biological helpmeets now seems absurd. Yet is the basic method that different from rerouting waterflow to generate power? Predation is irrational and causes suffering, so why not reroute biology’s expertise in tooth and claw toward more economical ends? Why not turn predators into helpful companions that maximise utility rather than pain? Today we may feel uncomfortable about harnessing animals in this way, but remember that in Fourier’s time most people would have rather seen these hostile species

56. For more on this fascinating argument, see M.M. Ćirković, ‘Post-Post Biological Evolution’, *Futures* 99 (2018), 28–35.

57. Rosny, ‘La Légende sceptique’.

58. C. Fourier, *Traité de l’association domestique Agricole* (Paris, 1822), 529.



Dandridge Cole’s 1961 vision of ‘tame dolphins’ helping humans colonise aquatic planets. Another oasis in the great desert of extinction.

simply exterminated.<sup>59</sup> Almost a century and a half later, the pioneer of cross-species communications John C. Lilly was still imagining training dolphins to go to work ‘on submarine-hunting expeditions’. Alternately, he suggested, they could map ocean floors or even act as rescue teams. Not to mention the vast potential of ‘psycho-analysis (intra- and inter-species)’, of course....<sup>60</sup>

59. Moreover, domestication isn’t just something we inflict on other species, it is something we must inflict on ourselves: think of the proposal, favoured by idealists from Erasmus Darwin to Fedorov, that we route the world’s military resources towards more civilised goals.

60. Lilly, *Man and Dolphin*, 168–70.

Moving from crackpot schemes to the more serious insights to be gleaned from this tradition, the important point here is that artificialising nature need not *necessarily* mean destroying, disrupting, or degrading it. Minimally, it need only mean a more intelligent utilisation of resources. At its best, it ought to be the more seamless weaving of welfare into natural structures and the achievement of an greater yield of wellbeing from them (for humans and nonhumans alike).

Freeman Dyson wrote of 'gray' and 'green' approaches to technologisation. 'Human technology is gray, God's technology is green', he joked,<sup>61</sup> so why not take a leaf out of God's book?<sup>62</sup> Following this thread all the way through, X-risk specialist Milan Ćirković has recently speculated about the possibility of 'biocomputing so energy-efficient and widely distributed that it is literally woven into the biosphere of a planet including grass, marine flora, coral reefs, etc.'. Ćirković points out that this is not at all to be 'regarded as some simplistic "return to Mother Nature"'.<sup>63</sup> Instead, it actually represents the 'end of nature' in the sense of any residual natural realm untouched by our intelligent activity: a biosphere become biocomputer.

As the French geographer Élisée Reclus announced back in 1905, 'humanity is nature becoming self-conscious'.<sup>64</sup> This is because, with sufficient technology and foresight, we can weave our values directly into our environment. Achieving such interweaving, and awakening, at a planetary scale would massively insulate intelligence against global risks.

### A Solar Feast for Hungry Civilisations

But why stop at the planet? Marx wrote that 'the more universal man is, the more universal is the sphere of inorganic nature on which he lives'.<sup>65</sup> Why then should this potentially 'universal' sphere be limited to the parochial confines of one planet? It was not long before thinkers began to

61. F. Dyson, *Disturbing the Universe* (New York: Basic Books, 1979), 227.

62. *Ibid.*, 169.

63. Ćirković, 'Post-Post Biological Evolution', 31.

64. E. Reclus, *L'Homme et la Terre* (Paris: Librairie Universelle, 6 vols., 1905–1907), vol. 1, 4.

65. Marx, *Ökonomisch-philosophische Manuskripte*, 61.

realise that this sprawling exo-brain, this terrestrial nerve centre within which we have embedded our intelligent organisation, can in the long term ripple outwards to become far more encompassing and resilient.

As we have already seen, around the same time Odoevsky was already entertaining visions of human industry spilling off-world in the form of lunar prospecting, proposed in order to escape population explosion and overexploitation (which, in his 'Last Suicide', he predicted would lead to omnicide). But within decades the question would not just be measuring the economic limits of the Earth, but also those of the sun. Of course, it has been accepted since the 1600s that stars can die, but the emergence of thermodynamics in the 1800s not only made this fate more obviously permanent but also more measurable, and therefore suddenly a lot more real. Since the 1860s, scientists have been estimating our sun's age, predicting its senescence, and gauging other matters of solar gerontology.<sup>66</sup>

Once Plenitude fell apart and entropy took over, permanent, irreversible losses in nature became a reality. There is no inevitable conservation of value through cycles of destruction and extinction. Energy is scarce, not eternal. And therefore unused energy is not morally neutral. All valuable things (ecosystems, brains, goods and services, civilisations) need to *consume* energy to exist and persist—and because energy is not an infinite resource, a moral cost is incurred by letting any iota of it go to waste.

It is only a small step from here to the realisation that *not* working to cosmically expand the domain of value can no longer be morally neutral either. To give up the fight to maximise value is to immorally submit to the enviroing forces of extinction, to the unjust fact that extinction and sterility is the cosmic tendency and the uphill struggle toward complexity the exception. A further theme addressed by those exploring the human vocation in its relation to X-risk, then, has been that of a fuller harnessing of resources, and especially our principal energy source, the sun.

By the turn of the twentieth century, the conundrum was already on the minds of some scientists:

66. W. Thompson, 'On the Age of the Sun's Heat', *Macmillan's Magazine* 5 (1862), 388–93.



What becomes of the vast outpour of energy, of heat and light, from the monstrous surface of the sun? Some is intercepted by the little globule of iron that we call the earth; and to this, we know, every trace of life and movement on this globule is due; the rush of winds, the waterfall, the growth of the planet, every thrill of pain or joy, every idea, we experience is but the mechanical translation of energy of the sun. But the amount of this energy intercepted by the planets is infinitely slight—not a billionth. Whither all the rest?<sup>67</sup>

Maverick lightning wizard Nikola Tesla had already arrived at a full understanding of the problem in a 1900 essay entitled 'The Problem of Increasing Human Energy', which opens with a provocative vision of nature's entropic indifference:

*Tesla* Merciless is the law of nature, and rapidly and irresistibly we are drawn to our doom. Lord Kelvin, in his profound meditations, allows [our civilisation] only a short span of life, something like six million years, after which time the sun's bright light will have ceased to shine, and its life-giving heat will have ebbed away, and our own earth will be a lump of ice, hurrying on through the eternal night.<sup>68</sup>

To stave off such a 'gloomy future', Tesla suggests, we must acknowledge that the major problem of any civilisation is that of increasing its energetic throughput and its reservoir of available energy, and that finding ways to increase the total 'motive energy' of human civilisation is the fundamental question: 'We must [come] to the conclusion that the great problem of science is [to] increase the energy [and] force accelerating human movement [and] work'.<sup>69</sup>

Firstly this would mean saving energy by putting an end to war (Tesla predicted that all war would soon be waged, more economically, by means of automata) and reengineering the way we extract nutrition (he predicted some kind of powdered complete nutritional replacement).

67. C. Synder, 'Review of Arrhenius', *North American Review* 187:631 (1908), 932–34.

68. N. Tesla, 'The Problem of Increasing Human Energy', *The Century* 60 (1900), 175.

69. *Ibid.*, 177.

But above all else it would mean *intercepting more energy from the sun.* Our star, after all, is the ultimate battery, the source of all life, a huge ball of energy just waiting, in its blind purposelessness, to be more fully harnessed. Tesla therefore concludes with his fix to the 'great problem' of science: '[t]o increase the force accelerating human movement means to turn to the uses of man more of the sun's energy'.<sup>70</sup>

Like Etzler with his solar magnifying glasses, however, Tesla did not take the leap to realising that his plan to obtain 'electrical energy directly from the sun' could be taken off-world into the circumstellar expanses.<sup>71</sup> An unfortunate omission, given that Tesla was no stranger to visionary megaengineering proposals (such as an equator-circling ring structure to enable 'travel at a rate of one thousand miles an hour').<sup>72</sup>

Tesla was preceded, however, by an even more ambitious vision that looked far beyond planet Earth and its moon. Five years before Tesla's essay, in 1895, the Russian cosmist Konstantin Tsiolkovsky had published a fascinating short work entitled *Dreams of Heaven and Earth*. Calculating that the earth receives around only  $4 \times 10^{-10}$  of the sun's total energy output,<sup>73</sup> the Russian rocketeer insisted that there is no good reason for one drop of light to go to waste. Think of the vast potential for work and value being ejaculated uselessly into space with every passing second! The trailblazing Tsiolkovsky set about coming up with a host of schemes to better harness this otherwise profligate wastage so as to fight the downhill slope to inexorable extinction.

### Necklaces of Asteroids

*Tsiolkovsky* Despite spending his life in a log cabin in the Russian wilderness, Tsiolkovsky was a truly unparalleled thinker. Aside from being the first to formulate the Fermi Paradox, and being the innovator behind the mathematics of rocket propulsion, Tsiolkovsky's other visionary ideas included his proposal that, in pursuit of justice, our descendants will direct their evolution toward the adoption of photosynthesis as a

70. *Ibid.*, 192.

71. *Ibid.*, 210.

72. N. Tesla, *My Inventions* (Berlin: Severus, 2017), 32.

73. K. Tsiolkovsky, *Put' k zvezdam*, 107.

- human photosynthesis  
- need to learn sun & understand

less cruel mode of nutrition than consuming other animals and plants for fuel.<sup>74</sup> But above all, Tsiolkovsky, like Tesla, was interested in ways of escaping potential extinction and ensuring human flourishing by finding ways of more efficiently harnessing the sun. For the amount of solar flux we intercept determines all 'magnitude of progress', moral, aesthetic, and economic: 'Stop the glow of the sun and everything will petrify and freeze: the whole pyramid of organisms, however great, will collapse.'<sup>75</sup> After a few years without sunlight the temperature of the surface of our planet would drop to that of outer space: the 'oceans would freeze' and the creeping cold inevitably eradicate the final humans, huddled together in deep 'burrows' providing 'the last hearth'.<sup>76</sup>

The imperative behind all imperatives means that doing nothing is no longer ethically neutral; Tsiolkovsky was the first to truly realise that being happy with the current energetic regime and allowing vast quantities of perfectly good sunlight to go to waste amounts to forging an immoral alliance with the universal reign of extinction. Faced with the eventual possibility of dwindling for want of resources, a maturing civilisation can no longer accept wasted opportunities.<sup>77</sup>

Tsiolkovsky saw that if we were to more completely tap the solar energy daily bathing the Earth's face, we could increase 'the number of animals (or people) by 1,000 times'.<sup>78</sup> Fighting the affront of extinction doesn't just mean minimising X-risks (as active privation of value), it also involves materially maximising the yield of welfare from otherwise inert matter. In comments harking back to Shelley's vision of a fully

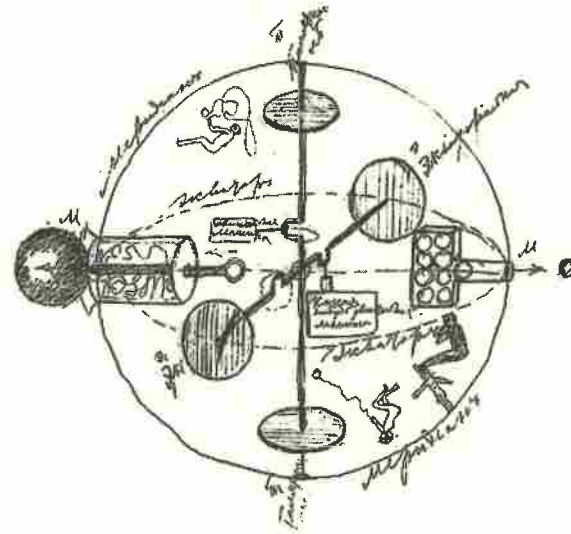
74. K. Tsiolkovsky, 'Monism vselennoi', in S.G. Semonova and A.G. Gacheva (eds.), *Russkii kosmizm* (Moscow: Pedagogika-Press, 1993), 271.

75. K. Tsiolkovsky, 'Kogda pogasnet Solntse', MS in *Archive of the Russian Academy of Sciences*, F.555, C.278.

76. Tsiolkovsky, *Put' k zvezdam*, 48.

77. Admittedly, Tsiolkovsky did endorse some form of Plenitude, claiming that all past and future phases of Earth evolution will be repeated elsewhere, and that 'our solar system must die and arise many times', but he used this as an argument for the existence of advanced extraterrestrials rather than a trivialisation of the stakes involved in humanity's plight. See Tsiolkovsky, *Put' k zvezdam*, 112.

78. K. Tsiolkovsky, 'Veroyatnost' zhizni', MS in *Archive of the Russian Academy of Sciences*, F.555, C.522.



Design for a space habitat by Tsiolkovsky.

habitable planetary interior, he even claimed that utilising this incoming sunlight *fully* could allow the earth to be converted entirely into biomatter: the planetary brain would then reach down into the core and '[t]he whole planet to its very depths could [...] come to life'.<sup>79</sup>

But even if we were to fully utilise all of this solar wealth hitting the Earth, it would still amount to only a fraction of the sun's total output. Tsiolkovsky went further, observing that because of their shape and size, '[p]lanets use only a small fraction of solar energy', with the rest being 'squandered into space'.<sup>80</sup> The full output of solar energy 'is 2.2 billion times more than that obtained by the Earth and 2000 million times more than what all the planets of our solar system have'.<sup>81</sup> Moreover, look at all the wasted space in the Solar System: 'Why not live there, in the spaces of ether, as they are billions of times

79. Tsiolkovsky, 'Monism vselennoi', 267.

80. Tsiolkovsky, *Put' k zvezdam*, 107.

81. Tsiolkovsky, *Put' k zvezdam*, 249.

USG. Space in solar system

more extensive than on Earth?', he demanded.<sup>82</sup> Then we could fill circumstellar space with structures allowing us to intercept the totality of solar output. Again, to accept wasted resources and unoccupied real estate is to accept the natural predominance of extinction and uninhabitability over oases of value and wellbeing—an immoral concession to this indecorous reality.

At one point Tsiolkovsky even considered dismantling the Earth and reconstructing it as a sun-girdling shell, but realised that the entire volume of the Earth would only stretch out into a sphere of about 3.55mm thickness.<sup>83</sup> So he instead suggested changing the shape of all the planets and redistributing the matter of the entire Solar System—from asteroids to planets—so as to create shapes and structures that would more completely intercept the sun's emanations and thus more securely ensconce intelligence as the organising principle of our corner of the universe, rather than a rarity cowering on a single planetary body beleaguered by X-risks.

Estimating the horsepower that would be necessary to decompose planets ranging in size from Earth to Jupiter, Tsiolkovsky proposed that with enough 'mechanical work', their raw matter could be moulded into 'cubes, discs, rings'.<sup>84</sup> By 'borrowing material' from all the celestial bodies, we can '[s]urround the sun with artificial dwellings'.<sup>85</sup> Star-girdling rings of matter would be able to intercept a wider share of the sun's rays than orbiting balls. Moreover, we should also turn the asteroids and planetesimals into habitations, stringing them together into 'necklaces' encircling the sun at varying distances.<sup>86</sup> 'We can build transparent and impervious shells', he said, creating miniature self-sustaining life-worlds out of requisitioned asteroid bodies specially hollowed out for the purpose. With these little floating gardens, these

82. K. Tsiolkovsky, 'Zhizn 'v mezhzvezdnoy srede', MS in *Archive of the Russian Academy of Sciences*, F.555, C.238.

83. K. Tsiolkovsky, 'So vremenem zemlyu razberut do tsentra', MS in *Archive of the Russian Academy of Sciences*, F.555, C.317.

84. Tsiolkovsky, *Put' k zvezdam*, 106.

85. Tsiolkovsky, 'Monism vselennoi', 271.

86. Tsiolkovsky, *Put' k zvezdam*, 94–98.

little terrarium biosphere spores, the entire Solar System can be vivified. Indeed, we might be able to use 'solar motors' to propel these micro-worlds and direct them wherever we want, just as we currently 'drive horses'<sup>87</sup> (An even better alternative to riding a synthetic anti-lion.) Our descendants 'will control [the] Solar System just as they [currently] control the Earth'.<sup>88</sup>

### Suckling on Stars

In 1925 Tsiolkovsky's compatriot, Vladimir Vernadsky, lecturing at the Sorbonne University in Paris, urges that humanity must use technology to feed directly off the sun or face existential crisis through terminal resource depletion.<sup>89</sup> A few years later over in Cambridge, England, the Irish scientist John Desmond Bernal arrived independently at similar conclusions:

On earth, even if we should use all the solar energy which we receive, we should still be wasting all but one two-billionths of the energy that the sun gives out.<sup>90</sup>

Phrases handpicked from Bernal's oeuvre appear in the epigraphs of each chapter in this book, and this is because he was truly visionary when it came to thinking about humanity in light of X-risk and X-hope. With his tousled head of hair and kaleidoscopic conversational style, Bernal, a pioneer of X-ray crystallography and molecular biology as well as a die-hard Marxist and deft historian of science, was as ingenious a polymath as they come (aside from marked discrepancies, such as his unrelenting support for Stalinist Russia). As well as independently arriving at similar ideas to Tsiolkovsky on reducing solar wastage, Bernal also proposed that, with the right energy economy, we could

87. *Ibid.*, 96.

88. K. Tsiolkovsky, 'Planety zaseleny zhivymi sushchestvami', MS in *Archive of the Russian Academy of Sciences*, F.555, C.505.

89. V. Vernadsky, 'L'autotrophie de l'humanité', *Revue générale des sciences pures et appliquées* 36 (1925), 495–502.

90. Bernal, *The World, The Flesh, and the Devil*, 17.



Bernal → pau  
habitation - stellivore civi-

turn the entire interior of the earth into verdant fields rather than unoccupied wastes.<sup>91</sup> Again like Tsiolkovsky, he suggested the manufacture—from ‘asteroidal and meteoric matter’—of translucent ‘spherical shells’ as outer-space habitations.<sup>92</sup> And just like his Russian counterpart, he envisioned that by populating and restructuring the Solar System, humanity will eventually become what astrobiologist today call a **stellivore civilisation**: a species that lives directly off starlight.<sup>93</sup> Our civilisation would be an autotroph, like a plant, able to convert energy to work without the messy (and immoral) mediation of a food chain. (Perhaps floriculture is the ultimate answer, after all.) This stellivorous status will be the launchpad for innumerable grand feats of solar engineering. Ultimately, Bernal wrote, ‘mankind’ will not ‘be content to be parasitic’ on the sun but ‘will invade [it] and organize [it] for his own purposes’.<sup>94</sup>

As Bernal explained, ‘[a] star is essentially an immense reservoir of energy which is being dissipated as rapidly as its bulk will allow’. Why not channel this purposeless expenditure into something purposeful? We have used artifice to ‘tidy up the awkward parts of the world’ on Earth, why not do the same for the firmament? Rather than being a churning cataract of prodigality, our Solar System could become the battery and foundry of an ‘efficient heat engine’ of gigantic scale—that will drive whatever it is that our supercivilised descendants decide to delight themselves with. This, of course, would usher our entire planetary system—rather than just our planet—into a glorious Psychozoic Era.

Bernal was clear that these were all consequences that flowed directly from our position as moral beings in a physical universe that will do nothing to promote our values independently of us—in fact, it exerts pressure upon the amount of time within which we can do beautiful or virtuous or creative or economic things. Bernal was well aware of the X-risks threatening the human race, and insisted that with every second

91. Ibid., 45.

92. Ibid., 18–28.

93. See C. Vidal, ‘Stellivore Extraterrestrials? Binary Stars as Living Systems’, *Acta Astronautica* 128 (2016), 251–56.

94. Ibid., 28.



John Desmond Bernal (1901–1971), considering prospects and the perils.  
Lithographic chalk by Edmond Xavier Kapp, 1920s.

that we allow sunlight to pump extravagantly out into space, we are losing yet more time, acquiescing to the indifference of physics and the forces of extinction. In a universe where extinction is the rule, we must face up not just to the unfairness of the active deprivation of life *but also* the wasted opportunity for life. Like Federov, Bernal thought the decision was stark: expand life’s activity or resign to eventual extinction.<sup>95</sup>

### Life Among the Jupiter Brains

The Gaia-fearing amongst us may balk at the idea of industrialising the Solar System, but in these visions it is pursued precisely as a ‘greening’

95. Ibid., 79.

of empty deserts. Around the same time as Bernal was writing, Tsiolkovsky attempted, in rudimentary terms, to calculate the ratio of dead matter to intelligent matter throughout the cosmos. Taking the Earth alone, he pointed out that—even here on this verdant planet—the proportion of living material to inert matter remains incredibly small. Enquiring what the ‘mass of higher life throughout the entire universe’ may therefore be, he deployed very rough probabilities in an ambitious attempt to calculate the odds of finding oneself as a piece of thinking matter within this cosmic immensity.<sup>96</sup> He wanted to ascertain the probability of ‘waking up’ as one of those lucky ensouled regions of matter within an ocean of unconsciousness. Tsiolkovsky saw it as the duty of humans to widen the circle of moral agency within a physical universe in order to maximise this likelihood of ‘having the lights on’ by phasing out the irrationalities—such as accidental extinctions and light-year-long sterile spaces—that bar its way.

Fedorov, Tsiolkovsky’s cosmist predecessor and mentor, had also anticipated the megastructural manipulation of the Solar System, and, in line with the notion of the Psychozoic Era, saw such increasing coordinated organisation of the heavens as comparable to the developing of a galactic cerebrum.

This idea of a Psychozoic Era of terrestrial evolution had been largely based upon James Dwight Dana’s observations of what he saw as the steadily increasing trend of ‘cephalisation’—a concentration of nervous complexity in the head—across the fossil record. Writing from the 1860s onward, Dana described this as an evolutionarily convergence upon consciousness.<sup>97</sup> Life on Earth evolves inexorably headwards, bulging into an increasingly luxuriant brain: it seemed to the Danas of the time as if evolution were somehow striving to awaken itself by building a neocortex.

96. Tsiolkovsky, ‘Veroyatnost’ rozhdeniya i veroyatnost’ vysshey zhizni i chuvstva’, MS in *Archive of the Russian Academy of Sciences*, F.555, C.501; and see Tsiolkovsky, ‘Veroyatnost’ zhizni’.

97. J.D. Dana, ‘The Classification of Animals Based on the Principle of Cephalization’, *American Journal of Science and Arts* 35 (1863), 321–53.

Fedorov simply scaled this ardently progressivist idea up dramatically, seeing humanity’s growing sphere of organisation and coordination as a cephalisation of the Solar System itself. Through the inevitable off-world spread of human architecture, Fedorov forecast, the planetary system will *grow a brain for itself*. The ‘present state of the Solar System’, he wrote, ‘can be compared to an organism in which the nervous system has not yet fully developed and has not yet become differentiated from its muscular and other systems’. In other words, it is a blind substrate simply awaiting the ingress of *civilisation* as its central-planning system and cogito. The planets will not just be verdant farmsteads but also neuronal relays:

Man’s economic needs require the organization of just such a regulatory apparatus, without which the Solar System would remain a blind [...] entity. The problem consists, on the one hand, in elaborating the paths which would transmit to human consciousness everything going on in the Solar System and, on the other, in establishing the conductors by means of which all that is happening in it [...] could become [rational] activity.<sup>98</sup>

Once again, here the artificialising of nature slides into the naturalisation of artifice, as humans incorporate the entirety of the Solar System as a type of massively distributed nervous system, an inorganic extended prosthesis. Fedorov imagined using ‘the heavenly bodies’ as the replacement for ‘sensory and motor nerves’ in order to forge an outward ‘brain center’. The weaving together of such a distributed array would allow the otherwise ‘unconscious’ and ‘blind’ expanses of outer space to ‘achieve full self-consciousness and self-government’.<sup>99</sup> Just as over the course of evolution the nervous system centralised into a brain, so the Solar System, through the course of human civilisation, will unify into self-consciousness. Think of the cogitations of a mind the size of the Oort cloud! Crazy though this may seem, scientists in our own

98. Fedorov, *The Philosophy of the Common Task*, 100.

99. *Ibid.*, 107.

time now seriously consider and calculate the physical plausibility of reworking entire gas giants into megascale computers.<sup>100</sup> Surely such 'Jupiter Brains' could provide the answers to the X-risks threatening our expanding oases.

For Fedorov, this was all part of the mature recognition of the possibility of extinction. Left to its own devices, nature is a 'lethal force' heralding our 'inevitable extinction'. It sometimes creates beauty and life and value, but only as an exception to the rule of entropy and extinction. To refuse the artificial and simply accept nature is therefore 'to become passively fossilised in contemplating the slow destruction of our home and graveyard'.<sup>101</sup> We must weed out extinction at the root—which means changing the entire structure of the universe. Anything other than the total securing of everything of value from X-risk is a deprivation—a penury even—so we cannot rest until every resource in reach awakens to a fulsome life of value rather than allowing it to stagnate in its current slumber of sterility.

### Back to Nature? Never! Forward to the Machine!

It wasn't just in Russia that such heady sentiments were brewing. The point was beautifully put by Lester Frank Ward, the American botanist and sociologist, in 1893:

Nature has no economy. Only through foresight and design can anything be done economically.<sup>102</sup>

The very same year, the giant of Victorian biology Thomas Henry Huxley announced that '[s]ocial progress means the checking of the cosmic process at every step and the subordination for it of another which may be called ethical process'. Nature may have produced prudence and aim in the form of mind and life, but only after squandering many aimless aeons. It is our duty to justify such aeonic wastage by forging an

100. A. Sandberg, 'Physics of Information Processing Superobjects: Daily Life Among the Jupiter Brains', *Journal of Evolution and Technology* 5:1 (1999), 1–34.

101. Fedorov, *Philosophy of the Common Task*, 96–97.

102. L.F. Ward, *The Psychic Factors of Civilization* (Boston, 1893).

artificial nature, defined instead by purpose and justice. It is our job, as Huxley wrote, to embark upon 'building up an artificial world within the cosmos'.<sup>103</sup> Or, in Tsiolkovsky's words:

Nature creates slowly, but when a higher mind intervenes in its activity—which is also a part and product of nature—everything accelerates: millions of years are compressed into hundreds or thousands.<sup>104</sup>

Such sentiment finds its best expression, however, in the declarations of a certain Edwin Emery Slosson. In his 1919 bestseller *Creative Chemistry*, this Kansas-born chemist with a keen awareness of humanity's precariousness within wider nature wrote:

Imitate Nature? Yes, when we cannot improve upon her. Admire Nature? Possibly, but be not blinded to her defects. Learn from Nature? We should fit humbly at her feet until we can stand erect and go our own way. Love Nature? Never! She is our treacherous and unsleeping foe, ever to be feared and watched and circumvented, for at any moment and in spite of all our vigilance she may wipe out the human race by famine, pestilence or earthquake and within a few centuries obliterate every trace of its achievement. The wild beasts that man has kept at bay for a few centuries will in the end invade his palaces: the moss will envelop his walls and the lichen disrupt them. The clam may survive man by as many millennia as it preceded him.

Without rational intervention, all life will one day die. Ecosystems will eventually degrade and 'the three kingdoms of [living] nature will be reduced to one, the mineral'. It is by 'means of applied science that the earth can be made habitable', Slosson announced:

Chaos is the 'natural' state of the universe. Cosmos is the rare and temporary exception.

103. T.H. Huxley, *Evolution and Ethics* (London, 1897), 83.

104. Tsiolkovsky, 'Budushcheye Zemli'.



Indeed, the Greek word *kosmos* means 'order' or 'arrangement', and Slosson emphasises that it is humanity's *responsibility* to forge a cosmos that is finally worthy of the name, one insulated from the otherwise all-enveloping forces of extinction:

Gradually then [man] will substitute for the natural world an artificial world, moulded nearer to his heart's desire. Man the Artifex will ultimately master Nature and reign supreme over his own creation until chaos shall come again.

Slosson's musings were republished in 1920, in New York's *Independent Magazine*, under the rousing title 'Back to Nature? Never! Forward to the Machine!'.<sup>105</sup>

### Even the Past Must Be Saved

For Fedorov, similarly, independent nature is a 'blind, death-bearing force'.<sup>106</sup> Leaving it untouched is tantamount to ushering in extinction. And, even worse, it has only created us at the cost of the trial-and-error sacrifice of countless beings. As Hoyle later beseeched:

We exist today because of a past in which our forebears suffered untold distress and anguish. I am not referring to our human ancestors but to the long chain of creatures that preceded the human; their sufferings were certainly untold because they could not speak—we need only think of the shriek of the dying animal in the jungle.<sup>107</sup>

This is a weighty truth. Even as far back as Leopardi, in the early 1800s, it was observed that we only think of biology as purposeful because of survivorship bias: we only see the tiny fraction of victors, what we don't see is the towering wreckage atop which they sit, precariously.<sup>108</sup> Once Darwin confirmed this suspicion, it became glib to defend Mother

105. E.E. Slosson, *Creative Chemistry* (New York: Century, 1919), 10–13.

106. Fedorov, *Philosophy of the Common Task*.

107. Hoyle, *Of Men and Galaxies*, 67.

108. Leopardi, *Zibaldone*, 4248, 4510.

Nature because of its (accidental) birthing of love and beauty in much the same way it was glib for Pope, in a prior age, to compare exploded planets to popped bubbles. Nature evolved love and altruism, true, but only by arduous accident. 'What a chance it has been [that] has made a man', as Darwin exclaimed.<sup>109</sup> A chance that required the 'statistical fury' of untold contingencies, Lem said.<sup>110</sup> And at what cost? How many aeons of silent suffering? How many light years of sterile silence? How many strife-filled biospheres snuffed before ever reaching lucidity about their sentence or the ability to alleviate it?

Even if you don't accept that all wasted resources amount to an immoral acquiescence to future extinction, consider the past extinctions that created us. Each was a wasted opportunity, and we have only been spared purely by chance. It is our duty to bring economy to nature at the largest scale, Fedorov hinted, as the payment of a penance. Because only in this way, perhaps, can we bring reason *even to the prehuman past* by retrospectively atoning for those aeons of extinctions and wastage that preceded us. 'Through us, through rational beings, nature realizes its consciousness and self-government [and] reconstructs all that has been destroyed and is still being destroyed in its blindness'.<sup>111</sup> Only intelligence, Fedorov realised, has the capacity to atone for the entirety of its blind, awful, woeful past. If our rational and moral vocation consists in not allowing crimes to go unnoticed and unatoned, then this includes *all* of the crimes that birthed rationality and morality themselves. Even if we originally played no role in them, by offering reparations we can attain full agency over them. This was what motivated Fedorov's plan for reorganising the entire structure of the physical universe so as to eradicate sterility and extinction here and everywhere.<sup>112</sup>

Moreover, in a grand overturning of the trivial absolutes of the Principle of Plenitude, Fedorov claimed that this is our duty precisely

109. C. Darwin, *Notebooks on Transmutation of Species* (London: British Museum, 1960).

110. Lem, *One Human Minute*, 100.

111. N. Fedorov, 'Filosofia obshchego dela', in K. Isupov and I. Savkin (eds.), *Russkaia filosofia sobstvennosti XVIII–XIX vek* (St. Petersburg: Ganza, 1993), 135.

112. For Fedorov, it also involved resurrecting *all* of our dead predecessors, but that's another story.

because it can *put a stop* to the eternally returning cycles of speciation and extinction on our planet and far beyond. By 'turning these cycles into mind-controlled ones, we are no longer subject to these movements, but these movements obey us'.<sup>113</sup> Why submit to the authority of a lavishly dying universe? Also rejecting the Myth of Progress as professed by nineteenth century biologists, Fedorov was clear: we can't just 'wait for blind nature itself to give rise to a new, higher species of animals' to undertake the task of cosmic salvation—because this is just to 'place all [our] hope in [the] blind birth and death' exacted by indiscriminate natural selection.<sup>114</sup> This is why we must act *as if* the 'salvation of the measureless universe' originates 'in that insignificant speck of dust, the Earth'.<sup>115</sup> It is simply the duty of any moral being to undertake this task.

For Fedorov, the task of salvation compels us to populate and 'spiritualize [all] the vast heavenly worlds, which have no rational beings' and, as yet, 'have no history'.<sup>116</sup> Our vocation is a vast flight from the possibility of extinction, fructifying and cephalising the galactic volume which blindly awaits its awakening.

### Salvation Without Gods

Fedorov was deeply religious, but his answer to religious questions often fell far beyond the pulpit, aiming at renovating the entire material world using artificial ingenuity. In this, he embodies a giant historical transition of the modern age, one that continues to motivate much research into minimising X-risk: as science develops, it becomes capable of answering the riddles that motivated the religious world view, but it does so with reliable predictions and genuine solutions rather than with coddling consolations or callous capitulations.

Take for example, the question of the 'end of the world'. In recent years, scientists have replaced religious eschatology (the study of the

113. N. Fedorov, 'Zhizn' kak op'yaniye ili kak otrezvleniye', in *Sochineniya*, vol. 2, 161–62.

114. N. Fedorov, *Filosofia obshchego dela* (Westmead: Gregg International, 2 vols., 1970), vol. 1, 427–9.

115. Fedorov, *Philosophy of the Common Task*, 189.

116. *Ibid.*

end times) with the scientific study of physical eschatology—the study of the universe's long-term fate based purely on physical, natural laws. Now, we can begin to answer this question. But what of those grand and perennial problems of sin and suffering? In Fedorov's outlining of the 'common task' at the dawn of the twentieth century, we first see emerging the contours of a physical soteriology in the same vein: a secularised doctrine of salvation, a non-religious study of the eventual removal of privation, frustration, need, suffering, and waste from the world.

Around the time Fedorov was writing, over in England the spiritualist cynic Edmund Gurney was making negative utilitarian noises, claiming that no matter how 'far social improvement may advance' and attain future happiness, it seems unlikely to outweigh the sheer gigantism of past sufferings. One 'billion happy people are bound, *each in turn*, to submit to extinction, if by that means the one unhappy life can be extinguished'. But he said this because he believed in an afterlife. If not for this, he admitted he would will the 'immediate extinction of the race'.<sup>117</sup> But we have since moved away from such security of belief, having realised it is yet another resignation and acquiescence. Life may be defined by frustration, and it may seem an insurmountable task to rectify the wasted opportunities and privations of the past, but we have fully awoken to the fact that it is our duty to do something about them. There are no other guarantees, no excuses, no supernatural deliverances.

A physical soteriology would be a mature scientific and naturalistic study of how to achieve such salvation, at a cosmically meaningful scale, through our own ingenuity and effort. And despite their sometimes crazy extravagances and speculative detours, what thinkers such as Fedorov help us to understand is that modernity has been the process of gradually becoming aware *that our vocation may consist in the long work of physical soteriology*. To completely justify one's existence requires escape from extinctions and privations of value not just future and present, but even past:

117. E. Gurney, 'On the Controversy of Life', *Fraser's Magazine*, 18 (1878), 159–60.

For we know that the whole creation has been groaning and travail-  
ing in the pains of childbirth until now. (Rom. 8:22)

Fallible creatures like humans can only build perfection out of the stockpile of errors that is our past. Only by correcting and atoning for this past—piece by piece, and whether or not we had any hand in it—can we leave it behind.

As time has gone on, and we have overcome ignorance in the pursuit of more predictive and practical knowledge, we have actually begun to develop the technical capabilities with which some of Fedorov's visions might be implemented, and Gurney's pessimism seems less inevitable. In 2007, David Pearce outlined what he calls the 'abolitionist project' to an intent audience in Oxford:

This talk is about suffering and how to get rid of it. The abolitionist project outlines how biotechnology will abolish suffering throughout [...] the furthest reaches of the living world.<sup>118</sup>

*Pearce*  
When Pearce says 'furthest reaches', he really means it—his soteriological project takes in everything within our cosmological horizon, potentially everything within causal reach. All other limits are imposed by our own meanness and want of ambition. Pearce talks persuasively of genetic engineering, CRISPR, designer drugs, and ethical wireheading, along with neurostimulated bliss and other pharmaceutical and bioenhancement methods for 'paradise engineering'—creating beatific states of depression-resistance and hyper-empathy. A physical soteriology, then, for a fallen world—fallen not by design, but for sheer lack of it.

### At Home in the Universe

So, as well as spreading beyond the Earth in order to stave off our own specific extinction, we must also spread beyond Earth in order to stave off extinctions, sterility, and squander *generally*. It's the only moral thing to do. Dyson often referred to this as the 'greening of the

118. D. Pearce, 'The Abolitionist Project' (2007), <<https://www.abolitionist.com/>>.



FWJ. Schelling, in his old age and cosmic wisdom.

galaxy'.<sup>119</sup> The argument is that we must leave Earth out of selfishness rather than selfishness.

This idea goes back further than Fedorov. Back in the 1840s, the year before the young Marx jotted down his thoughts on humanising nature in Paris, FWJ. Schelling—now a craggy old man—had delivered a lecture in Berlin in which he noted that humanity's pursuit of the universal necessarily involves breaking 'free of the fetters of the concrete'. And one of these fetters, he claimed, is our planetary birthplace.

Schelling acknowledged that humanity is, through and through, a product of the earth and remains dependent upon it. But this is a matter of contingency, he remarked. Our being born here is a result of a series of totally accidental factors; that which is contingent lacks any good reason for being the way it is; such limitations cannot be ethically

119. F. Dyson, *Disturbing the Universe*, 236.



binding. In this sense, then, our attachment to our planetary birthplace itself is just another irrational and unfounded chauvinism that we must surpass and overcome: 'our home is in heaven, that is, precisely in the universe'.<sup>120</sup>

Schelling was already seeing that reason reveals blind attachment to our planetary and stellar birthplace—*which is a matter of contingency rather than choice*—to be just as unreasonable as blind allegiance to one's nation or race. Emancipation must entail breaking from all such 'concrete fetters'. To overcome accidents of birth and privations of extinction is to drift towards the furthest physical reaches. But beyond the idealisms of a Schelling, and his captivating proclamation of cosmic universalism, others were soon stumbling upon the idea that this is truly also a practical issue. Indeed, as demonstrated in Chapter 4, it has long been realised that there are astrophysical catastrophes, 'those exploded worlds on the horizon', risks beyond the internal limitations of our biosphere. In order not to succumb to a roaming planetoid or molecular cloud, we must eventually spread further abroad. For *no amount of X-risk is morally acceptable*.

One of the first places this idea is found is, ironically enough, in a satire of the drive to improve our world and fix its iniquities—in a cutting response to Etzler's work on paradise-engineering by Henry David Thoreau, the rugged all-American essayist. In his review of Etzler's crackpot plans published in 1843 (the same year that Schelling delivered his Berlin lecture), Thoreau produced what he intended as a satirical exaggeration, a *reductio ad absurdum*, of the Hegelian engineer's vision. Why, he asked, could we not accumulate enough power so 'as to run the earth off its tracks into a new orbit [and] so change the tedious vicissitude of the seasons?'. And having alleviated the annoyance of bad weather, why not also remove the inconvenience of terrestrial extinction?

Or, perchance, coming generations will not abide the dissolution of the globe, but, availing themselves of future inventions in aerial

120. Schelling, *Sämmtliche Werke*, vol. 10, 389–90.

locomotion, and the navigation of space, the entire race may migrate from the earth, to settle some vacant and more [clement] planet [...] It took but a little art, a simple application of natural laws, a canoe, a paddle, and a sail of matting, to people the isles of the Pacific, and a little more will people the shining isles of space. Do we not see in the firmament the lights carried along the shore by night as Columbus did?<sup>121</sup>

Thoreau clearly thought planetary exodus a preposterous prospectus. Yet, despite being announced in jest, others were already seriously taking up the idea: perhaps avoiding extinction by leaving Earth *isn't* such a stupid idea? Not long afterward, William Winwood Reade, a British explorer and correspondent of Darwin, published his own sweeping view of humanity's vocation which, apart from the abolition of disease and suffering, forecasts an exit from the planet:

And then, the Earth being small, mankind will migrate into space, and will cross the airless Saharas which separate planet from planet and sun from sun. [...] Finally, men will master the forces of Nature; they will become themselves architects of systems, manufacturers of worlds. Man will then be perfect; he will then be a creator; he will therefore be what the vulgar worship as a god.<sup>122</sup>

As with Swift's satire of the comet-predicting scientists, Thoreau's sneer would be shown up as the 1900s dawned and humanity's interests began moving further and further afield.

As scientists have been telling us since Thoreau's day, our sun will one day become geriatric and infirm, and leave us to die. Thus, in order to keep history going and keep our options alive, our vocation *must* take us further afield. 'After the population of our Solar System', Tsiolkovsky confidently declared, 'other Solar Systems of our Milky Way

121. H.D. Thoreau, 'Paradise (to be) Regained', *The United States Magazine and Democratic Review* 13:45 (1843), 451–63.

122. W.W. Reade, *The Martyrdom of Man* (London, 1872), 515. Thanks to Anders Sandberg for alerting me to Reade's work.



Early depiction of interplanetary travel, from Astor's *A Journey in Other Worlds*, 1894. Aside from Solar System colonisation, the book also documents the successes of the 'Terrestrial Axis Straightening Company': a business whose goal, as agreed by its 'bondholders and stockholders', is to 'straighten the axis of the earth', engineering a universally perfect climate.

will begin to be populated'.<sup>123</sup> From the swirling outer necklaces of inhabited asteroids we will seed other systems, as our descendants will burst beyond the limits of our planet system and reach other stars, leaving behind our fading star in order to harvest the 'luminous vitality' of fresh suns so as to keep our project and potential alive.<sup>124</sup> Earth is thus

123. Tsiolkovsky, 'Monism vselennoi', 271.

124. K. Tsiolkovsky, *Issledovaniye mirovykh prostranstv reaktivnymi priborami* (Moscow: Mashinostroenie, 1967), 100.

the 'starting point' for the 'settlement of the Milky Way'.<sup>125</sup> Our vocation is to float upwards and outwards (Tsiolkovsky proudly professed his 'hatred of gravity'). Fedorov, also, was aware that the Earth is a 'cemetery' in the long run: to no longer be Earth-locked is to liberate ourselves not just from abstract 'fetters' but from the fate of one dying planet.<sup>126</sup>

Over in America, another architect of the age of rocketry, Robert H. Goddard, soon jotted down his own vision of an extraplanetary vocation just as vast as Fedorov's and Tsiolkovsky's. It was 14 January 1918, and as America mobilised to enter the First World War, Goddard, an engineer and inventor, laid out upon four unassuming sheets of white paper his drastic plan for humanity's future. He folded the sheets, placed them in an envelope, and entrusted them to a friend for safekeeping. On the outside of the envelope was scrawled the title '*The Final Migration*', along with the following ominous warning:

The notes should be read thoroughly only by a person who is an optimist.

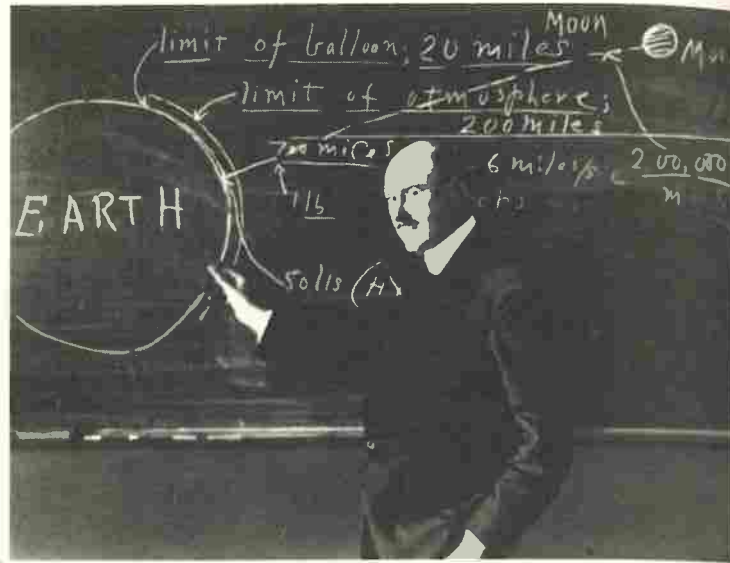
Goddard's notes open by setting out the stakes: staying put on earth poses an X-risk to humanity, and it is high time we ask *Where next?*:

Will it be possible to travel to the planets which are around the fixed stars, when the sun and the earth have cooled to such an extent that life is no longer possible on the earth?

His proposal, as you may have guessed, involved sending humanity on an exodus from the solar system. Living on one planetary speck is like flying on a plane without any failsafes; space diaspora builds **existential redundancy** into the human project. Of course, interstellar travel will be hard on the human frame, but Goddard had a helpful suggestion here. Couldn't we 'reduce the protoplasm in the human body to [a] granular

125. Tsiolkovsky, 'Monism vselennoi', 272.

126. Fedorov, *Philosophy of the Common Task*, 189.



Robert H. Goddard, crunching the numbers.

state, so that it can withstand the intense cold of inter-stellar space'? Humans would be turned into desiccated dust (taking inspiration from the biological phenomenon called cryptobiosis, where an organism enters extreme dormancy) and canned up in rockets, before being slung far beyond the Solar System. Imagine waking up from that! (Goddard thought of everything, including atomic alarm clocks). If awakening fully-formed human adults like sea monkeys is unworkable, then we could always seed the Milky Way with protoplasm 'being of such a nature as to produce human beings eventually by evolution'. Of course, one must consider the ethics of kickstarting the whole Darwinian ordeal over again. But again Goddard had the answer: each expedition should also contain the entirety of human knowledge in 'as condensed, light, and indestructible a form as possible so that the new civilization could begin where the old ended'.<sup>127</sup> Human culture on a floppy disk—simple!

127. R.H. Goddard, 'The Final Migration', *Beyond Reality* 31 (1978), 20–23, 60.

### A Billion-Year Mission Measured In Postage Stamps

If the problems attendant upon such projects seem insurmountable, don't forget that we have a lot of time on our hands, and that work has only just begun. The influential physicist Sir James Jeans knew well the fate of our 'dying sun' and 'heat death', but he calculated that—'[a]part from accidents'—our 'earth is likely to remain a possible abode of life for something of the order of a million million years to come'.<sup>128</sup> We '[u]tterly inexperienced beings', he announced in 1929, are 'standing at the first flush of the dawn of civilization'.<sup>129</sup>

To conceive of ourselves in this way, as creatures of the dawn, entails negotiating a new relationship to time. Remember that, for the majority of human history, the prospect of eternity and its indefatigable cycles trivialised what was at stake in what we think and do, existentially speaking. Now, with a finite prospect before us, we realise that value is scarce. Our vocation lies in maximising the amount of value we build in the limited time available to us. But our endowment of energy is vast. We need not fear the far-off sunset, so long as we keep our eye on the job, keep our vocation in view. Jeans had a remarkable way of envisioning it: imagine stacking a postage stamp on a penny, and then balancing both upon the pinnacle of a twenty-metre-high Egyptian obelisk. The thickness of the stamp is the extent of human civilisation, the thickness of the stamp *and* penny is the extent of our species's existence, and the distance from the stamp to the obelisk's base is the age of our Earth.

Now stick another postage-stamp on top of the first to represent the next 5000 years of civilization, and keep sticking on postage-stamps until you have a pile as high as Mont Blanc. [...] The first postage-stamp was the past of civilization; the column higher than Mont Blanc its future. Or, to look at it in another way, the first postage-stamp represents what man has already achieved; the pile which outtops Mont Blanc represents what he may achieve [...]

128. J. Jeans, *The Universe Around Us* (Cambridge: Cambridge University Press, 1929), 352.

129. J. Jeans, *Eos: or the Wider Aspects of Cosmogony* (London: Kegan Paul, 1928), 12–13, 83–84.



Accidents may happen to the race [...] Celestial collisions may occur; shrinking into a white dwarf, the sun may freeze terrestrial life out of existence; bursting out as a nova it may scorch our race to death. Accident may replace our Mont Blanc of postage-stamps by a truncated column of only a fraction of the height of Mont Blanc. Even so, there is prospect of tens of thousands of millions of years before our race. [...] We have come into being in the fresh glory of the dawn, and a day of almost unthinkable length stretches before us with unimaginable opportunities for accomplishment. [...] We are still too much engulfed in the greyness of the morning mists to be able to imagine, however vaguely, how this world of ours will appear to those who will come after us and see it in the full light of day. But by what light we have, we seem to discern that the main message [is] one of responsibility [...] of responsibility because we are drawing plans and laying foundations for a longer future than we can well imagine.

*Jean -> Toynbee*  
Having read Jeans's optimistic vision regarding extinction and enlightenment, the historian Arnold J. Toynbee remarked that it is no longer the case, as the Ancients once thought, that we live on the ruins of innumerable past civilisations where everything virtuous and valuable has already been done. No, we live in a position of vast opportunity: there are new knowledges and arts to master and discover. Toynbee calculated that, given that the average lifespan of prior civilisations has been around six thousand years, Jeans's prospect affords us 1,743,000,000 civilisations yet to come.<sup>130</sup> This gives us ample opportunity to plan our jailbreak from extinction, as Bertrand Russell reflected the year after Toynbee made his calculation. Citing Jeans, in a 1935 essay entitled 'Cosmic Purpose', Russell wrote:

A million million years gives us some time to prepare for the end, and we may hope that in the meantime both astronomy and gunnery

130. A.J. Toynbee, *A Study of History: Volume 1, The Geneses of Civilizations* (Oxford: Oxford University Press, 1935), 173, 460–63.

will have made considerable progress. The astronomers may have discovered another star with habitable planets, and the gunners may be able to fire us off to it with a speed approaching that of light, in which case, if the passengers were all young to begin with, some might arrive before dying of old age. It is perhaps a slender hope, but let us make the best of it.<sup>131</sup>

Our civilisation may well live into its Methuselah years, as George Bernard Shaw suggested in 1918. If we do not stagnate and fossilise alive by succumbing to 'solar shrinkage', we may just succeed in spreading out through 'starry mansions' as yet 'empty [and] unbuilt'. Though this 'vast domain is as yet unbearably desert', our 'seed shall one day fill it and master its matter to its uttermost confines'.<sup>132</sup> Extinction is not part of an inevitable cycle of losses and returns, it is something which, with will and ingenuity, we can stave off—if not for eternity, then for immense periods of future time.

On the other side of the Channel, Teilhard de Chardin would soon be envisioning jailbreak scenarios where intelligence would 'succeed in ingeniously forcing the bars of its earthly prison'. 'Consciousness would thus finally construct itself by synthesis of planetary units', he wrote, just as it currently constructs itself by the parallel processing of synapses. **Noosphere nets**, rather than neural ones, knitted together across sidereal space—this is how intelligence can escape what Chardin later called 'the congenital mortality of the planets'.<sup>133</sup> J.B.S. Haldane, in 1927, declared that '[m]an will certainly attempt to leave the earth':

There is no reason why their successors should not succeed in colonizing some, at least, of the other planets of our system, and ultimately the planets, if such exist, revolving around other stars than our sun. There is no theoretical limit to man's material progress but

131. B. Russell, *Religion and Science* (Oxford: Oxford University Press, 1949), 217.

132. G.B. Shaw, *Back to Methuselah (A Metabiological Pentateuch)* (London: Penguin, 1939), 47, 305–6.

133. Teilhard de Chardin, *Phenomenon of Man*, 286–87. However, as previously explored, Chardin elsewhere remained highly sceptical of cosmic colonisation and communication efforts.

the subjection to complete conscious control of every atom and every quantum of radiation in the universe.<sup>134</sup>

At this point, exodus from the iniquity of X-risk—and hence maturity—would seem all but complete. Two years later, Bernal likewise envisioned our descendants leveraging such power that the ‘motions of the stars’ themselves ‘could be directed’.<sup>135</sup> He said that superintelligence will not be content without a ‘real externalization [of itself] in the transforming of the universe and itself’.<sup>136</sup> It fell to Olaf Stapledon, in his 1937 *Star Maker*, to fully imagine such a process. In his novel, he spoke of the ‘irresistible coming of utopia throughout the galaxy’ as a propagating shockfront of artifice and astroengineering:

This was visible to us chiefly as a steady increase of artificial planets. Star after star blossomed with orbit after crowded orbit of these vital jewels, these blooms pregnant with the spirit. Constellation after constellation, the whole galaxy became visibly alive with myriads of worlds. [E]very solar system [was] now surrounded by a gauze of light traps, which focused the escaping solar energy for intelligent use, so that the whole galaxy was dimmed<sup>137</sup>

### Music of the Spheres

Inspired by Bernal and Stapledon, in 1960 Freeman Dyson published his groundbreaking essay on the plausibility of gigantic star-sapping feats of astroengineering:

One should expect that, within a few thousand years of its entering the stage of industrial development, any intelligent species should be found occupying an artificial biosphere which completely surrounds its parent star.<sup>138</sup>

134. Haldane, *Inequality of Man*, 144.

135. Bernal, *The World, The Flesh, The Devil*, 45.

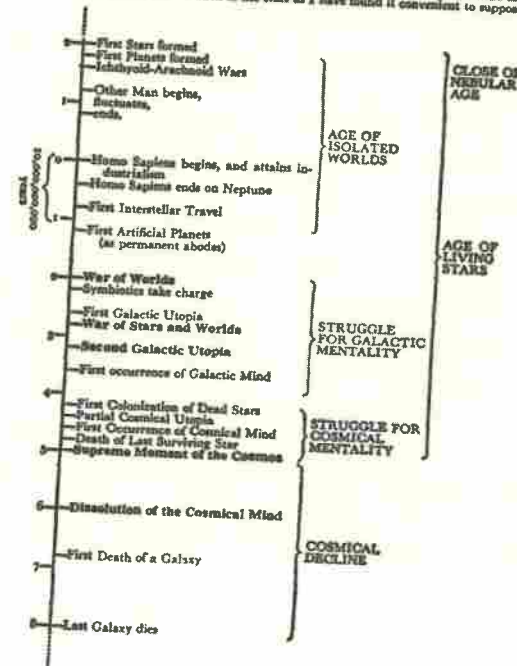
136. *Ibid.*, 57.

137. Stapledon, *First and Last Men/Star Maker*,

138. Dyson, ‘Search for Artificial Stellar Sources of Infrared’, 1667.

### Time Scale 1

Note.—Every item on this scale is placed where it is solely to illustrate the fictitious story of this book. Many scientists would deny that man can be so far from the birth of the stars as I have found it convenient to suppose.



Olaf Stapledon's prospectus for the grand future, from *Star Maker*.

His reasoning followed Tsiolkovsky's: civilisations need energy, and planets receive limited amounts of energy from their stars. So there is good reason to expect that civilisations will expand their 'energy metabolisms' beyond planetary confines. (As we have seen, Malthus implied this, and Odoevsky and Tsiolkovsky picked up on it.)<sup>139</sup>

Dyson proposed that we dismantle Jupiter in order to repurpose its materials for the manufacture of a gargantuan shell of orbiting panels circumscribing our Sun—encompassing a radius of ~150 million km—so as to intercept and harvest every last one of its outgoing photons.

139. See Fedorov, *Philosophy of the Common Task*, 97.

*Jupiter as sun  
replaces  
- Dyson*

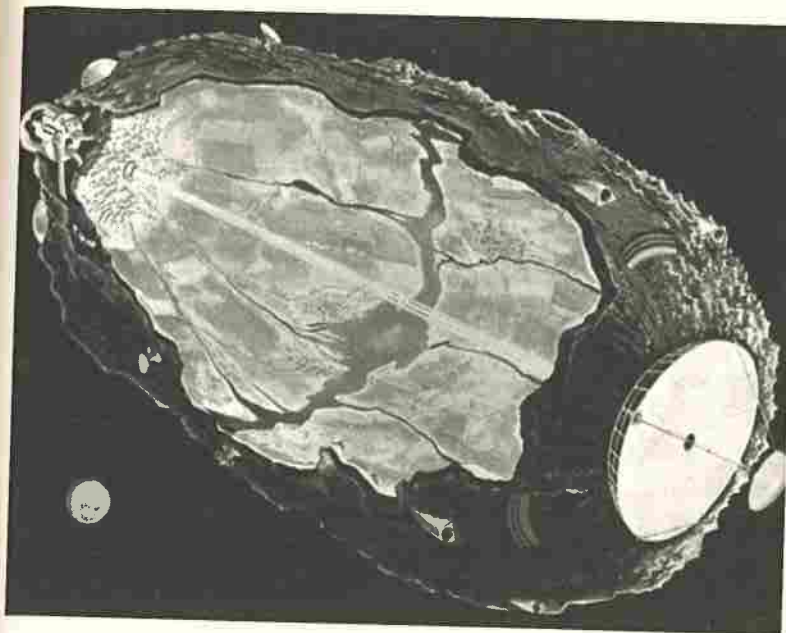
This is nothing other than an engineering fix for the historical loss of the Principle of Plenitude: for when the comforting illusions of an eternity of energy and indestructible value finally crumbled, it was realised that sunlight is a scarce resource, as is the complex value that depends upon it. Where misanthropic thinkers from Sade to Georges Bataille thought that the dissolute stars somehow enjoin us to be libertine in our own behaviours, others countered that—with the right artifice, architecture, ambition, and overheads—such unrestrained expenditure need not be the cosmic default. There is nothing in physical science that says we cannot channel such lavish expenditure into utility, adapting it as the ‘motive force accelerating humanity’. Suns need not be malignant waste, they can be the throughput of the metabolism of moral welfare within the physical world, further fortifying it against the iniquity of its own scarcity and inexistence.

Following from Tsiolkovsky, Tesla, and Bernal, Dyson’s proposal is in many ways a culmination of this tradition. A star in its natural state is a gigantic unjustified orgy of waste. Constructing a Dyson sphere around it gives it a justifying reason, channelling its energy into the promotion, procreation, and prolongation of value, allowing welfare and worth to weave itself more securely into the architecture of the local cosmos.<sup>140</sup>

### Black Hole Powerplants, Type $\Omega$ Civilisations, and Universe Engineering

From the moment of the introduction of Dyson Spheres, things start moving fast. Four years after Dyson’s paper, Dandridge Cole is proposing that the answer to ‘biodetonation’ on earth is to spread outwards

140. Note also that constructing a Dyson sphere, where a civilisation potentially lives on the inside of the shell, is like returning to the enclosure and security of the pre-Copernican cosmos. As explored in Chapter 2, the Ancient Ptolemaic cosmology allowed the human mind to feel at home in the cosmos. Ethical values were presumed contained—almost umbilically—within a similar medium because the cosmos at large reflects them perfectly. The post-Copernican cosmos, with its infinite cold spaces, represents the acknowledgement that value is not contained nor cradled within the universe. Again, a Dyson sphere represents an engineering fix to this historical sense of cosmic displacement and dislocation, a return to enclosure and security.



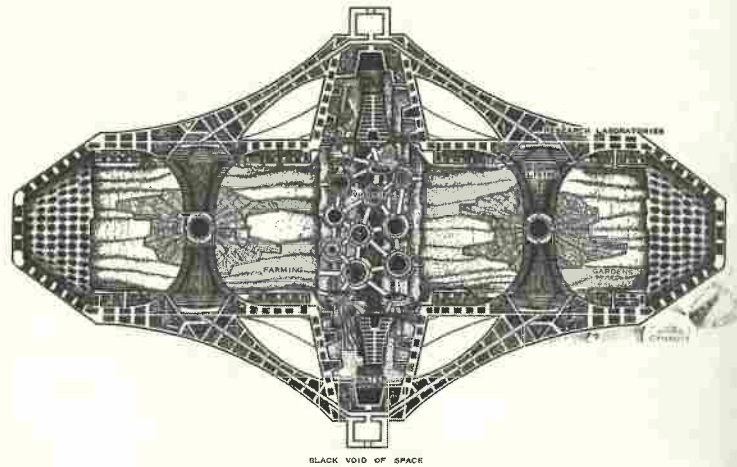
Asteroid colonies as the ova, or sperm, of a supercivilisation: the ultimate immortality. Illustration by Roy G. Scarfo, from Dandridge Cole's *Beyond Tomorrow: The Next 50 Years in Space* (Amherst, WI: Amherst Press, 1965).

into the asteroids. Echoing Tsiolkovsky, he suggests that a floating rock could become a ‘nomadic pseudo-earth’ made up of a ‘gigantic geodesic interior chamber’ and manufactured ‘in much the same way as a glassblower shapes a small solid lump of molten glass into a large empty bottle’.<sup>141</sup> This, he concluded, would give our civilisation that one quality of a living organism that it currently lacks: *the ability to reproduce*. What better route to existential redundancy than this? Having kids is a form of immortality engineering, after all.

Dyson’s idea of sun-sapping spheres catches on in Russia, with Soviet astronomers including Iosif Shklovsky and Nikolai Kardashev championing and extending it. Shklovsky is soon insisting that ‘the

141. D.M. Cole and D.W. Cox, *Islands in Space: The Challenge of the Planetoids* (Philadelphia, PA: Chilton, 1964).





Paolo Soleri's plan for an asteroid requisitioned and transformed into a floating city, 'As-teromo'. Population: 70,000, from P. Soleri, *Arcology: City in the Image of Man* (Cambridge, MA: MIT Press, 1969).

confines of a planetary system' cannot 'actually set a limit to the development and expansion of that highly organized form of matter which we call life'. Oases of value will start 'diffusing' their cultivating forces 'to the neighbouring stars', he proclaims.<sup>142</sup> Soviet scientists were already looking at how cosmic rhythms unfolding far beyond our own solar region, might have destabilised life in the past.<sup>143</sup> Indeed, Shklovsky was himself among the first astronomers to acknowledge that nearby supernova explosions might pose a threat of mass extinction via the emission of deadly jets of cosmic rays: it follows from this that colonising a single star system might not yet be sufficient insulation against X-risk, because supernovas can bathe *multiple* surrounding systems in a nasty flux of cosmic radiation—they have a 'kill distance' of many parsecs.<sup>144</sup> And if there are cosmic killers in the neighbour-

142. Shklovsky, 'Multiplicity of Inhabited Worlds', 11.

143. B.N. Lichkov, *K osnovam sovremennoi teorii zemli* (Leningrad: Izdatel'stvo universiteta, 1965), 87.

144. After people starting properly studying supernovae in the 1930s, Edwin Hubble

hood, it makes sense to distribute the risk.<sup>145</sup> (Although more recently there have been suggestions of building vast shielding shells that could screen a delimited region.)<sup>146</sup>

The same year that Shklovsky announces that intelligence was bound to go further abroad, Kardashev extends Dyson's vision by proposing an ascending scale of domestication at planetary, stellar, and galactic levels. Kardashev's scale measures how much energy is available to a civilisation.<sup>147</sup> For reference, our civilisation currently has a metabolism comprising 12 trillion watts of power. This, as Ord calculates, puts us only halfway toward being a planet-harnessing civilisation at Number 1 on Kardashev's scale—creatures of the dawn indeed.<sup>148</sup> Dyson, in 1966, agreed that artificial activity would not stop at channelling the irradiance of one star but could plausibly spread 'from one end of a galaxy to another in 10 million years'—'a short time by astronomical standards'. Other astronomers were soon proposing plans for scaling up production: working out a route to building 'several hundred Dyson Spheres simultaneously': there is no 'fundamental law', it was argued, 'that says that we cannot [...] occupy and exploit the entire Galaxy of

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claimed that if our own sun went nova, it would sterilise Earth and '[t]he slow process of evolution would have to start anew on [our] dead planet'. See B. Millard, 'Solar Explosion a Possibility', *Los Angeles Times*, 20 March, 1941), 36. By 1957, Shklovsky proposed that supernovas in neighbouring systems had caused previous mass extinctions. See I.S. Shklovsky and V.I. Krasovskiy, 'Vozmozhnoye vliyaniye vspyshek sverkhnovykh na evolyutsiyu zhizni na Zemle', *Reports of the USSR Academy of Sciences* 116:2 (1957), 197–99. The founder of neo-catastrophism, Otto Schindewolf, also endorsed cosmic radiation as an extinction mechanism. See O. Schindewolf, 'Über die möglichen Ursachen der grossen erdgeschichtlichen Faunenschnitte', *Neues Jahrbuch für Geologie und Paläontologie* 10 (1954), 457–65; see also K.D. Terry and W.H. Tucker, 'Biologic Effects of Supernovae', *Science* 159:381 (1968), 421–23; and D. Russel and W.H. Tucker, 'Supernovae and the Extinction of the Dinosaurs', *Nature* 229 (1971), 553–54.

145. D. Lunan, *Man and the Stars* (London: Souvenir Press, 1974), 114.

146. Ćirković and Vukotic, 'Long-term prospects: Mitigation of supernova and gamma-ray burst threat to intelligent beings'.

147. N. Kardashev, 'Transmission of Information by Extraterrestrial Civilizations', *Soviet Astronomy* 8 (1964), 217–21.

148. Ord, *The Precipice*, 283.

Galaxy side  
100 billion suns'.<sup>149</sup> Not happy to be beaten to an idea, the Russians quickly came up with a competing device, the Pokrovsky Shell, which would allow full enclosure of a star whilst also leaving gaps for exit and entrance by being shaped like a clamshell.<sup>150</sup> Georgy Pokrovsky, the physicist behind the idea, beautifully illustrated these projects in Soviet science magazines which dreamed of 'ethereal cities in the intergalactic expanses'.<sup>151</sup> At this scale, even the calamity of supernovae and other disastrous cosmic emissions would be tolerable.

The aimless swirling of the Milky Way, currently a cyclone of pointless 'hecatombs and holocausts', would no longer be a massive whirlpool of extinction and waste. It would become a feat of ordered architecture and artisanship. Chaos would become cosmos on a galactic scale. In the words of Dyson,

[s]tarlight, instead of shining wastefully, would be carefully dammed and controlled. Stars, instead of moving at random, would be grouped and organised.<sup>152</sup>

Stanisław Lem spoke of the 'psychozoic density' of the cosmos, the ratio of cultivation to sterility. By colonising the Milky Way, this density would be increased, hugely reducing X-risk. A galaxy become a garden as opposed to an inhospitable desert.

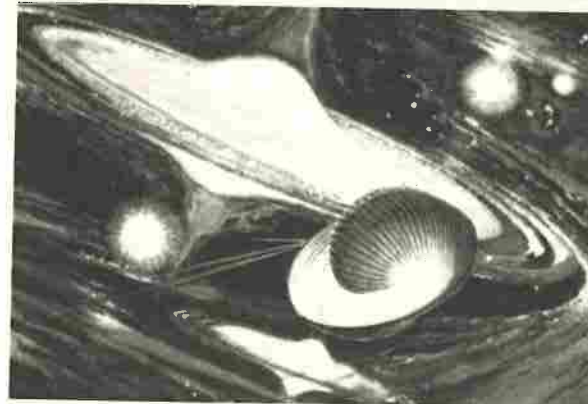
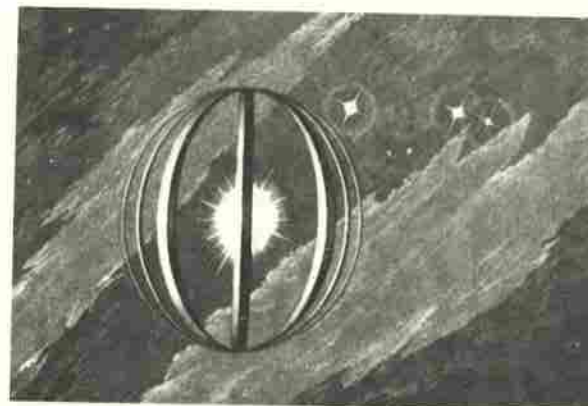
In 1966, Carl Sagan and Iosif Shklovsky put their heads together—from either side of the Iron Curtain—in order to think about the prospects of intelligent life in the physical cosmos. They wrote of it, potentially, becoming 'a factor on the cosmic scale'. What could then be achieved? They listed some potential feats of supercivilisations.

149. A. Berry, *The Next Ten Thousand Years* (London: Jonathan Cape, 1974), 167–68; see also A. Berry, '...And Man Remade the Firmament', *Daily Telegraph Magazine* 342 (1961).

150. G.I. Pokrovsky, 'Dva vozmozhnykh obyektov poiskov vysokorazvitykh tsivilizatsiy', *Priroda* 6 (1973), 97–98.

151. V. Kozmin, 'Na granitsakh gryadushchego s bespredel'nyim', *Tekhnika Molodezhi* 10 (1973), 12–13.

152. Dyson, 'The Search for Extraterrestrial Technology', 653–54.



Pokrovsky's illustrations of engirdled suns and urbanised galaxies. From the magazine *Техника-молодёжи* [*Technology and Youth*], 1973.

Sagan &  
Shklovsky  
1966 -  
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supercivilisations

These included turning gas giants into titanic 'thermonuclear reactors', dismantling planets to create 'space cities', and using gigantic laser beams to trigger 'artificial supernovas' to be used as 'quarries' for heavy elements.<sup>153</sup> Through these 'transforming activities' of intelligence, entire galaxies would enter their own Psychozoic Era. From there, suggested others in the same year, the limits to the development

153. C. Sagan and I. Shklovsky, *Intelligent Life in the Universe* (San Francisco: Holden-Day, 1966), 467–78.

of 'extrasolar intelligent societies are probably generally delineated by absolute physical limitations'.<sup>154</sup>

At the first Soviet-American SETI conference in 1971, Kardashev was already speculating on how supercivilisations could utilise black holes in order to radically stave off their extinction and maintain productivity on virtually immeasurable timescales.<sup>155</sup> In 1979, Dyson published another mind-bending paper, this time proposing that 'it is conceivable that by intelligent intervention, converting matter into radiation and causing energy to flow purposefully' on a cosmic scale, we could artificially expand the *lifespan* of our entire universe.

It is impossible to calculate in detail the long-range future of the universe without including the effects of life and intelligence.<sup>156</sup>

The ultimate mitigation of X-risk. Three years later, in 1982, Steven Frautchi came to similar conclusions, suggesting that black holes could be 'towed' and arranged as energy sources, thus envisioning 'how life might attempt to maintain itself indefinitely and play a major role in shaping the universe'.<sup>157</sup> The same year, the cosmologists John D. Barrow and Frank J. Tipler supplied an equally brain-boggling vision of intelligences mongering black holes in order to stave off cosmic extinction. In a striking inversion of Eduard von Hartmann's omnicidal doctrine, they conclude with the following resonant declaration of the vocation of intelligent life:

Thus ultimately life exists in order to prevent the Universe from destroying itself!<sup>158</sup>

154. MacGowan and Ordway, *Intelligence in the Universe*, 248.

155. Sagan, *Communication with Extraterrestrial Intelligence*, 192-99.

156. F. Dyson, 'Time Without End: Physics and Biology in an Open Universe', *Reviews of Modern Physics* 51:3 (1979), 447.

157. S. Frautchi, 'Entropy in an Expanding Universe', *Science* 217 (1982), 593-99; see also L. Wood, T. Weaver, and J. Nuckolls, 'New Approaches to CTR: General Relativistic Power Plants', *New York Academy of Sciences* 251:1 (1975), 623-31.

158. J.D. Barrow and F.J. Tipler, *The Anthropic Cosmological Principle* (Oxford: Oxford University Press, 1986), 674.

At the same moment that Kardashev proposed his 'Urbanization Hypothesis' for the entire light cone, the 'complete colonization of space' via 'unification at a scale of large galaxies' and total harnessing of cosmological energy flow.<sup>159</sup> Sterility could be extirpated from the cosmos entirely. Near the turn of the millennium, Barrow suggested extending the Kardashev scale. He stressed not only the extensive but also the *intensive forms of progress*: not just how great a civilisation's energy consumption is, but also how fine-grained its ability to manipulate space-time is. The last rung on this ascending ladder, he suggested, might be a 'Type  $\Omega$  Civilization' which—'in the far future'—might 'go about influencing the fabric of the universe in the far future'.<sup>160</sup> Paul Davies wrote in 1985 that this would allow intelligences to create 'bizarre artificial worlds with unimaginable properties'.<sup>161</sup> At this scale of control, risk could be maximally eliminated.

### Shitting on the Morning Star, or, the Uses and Abuses of History

But there will, no doubt, be a mammoth in the room here for many readers. We all know the stories of Icarus, Prometheus, Frankenstein, and Jurassic Park: of 'science going too far' in its pursuit of resurrecting necrofaunal relatives of elephants or building castles in the sky. One newspaper columnist reacted to the above visions of cosmic longevity by grumbling that 'I, for one, am not enchanted by the notion of rows of suburban-style solar systems and stars turned into traffic lights'.<sup>162</sup>

But there are far worse things we could pave the stars with than ennui.... As Fred Hoyle pointed out in the mid-1960s, there is perhaps nothing *inherently* dignified or moral about merely increasing the amount of humans throughout the universe. '[I]s there any interest in

159. N. Kardashev, 'On the Inevitability and Possible Structures of Supercivilizations', in M. Papagiannis (ed.), *The Search for Extraterrestrial Life* (New York: Springer, 1984), 497-504.

160. J.D. Barrow, *Impossibility: The Limits of Science and the Science of Limits* (Oxford: Oxford University Press, 1998), 130.

161. P.W. Davies, *Superforce* (New York: Simon and Schuster, 1984), 168.

162. B. Hunter, 'Think Big', *Vancouver Sun*, July 30 1971, 29.





Pokrovsky's painting of an intelligently-harnessed black hole. From the magazine *Техника-молодёжи* [*Technology and Youth*] (1973)

sheer weight of numbers?', he asked. 'I do not think so'.<sup>163</sup> It depends on what these humans are doing. Many have argued that our spread could be the spread of suffering and stupidity rather than the creation of a sapient paradise, amounting to a repetition of the sins of our past across multiple planets. Already in 1886, Anatole Leroy-Beaulieu (brother of the noted French economist) was unwittingly vindicating such fears, gleefully rubbing his hands in anticipation of a future of interstellar imperialism. He *actively wanted* to bring colonialism and acquisitiveness to the stars:

It has been long said that Europe is becoming too small; cramped up at home, it extends more and more into the four corners of the world. Today, it is the Earth itself, which we so easily traverse, which seems too limited for our voyagers and scientists, for our

163. Hoyle, *Of Galaxies and Men*, 42.

commercial or political ambitions. And, because of the way civilized peoples take possession of the globe, spreading out over the two hemispheres, subjugating barbarian peoples and still-vacant lands, we will soon regret that we do not have within our reach other planets where to transport our products and our competition.<sup>164</sup>

Many would quite rightly find this vision of the interplanetary creep of extractive empire and exploitation disturbing: such rapacity has already caused enough extinction and suffering on our own planet. Sensing this, Fedorov swiftly reacted to Leroy-Beaulieu's cosmic cupidity with revulsion. Achieving an interplanetary empire-state mercantilism would be merely to 'transfer to Heaven the imperfection of the Earth', he wrote. This cosmic contagion is the sick fantasy of all 'millionaires and billionaires', the Russian petitioned: 'to spread our industry to other planets and worlds and infect them with our commercial gain'.<sup>165</sup> Stapledon's various self-induced existential catastrophes included the horrifying prospects of intergalactic warfare and interspecies genocide. He envisioned civilisations frying and 'roasting' each other's suns in order to extinguish each other, entire populous 'systems of worlds' blown up in acts of aggression, and 'pervert' civilisations which, in their insanity and psychopathy, eradicate others for no good reason.<sup>166</sup> Many others, from C.S. Lewis to Jared Diamond, have since voiced similar concerns and fears of sidereal exodus based upon the genocidal history of contact between peoples.<sup>167</sup> Lewis, in his final interview of 1963, looked 'forward in horror' to 'a new colonialism' transporting 'all of our sin' across the firmament.<sup>168</sup>

164. A. Leroy-Beaulieu, 'Les rivalités coloniales: L'Angleterre et la Russie', *Revue des Deux Mondes* 73 (1886), 283.

165. Fedorov, *Sochineniya*, vol. 2, 405. At the time of Fedorov's writing, there were not yet any billionaires....

166. Stapledon, *Last and First Men/Star Maker*, 362.

167. J. Diamond, *The Third Chimpanzee: The Evolution and Future of the Human Animal* (New York: Harper, 1992), 214-15.

168. C.S. Lewis, *God in the Dock: Essays on Theology and Ethics* (Grand Rapids, MI: Eerdmans, 1970), 267.

Writing for the *Scientific American* in 1964, Dyson commented:

Intelligence may indeed be a benign influence, creating isolated groups of philosopher-kings far apart in the heavens and enabling them to share at leisure their accumulated wisdom. Or intelligence may be a cancer of purposeless technological exploitation, sweeping across the galaxy as irresistibly as it swept across our own planet.<sup>169</sup>

A technologically mature civilisation, he emphasised, could ripple across its host galaxy in a mere ‘few million years’—a civilisational wave he later envisioned as, potentially, a ‘spread of insanity’. ‘Some of us will shit on the morning star’, Dyson admitted,<sup>170</sup> a phrase he borrowed from the American poet Robinson Jeffers, who, writing in the aftermath of the Second World War, lamented:

The human race is bound to defile, I’ve often noticed it,  
Whatever they can reach or name, they’d shit on the morning star  
If they could reach...<sup>171</sup>

Recall the Estonian astrophysicist Ernst Öpik, who feared that supernovas may be the after-effects of ‘other humanities’ shitting on their local stars.... Researchers today now worry about ‘suffering risks’, or **S-risks**, urging that space colonisation will introduce ‘truly astronomical stakes’ because it may ‘create unprecedented amounts of suffering’ and other immense consequences, simply given the vast increase in potential sufferers.<sup>172</sup> Elsewhere, there has long been an unfortunate tendency to rhetorically compound the proximity of ‘colonisation’

169. I. Shenker, ‘Will Galaxy Reveal a Technological Cancer? A Physicist Wonders’, *New York Times*, 27 November 1972, 37.

170. Dyson, *Disturbing the Universe*, 237.

171. R. Jeffers, *The Selected Poetry of Robinson Jeffers* (Stanford, CA: Stanford University Press, 2001), 596.

172. See P. Torres, ‘Space colonization and suffering risks: Reassessing the “maxipok rule”’, *Futures*, 100 (2018), 74–85; D. Althaus and L. Gloor, ‘Reducing Risks of Astronomical Suffering: A Neglected Priority’ (2016), <[www.longtermrisk.org/reducing-risks-of-astronomical-suffering-a-neglected-priority](http://www.longtermrisk.org/reducing-risks-of-astronomical-suffering-a-neglected-priority)>.

to ‘colonialism’.<sup>173</sup> Indeed, the same newspaper columnist that moaned about Dyson’s suburbanised stars commented that it would be ‘tough’ if we end up destroying indigenous species on our journey, before sarcastically pronouncing that ‘nothing must get in the way of progress, eh?’<sup>174</sup>

But the massive mistake here is to presume that our very recent past will be the key to the very far future. Views like Beaulieu’s are utterly obsolete even today. No one holds them anymore. The motive is not to go and enslave aliens as chattel. From Fedorov onward, the motivation has invariably been that—regardless of the populousness of our galaxy—there is a shocking amount of unused, unoccupied, and virgin resource out there in the galactic commons.<sup>175</sup> (There’s enough to go around, *even if we are living in the wake of the colonising wave of an older species that has since moved on to greener pastures.*)<sup>176</sup> And there is further good news: modern physics also deems the manufacturing of galaxy-destroying ‘hyperweapons’—such as those imagined by Stapledon—highly implausible. Conflict *at this scale* seems nigh-on logistically impossible.<sup>177</sup> Moreover, is it not also a moral enormity, even a shirking of responsibility, to simply leave the cosmos in its currently uncultivated state, where there are possibly untold wasted opportunities for life and welfare as well as other unintelligent biospheres currently struggling under the cruel grip of blind natural selection? Further, given that most interstellar species will likely be post-biological in some

173. For a masterful rejoinder, see M.M. Ćirković, ‘Anthropocentrism and the roots of resistance to both human bioenhancement and space colonization’, in K. Szocik (ed.), *Human Enhancements for Space Missions, Lunar, Martian, and Future Missions to the Outer Planets* (New York: Springer, 2020).

174. Hunter, ‘Think Big’.

175. The giant evils of European colonialism resulted precisely from its failure to recognise that the ‘New World’ was *not* unoccupied. Criminally failing to recognise indigenous peoples as human, colonisers saw indigenous land as an unused resource. It was not. It does not follow from this historical atrocity that the utilisation of unoccupied space and the harnessing of unused resources—*when genuinely unoccupied or unused*—must be regarded as unconditionally evil in perpetuity.

176. R. Hanson, ‘Burning the Cosmic Commons: Evolutionary Strategies for Interstellar Colonization’ (2012), <<http://mason.gmu.edu/~rhanson/illuniv.pdf>>.

177. M.M. Ćirković, ‘Space colonization remains the only long-term option for humanity: A reply to Torres’, *Futures* 105 (2019), 166–73.

sense, a persuasive case has been made that they will have 'left behind' much of the 'baggage of natural selection' which remains the cause of our continuing tendencies towards 'aggression, territorial imperative, favouritism toward one's own kind, etc.'.<sup>178</sup> Thinking that these sins will necessarily define our future, such that we ought to remain Earth-locked, is actually a form of radical myopia and anthropocentrism.<sup>179</sup> Ćirković refers to the defenders of this pernicious view as the 'anthropocentric cartel', as represented by Gaia-fearing environmentalists, academic miserabilists, anti-science crusaders, and religious zealots:

One should be crystal-clear about one thing: contemporary anthropocentrism is a deep and insidious form of anti-humanism. Problems, difficulties, calamities, even catastrophes and existential risks facing humanity are always welcomed by the cartel, usually as a motivation for smug, self-congratulatory, and self-indulgent messages of pessimism. It is either the need of 'humbleness before the divine', or 'the tragic view of human nature', or even 'respect for the untamed wilderness of other worlds', or some similar hollow ideological mantra of the day.<sup>180</sup>

Dying is *not* a vitalistic aspiration. And everything other than expanding outward is—sooner or later—a definite death sentence.<sup>181</sup> To think that the crimes of our past define our future potential is just a way of shrugging off our vocation, our vast duty to manifest our future's potential, in that it trades current comfort against the existence of astronomical amounts of future value. Self-flagellation and smug resignation is just another form of comfort—and how comforting it is to think that the human is beyond saving, rather than acknowledging its flaws and attempting to find fixes for them.

178. Ibid.

179. It is a form of terrestrial omphalos syndrome to think that the potential of intelligent beings is *fully* defined by what has thus far unfolded on this insignificant Earth.

180. Ćirković, 'Anthropocentrism and the Roots of Resistance'.

181. Ibid.

### The Artifex Sloughs Off Its Biological Heritage

In the spirit of Pearce's project, outpacing and atoning for the flaws of our blind past also involves a confrontation with our haphazard and blood-soaked biological heritage. This is another common theme among precursors to modern transhumanism: following our vocation by coming to reside within a world of our own making—one maximally insulated from X-risk—involves somatic engineering as much as stellar engineering. This would be a true jailbreak from instinct and its ongoing capacity to topple our species by luring us into omnicide or evil.

The suggestion of overstepping the human goes back to figures like Condorcet. But it reached a whole new intensity with Bernal, who wrote that, as we unlock the secrets of biology, we will relentlessly reinvent ourselves so as to make our bodies 'more plastic, more directly controllable and at the same time more variable and more permanent than that produced by the triumphant opportunism of nature':

Bit by bit the heritage in the direct line of mankind—the heritage of the original life emerging on the face of the world—would dwindle, and in the end disappear effectively, being preserved perhaps as some curious relic, while the new life which conserves none of the substance and all the spirit of old would take its place and continue its development.<sup>182</sup>

For Haldane, who was close friends with Bernal, taking directive control of our own evolution was also imperative. Both saw it as a survive-or-die decision. Simply continuing to exist in the form we inherited from evolution would, eventually, be a death sentence for humanity. Acquiescence to biology is itself an X-risk, they argued. Indeed, Bernal remarked that '[n]ormal man is an evolutionary dead end'.<sup>183</sup> If we refuse this because of our sanctification of the natural, then 'humanity may become static until it is destroyed by cosmic forces'<sup>184</sup>—'fossilized

182. Bernal, *The World, The Flesh, and The Devil*, 46.

183. Ibid., 42.

184. Ibid., 55.



alive' as Fedorov put it. Paradoxically, then, the survival of humanity requires leaving behind everything narrowly defined as human.

In 1932, Haldane published an essay entitled 'Man's Destiny' in which he writes that 'unless he can control his own evolution as he is learning to control that of his domestic plants and animals, man and all his works will go into oblivion and darkness':<sup>185</sup>

Man's little world will end. The human mind can already envisage that end. If humanity can enlarge the scope of its will as it has enlarged the reach of its intellect, it will escape that end. If not, the judgement will have gone out against it, and man and all his works will perish eternally.<sup>186</sup>

As Bernal wrote, the posthuman may instinctively seem 'strange, monstrous, and inhuman', but in other cases, obeying our instincts leads to violence, exclusion, chauvinism, addiction, oppression, and even genocide—so why trust it here?<sup>187</sup> In our pursuit of the altruistic and unbiased, in order to intentionally design a more just future, we must shed all unintentional legacies of our past: from the flaws of the physiological to the biases of the behavioural, and all the way up to the accident of our planetary origin itself.

So, the pathway to the future—and to maturity over extinction—is the path of bioenhancement. Moreover, as Fedorov already saw with his project of physical soteriology, to remain on the earth is precisely the evil option, and even the selfish one, in that it amounts to tacit support for a universe where extinction and wasted opportunity is the rule. How truly geocentric it is to believe that the potentials and promises of intelligence *are forever limited* by those follies and atrocities committed upon this small, insignificant planet. How truly geocentric to hold that the historical crimes of our Earth must be repeated, again and again and again, on every other world. To truly assume maturity, perhaps, is

185. Haldane, *Inequality of Man*, 145.

186. Haldane, *Possible Worlds*, 312.

187. Bernal, *The World, The Flesh, and The Devil*, 41.

to realise that we must leave Earth and our evolutionary past behind. Tsiolkovsky put it best in 1911:

The Earth is the cradle of reason, but one cannot forever live in the cradle.<sup>188</sup>

### Posthumanism in the Bedroom

Ćirković, however, notes that internal risks such as conflict, totalitarianism, and ideological strife will inevitably remain with us as we expand. Assuming maturity is a *very* long-term project. Sage as ever, Dyson announced at a 1972 lecture held in London: 'The Devil will always find new varieties of human folly to frustrate our too rational dreams'.<sup>189</sup> The devil he was referring to was that of Bernal's 1929 book *The World, The Flesh, and The Devil*. Bernal had presented this trinity as comprising the 'three enemies of the rational soul'. Each was an obstruction to our creating a cosmic kingdom of ends, and each presented a potential threat of extinction to our oasis of morality: first, the sterile expanses; second, our feeble bodies; and, third, our fallible will—or its vitiation by the inheritances of our less-than-rational past.

Above we have seen a multitude of ways of removing the risks from the world and the flesh, by replacing the sterile expanses and our somatic flaws with artificial alternatives, but how can we escape the threats from the devil—that is to say, the existential perils of desire itself? One last theme in the historical elaboration of the idea of the human vocation is that of reengineering human motivation.

'Now it would seem that the present time is a very critical one for the evolution of human desire'—so wrote Bernal in 1929.<sup>190</sup> As we just saw, a cohort of early transhumanist voices had called for the reinvention of the human body. But it is just as important, in order to escape our doomed biological heritage, to remould the mind. Our motivational structures, our limbic systems, remain the result of Darwinian

188. Tsiolkovsky, *Issledovaniye mirovykh prostranstv reaktivnymi priborami*, 86.

189. Bernal, *The World, the Flesh and the Devil*, 13.

190. *Ibid.*, 55.

opportunism not rational design, and, aside from governing us with the cruel cane of suffering, as we explored in the previous chapter, they can be hijacked or misfired—potentially, as many have feared, even to the point of extinction.

Indeed, Bernal worried that, should we become able to use technological means to artificially alter our psychological states, this aptitude could become a grave peril:

Of course, it would be excessively dangerous for human beings in their present state to have [complete] control of their feelings. A great majority would probably be content to remain in a state of more or less ecstatic happiness [...].<sup>191</sup>

As explored in the prior chapter, although humans may well continue to exist, this would be a clear X-risk—a permanent curb on our potential. Haldane similarly worried that rapidly advancing technology may merely be used to gratify ancient sexual desires, rather than to cultivate more disinterested pursuits, such that our descendants would evolve so that ‘the human form [would not be] allowed to vary greatly’. He imagined humanity acquiescing to its own extinction through indolent stasis as

[t]he instinctive and traditional preferences of the individual, which were still allowed to influence mating, [would cause] a certain standard body form to be preserved.<sup>192</sup>

Our psychology itself poses an X-risk, Haldane and others thought. If we allow our instinctual past to control our future evolution, we get more of what we want—as dictated by narrow desires—rather than changing what we want in order to be more altruistic. Our future collapses into our past and its promise is foreclosed. The chameleon regresses from the angelic to the animal, acquiescing to extinction (as is

191. Ibid.,

192. Haldane, *Possible Worlds*, 295.

the eventual fate for all Darwinian beings). For thinkers from Fedorov to Haldane to Bernal, then, the indulgence of the same old appetites would undoubtedly lead—sooner or later in cosmic timespans—to ‘the extinction of the race’ through ‘submission to blind evolution’.<sup>193</sup> Leaving desire as an uninspected institution would be like leaving any other historical tradition—from monarchy to slavery—untouched and uncritiqued. (It is no coincidence that Haldane was the first to propose ‘ectogenesis’, or the development of embryos in artificial wombs, which the feminist activist Shulamith Firestone later celebrated in 1970 as potentially emancipating ‘women from the tyranny of their reproductive biology’).<sup>194</sup>

Of course, at the moment, sexual reproduction is justified—and necessary—but only in so far as it is currently the *sole* way we know to expand the circle of moral agents within a physical world. Unfortunately it also happens to be the way that biology creates more pain receptors, perpetuating a lineage of beings doomed to learn through negative reinforcement, spurred on by privation and pain. This is why, as Fedorov put it, ‘reproduction is only the perpetuation of devouring’.<sup>195</sup> The aim of transhumanists ever since has been to develop less morally fraught alternatives to institutions like sex and motivation (and, also, often more fun ones). Instead of being motivated by feeling bad, Pearce envisions that, through biotechnology, we could be compelled by ‘gradients of bliss’; instead of reproducing by sexual means, the rearing and replication of artificial minds could totally transform what parenthood and kinship means. Of course, such developments may offend some of our most ancient inclinations and attachments. But to help us focus on the task at hand, here is Bernal’s adroit advice:

The immediate future which is our own desire, we seek; in achieving it we become different; becoming different we desire something new, so there is no staleness except when development itself has stopped.

193. Fedorov, *Sochineniya*, vol. 1, 402.

194. S. Firestone, *The Dialectic of Sex: The Case for Feminist Revolution* (New York: Bantam, 1970), 206.

195. Fedorov, *Sochineniya*, vol. 2, 252.

[...] Having seen [this future], are we to turn away from something that offends the very nature of our earliest desires, or is the recognition of our new powers sufficient to change those desires into the service of the future which they will have to bring about?

If we truly follow our vocation, and if our vocation is truly *historical*, then it is only to be expected that the future will look unrecognisable relative to what we now wish and desire: 'from here it is out of sight'.<sup>196</sup> Yet throughout these earlier visions, there are nonetheless some intimations as to what this furthest future may look like.

### Beautifying the Universe

Bernal tackled the question of desire head-on. Selfish and carnal drives will have to have become expropriated by varying regimes of bioenhancement, allowing us to reroute their motivating energies toward more truly selfless ends. As humanity progresses into posthumanity, what was once self-interested sexual appetite will be refitted and redirected into alignment with more disinterested goals (just as sunlight will be channelled and controlled):

A part of sexuality may go to research, and a much larger part must lead to aesthetic creation.

In other words, sexuality will drift away from a biological drive to blindly replicate, eventually turning into a disinterested form of pure 'aesthetic creation'.<sup>197</sup> Sex need not mean creating more carriers of your own genes in order to selfishly propagate a narrow effect on reality in the form of kin; it can be the ecstatic creation of entirely new realities, beyond all the bondages of self-interest. Remember, the human is a being whose vocation is not just to liberate itself from its own extinction, but to *justify* every aspect of this jailbreak. Emancipating sex from biology and its morphological conservatism collapses the difference

196. Bernal, *The World, The Flesh, and The Devil*, 68, 81, 47.

197. *Ibid.*, 65–66.

between sex and art. Instead of expanding the moral universe indirectly through creating more copies of yourself, why not propagate moral worth directly by editing the structure of nature itself in order to make it more morally beautiful?

Of course, for Bernal this delamination of the formative impulse from the genetic-biological domain would be achieved in lockstep with an awe-inspiring scope for environmental manipulation. Because 'of the very opportunities and materials' that 'the art of the future' will have at its disposal, aesthetic creation will become indistinct from cosmic creation.<sup>198</sup> Superintelligence will propagate value not through meiosis nor through mimesis, but instead by directly manipulating the very laws of nature itself. The ultimate escape from X-risk: baking value into the very fabric of the universe. Artifice and nature would become indistinguishable and, in a final fateful twist, natural law would finally become consonant with moral law, just as the Ancients once supposed it to be:

The cardinal tendency of progress is the replacement of an indifferent chance environment by a deliberately created one. As time goes on, the acceptance, the appreciation, even the understanding of nature, will be less and less needed. In its place will come the need to determine the desirable form of the humanly-controlled universe which is nothing more nor less than art.<sup>199</sup>

At this point, the only real concerns might be ones of play or taste, of ludics or aesthetics—meaningfulness may come from fun rather than strife, the only responsibility coming from risking in games rather than continually betting one's own life.

Fedorov similarly believed the eventual goal as aesthetic 'regulation of the universe'. He rhapsodised that 'aesthetics must give a purpose to Creation and thus must be an act of Re-Creation of the Universe'.<sup>200</sup> A vastly powerful supercivilisation will transition from 'the

198. *Ibid.*

199. *Ibid.*

200. Fedorov, *Sochineniya*, vol. 1., 420.



art of imitation to the art of reality' and 'the study of the stars' will be 'transformed from experiment into action'.<sup>201</sup> Instead of creating 'dead semblances of what has passed away' or 'simulations' of the currently flawed universe, art could be the genuine restitution of all the wasted opportunities that past extinctions and deaths represent. In this, intelligence will finally have fully justified its existence—and thus fulfilled its vocation—by reversing and recompensing all the countless silent sufferings and unjust extinctions that provided its past and prologue. To achieve this future is to justify its past. The implication here is that the only way to *fully* escape the iniquity of extinction, in this irrational universe, is for reason to rectify all the past perishings that made us possible.

### A World Out of Joint

Such grand and mind-boggling visions of the end remain just that: visions, prophecies, possibly manias. We are still in the midst of the historical process, suffering the growth spurts of a long adolescence. Back during the crescendo of the Cold War, the architect Buckminster Fuller gave a lecture pointing to humanity's potential to move 'swiftly outwardbound' so as to 'occupy ever greater ranges of universe':

Within decades we will know whether man is going to be a physical success around earth, able to function in ever greater patterns of local universe or whether he is going to frustrate his own success with his negatively conditioned reflexes of yesterday and will bring about his own extinction around the planet earth.

The options are 'utopia or oblivion'.<sup>202</sup> At the same time, the German-Jewish bacteriologist Paul Alsberg echoed this sentiment, writing that 'the world' is 'out of joint'—and 'civilization on the move'—as 'new waves' of unprecedented risks and 'ever-growing devices of destruction' are 'spreading over the globe'. Alsberg added that, because

201. Fedorov, *Philosophy of the Common Task*, 189.

202. B. Fuller, *Utopia and Oblivion* (London: Penguin, 1970), 413.

of these spasms, the lofty ideals of prior optimists—such as, say, that of a human vocation—now seem 'antiquated and impracticable romanticisms'. More than ever, it looks wise to give up on hope, dignity, progress, purpose.... But this is just because, as Alsberg saw, we are in an exceptional 'transitional period', between adolescence and maturity—and this is what endows our epoch with 'profound significance':

Human evolution is still in full flux, and its path is inevitably beset with new problems and difficulties. [...] It is in this perspective that we must look upon the turmoil of present-day events, when the globe is on fire and the atomic bomb looms on the horizon.

Alsberg hoped that one day we may 'come of age' and reach a 'state of equilibrium'. But this was always the fate of the creature who is a specialist in being unspecialised, he thought. Ever since it first began to assume control over its means of existence and its ethical actions, the human has had 'to face a new situation in which Nature no longer holds her protecting hand over him, but now charges him with the heavy burden of his own *responsibility* and obligations to himself, to the human community, and to Nature'. This was a 'great but precarious achievement, and often enough has led to fatal errors', Alsberg concluded.<sup>203</sup> Teilhard de Chardin, likewise, noted that 'with age and increasing complication, we are ever more threatened by internal dangers at the core of [civilization]'.<sup>204</sup> But he also acknowledged that '[w]e cannot recapture the animal security of instinct'.<sup>205</sup> There is no return to innocence; the path of the dolphin is closed to us.

Entering its phase of adolescence, our species is now truly 'sufficient to have stood, though free to fall', in the auspicious words of Milton's religious epic *Paradise Lost*, penned long before any mushroom clouds unfurled, long before anyone dreamt of fructifying Alpha Centauri. They are spoken by Milton's God, addressing Adam and Eve. But

203. P. Alsberg, *In Quest of Man: A Biological Approach to the Problem of Man's Place in Nature* (Oxford: Pergamon, 1970), 179–83.

204. Teilhard de Chardin, *The Phenomenon of Man*, 274–75.

205. Teilhard de Chardin, *The Future of Man*, 44.

these words have only become infinitely more apt as we have grown our own God-like powers, and seem likely to continue to become yet more so. Science and technology may imperil us, even existentially, but once we have bitten the apple, there is no turning back. The only way through the current predicament—one of simultaneous precarity and power—is to eat it down to the core.

\*

Once upon a time, we lived happily under the illusion that value was a permanent and independent feature of the universe. In the brief moments when they had the spare time and energy to think about it, cultures from prehistory down to roughly the 1600s invariably assumed that value is in some way indestructible. Any value lost will one day be returned elsewhere and elsewhere. Recall Aristotle's assertions that *all* useful and virtuous things have been done 'infinitely many times' in the past (and, thus, will be done again in the future).

When the Scientific Revolution arrived in the 1600s, we suddenly found ourselves living on one insignificant planet among countless others, scattered across a vast void. And yet it was still presumed that all of these other planets were filled with humanoids and, moreover, that for every populated planet, sun, or species destroyed, another would inexorably grow. This perpetuated into the modern era a comforting sense not only that we cannot influence the total amount of value in the universe, but that it remains constant regardless of what we might do. Some otherwise incredibly wise thinkers even recommended we look upon such decimations with a sense of complacency....

As the discoveries of science, combined with the philosophical insights of figures such as Kant, taught us that we should not contaminate our objective theories about what *is* with our moral feelings about what *ought to be*, the universe suddenly seemed less philanthropic. Geology began to turn up evidence that meaningless extinction had been the rule, and survival the exception, throughout the history of the planet; cosmology and mathematics predicted future disasters that could irreversibly put an end to the habitability of our planet and elsewhere;

modern psychology implied that our ingrained irrationality made us a danger to ourselves. And gradually, cosmic nonchalance evolved into cosmic loneliness.

As we learnt not to bias our natural theories with moral prejudice, we became more and more wary of *simply assuming* that the universe is maximally populated. Recently this has been corroborated by the continuing failings of SETI to return that single reassuring message of maturity that Sagan wished and hoped for. However, in recognising that the universe does not seem to be populated with maximal value, we have slowly come to figure out that we may be able to *make an astronomical difference*—that our survival may be of a cosmic significance which, as Amo foresaw all those years ago, far surpasses the instinctual drive to blindly propagate. Only upon appreciating the predominance of the sterility in the inactive firmament above did we recognise the vastness of our capacity to make the cosmos a better place, by filling these empty spaces with systems of value. Only through this have we very recently become fully aware of the significance of our actions and the full, astronomical stakes involved in X-risk.<sup>206</sup>

We have awoken from the illusion of indestructible value and plenitude, and we have been coping with the consequences of this rude awakening ever since. Not only is value *not* baked into the fabric of the cosmos; it is even possible that it may go utterly extinct. The sterility of the skies, the instability of the earth, and the unpredictability of the future, as well as the flaws of our own soul and psyche, alert us to the preciousness and the precarity of our project as moral beings. But this only makes our duties to ourselves even more demanding. It was only in realising the peril that we began to realise our true promise, and vice versa. As Fichte declared, back in the heady days of the 1790s, when humanity was first discovering its extinction and coming to recognise the summons of a seemingly silent universe:

When I assumed this great task I laid hold of eternity at the same time. I lift my head boldly to the threatening stony heights, to the

206. Bostrom, 'Astronomical Waste'.

roaring cataract, to the crashing clouds in their fire-red sea. [...] 'I defy your power! Rain everything down upon me! You earth, and you, heaven, mingle all of your elements in wild tumult. Foam and roar, and in savage combat pulverize the last dust mote of that body which I call my own. Along with its own unyielding project, my will shall hover boldly and indifferently above the wreckage of the universe. For I have seized my vocation, and it is more permanent than you.'<sup>207</sup>

As we've seen, our vocation may well plausibly prove more permanent than the inorganic tumult and bodily pain of this little corner of the cosmos. But, against Fichte, it will not prove eternal or more permanent than the wreckage of our lavishly dying universe. We are creatures born of scarcity. And on the furthest horizon of our action, as far as thought can reach, even in the most economically abundant potential utopia, *scarcity will always remain a factor*. There is finite time and finite energy, and there is no way out or round or through. The indestructibility of value is a dream. One day all this will be over. But in the time remaining—which is gargantuan beyond imagining, especially when measured in postage-stamps—we can, if we find it within ourselves, maximise its potential flourishing, whether this is understood in terms of energy efficiency, aesthetic beauty, historical reparation, or the abolition of pain. Dyson, in his characteristic wisdom, predicted that it could be all of these things and much more. He saw that 'humanity is provisional and contemptible, big with promise and mischief' and, thus, our 'path into the future will not be simple and easy'.<sup>208</sup> Nonetheless, writing in 1997, he announced that

[i]n detail the world shows no evidence of any sort of conscious design. If there is to be a conscious design, it probably has to be ours.<sup>209</sup>

207. J.G. Fichte, *Early Philosophical Writings*, tr. D. Breazeale (Ithaca, NY: Cornell University Press, 1988), 168.

208. Dyson, *Disturbing the Universe*, 227.

209. W. Kayzer and O.W. Sacks, *A Glorious Accident: Understanding Our Place in the Cosmic Puzzle* (New York: W.H. Freeman, 1997).

Elsewhere, he more fully glossed what he meant by this, explaining that it might be our fate to have made our universe *as interesting as possible*:

I propose that our universe is the most interesting of all possible universes, and our fate as human beings it to make it so.<sup>210</sup>

There will always be some residual existential challenge to be over even if it results from our own enlightenment and progress, but this is what makes life interesting. As we embark 'outwardbound', facing novel and unique X-risks, humanity and its descendants will diversify and diverge. It seems that, as civilisations become more historical and defined by their own branching decisions, they also seem to become more unrepeatable: so maybe it is our vocation to become as unrepeatable as possible, and thus to transcend the unremarkable cycles of nature as much as we can, not as any brute and unearned fact of biological rareness, but as an outcome of our having authentically authored ourselves, by learning from our unique and contingent histories, in order to make this universe ever more interesting in the sense of making it full of truly diverse, and unrepeatable, things. Then, as well as moving toward being as full of value as possible, our cosmos might also approach being as full of *different* values as possible. Not only would our maturing entail the eradication of waste, we might also have come close to eradicating wasted opportunity for diversity. After all, going extinct is just as noxious as never having been born—as the first thinkers of the Principle of Plenitude, such as Plato, dimly recognised. The most valuable universe is not only as full of value as possible, but as full of as many splendidly differing values too. Then we would have finally, fully found a fix for the loss of Plenitude, bringing the story of this book full circle. X-risk, after all, is as much unrealised potential as it is active privation.

What Dyson's vision has over Bernal's and Fedorov's, then, is that it embodies the principle of tolerance, the spirit of learning, openness and revision, rather than convergence or homogeneity. (Indeed, might

210. F. Dyson, *Infinite in All Directions* (London: Pelican, 1989), vii.



not a cosmic shockwave of beautronium ultimately be yet another homogenising, deathly tsunami?) It embodies the exploratory spirit of Enlightenment in its acknowledgement that true meaning is not opposed to adversity and dissensus but, in fact, thrives upon it and must be laboriously built out of it. Dyson thus sagely compares the human plight—in its ceaseless flight from cosmically environing X-risks—to the migration of a monarch butterfly.<sup>211</sup> In its delicacy and grace, its daring and defiance, it is sometimes hard to tell whether a butterfly is drifting aimlessly or directing itself. So it is with our waywardness, and so it will continue to be, caught as we are between angel and animal, a 'great amphibium'.

It is precisely this waywardness, this constant buffeting by setback and accident, that forces us to learn, and in learning from our history we author ourselves and raise our civilisation and its contents above the cycles of repetition or recurrence in nature. Of similar histories, elsewhere and forever, there will be none...

Like Dyson, Loren Eiseley was drawn to the image of the Monarch butterfly when pondering upon our human fate in the cosmos. Writing in 1953, like so many of the figures we have met in this journey, he wondered about our responsibility to ourselves as sapient creatures within an otherwise seemingly silent universe. If we fail down here, will others succeed up above?

It is not my contention that in the long cycles to come some of man's traits, even to an advanced brain, may not emerge once more in other living forms. [...] One thing, however, is apparent: the same life does not come again, the same hands will never twice build the golden cities of this world. The time stream, the on-pouring, whatever we may call it, is far more original than this.

I think sometimes of the account of a traveller who, far up in the Himalayan snows, watched in astonishment a flight of lowland butterflies caught in one of the mysterious migratory impulses of

211. Ibid., 298–99.

their race. High in that desperately cold and thinning air, the delicate-winged insects, strung out over a great distance in a long, flickering line, were moving upward! The tattered columns wavered; stragglers dropped frozen in the snow. Nevertheless the dying creatures headed indomitably upward toward the blue ice of the peaks, their little wings beating in unison as though the march might have been boldly outward toward the moon. They were a living manifestation of discontent; they were life going about its immense business of changing worlds—or perishing in the attempt.<sup>212</sup>

Many will still ask: 'But *why*'? <sup>213</sup> Why bother fighting when we could be wrong about so many things? Look to all the times we have deluded ourselves; look to all the times we have failed our lofty values with immense criminal consequence; look to all the instances when we have rationalised our irrational behaviours rather than given them an undistorted reason. Our history is a cascade of calamity, but the wisdom of the ages has proven limited in the past. And this is precisely the point. *At least we have the capacity to acknowledge that we are wrong.* We are the only entity we know of that has a *history* in the sense of escaping and atoning for the errors of the past. And by learning more, by becoming more 'historical', by accumulating more lessons wrought by contingency, we become more diversified by our history and it becomes more properly 'ours'—more remarkable, less repeatable. This truly is a civilisational virtue: the ability to become *more contingent* through our own hard work, through keeping the branching options of history going. As yet, we have neither met with nor made anything else with this capacity, so, for now, our existence matters absolutely. Indeed, current knowledge of X-risk will not be complete nor final. We are surely wrong about many things. But we can learn. Even if we are mistaken now, there is vast, unimaginably vast, value in keeping our options open, *in keeping history going.* We owe it to the past lives that suffered so we could exist, and to future lives, for whom we suffer so that they may exist better than we do.

212. Eiseley, 'Is Man Alone in Space?', 86.

213. See M.J. Midgely, *Science as Salvation: A Modern Myth and its Meaning* (London: Routledge, 1992).

Keeping history going means acknowledging our ability, and thus our duty, to learn from our mistakes. It means acknowledging our obligation to continue and to survive, to avoid the precipice of X-risk, in order to find out where we might be taking ourselves. This remains our duty even when the world of tomorrow appears a progressively worse place; it remains regardless of immediate disillusionment, weariness, or resignation, because, as long as ethical beings are still around, *there is at least potential for the world to become astronomically better*. When we first embarked upon this precarious path, of self-consciousness, of recognising something in ourselves *truly disinterested*, we became obliged to ourselves to see it all the way through, and our history is the story of trying to rise to this obligation we have to ourselves. And to others, since we have also become beings capable of drifting beyond our own interested appetites to consider the welfare of the species and that of other beings and biospheres beyond. Part of this was eventually awakening—after millennia of immature nonchalance—to the mature truth of extinction, and eventually X-risk, in all its moral severity. For what could be more obviously ethical than caring for the well-being of the one and only foothold, within an indifferent universe, of ethics itself? In this sense, as rational and ethical beings, no matter how fallible—for we are also historical beings—we were *bound* to discover our own extinction. This is perhaps the deepest lesson to be drawn from the history covered in this book. The discovery of extinction can be considered as a kind of centrepiece of modernity: a truly fundamental threshold in our assumption of maturity as a global community. Further, it can be considered a threshold that *any* sapient species must necessarily pass through in order to achieve any longevity and autonomy from nature's wanton cycles of squander, extinction, and sterility.

Why bother? We do not *fully* know yet. But as we continue to correct our course, and thus ever so slowly remove the reasonless from our existence, we are slowly giving ourselves the reason to survive and keep existing.

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